

## Quantitative Aptitude

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# Chapter – 1

## Number System

### Laws of Indices

$$\begin{aligned} a^m \times a^n &= a^{m+n} \\ a^m \div a^n &= a^{m-n} \\ (a^m)^n &= a^{mn} \\ a^{\frac{1}{m}} &= \sqrt[m]{a} \\ a^{-m} &= \frac{1}{a^m} \\ a^{\frac{m}{n}} &= \sqrt[n]{a^m} \\ a^0 &= 1 \end{aligned}$$

### DIVISIBILITY RULES

There are some specific rules by which we can determine the divisor of the given number. In this chapter, we will discuss divisibility rules from 2 to 19. Using these rules you can easily determine a divisor of given number, however large it may be. Let me tell you the rules of divisibility from 2 to 19.

#### Divisibility Rules

##### Divisibility by 2

Number which ends with even number or 0 is always divisible by 2.

For Example: 44, 120, 56, 70 etc are divisible by 2.

23, 57, 79 etc are not divisible by 3.

##### Divisibility by 3

For a given number, if sum of its digits is divisible by 3, then the number will be divisible by 3.

For Example:  $5676 = 5 + 6 + 7 + 6 = 24$ , which is divisible by 3

$8912 = 8 + 9 + 1 + 2 = 20$ , not divisible by 3

##### Divisibility by 4

Given number will be divisible by 4, if last two digits are divisible by 4 and if number with two or more zeros at end is also divisible by 4

For Example: 4500, 134000 are divisible by 4

5228 = last two digits i.e. 28 is divisible by 4, therefore number is divisible by 4

##### Divisibility by 5

Numbers ends with 5 or 0, will be divisible by 5.

For Example: 465, 670, 565 will be divisible by 5.

556, 877 are not divisible by 5.

### **Divisibility by 6**

Number divisible by 3 and 2 both will be divisible by 6. For divisibility by 3, you will use the same rule of 3 as discussed above.

For Example: 154: Divisible by 2.

$1 + 5 + 4 = 10$  which is not divisible by 3? Therefore, number is not divisible by 6.

3924: Divisible by 2. Also,  $3 + 9 + 2 + 4 = 18$ , which is divisible by 3? Therefore, number divisible by 6

### **Divisibility by 7**

To check divisibility by numbers like 7, 13, 17, 19, we always use one key digit known as Osculator. Osculators for 7 is -2 i.e. negative osculator 2. Let's see how we will use osculator to check divisibility.

Suppose, we need to check divisibility of number 119,

$$11\cancel{9} = 11 - 9 * 2 = -7$$

**This number is to be multiplied  
with osculator(-2)**

Last digit of number is to be multiplied with -2 (osculator) and then added to the remaining part of number. Check that whether the resultant number is divisible by 7 or not.

Therefore, number will be divisible by 7, if resultant is divisible by 7

### **Divisibility by 8**

Given number will be divisible by 8, if last three digits are divisible by 8 and number with three zeros at end is also divisible by 8

For Example: 4589000, 1256 are divisible by 8

### **Divisibility by 10**

A number ends with 0 is always divisible by 10

For Example: 100, 2890, 4560 are divisible by 10

### **Divisibility by 11**

If sums of digits at odd places and even places are equal or differ by a number divisible by 11, then number will be divisible by 11

For Example: 3245693

Sum of odd digits =  $3 + 4 + 6 + 3 = 16$

Sum of even digits =  $2 + 5 + 9 = 16$

Sums are equal; therefore give number is divisible by 11

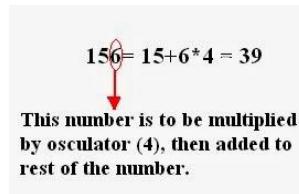
### **Divisibility by 12**

Number divisible by 4 and 3 both will be divisible by 12. For divisibility by 4 and 3, you will use the same rule of 4 and 3 as discussed above.

For Example: 156:  $1 + 5 + 6 = 12$  which is divisible by 3?  
 Last two digits 56 are divisible by 4. Therefore, number is divisible by 12  
 3924: Divisible by 4. Also,  $3 + 9 + 2 + 4 = 18$ , which is divisible by 3? Therefore, number divisible by 12.

### **Divisibility by 13**

Osculator for 13 = 4 The method is same as 7 as discussed above.



See how we check the divisibility by 13, last digit is multiplied with osculator (4), then added to remaining number.

### **Divisibility by 14**

Number divisible by 7 and 2 both will be divisible by 14. To check divisibility by 7 and 2, you will use the same rules as discussed above.

### **Divisibility by 15**

Number divisible by 5 and 3 both will be divisible by 15. Divisibility by 5 and 3 will be same as discussed above.

### **Divisibility by 16**

Number divisible by 8 and 2 both will be divisible by 16. Divisibility by 8 and 2 will be same as discussed above.

### **Divisibility by 17**

Osculator for 17 is -5 (negative osculator). Method is same as discussed in divisibility by 7 and 13.

### **Divisibility by 18**

Number divisible by 9 and 2, will be divisible by 18.

### **Divisibility by 19**

Osculator for 19 is 2 (negative osculator). Method is similar as discussed in divisibility by 7 and 13.

So, Remember that

Osculator of 7 = - 2

Osculator of 13 = + 4

Osculator of 17 = - 5

Osculator of 19 = + 2

## Algebraic Formulae

$a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$ . Hence,  $a^3 \pm b^3$  is divisible by  $(a \pm b)$  and  $(a^2 \pm ab + b^2)$ .

$a^n - b^n = (a - b)(a^{n-1} + a^{n-2}b + a^{n-3}b^2 + \dots + b^{n-1})$  [for all n] Hence,  $a^n - b^n$  is divisible by  $a - b$  for all n.

$$a^n - b^n = (a + b)(a^{n-1} - a^{n-2}b + a^{n-3}b^2 \dots - b^{n-1}) \quad [n - \text{even}]$$

$$a^n + b^n = (a + b)(a^{n-1} - a^{n-2}b + a^{n-3}b^2 + \dots + b^{n-1}) \quad [n - \text{odd}]$$

$a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - ac - bc)$  Hence,  $a^3 + b^3 + c^3 = 3abc$  if  $a + b + c = 0$

## MULTIPLICATION

While doing multiplication of a two digit number with another two digit number, we take at least 6 steps. Try yourself. Multiply 62 with 32.

Now let's do this with a trick

### STEP 1

First step is same as conventional method, here we multiply 2 with 2.

$$\begin{array}{r} 62 \\ \times 32 \\ \hline 4 \end{array}$$

### STEP 2

This is an interesting step. Now multiply last digit first value and first digit of second value and vice-versa. Then we add outcomes. But we need the last number that is 8 here.

$$\begin{array}{r} 62 \\ \times 32 \\ \hline 12 \\ 18 \\ \hline 84 \end{array}$$

### STEP 3

This is the last step, in this step we do multiplication ten's digit of both value and add the remainder from previous calculation. That's it, we completed the calculation in 3 steps instead of six steps.

We can use this method for multiplication of three or even four digit numbers but time management is really important in IBPS exam and other recruitment exams so for longer calculations, estimation is the best trick. I will post an article about how to do long calculations using estimation and result is 95% accurate which is enough to arrive at answer.

## MULTIPLICATION OF 3 DIGIT NUMBERS

In this example I will multiply 432 with 346. Now the 3 step multiplication method will become 5 step. This method can be used for 4 and even 5 digit numbers but as in bank exams there is lack of time available for calculations I recommend you to use approximation for long calculations.

## STEP 1

$$\begin{array}{r}
 432 \\
 + 346 \\
 \hline
 778
 \end{array}$$

## STEP 2

$$\begin{array}{r}
 432 \\
 \times 346 \\
 \hline
 18 + 8 + 1 \\
 = 27 \\
 \text{Now carry forward } 2
 \end{array}$$

### STEP 3

~~432~~  
~~346~~  
472

## STEP 4

## STEP 5

## Squaring

In bank exams calculation speed is very crucial. So in this chapter we will explain binomial squaring technique.

## Technique

In case of two digit number deduct last digit and add it to another number and then add square of same.

In this technique we simplify the squaring method by making one unit's digit zero. It is far easy to multiply  $50 \times 24$  than  $54 \times 24$ . So I used this technique. Try practice more to become expert in this technique.

## Let's take some examples

**Example 1:** Find square of 53.

$$\begin{aligned}
 &= [53 \times 53] \\
 &= [53 + 3] \times [53 - 3] + [3 \times 3] \\
 &= [56 \times 50] + 9 \\
 &= [560 \times 5] + 9 \\
 &= 2800 + 9 = 2809
 \end{aligned}$$

**Example 2:** Find square of 69

$$\begin{aligned}
 &= [69 \times 69] \\
 &= [69 + 1] \times [69 - 1] + [1 \times 1] \\
 &= [70 \times 68] + 1 \\
 &= [680 \times 7] + 1 \\
 &\equiv 4761
 \end{aligned}$$

**Example 3:** Find square of 45

$$\begin{aligned}
 &= [45 \times 45] \\
 &= [45 - 5] \times [45 + 5] + [5 \times 5] \\
 &= [40 \times 50] + 25 \\
 &= 2000 + 25 \\
 &\equiv 2025
 \end{aligned}$$

## **Exercise - 1**

- 7) The difference between a positive proper fraction and its reciprocal is  $\frac{9}{20}$ . The fraction is :
- a)  $\frac{3}{5}$       b)  $\frac{3}{10}$       c)  $\frac{4}{5}$   
d)  $\frac{5}{4}$       e) None of these
- 8) Which one of the following is the common factor of  $(47^{43} + 43^{43})$  and  $(47^{47} + 43^{47})$  ?
- a)  $(47 - 43)$       b)  $(47 + 43)$       c)  $(47^{43} + 43^{43})$   
d) Data inadequate      e) None of these
- 9)  $(112 \times 5^4) = ?$
- a) 67000      b) 70000      c) 76500  
d) 77200      e) None of these
- 10) If the number  $517 * 324$  is completely divisible by 3, then the smallest whole number in place of \* will be :
- a) 0      b) 1      c) 2  
d) Data inadequate      e) None of these
- 11) Which of the following numbers is divisible by 24?
- a) 35718      b) 63810      c) 537804  
d) 3125736      e) None of these
- 12) How many prime numbers are less than 50?
- a) 16      b) 15      c) 14  
d) 18      e) None of these
- 13) On dividing a number by 56, we get 29 as remainder. On dividing the same number by 8, what will be the remainder?
- a) 4      b) 5      c) 6  
d) 7      e) None of these
- 14) The difference of the squares of two consecutive even integers is divisible by which of the following integers?
- a) 3      b) 4      c) 6  
d) 7      e) None of these
- 15) Which one of the following numbers will completely divide  $(4^{61} + 4^{62} + 4^{63} + 4^{64})$  ?
- a) 3      b) 10      c) 11  
d) 13      e) None of these
- 16) How many natural numbers are there between 23 and 100 which are exactly divisible by 6?







## Solutions:

- ### 1. Option D

91 is divisible by 7. So, it is not a prime number.

2. Option D

$$\text{(Local value of 7)} - \text{(Face value of 7)} \\ = (70000 - 7) = 69993$$

- ### 3. Option D

$$1400 \times x = 1050 \\ x = \frac{1050}{1400} = \frac{3}{4}$$

4. Option C

The number  $6x^2$  must be divisible by 8.  
So,  $x = 3$ , as 632 is divisible by 8.

5. Option B

Required numbers are 102, 108, 114 .... 996

This is an A.P. in which  $a = 102$ ,  $d = 6$  and  $L = 996$

Let the number of terms be  $n$ . Then,

$$A + (n - 1)d = 996$$

$$102 + (n - 1) \times 6 = 996$$

$$6 \times (n - 1) = 894$$

$$(n - 1) = 149$$

$$n = 150$$

Required number of terms = 150

6. Option E

The smallest 3 digit number is 100, which is divisible by 2

So, 100 is not a prime number.

$\sqrt{101} < 11$  and 101 is not divisible by any of the prime numbers

2, 3, 5, 7, 11

So, 101 is a prime number

Hence 101 is the smallest 3 digit prime number.

7. Option C

Let the required fraction be  $x$ . Then,  $\frac{1}{x} - x = \frac{9}{20}$

$$\frac{1 - x^2}{x} = \frac{9}{20}$$

$$20 - 20x^2 = 9x$$

$$20x^2 + 9x - 20 = 0$$

$$20x^2 + 25x - 16x - 20 = 0$$

$$5x(4x + 5) - 4(4x + 5) = 0$$

$$(4x + 5)(5x - 4) = 0$$

$$x = \frac{4}{5}$$

8. Option B

When  $n$  is odd,  $(x^n + a^n)$  is always divisible by  $(x + a)$

So, each one of  $47^{43} + 43^{43}$  and  $47^{47} + 43^{43}$  is divisible by  $47 + 43$

9. Option B

$$(112 \times 5^4) = 112 \times \left[\frac{10}{2}\right]^4 = \frac{112 \times 10^4}{2^4} = \frac{1120000}{16} = 70000$$

10. Option C

Sum of digits =  $(5 + 1 + 7 + x + 3 + 2 + 4) = (22 + x)$ , which must be divisible by 3  
So,  $x = 2$

11. Option D

$24 = 3 \times 8$ , where 3 and 8 are co-primes.

Clearly, 35718 is not divisible by 8, as 718 is not divisible by 8

Similarly, 63810 is not divisible by 8 and 537804 is not divisible by 8.

Consider part (d)

Sum of digits =  $(3 + 1 + 2 + 5 + 7 + 3 + 6) = 27$ , which is divisible by 3.

Also, 736 is divisible by 8.

So, 3125736 is divisible by  $(3 \times 8)$ , i.e. 24.

12. Option B

Prime numbers less than 50 are :

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47

Their number is 15.

13. Option B

Let  $x$  be the number &  $y$  be the quotient. Then,

$$x = 56 \times y + 29 = (8 \times 7y) + (8 \times 3) + 5 = 8 \times (7y + 3) + 5$$

So, required remainder = 5

14. Option B

Let the two consecutive even integers be  $2n$  and  $(2n + 2)$ . Then

$$(2n + 2)^2 - (2n)^2 = (2n + 2 + 2n)(2n + 2 - 2n)$$

=  $2(4n + 2) = 4(2n + 1)$ , which is divisible by 4.

15. Option B

$$\begin{aligned} (4^{61} + 4^{62} + 4^{63} + 4^{64}) &= 4^{61} \times (1 + 4 + 4^2 + 4^3) = 4^{61} \times 85 \\ &= 4^{60} \times (4 \times 85) = (4^{60} \times 340), \text{ which is divisible by 10.} \end{aligned}$$

16. Option D

Required numbers are 24, 30, 36, 42 ... 96.

This is an A.P. in which  $a = 24$ ,  $d = 6$  and  $L = 96$ .

Let the number of terms in it be  $n$ .

Then,  $t_n = 96$

$$a + (n - 1)d = 96$$

$$24 + (n - 1) \times 6 = 96$$

$$(n - 1) \times 6 = 72$$

$$(n - 1) = 12$$

$$n = 13$$

Required number of numbers = 13

17. Option B

$$\begin{aligned} 935421 \times 625 &= 935421 \times 5^4 = 935421 \times \left[\frac{10}{2}\right]^4 \\ &= \frac{935421 \times 10^4}{2^4} = \frac{9354210000}{16} \\ &= 584638125 \end{aligned}$$

18. Option A

$$\begin{aligned} 1397 \times 1397 &= (1397)^2 \\ &= (1400 - 3)^2 \\ &= (1400)^2 + (3)^2 - (2 \times 1400 \times 3) \\ &= 1960000 + 9 - 8400 \\ &= 1960009 - 8400 = 1951609 \end{aligned}$$

19. Option D

Sum of digits =  $(4 + 8 + 1 + x + 6 + 7 + 3) = (29 + x)$ , which must be divisible by 9.

$$x = 7$$

20. Option A

$$132 = 4 \times 3 \times 11$$

So, if the number divisible by all the three numbers 4, 3 and 11, then the number is divisible by 132 also.

$$264 \rightarrow 11, 3, 4 (\checkmark)$$

$$396 \rightarrow 11, 3, 4 (\checkmark)$$

$$462 \rightarrow 11, 3 (x)$$

$$792 \rightarrow 11, 3, 4 (\checkmark)$$

$$968 \rightarrow 11, 4 (x)$$

$$2178 \rightarrow 11, 3 (x)$$

$$5184 \rightarrow 3, 4 (x)$$

$$6336 \rightarrow 11, 3, 4 (\checkmark)$$

Therefore the following numbers are divisible by 132 : 264, 396, 792 and 6336.

Required number of numbers = 4

21. Option C

Let x be the number and y be the quotient. Then,

$$\begin{aligned}x &= 357 \times y + 39 \\&= (17 \times 21 \times y) + (17 \times 2) + 5 \\&= 17 \times (21y + 2) + 5 \\&\text{So, required number} = 5\end{aligned}$$

22. Option A

$$\begin{aligned}\text{Unit digit in } (6374)^{1793} &= \text{Unit digit in } (4)^{1793} \\&= \text{Unit digit in } (4^2)^{896} \times 4 \\&= \text{Unit digit in } (6 \times 4) = 4 \\&\text{Unit digit in } (625)^{317} = \text{Unit digit in } (5)^{317} = 5 \\&\text{Unit digit in } (341)^{491} = \text{Unit digit in } (1)^{491} = 1 \\&\text{Required digit} = \text{Unit digit in } (4 \times 5 \times 1) = 0\end{aligned}$$

23. Option D

Let the two consecutive odd integers be  $(2n + 1)$  and  $(2n + 3)$ . Then,

$$\begin{aligned}(2n + 3)^2 - (2n + 1)^2 &= (2n + 3 + 2n + 1)(2n + 3 - 2n - 1) \\&= (4n + 4) \times 2 = 8(n + 1), \text{ which is divisible by 8.}\end{aligned}$$

24. Option A

$$\begin{aligned}5358 \times 51 &= 5358 \times (50 + 1) \\&= 5358 \times 50 + 5358 \times 1 \\&= 267900 + 5358 \\&= 273258\end{aligned}$$

25. Option D

$$\begin{aligned}3^{25} + 3^{26} + 3^{27} + 3^{28} &= 3^{25} \times (1 + 3 + 3^2 + 3^3) = 3^{25} \times 40 = \\&= 3^{24} \times 3 \times 4 \times 10 = (3^{24} \times 4 \times 30), \text{ which is divisible by 30.}\end{aligned}$$

26. Option B

Let the smaller number be x. Then larger number =  $(x + 1365)$

$$\text{So, } x + 1365 = 6x + 15$$

$$5x = 1350$$

$$x = 270$$

$$\text{So, smaller number} = 270$$

27. Option D

Required numbers are 10, 15, 20, 25 .... 95

This is an A.P. in which  $a = 10$ ,  $d = 5$  and  $L = 95$

Let the number of terms in it be n. Then

$$t_n = 95$$

$$a + (n - 1)d = 95$$

$$10 + (n - 1) \times 5 = 95$$

$$(n - 1) \times 5 = 85$$

$$(n - 1) = 17$$

$$n = 18$$

$$\text{Required sum} = \frac{n}{2} (a + L) = \frac{18}{2} (10 + 95) = (9 \times 105) = 945$$

28. Option A

$$= \frac{(12)^3 \times (6)^4}{432} = \frac{(12)^3 \times (6)^4}{12 \times 6^2} = 12^2 \times 6^2 = 72^2 = 5184$$

29. Option C

$$\begin{aligned} 1904 \times 1904 &= (1904)^2 = (1900 + 4)^2 \\ &= (1900)^2 + 4^2 + 2 \times 1900 \times 4 = 3610000 + 16 + 15200 \\ &= 3610016 + 15200 = 3625216 \end{aligned}$$

30. Option A

$$\begin{aligned} 72519 \times 9999 &= 72519 \times (10000 - 1) \\ &= 72519 \times 10000 - 72519 \times 1 \\ &= 725190000 - 72519 \\ &= 725117481 \end{aligned}$$

31. Option A

$$\text{Given number} = 97215 \times 6$$

$(6 + 5 + 2 + 9) - (x + 1 + 7) = (14 - x)$ , which must be divisible by 11  
So,  $x = 3$

32. Option D

$$\begin{aligned} (4 + 5 + 2) - (1 + 6 + 3) &= 1, \text{ not divisible by 11} \\ (2 + 6 + 4) - (4 + 5 + 2) &= 1, \text{ not divisible by 11} \\ (4 + 6 + 1) - (2 + 5 + 3) &= 1, \text{ not divisible by 11} \\ (4 + 6 + 1) - (2 + 5 + 4) &= 0, \text{ So, 415624 is divisible by 11.} \end{aligned}$$

33. Option A

$$19657$$

$$33994$$

-----

$$53651$$

$$\text{Let } x - 53651 = 9999$$

$$\text{Then, } x = 9999 + 53651 = 63650$$

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34. Option A

$$\text{Given exp.} = \frac{(a^2 + b^2 - ab)}{(a^3 + b^3)} = \frac{1}{(a + b)} = \frac{1}{753 + 247} = \frac{1}{1000}$$

35. Option B

$$\begin{aligned} (.000216)^{1/3} &= \left[\frac{216}{10^6}\right]^{1/3} \\ &= \left[\frac{6 \times 6 \times 6}{10^2 \times 10^2 \times 10^2}\right]^{1/3} \\ &= \frac{6}{10^2} \\ &= \frac{6}{100} \\ &= 0.06 \end{aligned}$$

36. Option B

Clearly, 9261 is a perfect cube satisfying the given property.

37. Option C

$$\begin{aligned} \sqrt{0.16} &= \sqrt{16/100} \\ &= \sqrt{16} / \sqrt{100} \\ &= 4/10 \\ &= 0.4 \end{aligned}$$

38. Option A

Let the required number be x.

$$\begin{aligned} \text{Then, } \frac{x}{\sqrt{0.25}} &= 25 \\ &= \frac{x}{0.5} = 25 \\ &= x = 25 \times 0.5 \\ &= 12.5 \end{aligned}$$

39. Option A

$$675 = 5 \times 5 \times 3 \times 3 \times 3$$

To make it a perfect cube, it must be multiplied by 5.

40. Option B

$$\begin{aligned} 5808 &= 2 \times 2 \times 2 \times 2 \times 3 \times 11 \times 11 \\ &= 2^2 \times 2^2 \times 3 \times 11^2 \end{aligned}$$

To make it a perfect square, it must be multiplied by 3.

41. Option B

Sum of decimal places in the numerator and denominator under the radical sign being the same, we remove the decimal.

$$\begin{aligned} \text{Given exp.} &= \sqrt{81 \times 484 / 64 \times 625} \\ &= 9 \times \frac{22}{8} \times 25 \\ &= 0.99 \end{aligned}$$

42. Option C

$$\begin{aligned} \sqrt{4a^2 - 4a + 1} + 3a &= \sqrt{(1)^2 + (2a)^2 - 2 \times 1 \times 2a + 3a} \\ &= \sqrt{(1 - 2a)^2} + 3a \\ &= (1 - 2a) + 3a \\ &= (1 + a) \\ &= (1 + 0.1039) \\ &= 1.1039 \end{aligned}$$

43. Option C

$$\begin{aligned} \sqrt{50} \times \sqrt{98} &= \sqrt{50} \times \sqrt{98} \\ &= \sqrt{4900} \\ &= 70 \end{aligned}$$

44. Option B

$$\begin{aligned} 6 \times 24 &= 6 + 24 + \sqrt{6 \times 24} \\ &= 30 + \sqrt{144} \\ &= 30 + 12 \\ &= 42 \end{aligned}$$

45. Option C

$$\begin{aligned} \text{Money collected} &= [59.29 \times 100] \text{ paise} \\ &= 5929 \text{ paise} \\ \text{Number of members} &= \sqrt{5929} \\ &= 77 \end{aligned}$$

46. Option B

$$\begin{aligned} \frac{1}{\sqrt{5}} &= \frac{1}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \\ &= \frac{\sqrt{5}}{5} \\ &= \frac{2.236}{5} \end{aligned}$$

$$= 0.447$$

47. Option A

$$\begin{aligned} \text{Given exp.} &= \left[ \frac{25}{11} \times \frac{14}{5} \times \frac{11}{14} \right] \\ &= 5 \end{aligned}$$

48. Option A

$$\begin{aligned} \text{Clearly } a \times b &= \sqrt{a^2 + b^2} \\ &= \sqrt{5^2 + 12^2} \\ &= \sqrt{25 + 144} \\ &= \sqrt{169} \\ &= 13 \end{aligned}$$

49. Option A

LCM of 21, 36 and 66 = 2772

Now,  $2772 = 2 \times 2 \times 3 \times 3 \times 7 \times 11$

To make it a perfect square, it must be multiplied by  $7 \times 11$

So, required number  $= 2^2 \times 3^2 \times 7^2 \times 11^2 = 213444$

50. Option D

$$\begin{aligned} 3\sqrt{5} + \sqrt{125} &= 17.88 \\ 3\sqrt{5} + \sqrt{25 \times 5} &= 17.88 \\ 3\sqrt{5} + 5\sqrt{5} &= 17.88 \\ 8\sqrt{5} &= 17.88 \\ \sqrt{5} &= 2.235 \\ \therefore \sqrt{80} + 6\sqrt{5} &= \sqrt{16 \times 5} + 6\sqrt{5} \\ &= 4\sqrt{5} + 6\sqrt{5} \\ &= 10\sqrt{5} = (10 \times 2.235) = 22.35 \end{aligned}$$

51. Option C

$$\begin{aligned} x &= \frac{\sqrt{3}+1}{\sqrt{3}-1} \times \frac{\sqrt{3}+1}{\sqrt{3}-1} = \frac{(\sqrt{3}+1)^2}{(3-1)} = \frac{3+1+2\sqrt{3}}{2} = 2+\sqrt{3} \\ y &= \frac{\sqrt{3}-1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{(\sqrt{3}-1)^2}{(3-1)} = \frac{3+1-2\sqrt{3}}{2} = 2-\sqrt{3} \\ \therefore x^2 + y^2 &= (2 + \sqrt{3})^2 + (2 - \sqrt{3})^2 \\ &= 2(4+3) \\ &= 14 \end{aligned}$$

52. Option B

$$\sqrt{(7 + 3\sqrt{5})(7 - 3\sqrt{5})} = \sqrt{(7)^2 - (3\sqrt{5})^2} = \sqrt{49 - 45} = \sqrt{4} = 2$$

53. Option B

$$\text{Let } \sqrt{0.0169 \times x} = 1.3$$

$$\text{Then, } 0.0169x = (1.3)^2 = 1.69$$

$$x = \frac{1.69}{0.0169} = 100$$

54. Option B

$$\Rightarrow \sqrt{81} + \sqrt{0.81} = 10.09 - x$$

$$\Rightarrow 9 + 0.9 = 10.09 - x$$

$$\Rightarrow x = 10.09 - 9.9 = 0.19$$

55. Option A

$$3600 = 2^3 \times 5^2 \times 3^2 \times 2$$

To make it a perfect cube it must be divided by

$$5^2 \times 3^2 \times 2 = 450$$

## Chapter - 2

### AVERAGE

Average is a very simple topic and just involves simple mathematical calculations. Average concept has various applications. We will discuss its applications in next session. Firstly we will try to make you understand the basics of this topic.

Average is just a mean value of all the given observations or we can say it is an arithmetic mean of observations.

$$\text{Average} = \frac{\text{Sum of all observations}}{\text{Number of observations}}$$

Example1: Find an average of following observations:

3, 4, 8, 12, 2, 5, 1

$$\text{Solution: Average} = \frac{\text{Sum of all observations}}{\text{Number of observations}}$$

$$\text{Average} = \frac{3+4+8+12+2+5+1}{7} = 5$$

So, Average = 5

\*\*\*But, remember that this formula does not directly apply on average speed. Discussed in special cases\*\*\*

#### Properties of Average

- i) Average lies between maximum and minimum observation.
- ii) If value of each observation is multiplied by some value 'N', then average will also be multiplied by the same value i.e. N.

**For example:** Assume the previous set of observations. If 2 is multiplied with all observations, then new observations will be as follows:

6, 8, 16, 24, 4, 10, 2

$$\text{New Average} = \frac{70}{7} = 10 = 2(5) = 2 \times \text{Old Average}$$

iii) If value of each observation is increased or decreased by some number, then average will also be increased or decreased by the same number.

For example: Continuing with the same example. If 2 is added to all observations, then new observations will be as follows:

5, 6, 10, 14, 4, 7, 3

$$\text{New Average} = 49/7 = 7 = 5 + 2 = 2 + \text{Old Average}$$

iv) Similarly, if each observation is divided by some number, then average will also be divided by same number.

**For example 1:** If 2 is divided from all observations, then new observations will be as follows:

1.5, 2, 4, 6, 1, 2.5, 0.5

$$\text{New Average} = \frac{17.5}{7} = 2.5 = \frac{5}{2} = \frac{\text{Old Average}}{2}$$

Therefore, I can say any general operation applied on observations will have same effect on average.

**Example 2:** Find an average of first 20 natural numbers.

$$\text{Solution: Average} = \frac{\text{Sum of first 20 natural numbers}}{20}$$

$$\text{Now, we know that Sum of first } n \text{ natural numbers} = \frac{n(n+1)}{2}$$

$$\text{Therefore, Sum of first 20 natural numbers} = \frac{20 \times 21}{2}$$

$$\text{Average} = \frac{20 \times 21}{2 \times 20} = 10.5$$

**Example 3:** Out of three numbers, second number is twice the first and is also thrice the third. If average of these numbers is 44, then find the largest number.

Solution: Let 'x' be the third number

According to question, second number =  $3x = 2(\text{first number})$

$$\text{Therefore, first number} = \frac{3x}{2}$$

second number =  $3x$  and

third number =  $x$

$$\text{Now, average} = 44 = \frac{x + 3x + (3x)/2}{3}$$

$$\Rightarrow \frac{11x}{2} = 44 \times 3$$

$$\Rightarrow x = 24$$

So, largest number i.e.  $3x = 72$

**Example 4:** Average of four consecutive even numbers is 27. Find the numbers.

Solution: Let  $x, x+2, x+4$  and  $x+6$  be the four consecutive even numbers.

$$\text{According to question, } \frac{(x) + (x+2) + (x+4) + (x+6)}{4} = 27$$

$$\frac{4x + 12}{4} = 27$$

$$x = 24$$

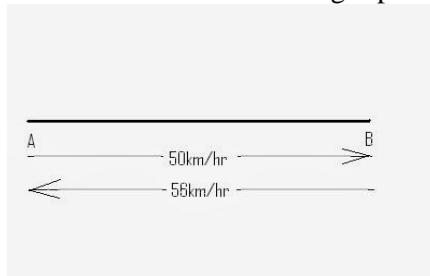
Therefore, numbers are 24, 26, 28, 30

### Special Case

To find average speed

Suppose a man covers a certain distance at  $x$  km/hr and covers an equal distance at  $y$  km/hr. The average speed during the whole distance covered will be  $\frac{2xy}{x+y}$

**Example 5:** A bike covers certain distance from A to B at 50 km/hr speed and returns back to A at 56 km/hr. Find the average speed of the bike during the whole journey.



$$\text{Solution: Average speed} = \frac{2xy}{x+y} = \frac{2 \times 50 \times 56}{50+56}$$

## **Exercise - 2**

- 1) In the first 10 over's of a cricket game, the run rate was only 3.2. What should be the run rate in the remaining 40 over's to reach the target of 282 runs?

a) 6.25                    b) 6.50                    c) 6.75  
d) 7                        e) None of these

2) A family consists of two grandparents, two parents and three grandchildren. The average age of the grandparents is 67 years, that of the parents is 35 years and that of the grandchildren is 6 ears. What is the average age of the family?

a)  $28\frac{7}{4}$  Years            b)  $31\frac{7}{5}$  Years            c)  $32\frac{7}{1}$  Years  
d) Data inadequate        e) None of these

3) A grocer has a sale of Rs. 6435, Rs. 6927, Rs. 6855, Rs. 7230 and Rs. 6562 for 5 consecutive months. How much sale must he have in the sixth month so that he gets an average sale of Rs. 6500?

a) Rs. 4991                b) Rs. 5991                c) Rs. 6001  
d) Rs. 6991                e) None of these

4) The average of 20 numbers is zero. Of them, at the most, how many may be greater than zero?

a) 0                        b) 1                        c) 10  
d) 19                      e) None of these

- 5) The average weight of 8 person's increases by 2.5 kg when a new person comes in place of one of them weighing 65 kg. What might be the weight of the new person?  
a) 76Kg                    b) 76.5Kg                    c) 85Kg  
d) Data inadequate        e) None of these
- 6) The captain of a cricket team of 11 members is 26 years old and the wicket keeper is 3 years older. If the ages of these two are excluded, the average age of the remaining players is one year less than the average age of the whole team. What is the average age of the team?  
a) 23 years                b) 24 years                c) 25years  
d) Data inadequate        e) None of these
- 7) The average monthly income of P and Q is Rs. 5050. The average monthly income of Q and R is Rs. 6250 and the average monthly income of P and R is Rs5200. The monthly income of P is:  
a) 3500                    b) 4000                    c) 4050  
d) 5000                    e) None of these
- 8) The average age of husband, wife and their child 3 years ago was 27 years and that of wife and the child 5 years ago was 20 years. The present age of the husband is:  
a) 35 years                b) 40 years                c) 50 years  
d) Data inadequate        e) None of these
- 9) A car owner buys petrol at Rs.7.50, Rs. 8 and Rs. 8.50 per liter for three successive years. What approximately is the average cost per liter of petrol if he spends Rs. 4000 each year?  
a) Rs. 7.98                b) Rs. 8                    c) Rs. 8.50  
d) Rs. 9                    e) None of these
- 10) In Arum's opinion, his weight is greater than 65 kg but less than 72 kg. His brother doest not agree with Arum and he thinks that Arum's weight is greater than 60 kg but less than 70 kg. His mother's view is that his weight cannot be greater than 68 kg. If all are them are correct in their estimation, what is the average of different probable weights of Arum?  
a) 67 kg                    b) 68 kg                    c) 69 Kg.  
d) Data inadequate        e) None of these
- 11) The average weight of A, B and C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, then the weight of B is:  
a) 17 kg                    b) 20Kg                    c) 26Kg  
d) 31Kg                    e) None of these
- 12) The average weight of 16 boys in a class is 50.25 kg and that of the remaining 8 boys is 45.15 kg. Find the average weights of all the boys in the class.  
a) 47.55 kg                b) 48 kg                    c) 48.55 kg  
d) 49.25 kg                e) None of these



- 21) The average age of boys in a class is 16 years and that of the girls is 15 years. The average age for the whole class is  
a) 15 years                    b) 15.5 years                    c) 16 years  
d) cannot be computed    e) None of these
- 22) The average age of 36 students in a group is 14 years. When teacher's age is included to it, the average increases by one, what is the teacher's age in years?  
a) 31                        b) 36                        c) 51  
d) 55                        e) None of these
- 23) The average of five numbers is 27. If one number is excluded, the average becomes 25. The excluded number is  
a) 25                        b) 27                        c) 30  
d) 35                        e) None of these
- 24) The batting average for 40 innings of a cricket player is 50 runs. His highest score exceeds his lowest score by 172 runs. If these two innings are excluded, the average of the remaining 38 innings is 48 runs. The highest score of the player is  
a) 165 runs                b) 175 runs                c) 172 runs  
d) 174 runs                e) None of these
- 25) The average score of a cricketer for ten matches is 38.9 runs. If the average for the first six matches are 42. Then find the average for the last four matches?  
a) 33.25                    b) 33.5                    c) 34.25  
d) 35                        e) None of these
- 26) The average of six numbers is X and the average of three of these is Y. If the average of the remaining three is z, then  
a)  $x = y + z$               b)  $2x = y + z$               c)  $x = 2y + 2z$   
d) Data inadequate        e) None of these
- 27) A motorist travel to a place 150 km away at an average speed of 50 km/hr and returns at 30 km/hr. His average speed for the whole journey in km/hr is  
a) 30                        b) 37                        c) 37.5  
d) 40                        e) None of these
- 28) The average age of a husband and his wife was 23 years at the time of their marriage. After five years they have a one year old child. The average age of the family now is  
a) 19 years                b) 23 years                c) 28.5 years  
d) 29.3 years              e) None of these
- 29) In an examination, a pupil's average marks were 63 per paper. If he had obtained 20 more marks for his Geography paper and 2 more marks for his history paper, his average per paper would have been 65. How many papers were there in the examination?  
a) 8                        b) 9                        c) 10



- a) 24  
d) 40

- b) 25  
e) None of these

- c) 20

38) The average salary of 12 employees of STAR plus is Rs.18,000 per month and 15 employees of NDTV is Rs.16,000 per month. The average salary of all the 27 employees is :

- a) Rs.17,000  
d) Data inadequate

- b) Rs.16,500  
e) None of these

- c) Rs.16,888.88

39) Sri Krishna took the chariot and started his journey from Mathura to Gokul by his chariot at the speed of 40 km/hr and then, the same distance he travelled on his foot at the speed of 10 km/hr from Gokul to Brindaban. Then he returned from Brindabann to Mathura via Gokul at the speed of 24 km/hr riding on the horse. The average speed of the whole trip is :

- a) 20 km/hr  
d) 18.5 km/hr

- b) 25 km/hr  
e) None of these

- c) 19.2 km/hr

40) The average age of 7 members of Patel's family is 25 years. The average age of the same family 3 years ago was :

- a) 21  
d) 28

- b) 22  
e) None of these

- c) 25

41) The average salary of A, B is Rs.6000 and that of C, D and E is Rs.8000. The average salary of all the 5 people is :

- a) Rs.7200  
d) Cannot be determine

- b) Rs.7000  
e) None of these

- c) Rs.7500

42) 6 months ago the present age of the student of class 10<sup>th</sup> was 14 years. 6 months hence, the age of the same students will be :

- a) 15 years  
d) Data inadequate

- b)  $15 \frac{1}{2}$  years  
e) None of these

- c) 20 years

43) The average salary of Rajesh, Bahadur and Amir is Rs.8000 per month. The average expenditure of Rajesh, Bahadur and Amir per month is Rs.5000. The average savings of all the 3 persons per month is :

- a) Rs.3000  
d) Rs.9000

- b) Rs.5000  
e) None of these

- c) Rs.2500

44) The average of first five multiples of 3 is :

- a) 3  
d) 15

- b) 9  
e) None of these

- c) 12

45) The average of the two digit numbers, which remain the same when the digits interchange their positions, is :

- a) 33  
d) 66

- b) 44  
e) None of these

- c) 55

## Solutions

- ## 1. Option A

$$\frac{282 - (302 \times 10)}{40} = \frac{250}{40} = 6.25$$

- ## 2. Option E

$$\left[ \frac{67 \times 2 + 35 \times 2 + 6 \times 3}{2 + 2 + 3} \right]$$

$$\begin{aligned} & \left[ \frac{134 + 70 + 18}{7} \right] \\ & = \frac{222}{7} \\ & = 31 \frac{5}{7} \end{aligned}$$

3. Option A

Total sale for 5 months = Rs.  $(6435 + 6927 + 6855 + 7230 + 6562) = \text{Rs. } 34009$ .

$$\begin{aligned} \therefore \text{Required sale} &= \text{Rs.} \left[ (6500 \times 6) - 34009 \right] \\ &= \text{Rs.} 39000 - 34009 \\ &= \text{Rs. } 4991 \end{aligned}$$

4. Option D

Average of 20 numbers = 0

$\therefore$  Sum of 20 numbers  $(0 \times 20) = 0$

It is quite possible that 19 of these numbers may be positive and if their sum is  $a$  then 20th number is  $(-a)$

5. Option C

Total weight increased  $= (8 \times 2.5) \text{ kg} = 20 \text{ kg.}$

Weight of new person  $= (65 + 20) \text{ kg} = 85 \text{ kg.}$

6. Option A

Let the average age of the whole team by  $x$  years.

$$\therefore 11x - (26 + 29) = 9(x - 1)$$

$$\Rightarrow 11x - 9x = 46$$

$$\Rightarrow 2x = 46$$

$$\Rightarrow x = 23$$

So, average age of the team is 23 years

7. Option B

Let P, Q and R represent their respective monthly incomes. Then, we have:

$$P + Q = (5050 \times 2) = 10100 \dots \text{(i)}$$

$$Q + R = (6250 \times 2) = 12500 \dots \text{(ii)}$$

$$P + R = (5200 \times 2) = 10400 \dots \text{(iii)}$$

Adding (i), (ii) and (iii), we get:  $2(P + Q + R) = 33000$  or  $P + Q + R = 16500 \dots \text{(iv)}$

Subtracting (ii) from (iv), we get  $P = 4000$

8. Option B

Sum of the present ages of husband, wife and child =  $(27 \times 3 + 3 \times 3)$  years = 90 years.

Sum of the present ages of wife and child =  $(20 \times 2 + 5 \times 2)$  years = 50 years

Husband's present age =  $(90 - 50)$  years = 40 years

9. Option A

$$\begin{aligned} \text{Total quantity of petrol consumer in 3 years} &= 4000 \left[ \frac{4000}{7.50} + \frac{4000}{8} + \frac{4000}{8.50} \right] \\ &= \left[ \frac{76700}{51} \right] \text{ litres} \end{aligned}$$

Total amount spent = Rs.  $(3 \times 4000)$  = Rs. 12000

$$\text{Average Cost} = \text{Rs.} \left[ \frac{12000 \times 51}{76700} \right] = \text{Rs.} \frac{6120}{767} = 7.98$$

10. Option A

Let Arun's weight by X kg.

According to Arun,  $65 < X < 72$

According to Arun's brother,  $60 < X < 70$

According to Arun's mother,  $X \leq 68$

The values satisfying all the above conditions are 66, 67 and 68

$$\text{Required Average} = \left[ \frac{66 + 67 + 68}{3} \right] = \left[ \frac{201}{3} \right] = 67 \text{ kg.}$$

11. Option D

Let A, B, C represent their respective weights. Then, we have:

$$A + B + C = (45 \times 3) = 135 \dots \text{(i)}$$

$$A + B = (40 \times 2) = 80 \dots \text{(ii)}$$

$$B + C = (43 \times 2) = 86 \dots \text{(iii)}$$

Adding (ii) and (iii), we get:  $A + 2B + C = 166 \dots \text{(iv)}$

Subtracting (i) from (iv), we get :  $B = 31$

$\therefore$  B's weight = 31 kg.

12. Option C

$$\text{Required Average} = \left[ \frac{50.25 \times 16 + 45.15 \times 8}{16 + 8} \right]$$

$$= \left[ \frac{804 + 361.20}{24} \right]$$

$$= \frac{1165.20}{24}$$

$$= 48.55$$

13. Option D

Since the month begins with a Sunday, there will be five Sundays in the month.

$$\begin{aligned}\text{Required Average} &= \left[ \frac{510 \times 5 + 240 \times 25}{30} \right] \\ &= \frac{8550}{30} \\ &= 285\end{aligned}$$

14. Option B

$$\begin{aligned}\text{Required Average} &= \left[ \frac{55 \times 50 + 60 \times 55 + 45 \times 60}{55 + 60 + 45} \right] \\ &= \left[ \frac{2750 + 3300 + 2700}{160} \right] \\ &= \frac{8750}{160} \\ &= 54.68\end{aligned}$$

15. Option C

Let there be  $x$  pupils in the class.

$$\begin{aligned}\text{Total increase in marks} &= \left[ X \times \frac{1}{2} \right] = \frac{X}{2} \\ \frac{X}{2} &= (83 - 63) \Rightarrow \frac{X}{2} = 20 \Rightarrow X = 40\end{aligned}$$

16. Option B

$$\begin{aligned}\text{Total weight of (36+44) Students} &= (36 \times 40 + 44 \times 35) \\ &= 2980 \text{ kg.}\end{aligned}$$

$$\begin{aligned}\text{Average weight of the whole class} &= \frac{2980}{80} \\ &= 37.25\end{aligned}$$

17. Option C

Let the average after 17th inning =  $x$ . Then, average after 16th inning =  $(x - 3)$

$$\begin{aligned}\text{Average} &= 16(x-3) + 87 \\ &= 17x \text{ or } x = (87-48) \\ &= 39\end{aligned}$$

18. Option B

Clearly, we have

$$\left[ 3 + 11 + 7 + 9 + 15 + 13 + 8 + 19 + 17 + 21 + 14 + \frac{x}{12} \right]$$

Number in place of x is

$$137 + x = 144$$

$$x = 144 - 137$$

$$x = 7$$

19. Option D

$$\text{Average} = \frac{375}{5}$$

$$76 + 65 + 82 + 67 + \frac{85}{5} = 75$$

20. Option B

Required average speed

$$= \frac{2xy}{x+y} \text{ km/hr}$$

$$= \frac{2 \times 84 \times 56}{84 + 56}$$

$$= \frac{2 \times 84 \times 85}{140}$$

$$= 67.2 \text{ km/hr.}$$

21. Option D

Clearly, to find the average, we ought to know the numbers of boys, girls or students in the class, neither of which has been given. So, the date provided is inadequate.

22. Option C

Age of the teacher

$$= (37 \times 15 - 36 \times 14)$$

$$= 51 \text{ years.}$$

23. Option D

Excluded number

$$= (27 \times 5) - (25 \times 4)$$

$$= 135 - 100$$

$$= 35$$

24. Option D

Let the highest score be x. Then,  
lowest score = (x-172)

$$= [(50 \times 40) - (x + (x-172))]$$

$$= 38 \times 48$$

$$2x = 2000 + 172 - 1824$$

$$2x = 348$$

$$x = 174$$

$$= \frac{38.9 \times 10 - 42 \times 6}{4}$$

25. Option C

Required average

$$= \frac{137}{4} \\ = 34.25$$

26. Option B

Clearly, we have

$$X = \left[ 3y + \frac{3z}{6} \right]$$

Or

$$2x = y + z$$

27. Option C

Average Speed

$$= \left[ \frac{2xy}{x+y} \right] \text{ km/hr}$$

$$= \left[ 2 \times 50 \times \frac{30}{50} + 30 \right] \\ = 37.5 \text{ km/hr.}$$

28. Option A

Sum of the present ages on  
husband, wife and child

$$= [23 \times 2 + 5 \times 2) + 1$$

$$= 57 \text{ years}$$

Required average

$$= \left[ \frac{57}{3} \right]$$

$$= 19 \text{ years.}$$

29. Option D

Let the number pf papers be x.

$$65x - 63x = 22$$

Then,  $63x + 20 + 2 = 65x$ 

$$2x = 22$$

$$x = 11$$

30. Option B

Let the total number of workers be x.  $2000x = 42000$ Then  $8000x = (12000 \times 7) + 6000$  ( $x - 7$ )

$$x = 21$$

7)

31. Option D

Age decreased

$$= (5 \times 3) \text{ years}$$

$$15 \text{ years}$$

So, required difference = 15 years.

32. Option A

Let the average expenditure of all the nine be Rs.x

$$\text{Then, } 12 \times 8 + (x + 8) = 9x \text{ or } 8x = 104 \text{ or } x = 13$$

$$\text{So, total money spent} = 9x = \text{Rs.}(9 \times 13) = 117$$

33. Option B

Clearly, thirteenth result = (sum of 25 results) - (sum of 24 results)

$$\begin{aligned} &= (18 \times 25) - [(14 \times 12) + (17 \times 12)] \\ &= 450 - (168 + 204) = 450 - 372 = 78 \end{aligned}$$

34. Option D

$$\text{Average number of pencils} = \frac{8 + 10 + 15}{3} = 11$$

35. Option A

$$\begin{aligned} \text{Required average} &= \frac{(7 - 1) + (8 - 1) + (10 - 1) + (13 - 1) + (6 - 1) + (10 - 1)}{6} \\ &= \frac{7 + 8 + 10 + 13 + 6 + 10}{6} - \frac{6 \times 1}{6} \\ &= 9 - 1 = 8 \end{aligned}$$

36. Option B

$$\begin{aligned} \text{Average salary} &= \frac{8000 + 5000 + 11000 + 7000 + 9000}{5} \\ &= \text{Rs.}8000 \end{aligned}$$

37. Option D

$$\begin{aligned} \text{Since } W &= (M + T + W) + (W + Th + F + S) - (M + T + W + Th + F + S) \\ &= (30 \times 3) + (28 \times 4) - (27 \times 6) \\ &= 202 - 162 = 40 \end{aligned}$$

38. Option C

$$\text{Required average salary} = \frac{12 \times 18,000 + 15 \times 16,000}{12 + 15} = \frac{4,56,000}{27} = \text{Rs.}16,888.88$$

39. Option C

Since the distance from Mathura to Gokul is same as that of Gokul to Brindaban.

$$\text{So, the average speed from Mathura to Brindaban} = \frac{2 \times 40 \times 10}{(40 + 10)} = 16 \text{ km/hr}$$

Again since he returned on the same path, so the distance from Mathura to Brindaban is same in both the directions.

$$\text{Thus, the required average speed} = \frac{2 \times 16 \times 24}{(16 + 24)} = 19.2 \text{ km/hr}$$

40. Option B

Present average age of family = 25 years

3 years ago average age of family =  $25 - 3 = 22$  years

41. Option A

$$\text{Required average salary} = \frac{6000 \times 2 + 8000 \times 3}{(2+3)} = \frac{36000}{5} = \text{Rs.} 7200$$

42. Option A

Since the time difference between two dates is 1 year, hence the average age will be increased by 1 year.

Thus, the average age of the class 6 months hence will be 15 years.

43. Option A

$$\begin{aligned}\text{Average saving} &= \text{Average income} - \text{Average expenditure} \\ &= 8000 - 5000 = 3000\end{aligned}$$

44. Option B

$$\text{Average} = \frac{3(1+2+3+4+5)}{5} = \frac{45}{5} = 9$$

45. Option C

$$\begin{aligned}\text{Average} &= \frac{11 + 22 + 33 + 44 + 55 + 66 + 77 + 88 + 99}{9} \\ &= \frac{(11+99)+(22+88)+(33+77)+(44+66)+55}{9} \\ &= \left[ \frac{4 \times 110 + 55}{9} \right] = \frac{495}{9} = 55\end{aligned}$$

46. Option C

$$\text{Required average} = \frac{38.9 \times 10 - (42 \times 6)}{4} = \frac{137}{4} = 34.25$$

47. Option C

Let the third number be  $x$ . Then, second number =  $2x$ . First number =  $4x$

$$\text{So, } \frac{1}{x} + \frac{1}{2x} + \frac{1}{4x} = \left[ \frac{7}{72} \times 3 \right] \text{ or } \frac{7}{4x} = \frac{7}{24} \text{ or } 4x = 24 \text{ or } x = 6$$

So, the numbers are 24, 12, 6

48. Option A

Sum of temperatures on 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> days =  $(58 \times 4) = 232$  degrees .. (i)

Sum of temperatures on 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> days =  $(60 \times 4) = 240$  degrees .. (ii)

Subtracting (i) from (ii), we get

Temp. on 5<sup>th</sup> day - Temp. on 1<sup>st</sup> day = 8 degrees

Let the temperatures on 1<sup>st</sup> and 5<sup>th</sup> days be 7x and 8x degrees respectively.

Then,  $8x - 7x = 8$  or  $x = 8$

So, Temperature on 5<sup>th</sup> day =  $8x = 64$  degrees

49. Option D

Total age increased =  $(8 \times 2)$  years = 16 years

Sum of ages of two new men =  $(21 + 23 + 16)$  years = 60 years

So average age of two new men =  $\left[ \frac{60}{2} \right]$  years = 30 years

50. Option C

Total age of 4 members, 10 years ago =  $(24 \times 4) = 96$  years

Total age of 4 members now =  $(96 + 10 \times 4)$  years = 136 years

Total age of 6 members now =  $(24 \times 6) = 144$  years

Sum of the ages of 2 children =  $(144 - 136) = 8$  years

Let the age of the younger child be x years.

Then, age of the elder child =  $(x + 2)$  years

So,  $x + x + 2 = 8$

$2x = 6$

$x = 3$

So, age of younger child = 3 years

51. Option C

$31 \times 31 - 30 \times 30 = 61$  years

## Chapter - 3

# LCM and HCF

LCM i.e. least common multiple is a number which is multiple of two or more than two numbers. For example: The common multiples of 3 and 4 are 12, 24 and so on. Therefore, l.c.m. is smallest positive number that is multiple of both. Here, l.c.m. is 12. HCF i.e. highest common factor are those integral values of number that can divide that number. LCM and HCF problems are very important part of all competitive exams.

Some important LCM and HCF tricks:

1) Product of two numbers = Their HCF  $\times$  Their LCM

2) HCF of given numbers always divides their LCM

3) HCF of given fractions = 
$$\frac{\text{HCF of numerator}}{\text{LCM of denominator}}$$

4) LCM of given fractions = 
$$\frac{\text{LCM of numerator}}{\text{HCF of denominator}}$$

5) If d is the HCF of two positive integer a and b, then there exist unique integer m and n, such that

$$d = am + bn$$

6) If p is prime and a, b are any integer then  $\frac{P}{ab}$ , This implies  $\frac{P}{a}$  or  $\frac{P}{b}$

7) HCF of a given number always divides its LCM

**Most important points about LCM and HCF problems :**

- 1) Largest number which divides x, y, z to leave same remainder = HCF of y - x, z - y, z - x.
- 2) Largest number which divides x, y, z to leave remainder R (i.e. same) = HCF of x - r, y - r, z - r.
- 3) Largest number which divides x, y, z to leave same remainder a, b, c = HCF of x - a, y - b, z - c
- 4) Least number which when divided by x, y, z and leaves a remainder R in each case = (LCM of x, y, z) + R

HCF and LCM questions:

**Example 1:** Least number which when divided by 35, 45, 55 and leaves remainder 18, 28, 38; is?

**Solution:** i) In this case we will evaluate LCM

ii) Here the difference between every divisor and remainder is same i.e. 17.

Therefore, required number = LCM of  $(35, 45, 55)-17 = (3465-17)= 3448$ .

**Example 2:** Least number which when divided by 5, 6, 7, 8 and leaves remainder 3, but when divided by 9, leaves no remainder?

**Solution:** l.c.m. of 5, 6, 7, 8 = 840

Required number =  $840 k + 3$

Least value of k for which  $(840 k + 3)$  is divided by 9 is 2

Therefore, required number =  $840 \times 2 + 3$

$$= 1683$$

**Example 3:** Greater number of 4 digits which is divisible by each one of 12, 18, 21 and 28 is?

**Solution:** LCM of 12, 18, 21, 28 = 254

Therefore, required number must be divisible by 254

Greatest four digit number = 9999

On dividing 9999 by 252, remainder = 171

Therefore,  $9999-171 = 9828$

### Exercise - 3

- 1) The smallest number which when diminished by 7, is divisible by 12, 16, 18, 21 and 28 is
  - a) 1008
  - b) 1015
  - c) 1022
  - d) 1032
  - e) None of these
  
- 2) The HCF of two numbers is 11 and their LCM is 7700. If one of the numbers is 275, then the other is
  - a) 279
  - b) 283
  - c) 308
  - d) 318
  - e) None of these
  
- 3) The product of two numbers is 4107. If the HCF of those numbers is 37, then the greater number is
  - a) 101
  - b) 107
  - c) 109
  - d) 111
  - e) None of these
  
- 4) The greatest possible length which can be used to measure exactly the length 7m, 3m, 85cm, 12m, 95 cm is
  - a) 15 cm
  - b) 25 cm
  - c) 35 cm
  - d) 42 cm
  - e) None of these
  
- 5) Find the greatest number that will divide 43, 91 and 183 so as to leave the same remained in each case.
  - a) 4
  - b) 7
  - c) 9
  - d) 13
  - e) None of these



- 16) Let N be the greatest numbers that will divide 43, 91 and 183 so as to leave the same remainder in each case.

  - a) 4
  - b) 7
  - c) 9
  - d) 13
  - e) None of these

17) Which of the following has most number of divisors?

  - a) 99
  - b) 101
  - c) 176
  - d) 182
  - e) None of these

18) Which of the following is a pair of co-primes?

  - a) (16, 62)
  - b) (18, 25)
  - c) (21, 35)
  - d) (23, 92)
  - e) None of these

19) The HCF of 1.75, 5.6 and 7 is :

  - a) 0.07
  - b) 0.7
  - c) 3.5
  - d) 0.35
  - e) None of these

20) The product of two numbers is 4107. If the HCF of these numbers is 37, then the greater number is :

  - a) 101
  - b) 107
  - c) 111
  - d) 185
  - e) None of these

21) The LCM of two numbers is 45 times their HCF. If one of the numbers is 125 and the sum of HCF and LCM is 1150, the other number is :

  - a) 215
  - b) 220
  - c) 225
  - d) 235
  - e) None of these

22) The greatest number that exactly divides 105, 1001 and 2436 is :

  - a) 3
  - b) 7
  - c) 11
  - d) 21
  - e) None of these

23) The smallest fraction, which each of  $\frac{6}{7}$ ,  $\frac{5}{14}$ ,  $\frac{10}{21}$  will divide exactly is :

  - a)  $\frac{30}{7}$
  - b)  $\frac{30}{98}$
  - c)  $\frac{60}{147}$
  - d)  $\frac{50}{294}$
  - e) None of these

24) The least number, which when divided by 48, 60, 72, 108 and 140 leaves 38, 50, 62, 98 and 130 as remainders respectively, is :

  - a) 11115
  - b) 15110
  - c) 15120
  - d) 15210
  - e) None of these

25) The HCF of two numbers is 12 and their difference is 12. The numbers are :

  - a) 66, 78
  - b) 70, 82
  - c) 94, 106
  - d) 84, 96
  - e) None of these

## Solutions

- ## 1. Option B

$$\begin{aligned}\text{Required numbers} &= (\text{LCM of } 12, 16, 18, 21, 28) + 7 \\ &= 1008 + 7 \\ &= 1015\end{aligned}$$

- ## 2. Option C

$$\text{Other number} = \left[ 11 \times \frac{7700}{275} \right] \\ = 308$$

- ### 3. Option D

Let the numbers be 37a and 37b.

$$\text{Then, } 37a \times 37b = 4107$$

$$ab = 3$$

Now, co-primes with product 3 are (1, 3)

So, the required numbers are  $(37 \times 1, 37 \times 3)$

i.e., (1, 111)  
Therefore greater number = 111

4. Option C

$$\begin{array}{ll} \text{Required length} & = \text{HCF of } 700 \text{ cm, } 385 \text{ cm and } 1295 \text{ cm} \\ & = 35 \text{ cm} \end{array}$$

5. Option A

$$\begin{array}{l} \text{Required number} \\ = \text{HCF of } (91 - 43), (183 - 91) \text{ and } (183 - 43) \\ = \text{HCF of } 48, 92 \text{ and } 140 \\ = 4 \end{array}$$

6. Option C

$$\begin{array}{l} \text{Given numbers are } 1.08, 0.36 \text{ and } 0.90 \\ \text{HCF of } 108, 36 \text{ and } 90 \text{ is } 18 \\ \text{HCF of given numbers} - 0.18 \end{array}$$

7. Option D

$$\begin{array}{l} \text{Let the required numbers be } x, 2x \text{ and } 3x \\ \text{The, their HCF} = x, \text{ So } x = 12 \\ \text{The numbers are } 12, 24, 36 \end{array}$$

8. Option B

$$\begin{array}{l} \text{Largest size of the tile.} \\ \text{HCF of } 378 \text{ cm and } 525 \text{ cm} = 21 \text{ cms.} \end{array}$$

9. Option A

$$\begin{array}{l} \text{LCM} \\ = \frac{\text{product of numbers}}{\text{HCF}} \\ = \frac{1320}{6} \\ = 220 \end{array}$$

10. Option B

$$\begin{array}{l} \text{HCF of co-prime numbers is } 1 \\ \text{So, LCM} \\ = \frac{117}{1} \\ = 117 \end{array}$$

11. Option A

Required number of students = HCF of 1001 and 910  
 = 91

12. Option A

Clearly,  $252 = 2 \times 2 \times 3 \times 3 \times 7$

13. Option C

Required measurement = HCF of (496, 403, 713) litres  
 = 31 litres

14. Option C

HCF of two numbers divides their LCM exactly. Clearly, 8 is not a factor of 60

15. Option A

Let the numbers be  $x$  and  $(100 - x)$

Then,  $x(100 - x) = 5 \times 495$

$$x^2 - 100x + 2475 = 0$$

$$(x - 55)(x - 45) = 0$$

$$x = 55 \text{ or } x = 45$$

Therefore, the numbers are 45 and 55

$$\text{Required difference} = (55 - 45) = 10$$

16. Option A

Required number = HCF of (91 - 43), (183 - 91) and (183 - 43)  
 = HCF of 48, 92 and 140  
 = 4

17. Option C

$$99 = 1 \times 3 \times 3 \times 11; \quad 101 = 1 \times 101$$

$$176 = 1 \times 2 \times 2 \times 2 \times 2 \times 11 \quad 182 = 1 \times 2 \times 7 \times 13$$

So, divisors of 99 are 1, 3, 9, 11, 33 and 99

Divisors of 101 are 1 and 101

Divisors of 176 are 1, 2, 4, 8, 16, 22, 44, 88 and 176

Divisors of 182 are 1, 2, 7, 13, 14, 26, 91 and 182

Hence, 176 has the most number of divisors.

18. Option B

HCF of 18 and 25 is 1. So, they are co-primes.

19. Option D

Given numbers with two decimal places are : 1.75, 5.60 and 7.00. Without decimal places, these numbers are : 175, 560 and 700, whose HCF is 35  
So, HCF of given numbers = 0.35

20. Option C

Let the numbers be  $37a$  and  $37b$ . Then,  $37a \times 37b = 4107$        $ab = 3$

Now, co-primes with product 3 are (1, 3)

So, the required numbers are  $(37 \times 1, 37 \times 3)$  i.e., (1, 111)

So, greater number = 111

21. Option C

Let HCF be H and LCM be L. Then,  $L = 45H$  and  $L + H = 1150$

So,  $45H + H = 1150$  or  $H = 25$ , So,  $L = (1150 - 25) = 1125$

Hence, other number =  $\left[ \frac{25 \times 1125}{125} \right] = 225$

22. Option B

HCF of 2436 and 1001 is 7. Also, HCF of 105 and 7 is

So, HCF of 105, 1001 and 2436 is 7

23. Option A

Required fraction = LCM of  $\frac{6}{7}, \frac{5}{14}, \frac{10}{21} = \frac{LCM\ of\ 6,5,10}{HCF\ of\ 7,14,21} = \frac{30}{7}$

24. Option B

Here  $(48 - 38) = 10$ ,  $(60 - 50) = 10$ ,  $(72 - 62) = 10$ ,  $(108 - 98) = 10$  &  $(140 - 130) = 10$

So, required number =  $(LCM\ of\ 48, 60, 72, 108, 140) - 10 = 15120 - 10 = 15110$

25. Option D

Out of the given numbers, the two with HCF 12 and difference 12 are 84 and 96

26. Option A

Product of numbers =  $11 \times 385 = 4235$

Let the numbers be  $11a$  and  $11b$ . Then,  $11a \times 11b = 4235$        $ab = 35$

Now, co-primes with product 35 are (1, 35) and (5, 7)

So, the numbers are  $(11 \times 1, 11 \times 35)$  and  $(11 \times 5, 11 \times 7)$

Since one number lies between 75 and 125, the suitable pair is (55, 77)

Hence, required number = 77

27. Option A

$$\begin{aligned}\text{Required number} &= \text{HCF of } (1356 - 12), (1868 - 12) \text{ and } (2764 - 12) \\ &= \text{HCF of } 1344, 1856 \text{ and } 2752 = 64\end{aligned}$$

28. Option B

$$\text{Required number} = (\text{LCM of } 24, 32, 36, 54) - 5 = 864 - 5 = 859$$

29. Option D

Interval after which the devices will beep together = (LCM of 30, 60, 90, 105)  
min. = 1260 min. = 21 hrs.

So, the devices will again beep together 21 hrs. after 12 noon i.e. at 9 am.

30. Option C

$$36 = 2^2 \times 3^2, 84 = 2^2 \times 3 \times 7$$

$$\text{So, HCF} = 2^2 \times 3 = 12$$

## Chapter - 4

# Ratio and Proportion

Some facts of Ratio and proportion:

- Ratio is written as  $2 : 3$ , where 2 and 3 are known as terms.
- First term i.e. 2 is known as Antecedent.
- Second term i.e. 3 is known as Consequent.
- $2^2 : 3^2$  is known as duplicate ratio of  $2 : 3$ .
- $2^3 : 3^3$  is known as triplicate ratio of  $2 : 3$ .
- $\sqrt{2} : \sqrt{3}$  is sub-duplicate ratio of  $2 : 3$ .
- $2^{1/3} : 3^{1/3}$  is sub-triplicate ratio of  $2 : 3$ .

### Ratio and Proportion Trick

One example which can be solved in 30 sec if you use this trick

Example: If  $A : B = 3 : 4$ ,  $B : C = 2 : 3$  and  $C : D = 5 : 7$ , then find  $A : B : C : D$ .

Solution: General method of solving this question is very lengthy, so let me tell you how we can calculate it easily.

$$\begin{array}{ccccccc}
 & & & 3 & : & 4 & \\
 & & & \swarrow & & \searrow & \\
 A:B & & & 2 & : & 3 & \\
 & & & \swarrow & & \searrow & \\
 & & & 5 & : & 7 & \\
 \hline
 A:B:C:D & = & 3*2*5 : 4*2*5 : 4*3*5 : 4*3*7 \\
 A:B:C:D & = & 30 : 40 : 60 : 84
 \end{array}$$

See how it is simple, you just need to remember the pattern and if you notice it, it is really simple

Last and first steps are just the straight lines. So, what is left, just the middle pattern?

If we talk about only three terms i.e. A, B and C. Then the pattern will be much easier. Let's see how,

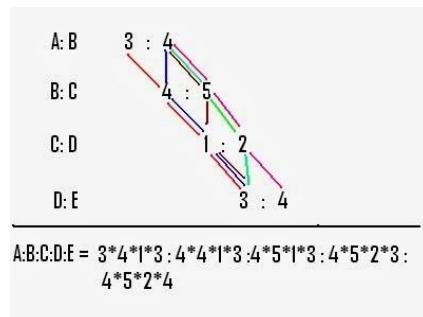
$$\begin{array}{ccccc}
 & & 5 & : & 9 \\
 & & \swarrow & & \searrow \\
 A:B & & 4 & : & 7 \\
 & & \swarrow & & \searrow \\
 & & 4 & : & 7 \\
 \hline
 A:B:C & = & 5*4 : 9*4 : 9*7
 \end{array}$$

Let us do an example of 5 terms:

**Example 1:** If  $A : B = 3 : 4$ ,  $B : C = 4 : 5$ ,  $C : D = 1 : 2$  and  $D : E = 3 : 4$ , Find  $A : B : C : D : E$ .

Solution: Similarly, in this case, make the same pattern as in above cases:

Take a pen and try to make it yourself first or do it step by step by looking at the solution, then only you can learn this technique.



$$\text{A:B:C:D:E} = 9 : 12 : 15 : 30 : 40$$

**Example 2:** Divide Rs.672 in the ratio 5 : 3

**Solution:** Sum of ratio terms =  $(5 + 3) = 8$

$$\text{First part} = \text{Rs.} \left[ 672 \times \frac{5}{8} \right] = \text{Rs.} 420, \text{ Second part} = \text{Rs.} \left[ 672 \times \frac{3}{8} \right] = \text{Rs.} 252$$

**Example 3:** Divide Rs.1162 among A, B C in the ratio 35 : 28 : 20

**Solution:** Sum of ratio terms =  $35 + 28 + 20 = 83$

$$\text{A's share} = \text{Rs.} \left[ 1162 \times \frac{35}{83} \right] = \text{Rs.} 490$$

$$\text{B's share} = \text{Rs.} \left[ 1162 \times \frac{28}{83} \right] = \text{Rs.} 392$$

$$\text{C's share} = \text{Rs.} \left[ 1162 \times \frac{20}{83} \right] = \text{Rs.} 280$$

#### Exercise - 4

- 1) A bag contains 50 p, 25 p and 10 p coins in the ratio 5 : 9 : 4, amounting to Rs.206. Find the number of coins of each type respectively.  
 a) 200, 305, 106      b) 210, 350, 148      c) 200, 360, 160  
 d) 200, 160, 180      e) None of these
- 2) The ratio of length to width of a rectangular sheet of paper is 5 : 3. If the width of the sheet is 18 cm, find its length?  
 a) 10 cm      b) 20 cm      c) 25 cm  
 d) 30 cm      e) None of these
- 3) The ratio between the number of men and women in an office is 5 : 7. If the number of women working in the office is 56. Find the number of men working in the office?





- 22) The speeds of three cars are in the ratio 5 : 4 : 6. The ratio between the time taken by them to travel the same distance is :  
a) 5 : 4 : 6      b) 6 : 4 : 5      c) 10 : 12 : 15  
d) 12 : 15 : 10      e) None of these
- 23) The compounded ratio of (2 : 3), (6 : 11) and (11 : 2) is :  
a) 1 : 2      b) 2 : 1      c) 11 : 24  
d) 36 : 121      e) None of these
- 24) If  $4A = 5B$  and  $3A = 2C$ , the ratio of B : C is :  
a) 4 : 3      b) 5 : 8      c) 8 : 15  
d) 10 : 15      e) None of these
- 25) What number must be subtracted from each of the numbers 53, 21, 41, 17 so that the remainders are in proportion?  
a) 1      b) 3      c) 5  
d) Data inadequate      e) None of these
- 26) Two numbers are in the ratio 3 : 5. If 9 is subtracted from each, the new numbers are in the ratio 12 : 23. The smaller number is :  
a) 27      b) 33      c) 49  
d) 55      e) None of these
- 27) Rs.366 are divided amongst A, B and C so that A may get  $\frac{1}{2}$  as much as B and C together, B may get  $\frac{2}{3}$  as much as A and C together, then the share of A is :  
a) Rs.122      b) Rs.129.60      c) Rs.146.60  
d) Rs.183      e) None of these
- 28) Ratio of the earnings of A and B is 4 : 7. If the earnings of A increase by 50% and those of B decrease by 25%, the new ratio of their earnings becomes 8 : 7. What are A's earnings?  
a) Rs.21,000      b) Rs.26,000      c) Rs.28,000  
d) Data inadequate      e) None of these
- 29) The average age of three boys is 25 years and their ages are in the proportion 3 : 5 : 7. The age of the youngest boy is :  
a) 21 years      b) 18 years      c) 15 years  
d) 9 years      e) None of these
- 30) The ratio of the incomes of A and B is 5 : 4 and the ratio of their expenditure is 3 : 2. If at the end of the year, each saves Rs.1600, then the income of A is :  
a) Rs.3400      b) Rs.3600      c) Rs.4000  
d) Rs.4400      e) None of these





## Solutions:

- ### 1. Option C

Let the number of 50 p, 25 p and 10 p coins be  $5x$ ,  $9x$  and  $4x$  respectively.

$$\text{Then, } \frac{5x}{2} + \frac{9x}{4} + \frac{4x}{10} = 206$$

$$50x + 45x + 8x = 4120 \quad 103x = 4120 \quad x = 40$$

Number of 50 p coins =  $(5 \times 40) = 200$ ; number of 25 p coins =  $(9 \times 40) = 360$ ;  
 number of 10 p coins =  $(4 \times 40) = 160$

2. Option D

Let the length of sheet of paper be  $x$  cm. Then the ratio of length to width =  $x : 18$

Thus,  $x : 18 = 5 : 3$

$$x \times 3 = 18 \times 5$$

$$x = 30$$

Hence the length of paper = 30 cm

- ### 3. Option A

$$5 : 7 = x : 56 \quad (\text{suppose number of men} = x)$$

$$x = 40 \quad (\text{by the first property})$$

Therefore, number of men in the office = 40

- #### 4. Option B

$$\frac{(a + b)}{(a - b)} = \frac{15}{1}$$

$$\frac{a}{b} = \frac{8}{7} \quad (\text{by componendo and dividend})$$

$$\text{Therefore } a^2 - b^2 = 64 - 49 = 15$$

5. Option B

$$\begin{aligned} 2x + 40 &= 4y & \dots (i) \\ 3x + 40 &= 5y & \dots (ii) \\ 4x + 40 &= 6y & \dots (iii) \end{aligned}$$

Therefore  $2x = 40$

$$x = 20$$

$$\begin{aligned} \text{Hence, total number of students} &= 2x + 3x + 4x = 9x \\ &= 9 \times 20 = 180 \end{aligned}$$

6. Option B

$$\begin{array}{lll} \text{Milk} & 20\% & 25\% \\ \text{Water} & 80\% & 75\% \\ \text{Therefore, required ratio} & = \frac{80}{75} = \frac{16}{15} \text{ or } 16 : 15 \end{array}$$

7. Option C

$$\begin{aligned} \text{Ratio of speed of camel and elephant} &= \frac{5}{3} : \frac{7}{5} = \frac{5}{3} \times 15 : \frac{7}{5} \times 15 \\ &= 25 : 21 \end{aligned}$$

8. Option C

Let the age of son is  $x$  years, then the age of Sachin will be  $4x$  years.

$$\text{So, } (4x - 5) = 9(x - 5) \quad x = 8$$

So, age of Sachin is 32 years.

9. Option D

Ratio of shares of Bhanu and Shafeeq =  $36000 : 63000 = 4 : 7$

$$\text{So, Share of Bhanu} = 5500 \times \frac{4}{11} = \text{Rs.}2000$$

$$\text{And share of Shafeeq} = 5500 \times \frac{7}{11} = \text{Rs.}3500$$

10. Option C

$$\left[ \frac{A}{B} = \frac{3}{4}, \frac{B}{C} = \frac{8}{9} \right] \quad \frac{A}{C} = \left[ \frac{A}{B} \times \frac{B}{C} \right] = \left[ \frac{3}{4} \times \frac{8}{9} \right] = \frac{2}{3} \quad A : C = 2 : 3$$

11. Option D

$$A : B = \frac{1}{2} : \frac{3}{8} = 4 : 3, B : C = \frac{1}{3} : \frac{5}{9} = 3 : 5, C : D = \frac{5}{6} : \frac{3}{4} = 10 : 9$$

$$A : B = 4 : 3, B : C = 3 : 5 \text{ and } C : D = 5 : \frac{9}{2}$$

$$A : B : C : D = 4 : 3 : 5 : \frac{9}{2} = 8 : 6 : 10 : 9$$

12. Option C

Let  $\frac{A}{3} = \frac{B}{4} = \frac{C}{5} = k$  Then,  $A = 3k$ ,  $B = 4k$  and  $C = 5k$   
 $A : B : C = 3k : 4k : 5k = 3 : 4 : 5$

13. Option C

$$\frac{\frac{1}{5}}{\frac{1}{x^2}} : \frac{\frac{1}{4}}{\frac{1}{x}} = \frac{\frac{1}{100}}{\frac{125}} \quad \left[ \frac{1}{x} \times \frac{1}{x} \right] = \left[ \frac{1}{5} \times \frac{100}{125} \right] = \frac{4}{25}$$

$$\frac{1}{x^2} = \frac{25}{4} \quad x^2 = \frac{25}{4} \quad x = \frac{5}{2} = 2.5$$

14. Option B

$$5x^2 - 13xy + 6y^2 = 0 \quad 5x^2 - 10xy - 3xy + 6y^2 = 0$$

$$5x(x - 2y) - 3y(x - 2y) = 0 \quad (x - 2y)(5x - 3y) = 0$$

$$x = 2y \text{ pr } 5x = 3y \quad \frac{x}{y} = \frac{2}{1} \text{ or } \frac{x}{y} = \frac{3}{5}$$

So,  $(x : y) = (2b : 1)$  or  $(3 : 5)$

15. Option C

Minimum number of chocolates are possible when he purchases maximum number of costliest chocolates.

Thus,  $2 \times 5 + 5 \times 2 = \text{Rs.}20$

Now, Rs.100 must be spent on 10 chocolates as  $100 = 10 \times 10$

Thus, minimum number of chocolates =  $5 + 2 + 10 = 17$

16. Option A

Share of a man, a woman and a boy =  $7x$ ,  $4x$  and  $3x$

Then the share of 4 men =  $4 \times 7x = 28x$

Then the share of 5 women =  $5 \times 4x = 20x$

Then the share of 2 boys =  $2 \times 3x = 6x$

Now, the share of all women =  $\frac{20x}{(28x + 20x + 6x)} \times 4536$   
 $= \frac{20}{54} \times 4536 = \text{Rs.}1680$

Hence, the share of one woman =  $\frac{1680}{5} = 336$

17. Option D

Let the incomes of A and M is  $2x$  and  $3x$

Let the savings of A be K, then the expenditure of M be K

Also expenditure of A =  $2x - K$

Given  $(2x - K) + K = 8000$

$x = 4000$

So, total income of A and B =  $2x + 3x = 5x = 5 \times 4000 = 20000$

So, total savings of A and B =  $20,000 - 8000 = \text{Rs.}12,000$

18. Option C

Let  $A = 2k$ ,  $B = 3k$  and  $C = 5k$

$$\text{A's new salary} = \frac{115}{100} \text{ of } 2k = \left[ \frac{115}{100} \times 2k \right] = \frac{23}{10}k$$

$$\text{B's new salary} = \frac{110}{100} \text{ of } 3k = \left[ \frac{110}{100} \times 3k \right] = \frac{33}{10}k$$

$$\text{C's new salary} = \frac{120}{100} \text{ of } 5k = \left[ \frac{120}{100} \times 5k \right] = 6k$$

$$\text{So, new ratio} = \frac{23k}{10} : \frac{33k}{10} : 6k = 23 : 33 : 60$$

19. Option B

Let the three parts be  $A$ ,  $B$ ,  $C$ . Then,

$$A : B = 2 : 3 \text{ and } B : C = 5 : 8 = \left[ 5 \times \frac{3}{5} \right] : \left[ 8 \times \frac{3}{5} \right] = 3 : \frac{24}{5}$$

$$A : B : C = 2 : 3 : \frac{24}{5} = 10 : 15 : 24$$

$$B = \left[ 98 \times \frac{15}{49} \right] = 30$$

20. Option C

Let 40% of  $A = \frac{2}{3}B$ . Then,  $\frac{40A}{100} = \frac{2B}{3}$

$$\frac{2A}{5} = \frac{2B}{3}$$

$$\frac{A}{B} = \left[ \frac{2}{3} \times \frac{5}{2} \right] = \frac{5}{3}$$

So,  $A : B = 5 : 3$

21. Option C

$$\text{Remainder} = \text{Rs.} \left[ 735 - (25 \times 3) \right] = \text{Rs.} 660$$

$$\text{So money received by C} = \text{Rs.} \left[ (660 \times \frac{2}{6}) + 25 \right] = \text{Rs.} 225$$

22. Option D

$$\text{Ratio of time taken} = \frac{1}{5} : \frac{1}{4} : \frac{1}{6} = 12 : 15 : 10$$

23. Option B

$$\text{Required ratio} = \left[ \frac{2}{3} \times \frac{6}{11} \times \frac{11}{2} \right] = \frac{2}{1} = 2 : 1$$

24. Option C

$$\begin{array}{ll} A : B = 5 : 4 & 10 : 8 \\ A : C = 2 : 3 & 10 : 15 \\ \text{So, } & A : B : C = 10 : 8 : 15 \\ \text{So, } & B : C = 8 : 15 \end{array}$$

25. Option C

$$\frac{(53 - x)}{(21 - x)} = \frac{(41 - x)}{(17 - x)}$$

$$x = 5$$

26. Option B

Let the numbers be  $3x$  and  $5x$ . Then,  $\frac{3x - 9}{5x - 9} = \frac{12}{23}$

$$23(3x - 9) = 12(5x - 9)$$

$$9x = 99$$

$$x = 11$$

So, the smaller number =  $(3 \times 11) = 33$

27. Option A

$$A : (B + C) = 1 : 2$$

$$A's \text{ share} = \text{Rs.} \left[ 366 \times \frac{1}{3} \right] = \text{Rs.} 122$$

28. Option D

Let the original earnings of A and B be Rs. $4x$  and Rs. $7x$ .

$$\text{New earnings of A} = 150\% \text{ of Rs.} 4x = \text{Rs.} \left[ \frac{150}{100} \times 4x \right] = \text{Rs.} 6x$$

$$\text{New earnings of B} = 75\% \text{ of Rs.} 7x = \text{Rs.} \left[ \frac{75}{100} \times 7x \right] = \text{Rs.} \frac{21x}{4}$$

$$\text{So, } 6x : \frac{21x}{4} = 8 : 7$$

$$\frac{6x \times 4}{21x} = \frac{8}{7}$$

This does not give  $x$ . So, the given data is inadequate.

29. Option C

$$\text{Total age of 3 boys} = 25 \times 3 = 75 \text{ year. Ratio of their ages} = 3 : 5 : 7$$

$$\text{Age of the youngest} = \left[ 75 \times \frac{3}{15} \right] \text{ years} = 15 \text{ years}$$

30. Option C

Let the incomes of A and B be Rs. $5x$  and Rs. $4x$  respectively and let their expenditures be Rs.  $3y$  and Rs. $2y$  respectively.

$$\text{The, } 5x - 3y = 1600 \quad \dots \text{(i)} \quad \text{and} \quad 4x - 2y = 1600 \quad \dots \text{(ii)}$$

On multiplying (i) by 2, (ii) by 3 and subtracting, we get  $2x = 1600$

$$x = 800$$

$$\text{So, A's income} = \text{Rs.}5x = \text{Rs.}(5 \times 800) = \text{Rs.}4000$$

31. Option D

$$S : (M + J) = 5 : 7 \quad 7S = 5M + 5J \quad \dots \text{(i)}$$

$$J : (S + M) = 1 : 2 \quad 2J = S + M \quad \dots \text{(ii)}$$

By solving equations (i) and (ii) we get

$$S : M : J = 5 : 3 : 4$$

$$\text{So, } S : M = 5 : 3$$

32. Option C

$$A : B = 2 : 3 \text{ and } B : C = 3 : 5$$

$$A : B : C = 2 : 3 : 5$$

$$\text{So, } (A + B) : C = 5 : 5 = 1 : 1$$

$$\text{Hence, share of } (A + B) = \frac{1}{2} \times 6940 = 3470$$

33. Option A

The number of days required by a single Kirlosker pump to fill the tank =  $6 \times 7 = 42$  days and the number of days required by a single USHA pump to fill the same tanks =  $2 \times 18 = 36$  days. Now, since efficiency is inversely proportional to the number of days. Hence,

$$\frac{\text{Efficiency of one K-pump}}{\text{Efficiency of U-pump}} = \frac{36}{42} = \frac{6}{7}$$

34. Option C

Let the numbers be  $3x$ ,  $4x$  and  $7x$ . Then,

$$3x \times 4x \times 7x = 18144$$

$$x^3 = 216$$

$$x^3 = 6^3 \quad x = 6$$

So, the numbers are 18, 24 and 42

35. Option C

For dividing 12 into two whole numbers, the sum of the ratio terms must be a factor of 12. So, they cannot be in the ratio  $3 : 2$

36. Option A

Let the third proportional to 0.36 and 0.48 be  $x$ .

Then,  $0.36 : 0.48 :: 0.48 : x$

$$x = \left[ \frac{0.48 \times 0.48}{0.36} \right] = 0.64$$

37. Option D

$$G = 19W \text{ and } C = 9W$$

Let 1 gm of gold be mixed with x gm of copper to get  $(1 + x)$  gm of the alloy.

$$(1 \text{ gm gold}) + (x \text{ gm copper}) = (x + 1) \text{ gm of alloy}$$

$$19W + 9Wx = (x + 1) \times 15W$$

$$19 + 9x = 15(x + 1)$$

$$6x = 4$$

$$x = \frac{2}{3}$$

$$\text{So, ratio of gold with copper} = 1 : \frac{2}{3} = 3 : 2$$

38. Option B

$$10\% \text{ of } B = \frac{1}{4}G$$

$$\frac{10B}{100} = \frac{1}{4}G$$

$$B = \frac{5}{2}G$$

$$\text{So, } \frac{B}{G} = \frac{5}{2}$$

$$B : G = 5 : 2$$

39. Option E

$$\text{Gold in } C = \left[ \frac{7}{9} + \frac{7}{18} \right] \text{ units} = \frac{7}{6} \text{ units. Copper in } C = \left[ \frac{2}{9} + \frac{11}{18} \right] \text{ units} = \frac{5}{6} \text{ units}$$

40. Option C

$$\text{Varsha : Vinay} = 5 : 6 = 5x : 6x$$

$$\text{Veera : Vikram} = 7 : 8 = 7y : 8y$$

But their ages are in A.P.

$$\text{Therefore, } 6x - 5x = 8y - 7y$$

$$x = y$$

$$\text{Again, } \frac{5x + 2}{8y + 2} = \frac{2}{3}$$

$$\frac{5x + 2}{8x + 2} = \frac{2}{3}$$

$$x = 2$$

Therefore, the ages of Varsha, Vinay, Veera and Vikram are 10, 12, 14 and 16 years respectively.

Therefore, the ratio of ages of Vinay and Veera = 6 : 7

41. Option B

$$\frac{H - 9}{W - 9} = \frac{5}{4} \text{ and } \frac{H + 6}{W + 6} = \frac{8}{7}$$

Thus the present age of husband is 34 and present age of his wife is 29 years.

Now, the maximum age of any child must be less than 9 years.

Hence their ages can be 2, 3 and 4 years or 4, 6 and 8 years. So the max, possible sum of age of this family

$$\begin{aligned} &= 34 + 29 + (1 \times 4 + 2 \times 6 + 3 \times 8) \\ &= 103 \text{ years} \end{aligned}$$

42. Option E

Let the original salaries of Ravi and Sumit be Rs.2x and Rs.3x respectively. Then,

$$\begin{aligned} \frac{2x + 4000}{3x + 4000} &= \frac{40}{57} \\ 57(2x + 4000) &= 40(3x + 4000) \\ 6x &= 68000 \\ 3x &= 34000 \end{aligned}$$

$$\text{Sumit's present salary} = (3x + 4000) = \text{Rs.}(34000 + 4000) = \text{Rs.}38,000$$

43. Option A

Originally, let the number of seats for Mathematics, Physics and Biology be  $5x$ ,  $7x$  and  $8x$  respectively.

Number of increased seats are (140% of  $5x$ ), (150% of  $7x$ ) and (175% of  $8x$ )

i.e.  $\left[ \frac{140}{100} \times 5x \right]$ ,  $\left[ \frac{150}{100} \times 7x \right]$  and  $\left[ \frac{175}{100} \times 8x \right]$  i.e.  $7x$ ,  $\frac{21x}{2}$  and  $14x$ .

So, required ratio =  $7x : \frac{21x}{2} : 14x = 14x : 21x : 28x = 2 : 3 : 4$

44. Option D

Let the third proportional to  $(x^2 - y^2)$  and  $(x - y)$  be  $z$ . Then,

$$(x^2 - y^2) : (x - y) :: (x - y) : z$$

$$(x^2 - y^2) \times z = (x - y)^2$$

$$z = \frac{(x - y)^2}{(x^2 - y^2)} = \frac{(x - y)}{(x + y)}$$

45. Option D

$$\frac{7}{15} = 0.466, \frac{15}{23} = 0.652, \frac{17}{25} = 0.68 \text{ and } \frac{21}{29} = 0.724$$

Clearly, 0.724 is greatest and therefore,  $21 : 29$  is greatest.

46. Option A

$$\begin{aligned} \text{The ratio of milk in 3 vessels} &= \frac{\frac{3}{4} \times \frac{5 \times 7}{5 \times 7} : \frac{2}{5} \times \frac{4 \times 7}{4 \times 7} : \frac{4}{7} \times \frac{4 \times 5}{4 \times 5}}{\frac{105}{140} : \frac{56}{140} : \frac{80}{140}} \end{aligned}$$

**Remember,** The value of 25 litre does not matter, the basic thing is that the amount of mixture in all the three quantities is same.

So, the total quantity of milk in mixture =  $105 + 56 + 80 = 241$

$$= [(3 \times 140) - 241] = 179 \text{ litre}$$

Therefore, ratio of water to milk in the new mixture =  $179 : 241$

47. Option D

Amount of alcohol in first vessel =  $0.25 \times 2 = 0.5$  litre

Amount of alcohol in second vessel =  $0.4 \times 6 = 2.4$  litre

Total amount of alcohol out of 10 litres of mixture is  $0.5 + 2.4 = 2.9$  litre

Hence, the concentration of the mixture is 29%  $\left[ = \frac{2.9}{10} \times 100 \right]$

48. Option D

Given ratio =  $\frac{1}{2} : \frac{2}{3} : \frac{3}{4} = 6 : 8 : 9$

So, 1<sup>st</sup> part = Rs.  $\left[ 782 \times \frac{6}{23} \right] = \text{Rs.}204$

49. Option C

Let the shares of A, B, C and D be Rs. $5x$ , Rs. $2x$ , Rs. $4x$  and Rs. $3x$  respectively.

Then,  $4x - 3x = 1000$

$x = 1000$

So, B's share = Rs. $2x$  = Rs. $(2 \times 1000)$  = Rs.2000

## Chapter - 5

# Partnership

When two or more people join hands with a common goal to attain profits, every partner invests either time, money or his patents to help partnership firm to reap profits.

There are many problems in partnerships regarding profit shares, investment period etc. Let us discuss each example one by one.

**Example 1** - Raj invested Rs 76000 in a business. After few months Monty joined him and invests Rs 57000. At the end of year both of them share the profits at the ratio of 2:1. After how many months Monty joined Raj?

**Solution** - We can simply compute per month investment of both partners Raj invested Rs 76,000 for 12 months and Monty invested Rs 57,000 for x months.

$$\text{Now } \frac{76000 \times 12}{57000 \times x} = 2 : 1$$

$$\Rightarrow \frac{76 \times 12}{2} = 56x \\ \Rightarrow x = 8$$

So Monty invested his money for 8 months and he joined after 4 months

**Example 2** - A and B started a business by investing money in ratio of 5:6. C joined them after few months by sharing an amount equal to B's share. At the end of year 20% profit was earned which was equal to Rs 98,000. How much money was invested by C?

**Solution** - = First of all we will calculate the weighted ratios

$$\Rightarrow A = 5 \times 12 = 60 \\ \Rightarrow B = 6 \times 12 = 72 \\ \Rightarrow C = 6 \times 6 = 36$$

$$\text{Total investment at the end of year} = 98000 \times \frac{100}{20} = \text{Rs } 4,90,000 \\ \Rightarrow \text{Investment by C} = \frac{490000 \times 36}{168 \times 2} = \text{Rs } 210000$$

**Example 3** - A, B and C shared profits in ratio of 5 : 7 : 8. They partnered for 14 months, 8 months and 7 months respectively. What was the ratio of their investments?

**Solution** - Simply multiply profit sharing ratio with investment ratio to get investment amount ratio.

Let X is the total investment

$$\Rightarrow 14x = 5$$

$$\Rightarrow 8x = 7$$

$$\Rightarrow 7x = 8$$

⇒ Final investment ratio = 20 : 49 : 64

## **Exercise - 5**

- 7) Kamal started a business investing Rs.9000. After five months, Sameer joined with a capital of Rs.8000. If at the end of the year, they earn a profit of Rs.6970, then what will be the shares of sameer in the profit?  
a) Rs.1883.78      b) Rs.2380      c) Rs.3690  
d) Rs.3864      e) None of these
- 8) Murugan, Prasanna and Arun invested Rs.8000, Rs.4000 and Rs.8000 respectively in a business. Arun left after six months .If after eight months, there was a gain of Rs.4005, then what will be the share of Prasanna?  
a) Rs.890      b) Rs.1335      c) Rs.1602  
d) Rs. 1780      e) None of these
- 9) A, B and C enter into a partnership. They invest Rs.40,000, Rs.80,000 and Rs.1,20,000 respectively. At the end of the first year, B withdraws Rs.40,000 while at the end of the second year, C withdraws Rs.80,000. In what ratio will the profit be shared at the end of 3 years?  
a) 2 : 3 : 5      b) 3 : 4 : 7      c) 4 : 5 : 9  
d) Data inadequate      e) None of these
- 10) A starts a business with Rs.3500 and after 5 months, B joins with A as his partner. After a year, the profit is divided in the ratio 2 : 3. What is B's contribution in the capital?  
a) Rs.7500      b) Rs.8000      c) Rs.8500  
d) Rs.9000      e) None of these
- 11) A started a business with Rs.21,000 and is joined afterwards by B with Rs.36,000. After how many months did B join if the profits at the end of the year are divided equally?  
a) 3      b) 4      c) 5  
d) 6      e) None of these
- 12) X and Y invested in a business. They earned some profit which they divided in the ratio of 2 : 3. If X invested Rs.40,000. the amount invested by Y is  
a) Rs.45,000      b) Rs.50,000      c) Rs.60,000  
d) Rs.80,000      e) None of these
- 13) A and B started a business in partnership investing Rs.20,000 and Rs.15,000 respectively. After six months, C joined them with Rs.20,000. What will be B's share in the total profit of Rs.25,000 earned at the end of 2 years from the starting of the business?  
a) Rs.7500      b) Rs.9000      c) Rs.9500  
d) Rs.10, 000      e) None of these
- 14) A, B, C hired a car for Rs.520 and used it for 7,8 and 11 hours respectively. Hire charges paid by B were  
a) Rs.140      b) Rs.160      c) Rs.180  
d) Rs.220      e) None of these





- 30) A, B, C enter into a partnership investing Rs.35,000, Rs.45,000 and Rs.55,000 respectively. The respective shares of A, B, C in an annual profit of Rs.40,500 are :
- Rs.10,500, Rs.13,500, Rs.16,500
  - Rs.11,500, Rs.13,000, Rs.16,000
  - Rs.11,000, Rs.14,000, Rs.15,500
  - Rs.11,500, Rs.12,500, Rs.16,500
  - None of these

## Solutions

1. Option B

$$\begin{aligned} \text{Ratio of their shares} &= (35000 \times 8) : (42000 \times 10) \\ &= 2 : 3 \\ \text{Reena's share} &= \text{Rs.}(31570 \times 2/5) \\ &= \text{Rs.12628.} \end{aligned}$$

Option B

$$\begin{aligned} 2. \text{Aman : Rakhi : Sagar} &\\ &= (70000 \times 36) : (105000 \times 30) : 140000 \times 24 \\ &= 12 : 15 : 16 \end{aligned}$$

3. Option D

$$\begin{aligned} P : Q &= 85000 : 15000 \\ &= 85 : 15 \\ &= 17 : 3 \end{aligned}$$

4. Option C

$$\text{Simran : Nanda} = 50000 \times 36 : 80000 \times 30 = 3 : 4$$

$$\begin{aligned} &= (5000 \times 36) : (80000 \times 30) \\ &= 3 : 4 \\ \text{Simran's share} &= \text{Rs.}(24500 \times 3/7) \\ &= \text{Rs.10,500} \end{aligned}$$

$$\text{Simran's share} = \text{Rs.}24500 \times \frac{3}{7} = \text{Rs.}10500$$

5. Option C

Let the initial investments of A and B be  $3x$  and  $5x$ .

$$\begin{aligned} A : B : C &= (3x \times 12) : (5x \times 12) : (5x \times 6) \\ &= 36 : 60 : 30 \end{aligned}$$

$$= 6 : 10 : 5$$

6. Option C

Ratio of their shares	$= 22500 : 35000$
	$= 9 : 14$
Deepak's share	$= \text{Rs.}(13800 \times 14/23)$
	$= \text{Rs. } 8400$

7. Option B

Kamal : Sameer	$=(9000 \times 12) : (8000 \times 7)$
	$= 108 : 56$
	$= 27 : 14$
Sameer's share	$= \text{Rs.}(6970 \times 14/41)$
	$= \text{Rs. } 2380$

8. Option A

Murugan : Prasanna : Arun	$=(8000 \times 6) : (4000 \times 8) : (8000 \times 8)$
	$= 48 : 32 : 64$
	$= 3 : 2 : 4$
Kamal's share	$= \text{Rs.}(4005 \times 2/9)$
	$= \text{Rs. } 890$

9. Option B

A : B: C	$=(40000 \times 36) : (80000 \times 12 + 40000 \times 24) : (120000 \times 24 + 40000 \times 12)$
	$= 144 : 192 : 336$
	$= 3 : 4 : 7$

10. Option D

$$\begin{aligned} \text{Let B's capital be Rs.}x. \text{ Then,} \\ 3500 \times 12 / 7x &= 2/3 \\ \Leftrightarrow 14x &= 126000 \\ x &= 9000 \end{aligned}$$

11. Option C

Suppose B joined after x months.

Then,

$$\begin{aligned} 21000 \times 12 &= 36000 \times (12 - x) \\ \Leftrightarrow 36x &= 180 \\ \Rightarrow x &= 5 \end{aligned}$$

12. Option C

Suppose Y invested Rs.y

Then,

$$\begin{aligned} 40000 / y &= 2 / 3 \\ \Leftrightarrow y &= (40000 \times 3 / 2) \\ \Leftrightarrow y &= 60000. \end{aligned}$$

13. Option A

A : B : C

$$\begin{aligned} &= (20000 \times 24) : (15000 \times 24) : (20000 \\ &\quad \times 18) \\ &= 4 : 3 : 3 \end{aligned}$$

B's share

$$\begin{aligned} &= \text{Rs.} \left[ 25000 \times \frac{3}{10} \right] \\ &= \text{Rs.} 7500 \end{aligned}$$

14. Option B

A : B : C

$$= 7 : 8 : 11$$

Hire charges paid by B

$$\begin{aligned} &= \text{Rs.} \left[ 520 \times \frac{8}{26} \right] \\ &= \text{Rs.} 160 \end{aligned}$$

15. Option A

A : B : C

$$\begin{aligned} &= [10 \times 7] : [12 \times 5] : (15 \times 3) \\ &= 70 : 60 : 45 \\ &= 14 : 12 : 9 \end{aligned}$$

C's rent

$$\begin{aligned} &= \text{Rs.} \left[ 17 \right. \\ &\quad \left. 5 \times \frac{9}{35} \right] \\ &= \text{Rs.} 45. \end{aligned}$$

16. Option B

Sekar:Rajeev:Jatin =

$$\begin{aligned} &[25000 \times 12 + 35000 \times 12 + 4 \\ &\quad 5000 \times 12 : 35000 \times 24] : \\ &\quad [35000 \times 12] \\ &= 1260000 : 840000 : \end{aligned}$$

Rajeev's share

$$\begin{aligned} & \frac{420000}{= 3 : 2 : 1.} \\ & = \text{Rs.} \left[ 150000 \times \frac{2}{6} \right] \\ & = \text{Rs.} 50000. \end{aligned}$$

17. Option B

Let the total profit be Rs. 100.

$$\text{After paying to charity, A's share} = \left( 95 \times \frac{3}{5} \right) = \text{Rs.} 57.$$

If A's share is Rs. 57, total profit = Rs. 100.

$$\text{If A's share Rs.} 855, \text{total profit} = \left( \frac{100}{57} \times 855 \right) = 1500$$

18. Option B

For managing, A received = 5% of Rs. 7400 = Rs. 370.

Balance = Rs. (7400 - 370) = Rs. 7030.

Ratio of their investments =  $(6500 \times 6) : (8400 \times 5) : (10000 \times 3)$

$$= 39000 : 42000 : 30000$$

$$= 13 : 14 : 10$$

$$\text{B's share} = \text{Rs.} \left[ 7030 \times \frac{14}{37} \right] = \text{Rs.} 2660$$

19. Option D

$$\text{Ration of initial investments} = \left[ \frac{7}{2} : \frac{4}{3} : \frac{6}{5} \right] = 105 : 40 : 36$$

Let the initial investments be 105x, 40x and 36x.

$$\begin{aligned} \text{A : B : C} &= \left[ 105x \times 4 + \frac{150}{100} \times 105x \times 8 \right] : [40x \times 12] : [36x \times 12] \\ &= 1680x : 480x : 432x = 35 : 10 : 9 \end{aligned}$$

$$\begin{aligned} \text{Hence, B's Share} &= \text{Rs.} \left[ 21600 \times \frac{10}{54} \right] \\ &= \text{Rs.} 4000 \end{aligned}$$

20. Option D

Let C = x.

Then, B = x + 5000 and A = x + 5000 + 4000 = x + 9000.

So, x + x + 5000 + x + 9000 = 50000

$$\Rightarrow 3x = 36000$$

$$\Rightarrow x = 12000$$

$$\text{A : B : C} = 21000 : 17000 : 12000 = 21 : 17 : 12$$

$$\text{A's Share} = \text{Rs.} \left[ 35000 \times \frac{21}{50} \right] = 14700$$

## 21. Option B

Let their investments be Rs.x for 14 months, Rs.y for 8 months and Rs.z for 7 months respectively.

Then,  $14x : 8y : 7z = 5 : 7 : 8$

$$\text{Now, } \frac{14x}{8y} = \frac{5}{7}$$

$$= 98x = 40y$$

$$= y = \frac{49}{20} \times$$

$$\text{And, } \frac{14x}{7z} = \frac{5}{8}$$

$$= 112x = 35z$$

$$= z = \frac{112}{35}x = \frac{16}{5}x$$

$$x : y : z = x : \frac{49}{20}x : \frac{16}{5}x$$

$$= 20 : 49 : 64$$

## 22. Option A

$$\begin{aligned} A : B &= \left[ 4x \times 3 + \left[ 4x - \frac{1}{4} \times 4x \right] \times 7 \right] : \left[ 5x \times 3 + \left[ 5x - \frac{1}{5} \times 5x \right] \times 7 \right] \\ &= (12x + 21x) : (15x + 28x) \\ &= 33x : 43x \\ &= 33 : 43 \end{aligned}$$

$$\text{A's Share} = \text{Rs. } \left[ 760 \times \frac{33}{76} \right] = \text{Rs. } 330$$

## 23. Option D

Suppose B joined for  $x$  months. Then,

$$\text{Then, } \left[ \frac{85000 \times 12}{42500 \times x} \right] = \frac{3}{1}$$

$$x = \left[ \frac{85000 \times 12}{42500 \times 3} \right] = 8$$

So, B joined for 8 months

$$\frac{2}{9} \left[ \frac{2}{9} \right] = 890$$

## 24. Option C

$$A : B = 3 : 2$$

$$B : A = 2 : 3 = 4 : 6 \text{ and } A : C = 2 : 1 = 6 : 3$$

$$\text{So, } B : A : C = 4 : 6 : 3 \text{ or } A : B : C = 6 : 4 : 3$$

$$\text{B's share} = \text{Rs.} \left[ 157300 \times \frac{4}{13} \right] = \text{Rs.} 48400$$

25. Option C

$$\text{Ratio of their shares} = 22500 : 35000 = 9 : 14$$

$$\text{Deepak's share} = \text{Rs.} \left[ 13800 \times \frac{14}{23} \right] = \text{Rs.} 8400$$

26. Option E

$$\begin{aligned} \text{A : B : C} &= (25 \text{ lakhs} \times 1) + (35 \text{ lakhs} \times 2) : (35 \text{ lakhs} \times 2 + 25 \text{ lakhs} \times 1) : (30 \text{ lakhs} \times 3) \\ &= 95 \text{ lakhs} : 95 \text{ lakhs} : 90 \text{ lakhs} = 19 : 19 : 18 \end{aligned}$$

27. Option D

Suppose B invested Rs. x for y months. Then, A invested Rs. 3x for 2y months.

$$\text{So, A : B} = (3x \times 2y) : (x \times y) = 6xy : xy = 6 : 1$$

So, B's profit : total profit = 1 : 7

$$\text{Let the total profit be Rs. x. Then, } \frac{1}{7} = \frac{4000}{x} \text{ or } x = 28000$$

28. Option A

$$\text{A : B : C} = 27000 : 72000 : 81000 = 3 : 8 : 9$$

$$\text{So, C's share : total profit} = 9 : 20$$

$$\text{Let the total profit be Rs. x. Then, } \frac{9}{20} = \frac{36000}{x} \text{ or } x = \frac{36000 \times 20}{9} = 80000$$

29. Option C

Let the total profit be Rs. z. Then,

$$\text{B's share} = \text{Rs.} \frac{2z}{3}, \text{ A's share} = \text{Rs.} \left[ z - \frac{2z}{3} \right] = \text{Rs.} \frac{z}{3}$$

$$\text{So, A : B} = \frac{z}{3} : \frac{2z}{3} = 1 : 2$$

Let the total capital be Rs. x and suppose B's money was used for x months. Then,

$$\frac{\frac{1}{4}x \times 15}{\frac{3}{4}x \times y} = \frac{1}{2}$$

$$y = \left[ \frac{15 \times 2}{3} \right] = 10$$

Thus, B's money was used for 10 months.

30. Option A

$$\text{A : B : C} = 35000 : 45000 : 55000 = 7 : 9 : 11$$

$$\text{A's share} = \text{Rs.} \left[ 40500 \times \frac{7}{27} \right] = \text{Rs.} 10500$$

$$\text{B's share} = \text{Rs.} \left[ 40500 \times \frac{9}{27} \right] = \text{Rs.} 13500$$

$$\text{C's share} = \text{Rs.} \left[ 40500 \times \frac{11}{27} \right] = \text{Rs.} 16500$$

## Chapter - 6

# Permutation and Combination

Permutation implies arrangement where order of things is important. It includes various patterns like word formation, number formation, circular permutation etc. Combination means selection where order is not important. It involves selection of team, forming geometrical figures, distribution of things etc.

Factorial = Factorial are defined for natural numbers, not for negative numbers.

$$n! = n.(n-1).(n-2) \dots \dots \dots 3.2.1$$

For example: 1)  $4! = 4.3.2.1 = 24$

$$2) \frac{6!}{4!} = \frac{6.5.4!}{4!} = \frac{6.5}{1} = 30$$

$$3) 0! = 1$$

PERMUTATION	COMBINATION
Implies Arrangement	Implies Selection
Order of things is important	Order of things is NOT important
Permutation of three things a, b and c taking two at a time are ab, ba, ac, ca, bc and cb (Order is important).	Combination of three things a,b and c taking two at a time are ab, ca and cb (Order is not important).
$nPr = \frac{n!}{(n-r)!}$	$nCr = \frac{n!}{(n-r)!} r!$
$nPn = n!$	$nCn = 1$
$n_{p0} = 1$	$n_{C0} = 1$

### Example of Word Formation:

**Example - 1:** How many new words can be formed with the word "PATNA"?

Solution: In word "PATNA", P,T,N occurs once and A occurs twice.

\*\*\*\*Always remember in word formation, if word repeats, number of repetition will be in denominator.

So, total number of words that can be formed =  $\frac{5!}{2!} = 60$  i.e.  $\frac{\text{total number of letters}}{\text{repetition}}$

Therefore, except PATNA there are 59 new words (60-1).

**Example – 2 :** How many words can be formed from the letters of the word "EXAMINATION"?

Solution: E, X, M, T, O : Occurs ONCE

A, I, N : Twice

So, total number of words =  $\frac{11!}{2! 2! 2!}$

(Total number of letters=11 and 3 letters are occurring twice)

### Problems for practice

**Problem 1:** Choose permutation or combination in following terms:-

1) Selection of captain and bowler for a play.

Permutation

2) Selection of four students for a lecture.

Combination

3) Assigning people to their seats during conference.

Permutation

**Problem 2:** Evaluate 7P2, 4P3

$$\text{Solution: } \left[ \frac{7!}{5!} \right] \left[ \frac{4!}{1!} \right]$$

$$\Rightarrow (7 \times 6) \cdot (4 \times 3 \times 2)$$

$$\Rightarrow 1008$$

**Problem 3:** Evaluate 5C2, 3C2

$$\text{Solution: } \left[ \frac{5!}{3! 2!} \right] \left[ \frac{3!}{2! 1!} \right]$$

$$\Rightarrow \left[ \frac{5 \times 4}{2} \right] \cdot [3]$$

$$\Rightarrow 30$$

**Problem 4:** How many ways are there in selecting 5 members from 6 males and 5 females, consisting 3 males and 2 females?

Solution: This is a case of combination i.e. selecting 3 males from 6 males and 2 females from 5 females.

$\Rightarrow$  Required number of ways =  $(^6C_3 \times ^5C_2)$

$$\frac{6!}{3! 3!} \times \frac{5!}{2! 3!}$$

$$\Rightarrow \left[ \frac{6 \times 5 \times 4}{3 \times 2} \right] \times \left[ \frac{5 \times 4}{2} \right]$$

$$\Rightarrow 200$$

**Problem 5:** How many words can be formed by using letters of the word "DAUGHTER" so that the vowels come together?

Solution: This is a case of permutation. In a word "DAUGHTER", there are 8 letters including 3 vowels (AUE)

According to the question, vowels should always come together. Therefore, in this case we will treat all the vowels as one entity or one alphabet. This implies, in total there are 6 words (one word which is a group of vowels)

These 6 words can be arranged in  ${}^6P_6$  ways

$$\Rightarrow {}^6P_6 = \frac{6!}{1!} = 6! = 720 \text{ WAYS}$$

Also, three vowels in a group may be arranged in  $3!$  ways

$$\Rightarrow 3! = 6 \text{ ways}$$

Therefore, required number of words =  $(720 \times 6) = 4320$

### Exercise - 6

- 1) From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there on the committee. In how many ways can it be done?
  - a) 564
  - b) 645
  - c) 735
  - d) 756
  - e) None of these
  
- 2) In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?
  - a) 360
  - b) 480
  - c) 720
  - d) 5040
  - e) None of these
  
- 3) In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?
  - a) 810
  - b) 1440
  - c) 2880
  - d) 50400
  - e) None of these
  
- 4) Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?
  - a) 210
  - b) 1050
  - c) 25200
  - d) 21400
  - e) None of these
  
- 5) In how many ways can the letters of the word 'LEADER' be arranged?
  - a) 72
  - b) 144
  - c) 360
  - d) 72
  - e) None of these



- 15) How many different words can be made using the letters of the word 'HALLUCINATION' if all consonants are together?  
a) 129780      b) 1587600      c) 35600  
d) Data inadequate      e) None of these
- 16) If all S's come together, then in how many ways the letters of the word 'SUCCESSFUL' be arranged?  
a) 10080      b) 40080      c) 2378  
d) Data inadequate      e) None of these
- 17) In how many different ways can 6 different balls be distributed to 4 different boxes, when each box can hold any number of ball?  
a) 2048      b) 1296      c)  $(24)^2$   
d) 4096      e) None of these
- 18) What is the total number of 4 digit numbers that can be formed using the digits 0, 1, 2, 3, 4, 5 without repetition, such that the number is divisible by 9?  
a) 36      b) 28      c) 15  
d) 18      e) None of these
- 19) Seven delegates are to address a meeting. If a particular speaker is to speak before another particular speaker, find the number of ways in which this can be arranged.  
a) 1220      b) 2520      c) 3250  
d) 7826      e) None of these
- 20) In how many ways can 15 billiard balls be arranged in a row if 3 are red, 4 are white and 8 are black?  
a) 12      b) 18      c) 96  
d) Data inadequate      e) None of these
- 21) In how many ways can 4 books be arranged out of 16 books on different subjects?  
a) 34650      b) 43680      c) 43890  
d) Data inadequate      e) None of these
- 22) Four dice are rolled. The number of possible outcomes in which atleast one die shows 4 is :  
a) 671      b) 168      c) 176  
d) Data inadequate      e) None of these
- 23) In how many ways can the letters of the word APPLE be arranged?  
a) 720      b) 120      c) 60  
d) 180      e) None of these
- 24) In how many different ways can the letters of the word 'RUMOUR' be arranged?  
a) 180      b) 90      c) 30  
d) 720      e) None of these

- 25) A number plate of a vehicle has always a fixed code UP-32 for Lucknow city followed by the number of particular vehicle which is in two parts. First part is occupied by 2 English alphabets and second part is occupied by 4 digit numbers (0001, 0002, .... 9999). If the latest registration number of vehicle [UP-32-SK-0123] find the number of vehicles registered before this vehicle number in Lucknow.
- a) 2449744      b) 4779644      c) 4669235  
d) 9235888222      e) None of these
- 26) The number of positive integral solutions of  $abc = 42$  is :
- a) 17      b) 27      c) 21  
d)  $3! \times 42$       e) None of these
- 27) A four digit number is formed with the digits 1, 3, 4, 5 without repetition. Find the chance that the number is divisible by 5 :
- a)  $\frac{3}{4}$       b)  $\frac{1}{4}$       c)  $\frac{9}{16}$   
d)  $\frac{1}{16}$       e) None of these
- 28) 20 girls, among whom are A and B sit down at a round table. The probability that there are 4 girls between A and B is :
- a)  $\frac{17}{19}$       b)  $\frac{2}{19}$       c)  $\frac{13}{19}$   
d)  $\frac{6}{19}$       e) None of these
- 29) The probability that the birthdays of 4 different persons will fall in exactly two calendar months is :
- a)  $\frac{77}{1728}$       b)  $\frac{17}{87}$       c)  $\frac{11}{144}$   
d) Data inadequate      e) None of these
- 30) A committee of five persons is to be chosen from a group of 9 people. The probability that a certain married couple will either serve together or not at all is :
- a) 4/9      b) 5/9      c) 13/18  
d) Data inadequate      e) None of these
- 31) In how many different ways can the letters of the word ‘SOFTWARE’ be arranged in such a way that the vowels always come together?
- a) 120      b) 360      c) 1440  
d) 13440      e) 720
- 32) In how many different ways can the letters of the word ‘AUCTION’ be arranged in such a way that the vowels always come together?
- a) 30      b) 48      c) 144  
d) 576      e) None of these

## Solutions

- ### 1. Option D

$$\therefore \text{Required number of ways} = (^7C_3 \times ^6C_2) + (^7C_4 \times ^6C_1) + (^7C_5)$$

$$\begin{aligned}
 &= \left( \frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{6 \times 5}{2 \times 1} \right) + ({}^7C_3 \times {}^6C_1) + ({}^7C_2) \\
 &= 525 + \left( \frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times 6 \right) + \left( \frac{7 \times 6}{2 \times 1} \right) \\
 &= (525 + 210 + 21) \\
 &= 756
 \end{aligned}$$

- ## 2. Option C

The word 'LEADING' has 7 different letters.

When the vowels EAI are always together, they can be supposed to form one letter. Then, we have to arrange the letters LNDG (EAI).

Now, 5 ( $4 + 1 = 5$ ) letters can be arranged in  $5! = 120$  ways.

The vowels (EAI) can be arranged among themselves in  $3! = 6$  ways.

∴ Required number of ways =  $(120 \times 6) = 720$

- ### 3. Option D

In the word 'CORPORATION', we treat the vowels OOAIO as one letter. Thus, we have CRPRTN (OOAIO).

This has 7 (6 + 1) letters of which R occurs 2 times and the rest are different.

$$\text{Number of ways arranging these letters} = \frac{7!}{2!} = 2520.$$

Now, 5 vowels in which O occurs 3 times and the rest are different, can be arranged in  $\frac{5!}{3!} = 20$  ways.

$$\text{Required number of ways} = (2520 \times 20) = 50400$$

4. Option C

Number of ways of selecting (3 consonants out of 7) and (2 vowels out of 4)  
 $= {}^7C_3 \times {}^4C_2$

$$= \left( \frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{4 \times 3}{2 \times 1} \right)$$

$$= 210$$

Number of groups, each having 3 consonants and 2 vowels = 210.

Each group contains 5 letters.

Number of ways of arranging 5 letters among themselves

$$= 5 \times 4 \times 3 \times 2 \times 1$$

$$= 120.$$

$$\therefore \text{Required number of ways} = (210 \times 120) = 25200$$

5. Option C

The word 'LEADER' contains 6 letters, namely 1L, 2E, 1A, 1D and 1R.

$$\text{Required number of ways} = \frac{6!}{(1!)(2!)(1!)(1!)(1!)} = 360$$

6. Option D

We may have (1 boy and 3 girls) or (2 boys and 2 girls) or (3 boys and 1 girl) or (4 boys).

$$\begin{aligned} \text{Required number of ways} &= ({}^6C_1 \times {}^4C_3) + ({}^6C_2 \times {}^4C_2) + ({}^6C_3 \times {}^4C_1) + ({}^6C_4) \\ &= ({}^6C_1 \times {}^4C_1) + ({}^6C_2 \times {}^4C_2) + ({}^6C_3 \times {}^4C_1) + ({}^6C_2) \\ &= (6 \times 4) + \left[ \frac{6 \times 5}{2 \times 1} \times \frac{4 \times 3}{2 \times 1} \right] + \left[ \frac{6 \times 5 \times 4}{3 \times 2 \times 1} \times 4 \right] + \left[ \frac{6 \times 5}{2 \times 1} \right] \\ &= (24 + 90 + 80 + 15) \end{aligned}$$

$$= 209$$

7. Option D

Since each desired number is divisible by 5, so we must have 5 at the unit place. So, there is 1 way of doing it.

The tens place can now be filled by any of the remaining 5 digits (2, 3, 6, 7, 9). So, there are 5 ways of filling the tens place.

The hundreds place can now be filled by any of the remaining 4 digits. So, there are 4 ways of filling it.

$$\text{Required number of numbers} = (1 \times 5 \times 4) = 20$$

8. Option C

$$\text{Required number of ways} = ({}^8C_5 \times {}^{10}C_6)$$

$$= ({}^8C_3 \times {}^{10}C_4)$$

$$= \left[ \frac{8 \times 7 \times 6}{3 \times 2 \times 1} \times \frac{10 \times 9 \times 8 \times 7}{4 \times 3 \times 2 \times 1} \right]$$

$$= 11760$$

9. Option C

We may have (1 black and 2 non-black) or (2 black and 1 non-black) or (3 black)

$$\text{Required number of ways} = ({}^3C_1 \times {}^6C_2) + ({}^3C_2 \times {}^6C_1) + ({}^3C_3)$$

$$= \left[ 3 \times \frac{6 \times 5}{2 \times 1} \right] + \left[ \frac{3 \times 2}{2 \times 1} \times 6 \right] + 1$$

$$= (45 + 18 + 1)$$

$$= 64$$

10. Option C

There are 6 letters in the given word, out of which there are 3 vowels and 3 consonants.

Let us mark these positions as under:

$$(1) (2) (3) (4) (5) (6)$$

Now, 3 vowels can be placed at any of the three places out 4, marked 1, 3, 5

$$\text{Number of ways of arranging the vowels} = {}^3P_3 = 3! = 6$$

Also, the 3 consonants can be arranged at the remaining 3 positions.

Number of ways of these arrangements =  ${}^3P_3 = 3! = 6$

Total number of ways =  $(6 \times 6) = 36$

11. Option A

$$\text{Required number of ways} = ({}^7C_5 \times {}^3C_2) = ({}^7C_2 \times {}^3C_1) = \left[ \frac{7 \times 6}{2 \times 1} \times 3 \right] = 63$$

12. Option C

In the word ‘MATHEMATICS’, we treat the vowels AEAI as one letter.

Thus, we have MTHMTCS (AEAI).

Now, we have to arrange 8 letters, out of which M occurs twice, T occurs twice and the rest are different.

$$\text{Number of ways of arranging these letters} = \frac{8!}{(2!)(2!)} = 10080$$

Now, AEAI has 4 letters in which A occurs 2 times and the rest are different.

$$\text{Number of ways of arranging these letters} = \frac{4!}{(2!)} = 12$$

$$\text{Required number of words} = (10080 \times 12) = 120960$$

13. Option B

The word ‘OPTICAL’ contains 7 different letters.

When the vowels OIA are always together, they can be supposed to form one letter.

Then, we have to arrange the letters PTCL (OIA).

Now, 5 letters can be arranged in  $5! = 120$  ways

The vowels (OIA) can be arranged among themselves in  $3! = 6$  ways

$$\text{Required number of ways} = (120 \times 6) = 720$$

14. Option C

$$9 \times 9 \times 9 \times 9 = 9^4$$

15. Option B

$$\begin{array}{ccccccc} H & L & C & N & T & & A & U & I & O \\ & L & & N & & & A & & I & \end{array}$$

There are total 13 letters out of which 7 are consonants and 6 are vowels. Also there are 2L's, 2N's, 2A's and 2I's

If all the consonants are together then the number of arrangements =  $\frac{7!}{(2!)(2!)} = 7!$

But the consonants can be arranged themselves in  $\frac{7!}{(2!)(2!)} = 7!$  ways.

$$\text{Hence the required number of ways} = \frac{7!}{(2!)(2!)} \times \frac{7!}{(2!)(2!)} = 7! \times 7! = 49 \times 7! = 49 \times 5040 = 247920$$

$$= (1260)^2 = 1587600$$

16. Option E

$$S \ U \ C \ E \ F \ L$$

S U C

S

There are 10 letters in the word SUCCESSFUL and S occurs 3 times, U occurs 2 times and C occurs 2 times.

The letters of the word SUCCESSFUL can be arranged in

$$= \frac{10!}{3! \times 2! \times 2!} \text{ ways}$$

$$= 151200 \text{ ways}$$

17. Option D

Every ball can be distributed in 4 ways.

$$\begin{aligned} \text{Hence the required number of ways} &= 4 \times 4 \times 4 \times 4 \times 4 \times 4 \\ &= 4^6 = 4096 \end{aligned}$$

18. Option A

There are two sets of numbers 0, 1, 3, 5 and 0, 2, 3, 4.

Therefore number of 4 digit numbers using digits 0, 1, 3, 5 =  $3 \times 3 \times 2 \times 1 = 18$

Similarly number of 4 digit numbers using digits 0, 2, 3, 4 =  $3 \times 3 \times 2 \times 1 = 18$

Hence the total required numbers =  $18 + 18 = 36$

19. Option B

Total number of ways =  $7!$

Let A has to speak before B.

Now since there are half of the total cases in which A speaks before B (similarly in half of the total cases B speaks before A)

$$\text{Required number of ways} = \frac{1}{2} \times 7! = 2520$$

20. Option C

$$\text{Required number of ways} = \frac{15!}{3! \times 4! \times 8!}$$

$$= 96$$

21. Option B

$$16p4 = 43680$$

22. Option A

Total number of possible outcomes =  $6^4$

The number of possible outcomes in which 4 does not appear on any die is  $5^4$ .

Therefore the number of possible outcomes in which atleast one die shows digit 4 =  $6^4 - 5^4 = 671$

23. Option C

The word APPLE contains 5 letters, 1A, 2P, 1L and 1E.

$$\text{Required number of ways} = \frac{5!}{(1!) (2!) (1!) (1!)} = 60$$

24. Option A

The word ‘RUMOUR’ contains 6 letters, namely 2R, 2U, 1M and 1U.

$$\text{Required number of ways} = \frac{6!}{(2!) (2!) (1!) (1!)} = 180$$

25. Option B

Number of vehicles registered upto RZ 9999

$$= 18 \times 26 \times (9999)$$

Number of vehicles registered between SA-0001 and SJ 9999 =  $1 \times 10 \times 9999$

Therefore number of vehicles registered before SK-0123

$$= 18 \times 26 \times 9999 + 1 \times 10 \times 9999 + 122$$

$$= 9999 \times 478 + 122 = 4779644$$

26. Option B

$$42 = 2 \times 3 \times 7$$

Here each of a, b and c can take 3 values.

Hence the required number of solutions =  $3 \times 3 \times 3 = 27$

27. Option B

Total possible number of 4 digits =  $4! = 24$

The number is divisible by 5 if unit digit itself is 5. Therefore we fix 5 at unit place and then remaining 3 places can be filled up in  $3!$  Ways.

$$\text{Hence, the required probability} = \frac{3!}{4!} = \frac{6}{24} = \frac{1}{4}$$

28. Option B

20 girls can be seated around a round table in  $19!$  Ways.

So, exhaustive number of cases =  $19!$

Excluding A and B, out of remaining 18 girls, 4 girls can be selected  ${}^{18}C_4$  ways which can be arranged in  $4!$  Ways. Remaining  $20 - (4 - 2) = 14$  girls can be arranged in  $14!$  Ways. Also A and B mutually can be arranged in  $2!$  Ways.

Required number of arrangements =  ${}^{18}C_4 \times 4! \times 2! \times 14!$

$$= 18! \times 2$$

$$\text{Required probability} = \frac{18! \times 2}{19!} = \frac{2}{19}$$

29. Option A

Since a person's birthday can fall in any of the 12 months.

So, total number of ways =  $12^4$

Now, any two months can be chosen in  ${}^{12}C_2$  ways. The 4 persons birthday can fall in these two months in  $2^4$  ways. Out of these  $2^4$  ways there are two ways when all of the four birthdays fall in one month.

So, favourable number of ways =  ${}^{12}C_2 \times (2^4 - 2)$

$$\frac{77}{12^4} = \frac{77}{1728}$$

30. Option A

Total number of ways in which 5 people can be chosen out of 9 people =  ${}^9C_5 = 126$

Number of ways in which the couple serves the committee =  ${}^7C_3 \times {}^2C_2 = 35$

Number of ways in which the couple does not serve the committee =  ${}^7C_5 = 21$

Favourable number of cases =  $35 + 21 = 56$

Hence, the required probability =  $\frac{56}{126} = \frac{4}{9}$

31. Option E

The word 'SOFTWARE' contains 8 different letters.

When the vowels OAE are always together, they can be supposed to form one letter.

Thus, we have to arrange the letters SFTWR (OAE).

Now, 5 letters can be arranged in  $6! = 720$  ways

The vowels (OAE) can be arranged among themselves in  $3! = 6$  ways.

Required number of ways =  $(720 \times 6) = 4320$

32. Option D

The word AUCTION has 7 different letters.

When the vowels AUIO are always together, they can be supposed to form one letter.

Then, we have to arrange the letters CTN (AUIO).

Now, 4 letters can be arranged in  $4! = 24$  ways.

The vowels (AUIO) can be arranged among themselves in  $4! = 24$  ways.

Required number of ways =  $(24 \times 24) = 576$

33. Option B

In order that two books on Hindi are never together, we must place all these books as under:

X E X E X E X .... X E X

Where E denotes the position of an English book and X that of a Hindi book.

Since there are 21 books on English, the number of places marked X are therefore, 22

Now, 19 places out of 22 can be chosen in  ${}^{22}C_{19} = {}^{22}C_3 = \frac{22 \times 21 \times 20}{3 \times 2 \times 1} = 1540$  ways

Hence, the required number of ways = 1540

34. Option B

Out of 30 numbers 2 numbers can be chosen in  ${}^{30}C_2$  ways.

So, exhaustive number of cases =  ${}^{30}C_2 = 435$

Since  $a^2 - b^2$  is divisible by 3 if either a and b are divisible by 3 or none of a and b is divisible by 3. Thus, the favourable numbers, of cases =  ${}^{10}C_2 + {}^{20}C_2 = 235$

Hence, required probability =  $\frac{235}{435} = \frac{47}{87}$

35. Option C

Required probability =  $\frac{4}{52} \times \frac{3}{51} = \frac{1}{221}$

## Chapter - 7

# Probability

Probability is one of the important chapter for IBPS and other competitive exams like CAT. Questions in this chapter are relatively easier than other chapters. Most of the time set of 4-5 questions is asked in competitive exams which can be solved in minutes. Try to read permutation and combination chapter before startintg this chapter.

$$\text{Probability} = \frac{\text{occurrence of event}}{\text{total possible events}}$$

Occurrence of event/Total possible events

### **Simple probability problem**

Simplest questions asked in bank exams are asked about deck of cards, dice and coins. There is no co-occurrence of events.

Let's take an example:-

Question -One card is drawn from a deck of 52 cards. Find the probability that it is a black queen or king.

Simple solution to this problem is  $\frac{2}{52} = \frac{1}{26}$   $\left[ \frac{\text{occurrence of black queen or king}}{\text{total number of cards}} \right]$

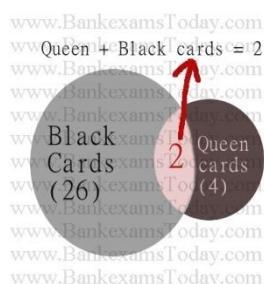
### **Venn Diagram**

**Question** - One card is drawn from a deck of 52 cards. Each card is equally likely to be drawn. Find the probability that card drawn is either black or queen.

In this question, generally we use a simple formula

$$P(AB) = A \cup B \cap AB$$

Don't be confused with the formula. Give a look to this diagram



In a deck of cards there are 26 black cards and 4 queens. But 2 black cards are queen. These cards are part of circles in above diagram. As centre (2) region is added twice, we

need to deduct it once.

So the solution is  $26 + 4 - 2 = 28$

$$\text{Probability } (AB) = \frac{28}{52} = \frac{7}{13}$$

### Independent Events

In case you need to find probability of happening of two independent events we use multiplication theorem.

$$P(AB) = P(A) \times P(B)$$

Let's understand this theorem with help of an example

**Question** - An unbiased coin is tossed twice. Find the probability of getting 1, 2, 3 or 4 in the first toss and 4, 5 or 6 in second toss?

Solution - Probability of getting 1, 2, 3 or 4 in first toss =  $\frac{4}{6} = \frac{2}{3}$

Probability of getting 4, 5 or 6 in second toss =  $\frac{3}{6} = \frac{1}{2}$

Now both events are independent and we will use multiplication theorem

$$\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$$

**Note:** Important Probability questions set - Venn diagram

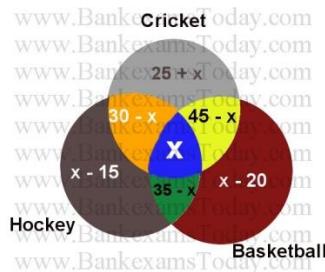
This question is frequently asked in the exams. Even in IBPS 2012 and SBI 2013, this question appeared with slight difference in amounts. Still most of the candidates are unable to solve this.

**Question** - There are 200 students in commerce batch of Khalsa College. Out of them 100 play cricket, 50 play hockey and 60 play basketball. 30 students play both cricket and hockey, 45 students play both cricket and basketball and 35 students play both hockey and basketball.

Answer the following questions:-

- 1) What is the maximum number of students who play all the games?
- 2) What is minimum number of students who play all three games?
- 3) What is the maximum number of students who play at least one game?
- 4) What is the minimum number of students playing at least one game?

Solution - To make the question simple, draw a Venn diagram and let  $x$  = number of students who play all games. Complete the diagram.



## Solutions

1. What is the maximum value of  $x$ ?

Consider equation 30 - x, it states that maximum value of x = 30

In case  $x > 30$ , for example 32 then  $30 - x$  will be negative and number of students can't be negative. So answer is 30.

2. What is the minimum value of  $x$ ?

Consider  $x-20$  is possible as negative value of students is not possible. It is possible to deduct 20 from  $x$ .

So minimum value of  $x \equiv 20$

3. and 4. For 3rd and 4th questions we will add everything:-

$$25 + x + x - 15 + x - 20 + 45 - x + 35 - x + 30 - x + x = \\ = 100 + x$$

Here we add maximum and minimum value of x.

So answer is 120 and 130 respectively.

## Exercise - 6

- a)  $\frac{1}{6}$       b)  $\frac{1}{8}$       c)  $\frac{1}{9}$   
d)  $\frac{1}{12}$       e) None of these
- 5) Three unbiased coins are tossed. What is the probability of getting at most two heads?  
a)  $\frac{3}{4}$       b)  $\frac{1}{4}$       c)  $\frac{3}{8}$   
d)  $\frac{7}{8}$       e) None of these
- 6) Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even?  
a)  $\frac{1}{2}$       b)  $\frac{3}{4}$       c)  $\frac{3}{8}$   
d)  $\frac{5}{16}$       e) None of these
- 7) In a class, there are 15 boys and 10 girls. Three students are selected at random. The probability that 1 girl and 2 boys are selected is:  
a)  $\frac{21}{46}$       b)  $\frac{25}{1}$       c)  $\frac{1}{50}$   
d)  $\frac{3}{25}$       e) None of these
- 8) In a lottery, there are 10 prizes and 25 blanks. A lottery is drawn at random. What is the probability of getting a prize?  
a)  $\frac{1}{10}$       b)  $\frac{2}{5}$       c)  $\frac{2}{7}$   
d)  $\frac{5}{7}$       e) None of these
- 9) Two dice are tossed. The probability that the total score is a prime number is:  
a)  $\frac{1}{6}$       b)  $\frac{5}{1}$       c)  $\frac{1}{2}$   
d)  $\frac{7}{9}$       e) None of these
- 10) A card is drawn from a pack of 52 cards. The probability of getting a queen of club or a king of heart is:  
a)  $\frac{1}{13}$       b)  $\frac{2}{13}$       c)  $\frac{1}{26}$   
d)  $\frac{1}{52}$       e) None of these
- 11) A bag contains 4 white, 5 red and 6 blue balls. Three balls are drawn at random from the bag. The probability that all of them are red, is:  
a)  $\frac{1}{22}$       b)  $\frac{3}{22}$       c)  $\frac{2}{91}$   
d)  $\frac{2}{77}$       e) None of these
- 12) Two cards are drawn together from a pack of 52 cards. The probability that one is a spade and one is a heart, is:  
a)  $\frac{3}{20}$       b)  $\frac{29}{34}$       c)  $\frac{47}{100}$   
d)  $\frac{13}{102}$       e) None of these
- 13) One card is drawn at random from a pack of 52 cards. What is the probability that the card drawn is a face card (Jack, Queen and King only)?

a)  $\frac{1}{13}$   
d)  $\frac{9}{52}$

b)  $\frac{3}{13}$   
e) None of these

c)  $\frac{1}{4}$

- 14) A bag contains 6 black and 8 white balls. One ball is drawn at random. What is the probability that the ball drawn is white?  
a)  $\frac{3}{4}$       b)  $\frac{4}{7}$       c)  $\frac{1}{8}$   
d)  $\frac{3}{7}$       e) None of these
- 15) A box contains 5 green, 4 yellow and 3 white marbles. Three marbles are drawn at random. What is the probability that they are not of the same color?  
a)  $\frac{3}{44}$       b)  $\frac{3}{55}$       c)  $\frac{52}{55}$   
d)  $\frac{41}{4}$       e) None of these
- 16) In a simultaneous throw of two dice, what is the probability of getting a total of 10 or 11?  
a)  $\frac{1}{4}$       b)  $\frac{1}{6}$       c)  $\frac{7}{12}$   
d)  $\frac{5}{36}$       e) None of these
- 17) In a single throw of a dice, What is the probability of getting a number greater than 4?  
a)  $\frac{1}{2}$       b)  $\frac{1}{3}$       c)  $\frac{2}{3}$   
d)  $\frac{1}{4}$       e) None of these
- 18) Four persons are chosen at random from a group of 3 men, 2 women and 4 children. The chance that exactly 2 of them are children, is:  
a)  $\frac{1}{9}$       b)  $\frac{1}{5}$       c)  $\frac{1}{12}$   
d)  $\frac{10}{21}$       e) None of these
- 19) A speaks truth in 75% cases and B in 80% of the cases. In what percentage Of cases are they likely to contradict each other, narrating the same incident?  
a) 5%      b) 15%      c) 35%  
d) 45%      e) None of these
- 20) Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn bears a number which is a multiple of 3?  
a)  $\frac{3}{10}$       b)  $\frac{3}{20}$       c)  $\frac{2}{5}$   
d)  $\frac{1}{2}$       e) None of these
- 21) In a class, 30% of the students offered English, 20% offered Hindi and 10% offered both. If a student is selected at random, what is the probability that he has offered English or Hindi?  
a)  $\frac{2}{5}$       b)  $\frac{3}{4}$       c)  $\frac{3}{5}$   
d)  $\frac{3}{10}$       e) None of these
- 22) A bag contains 6 white and 4 red balls. Three balls are drawn at random. What is the

- probability that one ball is red and the other two are white?
- a) 1/2                    b) 1/12                    c) 3/10  
 d) 7/12                   e) None of these
- 23) Two cards are drawn from a pack of 52 cards. The probability that either both are red or both are kings, is:
- a) 7/13                    b) 3/26                    c) 63/221  
 d) 55/221                e) None of these
- 24) The probability that a card drawn from a pack of 52 cards will be a diamond or a king is :
- a) 2/13                    b) 4/13                    c) 1/13  
 d) 1/52                    e) None of these

## Solutions

1. Option D

Here,  $S = \{1, 2, 3, 4, \dots, 19, 20\}$ .

Let  $E$  = event of getting a multiple of 3 or 5 = {3, 6, 9, 12, 15, 18, 5, 10, 20}.

$$P(E) = \frac{n(E)}{n(S)} = \frac{9}{20}$$

2. Option A

Total number of balls =  $(2 + 3 + 2) = 7$

Let  $S$  be the sample space.

Then,  $n(S)$  = Number of ways of drawing 2 balls out of 7

$$= {}^7C_2$$

$$= \frac{(7 \times 6)}{(2 \times 1)} \\ = 21$$

Let  $E$  = Event of drawing 2 balls, none of which is blue.

$n(E)$  = Number of ways of drawing 2 balls out of  $(2 + 3)$  balls.

$$= {}^5C_2$$

$$= \frac{(5 \times 4)}{(2 \times 1)}$$

$$= 10$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{10}{21}$$

## 3. Option A

Total number of balls =  $(8 + 7 + 6) = 21$

Let E = event that the ball drawn is neither red nor green  
= event that the ball draw is blue.

$$n(E) = 7$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{7}{21} = \frac{1}{3}$$

## 4. Option C

In two throws of a die,  $n(S) = (6 \times 6) = 36$

Let E = event of getting a sum =  $\{(3, 6), (4, 5), (5, 4), (6, 3)\}$   
 $P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$

## 5. Option D

Here S = {TTT, TTH, THT, HTT, THH, HTH, HHT, HHH}

Let E = event of getting at most two heads.

Then E = {TTT, TTH, THT, HTT, THH, HTH, HHT}

$$P(E) = \frac{n(E)}{n(S)} = \frac{7}{8}$$

## 6. Option B

In a simultaneous throw of two dice, we have  $n(S) = (6 \times 6) = 36$

Then, E = {(1, 2), (1, 4), (1, 6), (2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (3, 2), (3, 4), (3, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (5, 2), (5, 4), (5, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)}

$$n(E) = 27$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{27}{36} = \frac{3}{4}$$

$$\frac{n}{(S)}$$

## 7. Option A

Let S be the sample space and E be the event of selecting 1 girl and 2 boys.

Then,  $n(S) = \text{Number ways of selecting 3 students out of } 25$   
 $= {}^{25}C_3$

$$= \frac{(25 \times 24 \times 23)}{(3 \times 2 \times 1)}$$

$$= 2300$$

$$n(E) = {}^{10}C_1 \times {}^{15}C_2$$

$$= \left[ 10 \times \frac{(15 \times 14)}{(2 \times 1)} \right]$$

$$= 1050$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{1050}{2300} = \frac{21}{46}$$

8. Option C

$$P(\text{getting a prize}) = \frac{10}{(10+25)} = \frac{10}{35} = \frac{2}{7}$$

10. Option E

$$\text{Clearly, } n(S) = (6 \times 6) = 36$$

Let E = Event that the sum is a prime number.

Then = {(1, 1), (1, 2), (1, 4), (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, 4), (4, 1), (4, 3), (5, 2), (5, 6), (6, 1), (6, 5)}

$$n(E) = 15$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

11. Option C

$$\text{Here, } n(S) = 52$$

Let E = event of getting a queen of club or a king of heart.

$$\text{Then, } n(E) = 2$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{52} = \frac{1}{26}$$

12. Option C

Let S be the sample space.

Then, n(S) – number of ways of drawing 3 balls out of 15

$$\begin{aligned} &= {}^{15}C_3 \\ &= \frac{(15 \times 14 \times 13)}{(3 \times 2 \times 1)} \\ &= 455 \end{aligned}$$

Let E = event of getting all the 3 red balls.

$$n(E) = {}^5C_3 = {}^5C_2 = \frac{(5 \times 4)}{(2 \times 1)} = 10$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{10}{455} = \frac{2}{91}$$

13. Option D

Let S be the sample space.

$$\text{Then, } n(S) = \frac{(52 \times 51)}{(2 \times 1)} = 1326$$

Let E = event of getting 1 spade and 1 heart.

$N(E)$  = number of ways of choosing 1 spade out of 13 and 1 heart out of 13

$$= {}^{13}C_1 \times {}^{13}C_1$$

$$= (13 \times 13)$$

$$= 169$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{169}{1326} = \frac{13}{102}$$

14. Option B

Clearly, there are 52 cards, out of which there are 12 face cards.

$$P(\text{getting a face card}) = \frac{12}{52} = \frac{3}{13}$$

15. Option B

Let number of balls =  $(6 + 8) = 14$

Number of white balls = 8

$$P(\text{drawing a white ball}) = \frac{8}{14} = \frac{4}{7}$$

16. Option D

$$\begin{aligned} \text{Total cases} &= {}^{12}C_3 \\ &= \frac{12 \times 11 \times 10}{3 \times 2 \times 1} = 220 \end{aligned}$$

$$\begin{aligned} \text{Total cases of drawing same colour} &= {}^5C_3 + {}^4C_3 + {}^3C_3 \\ &= \frac{5 \times 4}{2 \times 1} + 4 + 1 = 15 \end{aligned}$$

$$\begin{aligned} \text{Probability of same colour} &= \frac{15}{220} \\ &= \frac{3}{44} \end{aligned}$$

$$\text{Probability of not same colour} = 1 - \frac{3}{44}$$

$$= \frac{41}{44}$$

17. Option D

In a simultaneous throw of two dice, we have  $n(S) = (6 \times 6) = 36$

Let E = event of getting a total of 10 or 11 =  $\{(4, 6), (5, 5), (6, 4), (5, 6), (6, 5)\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{5}{36}$$

18. Option B

When a dice is thrown, we have  $S = \{1, 2, 3, 4, 5, 6\}$

Let E = event of getting a number greater than 4 =  $\{5, 6\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

19. Option D

Let S be the sample space and E be the event of choosing four persons such that 2 of them are children. Then,

$$n(S) = \text{Number of ways of choosing 4 persons out of } 9 = {}^9C_4 = \frac{(9 \times 8 \times 7 \times 6)}{(4 \times 3 \times 2 \times 1)} = 126$$

$n(E) = \text{Number of ways of choosing 2 children out of 4 and 2 persons out of } (3+2) \text{ persons}$

$$= {}^4C_2 \times {}^5C_2 = \frac{(4 \times 3)}{(2 \times 1)} \times \frac{(5 \times 4)}{(2 \times 1)} = 60$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{60}{126} = \frac{10}{21}$$

20. Option C

Let A = Event that A speaks the truth

And B = Event that B speaks the truth.

$$\text{Then, } P(A) = \frac{75}{100} = \frac{3}{4} \quad P(B) = \frac{80}{100} = \frac{4}{5}$$

$$P(A) = 1 - \frac{3}{4} = \frac{1}{4} \text{ and } P(B) = 1 - \frac{4}{5} = \frac{1}{5}$$

P(A and B contradict each other)

$$= P[(A \text{ speaks the truth and } B \text{ tells a lie}) \text{ or } (A \text{ tells a lie and } B \text{ speaks the truth})]$$

$$= P[(A \text{ and } B) \text{ or } (A \text{ and } B)]$$

$$= P(A \text{ and } B) + (A \text{ and } B)$$

$$= P(A).P(B) + P(A).P(B)$$

$$= \frac{3}{4} \times \frac{1}{5} + \frac{1}{4} \times \frac{4}{5} = \frac{3}{20} + \frac{1}{5} = \frac{7}{20} = \frac{7}{20} \times 100\% = 35\%$$

21. Option A

Here,  $S = [1, 2, 3, 4, \dots, 19, 20]$

Let  $E$  = event of getting a multiple of 3 =  $[3, 6, 9, 12, 15, 18]$

$$P(E) = \frac{n(E)}{n(S)} = \frac{6}{20} = \frac{3}{10}$$

22. Option A

$$P(E) = \frac{30}{100} = \frac{3}{10}, P(H) = \frac{20}{100} = \frac{1}{5} \text{ and } P(E \cap H) = \frac{10}{100} = \frac{1}{10}$$

$$P(E \text{ or } H) = P(E \cup H)$$

$$= P(E) + P(H) - P(E \cap H)$$

$$= \frac{3}{10} + \frac{1}{5} - \frac{1}{10} = \frac{4}{10} = \frac{2}{5}$$

23. Option A

Let  $S$  be the sample space. Then,

$$n(S) = \text{Number of ways of drawing 3 balls out of 10} = {}^{10}C_3 = \frac{(10 \times 9 \times 8)}{(3 \times 2 \times 1)} = 120$$

Let  $E$  = event of drawing 1 red and 2 white balls

$n(E)$  = Number of ways of drawing 1 red ball out of 4 and 2 white balls out of 6

$$= {}^4C_1 \times {}^6C_2$$

$$= 4 \times \frac{6 \times 5}{2 \times 1} = 60$$

$$P(E) = \frac{n(E)}{n(S)} = \frac{60}{20} = \frac{1}{2}$$

24. Option D

$$\text{Clearly, } n(S) = {}^{52}C_2 = \frac{(52 \times 51)}{2} = 1326$$

Let  $E_1$  = event of getting both red cards,

$E_2$  = event of getting both kings

Then,  $E_1 \cap E_2$  = event of getting 2 kings of red cards.

$$n(E_1) = {}^{26}C_2 = \frac{(26 \times 25)}{(2 \times 1)} = 325; n(E_2) = {}^4C_2 = \frac{(4 \times 3)}{(2 \times 1)} = 6$$

$$n(E_1 \cap E_2) = {}^2C_2 = 1$$

$$P(E_1) = \frac{n(E_1)}{n(S)} = \frac{325}{1326} \quad P(E_2) = \frac{n(E_2)}{n(S)} = \frac{6}{1326} \quad P(E_1 \cap E_2) = \frac{1}{1326}$$

$P(\text{both red or both kings}) = P(E_1 \cup E_2)$

$$= P(E_1) + P(E_2) = P(E_1 \cap E_2)$$

$$= \frac{325}{1326} + \frac{6}{1326} - \frac{1}{1326}$$

$$= \frac{330}{1326}$$

$$= \frac{55}{221}$$

25. Option B

Here,  $n(S) = 52$

There are 13 cards of diamond (including one king) and there are 3 more kings.

Let  $E$  = event of getting a diamond or a king.

Then,  $n(E) = (13 + 3) = 16$

$$P(E) = \frac{16}{52} = \frac{4}{13}$$

Chapter - 7

# Problems Based on Ages

Age problems are one of the most common topics in IBPS, CAT, GMAT and other banks exams. Students waste lot of time in these questions When they start solving with triditional methods. We will sove various types of age problems which willhelp you to understand the trick.

Best way to solve Age questions is to assume fixed period with which further conditions will be compared. For example taking 2000 as fixed year.

## Example 1:

Raman's age after 15 years will be 5 times his age 5 years back. What is his present age ?

Solution - Let's assume right now it is year 2000

Age of Raman in 1995 = x

$$\text{Age of Raman in 2015} = 5x$$

Present age of Raman (in 2000) =  $x + 5$  or  $5x - 15$

We will solve these two equations to find x.

$X = 5$ . Then Raman's present age becomes  $= x + 5 = 10$

## Example 2:

Rahul was 4 times old as his son 8 years back and he will be 2 times old as his son after 8 years. Calculate Rahul and his son's age.

Assume that currently it is year 2000.

In 1992 Rahul's age =  $4x$ , Age of Rahul's son =  $x$

In 2008 Rahul's age =  $2y$  and Age of Rahul's son =  $y$

Now we get two equations  $2y - 4x = 16$  and  $y - x = 16$

By solving this equation  $x = 8$ , so Rahul's son's current age = 16 years and Rahul's age = 40 years.

## **Exercise - 7**

- 1) Present ages of Sameer and Anand are in the ratio of 5 : 4 respectively. Three years hence, the ratio of their ages will become 11 : 9 respectively. What is Anand's present age in years?

a) 24                    b) 27                    c) 40  
d) Data inadequate    e) None of these

- 2) The ratio between the present ages of P and Q is 5 : 7 respectively. If the difference between Q's present age and P's age after 6 years is 2, what is the total of P's and Q's present ages?
- a) 46 years      b) 48 years      c) 52 years  
d) 56 years      e) None of these
- 3) Eighteen years ago, a father was three times as old as his son. Now the father is only twice as old as his son. Then the sum of the present ages of the son and the father is
- a) 54      b) 72      c) 105  
d) 108      e) None of these
- 4) My brother is 3 years elder to me. My father was 28 years of age when my sister was born while my mother was 26 years of age when I was born. If my sister was 4 years of age when my brother was born, then, what was the age of my father and mother respectively when my brother was born?
- a) 32 yrs., 23 yrs.      b) 32 yrs., 29 yrs.      c) 35 yrs., 29 yrs.  
d) 35 yrs., 33 yrs.      e) None of these
- 5) A person was asked to state his age in years. His reply was, "Take my age three years hence, multiply it by 3 and then subtract three times my age three years ago and you will know how old I am." What was the age of the person?
- a) 14 years      b) 18 years      c) 20 years  
d) 32 years      e) None of these
- 6) A father said to his son, "I was as old as you are at present at the time of your birth." If the father's age is 38 years now, the son's age five years back was
- a) 14 years      b) 19 years      c) 33 years  
d) 38 years      e) None of these
- 7) Four years ago, the Father's age was three times the age of his son. The total of the ages of the father and the son after four years, will be 64 years. What is the father's age at present?
- a) 32 years      b) 36 years      c) 44 years  
d) 12 years      e) None of these
- 8) A man is 24 years older than his son. In two years, his age will be twice the age of his son. The present age of the son is
- a) 14 years      b) 18 years      c) 20 years  
d) 22 years      e) None of these
- 9) Q is as much younger than R as he is older than T. If the sum of the ages of R and T is 50 years, what is definitely the difference between R and Q's age?
- a) 1 year      b) 2 years      c) 25 years  
d) Date inadequate      e) None of these
- 10) The sum of the ages of 5 children born at the intervals of 3 years each is 50 years. What is the age of the youngest child?

- a) 4 years                    b) 8 years                    c) 10 years  
d) 12 years                    e) None of these
- 11) Ayesha's father was 38 years of age when she was born while her mother was 36 years old when her brother four years younger to her was born. What is the difference between the ages of her parents?  
a) 2 years                    b) 4 years                    c) 6 years  
d) 12 years                    e) None of these
- 12) Sneh's ago is  $\frac{1}{6}$ th of her father's age. Sneh's father's age will be twice of Vimal's age after 10 years. If Vimal's eighth birthday was celebrated two years before, then what is Sneh's present age?  
a) 10 years                    b) 25 years                    c) 35 years  
d) Data inadequate            e) None of these
- 13) A person's present age is two-fifth of the age of his mother. After 8 years, he will be one-half of the age of his mother. How old is the mother at present?  
a) 32 years                    b) 36 years                    c) 40 years  
d) 48 years                    e) None of these
- 14) The total age of A and B is 12 years more than the total age of B and C. C is how many years younger than A?  
a) 12                            b) 24                            c) C is elder than A  
d) Data inadequate            e) None of these
- 15) The ration between the present ages of P and Q is 6 : 7. If Q is 4 years old than P, what will be the ratio of the ages of P and Q after 4 years?  
a) 3 : 4                            b) 3 : 5                            c) 4 : 3  
d) 7 : 8                            e) None of these
- 16) Rajeev's age after 15 years will be 5 times his age 5 years back. What is the present age of Rajeev?  
a) 5 years                            b) 10 years                            c) 20 years  
d) 25 years                            e) None of these
- 17) Hitesh is 40 years old and Ronnie is 60 years old. How many years ago was the ration of their ages 3 : 5?  
a) 5 years                            b) 10 years                            c) 20 years  
d) 37 years                            e) None of these
- 18) The ages of two persons differ by 16 years. If 6 years ago, the elder one be 3 times as old as the younger one, find their present ages.  
a) 14 years                            b) 17 years                            c) 24 years  
d) 29 years                            e) None of these
- 19) The present ages of three persons are in proportions 4 : 7 : 9. Eight years ago, the sum of their ages was 56. Find present age of younger brothers.  
a) 8, 20, 28                            b) 16, 28, 36                            c) 20, 35, 45

- d) Data inadequate      e) None of these
- 20) Rajan got married 8 years ago. His present age is  $\frac{6}{5}$  times his age at the time of his marriage. Rajan's sister was 10 years younger to him at the time of his marriage. The age of Rajan's sister is  
a) 32 years      b) 36 years      c) 38 years  
d) 40 years      e) None of these
- 21) The ratio between the present ages of P and Q is 6 : 7. If Q is 4 years old than P, what will be the ratio of the ages of P and Q after 4 years?  
a) 3 : 4      b) 3 : 5      c) 4 : 3  
d) Data inadequate      e) None of these
- 22) Present ages of X and Y are in the ratio 5 : 6 respectively. Seven years hence this ratio will become 6 : 7 respectively. What is X's present age in years?  
a) 35      b) 42      c) 49  
d) Data inadequate      e) None of these
- 23) The ratio of the father's age to his son's age is 7 : 3. The product of their ages is 756. The ratio of their ages after 6 years will be :  
a) 5 : 2      b) 2 : 1      c) 11 : 7  
d) 13 : 9      e) None of these
- 24) The age of father 10 years ago was thrice the age of his son. Ten years hence, father's age will be twice that of his son. The ratio of their present ages is :  
a) 5 : 2      b) 7 : 3      c) 9 : 2  
d) 13 : 4      e) None of these
- 25) The difference between the ages of two persons is 10 years. Fifteen years ago, the elder one was twice as old as the younger one. The present age of the elder person is:  
a) 25 years      b) 35 years      c) 45 years  
d) 55 years      e) None of these
- 26) Father is aged three times more than his son Ronit. After 8 years, he would be two and a half times of Ronit's age. After further 8 years, how many times would he be of Ronit's age?  
a) 2 times      b)  $2\frac{1}{2}$  times      c)  $2\frac{3}{4}$  times  
d) 3 times      e) None of these
- 27) The product of the ages of Ankit and Nikita is 240. If twice the age of Nikita is more than Ankit's age by 4 years, what is Nikita's age?  
a) 12 years      b) 16 years      c) 20 years  
d) 18 years      e) None of these

- 28) The ratio of the ages of a man and his wife is  $4 : 3$ . After 4 years, this ratio will be  $9 : 7$ . If at the time of marriage, the ratio was  $5 : 3$ , then how many years ago were they married?

a) 8 years      b) 10 years      c) 12 years  
d) 15 years      e) None of these

29) Pooja, Shipra and Monika are three sisters. Pooja and Shipra are twins. The ratio of sum of the ages of Pooja and Shpra is same as that of Monika alone. Three years earlier theratio of age of Pooja and Monika was  $2 : 7$ . What will be the age of Shipra 3 years hence?

a) 21 years      b) 16 years      c) 8 years  
d) 12 years      e) None of these

30) At present, the ratio between the ages of Arun and Deepak is  $4 : 3$ . After 6 years, Arun's age will be 26 years. What is the age of Deepak at present?

a) 12 years      b) 15 years      c)  $19\frac{1}{2}$  years  
d) 21 years      e) None of these

31) The ratio between the school ages of Neelam and Shaan is  $5 : 6$  respectively. If the ratio between the one-third age of Neelam and half of Shaan's age is  $5 : 9$ , then what is the school age of Shaan?

a) 25 years      b) 30 years      c) 36 years  
d) Data inadequate      e) None of these

## Solutions:

- ### 1. Option A

Let the present ages of Sameer and Anand be  $5x$  years and  $4x$  years respectively.

$$\begin{aligned} \text{Then } & 5x + \frac{3}{4x} + 3 = \frac{11}{9} \\ & 9(5x + 3) = 11(4x + 3) \\ & x = 6 \\ \text{Anand's present age } &= 4x \\ &= 24 \text{ years} \end{aligned}$$

- ## 2. Option B

Let the present ages of P and Q be  $5x$  years and  $7x$  years respectively.

$$\begin{aligned} \text{Then } & 7x - (5x + 6) = 2 \\ & 2x = 8 \\ & x = 4 \end{aligned}$$

$$\begin{aligned}
 \text{Required sum} &= 5x + 7x \\
 &= 12x \\
 &= 12 \times 4 \\
 &= 48 \text{ years}
 \end{aligned}$$

## 3. Option D

Let the present ages of Father and Son be  $2x$  years and  $x$  years respectively.

$$\begin{aligned} \text{Then } & (2x - 18) = 3(x - 18) \\ & 2x - 18 = 3x - 54 \\ & x = 54 - 18 \\ & x = 36 \end{aligned}$$

$$\begin{aligned} \text{Required sum } &= (2x + x) \\ &= 3x \\ &= 3 \times 36 \\ &= 108 \text{ years} \end{aligned}$$

## 4. Option A

Clearly, my mother was born 3 years before I was born and 4 years after my sister was born.

$$\begin{aligned} \text{So, father's age when } &= (28 + 4) \\ \text{Brother was born } &= 32 \text{ years} \\ \text{Mother's age when brother was born } &= (26 - 3) \\ &= 23 \text{ years} \end{aligned}$$

## 5. Option B

Let the present ages of the person be  $x$  years.

$$\begin{aligned} \text{Then } &= 3(x - 3) - 3(x - 3) \\ &x = (3x + 9) - (3x - 9) \\ &x = 18 \end{aligned}$$

## 6. Option A

Let the son's present age be  $x$  years.

$$\begin{aligned} \text{Then } & (38 - x) = x \\ & 2x = 38 \\ & x = 19 \\ \text{Therefore son's age 5 years back } &= (19 - 5) \\ &= 14 \text{ years} \end{aligned}$$

## 7. Option E

$$\begin{aligned} y - 4 &= 3(x - 4) \\ (x + 4) + (y + 4) &= 64 \\ x + y + 8 &= 64 \\ x + y &= 56 \\ 3x - 12 - y + 4 &= 0 \\ 3x - y &= 8 \\ x + y &= 56 \end{aligned}$$

$$\begin{aligned}
 4x &= 64 \\
 x &= 16 \\
 y - 4 &= 3x - 12 \\
 16 + y - 56 &= \\
 y &= 40
 \end{aligned}$$

8. Option D

Let the son's present age be  $x$  years.

Then, man's present age

$$\begin{aligned}
 &= (x + 24) \text{ years} \\
 &= (x + 24) + 2 = x(x + 2) \\
 &= x + 26 = 2x + 4 \\
 &= 22 \text{ years}
 \end{aligned}$$

9. Option D

$$\begin{aligned}
 R - Q &= R - T & Q &= T \\
 \text{Also,} & & R + T &= 50 \\
 & & R + Q &= 50
 \end{aligned}$$

So,  $(R - Q)$  cannot be determined.

10. Option A

Let the ages of the children be  $x, (x + 3), (x + 6), (x + 9)$  and  $(x + 12)$  years.

Then,  $x + (x + 3) + (x + 6) + (x + 9) + (x + 12) = 50$

$$5x = 20$$

$$x = 4$$

Age of the youngest child = 4 years

11. Option C

$$\begin{aligned}
 \text{Mother's age when Ayesha's brother was born} &= 36 \text{ years} \\
 \text{Father's age when Ayesha's brother was born} &= (38 + 4) \text{ years} \\
 &= 42 \text{ years} \\
 \text{Required difference} &= (42 - 36) \\
 &= 6 \text{ years}
 \end{aligned}$$

12. Option E

$$\begin{aligned}
 \text{Vimal's age after 10 years} &= (8 + 2 + 10) \text{ years} \\
 &= 20 \text{ years} \\
 \text{Sneh's father age after 10 years} &= 40 \text{ years} \\
 \text{Sneh's father present age} &= 30 \text{ years} \\
 \text{Therefore Sneh's age} &= \left[ \frac{1}{6} \times 30 \right] \text{ years}
 \end{aligned}$$

$$= 5 \text{ years}$$

13. Option C

Let the mother's present age be  $x$  years.

$$\begin{aligned} \text{Then, the person's present age} &= \left[ \frac{2}{5x} \right] \text{ years} \\ \text{Therefore} &= \left[ \frac{2}{5x} + 8 \right] \end{aligned}$$

$$\begin{aligned} &= \frac{1}{2} (x + 8) \\ &= 2(2x + 40) \\ &= 5(x + 8) \\ &= 40 \text{ years} \end{aligned}$$

14. Option A

$$\begin{aligned} [(A + B) - (B + C)] &= 12 \\ &= A - C \\ &= 12 \end{aligned}$$

15. Option D

Let P's age and Q's age be  $6x$  years and  $7x$  years respectively.

$$\text{Then } 7x - 6x$$

$$x = 4$$

$$\begin{aligned} \text{Required ratio} &= (6x + 4) : (7x + 4) \\ &= 28 : 32 \\ &= 7 : 8 \end{aligned}$$

16. Option

Let Rajeev's present age be  $x$  years.

$$\text{Then Rajeev's age 15 years} = (x + 15) \text{ years}$$

$$\text{Rajeev's age 5 years back} = (x - 5) \text{ years}$$

$$\begin{aligned} \text{Therefore} &= x + 15 = 5(x - 5) \\ &= x + 15 = 5x - 25 \\ &= 4x = 40 \\ &= x = 10 \end{aligned}$$

17. Option B

Suppose, the ratio was  $3 : 5$ ,  $x$  years ago.

$$\begin{aligned} \text{Then,} &= 40 - \frac{x}{60} - x \\ &= \frac{3}{5} \\ &= 5(40 - x) = 3(60 - x) \\ &2x = 20 \end{aligned}$$

$$x = 10$$

18. Option A

Let the age of the younger person be  $x$  years.

Then, age of the elder persons

Therefore

$$= (x + 16) \text{ years}$$

$$= 3(x - 6) = (x + 16 - 6)$$

$$3x - 18 = x + 10$$

$$2x = 28$$

$$x = 14 \text{ years}$$

19. Option B

Let their present ages be  $4x$ ,  $7x$  and  $9x$  years respectively.

$$\text{Then, } (4x - 8) + (7x - 8) + (9x - 8)$$

$$= 56$$

$$20x = 80$$

$$x = 4$$

Their present ages are 16, 28, 36 years

20. Option C

Let Rajan's present age be  $x$  years

Then, his age at the time of marriage

$$= (x - 8) \text{ years}$$

Therefore

$$x = \frac{6}{5}(x - 6)$$

$$5x = 6x - 48$$

$$x = 48$$

Rajan's sister's age at the time of his marriage =  $(x - 18) = 30$

$$= (x - 8) - 10$$

Rajan's sister's present age

$$= (30 + 8)$$

$$= 38 \text{ years}$$

21. Option E

Let P's age and Q's age be  $6x$  years and  $7x$  years respectively.

$$\text{Then, } 7x - 6x = 4$$

$$x = 4$$

$$\text{So, required ratio} = (6x + 4) : (7x + 4) = 28 : 32 = 7 : 8$$

22. Option A

Let the present ages of X and Y be  $5x$  years and  $6x$  years respectively.

$$\text{Then, } \frac{5x + 7}{6x + 7} = \frac{6}{7}$$

$$7(5x + 7) = 6(6x + 7)$$

$$x = 7$$

$$\text{So, X's present age} = 5x = 35 \text{ years}$$

23. Option B

Let the present ages of the father and son be  $7x$  and  $3x$  years respectively.

Then,  $7x \times 3x = 756$

$$21x^2 = 756$$

$$x^2 = 36$$

$$x = 6$$

$$\text{So, required ratio} = (7x + 6) : (3x + 6) = 48 : 24 = 2 : 1$$

24. Option B

Let the ages of father and son 10 years ago be  $3x$  and  $x$  years respectively.

$$\text{Then, } (3x + 10) + 10 = 2[(x + 10) + 10]$$

$$3x + 20 = 2x + 40$$

$$x = 20$$

$$\text{So, required ratio} = (3x + 10) : (x + 10) = 70 : 30 = 7 : 3$$

25. Option B

Let their ages be  $x$  years and  $(x + 10)$  years respectively.

$$\text{Then, } (x + 10) - 15 = 2(x - 15)$$

$$x - 5 = 2x - 30$$

$$x = 25$$

$$\text{So, present age of the elder person} = (x + 10) = 35 \text{ years}$$

26. Option A

Let Ronit's present age be  $x$  years. Then, father's present age =  $(x + 3x)$  years =  $4x$  years

$$\text{So, } (4x + 8) = \frac{5}{2}(x + 8)$$

$$8x + 16 = 5x + 40$$

$$3x = 24$$

$$x = 8$$

$$\text{Hence, required ratio} = \frac{4x + 16}{x + 16} = \frac{48}{24} = 2$$

27. Option A

Let Ankit's age be  $x$  years. Then, Nikita's age =  $\frac{240}{x}$  years

$$\text{So, } 2 \times \frac{240}{x} - x = 4$$

$$480 - x^2 = 4x$$

$$x^2 + 4x - 480 = 0$$

$$(x + 24)(x - 20) = 0$$

$$x = 20$$

Hence, Nikita's age =  $\left[ \frac{240}{20} \right]$  years = 12 years

28. Option C

Let the present ages of the man and his wife be  $4x$  and  $3x$  years respectively.

$$\text{Then, } \frac{4x + 4}{3x + 4} = \frac{9}{7}$$

$$7(4x + 4) = 9(3x + 4)$$

$$x = 8$$

So, their present ages are 32 years and 24 years respectively.

Suppose they were married  $z$  years ago.

$$\text{Then, } \frac{32 - z}{24 - z} = \frac{5}{3}$$

$$3(32 - z) = 5(24 - z)$$

$$2z = 24$$

$$z = 12$$

29. Option C

Since Pooja and Shipra are twins so their ages be same. Let their ages be  $x$  and age of Monika be  $y$ , then,

$$x + x = y \quad \dots (i)$$

$$\text{and } \frac{x - 3}{y - 3} = \frac{2}{7}$$

$$7x - 2y = 15$$

Now, from equation (i),

$$7x - 4x = 15$$

$$x = 5$$

So, the age of Shipra 3 years hence will be  $5 + 3 = 8$  years

30. Option B

Let the present ages of Arun and Deepak be  $x$  years and  $3x$  years respectively.

$$\text{Then, } 4x + 6 = 26$$

$$4x = 20$$

$$x = 5$$

So, Deepak's age =  $3x = 15$  years

31. Option D

Let the school ages of Neelam and Shaan be  $5x$  and  $6x$  years respectively. Then,

$$\frac{\frac{1}{3} \times 5x}{\frac{1}{2} \times 6x} = \frac{5}{9} \quad \left[ \frac{1}{3} \times 9 \times 5x \right] = \left[ \frac{5}{2} \times 6x \right] \quad 15 = 15$$

Thus, Shaan's age cannot be determined.



## Chapter - 8

# Profit and loss

Profit and loss problems involves various terms like cost price, selling price, marked price etc. Basically, it is a difference between selling price and cost price. Cost price is the price paid to purchase an article or a product or we can say it is a cost incurred in manufacturing an article. Selling price is the price at which a product is sold.

Various profit and loss formulas used in profit and loss:

1) Generally, profit is calculated as:

$$\text{Profit or gain} = \text{Selling price(S.P)} - \text{Cost price (C.P)}$$

2) Similarly, Loss = Cost price - Selling price

$$3) \text{Gain percentage(}\%) = \frac{\text{Gain}}{\text{C.P.}} \times 100$$

$$4) \text{Loss percentage(}\%) = \frac{\text{Loss}}{\text{C.P.}} \times 100$$

5) There is a direct relationship between selling price and cost price:

$$S.P. = \frac{100 + \text{Gain percentage}}{100} \times \text{C.P.} \text{ (In case of gain)}$$

$$S.P. = \frac{100 - \text{Loss percentage}}{100} \times \text{C.P.} \text{ (In case of loss)}$$

**Example 1:**

If an article is sold at gain of 27%, then by using first formula, you can find that S.P. is 127% of C.P.

Similarly, If an article is sold at loss of 18%, then by using second formula, you can find that S.P. is 82% of C.P.

6) If a person sells two commodities at same prices. On one he gains x% and loses x% on another, then as a whole he will be in loss and the loss percentage will be equal to:

$$\frac{(\text{Common gain or loss percentage})^2}{100} = \frac{x^2}{10}$$

**Example 2:**

A man bought a horse and a carriage for Rs.3000. He sold the horse at a gain of 20% and the carriage at a loss of 10%, thereby gaining 2% on the whole. Find the cost of the horse.

**Solution:**

Let the C.P. of the horse be Rs.x, Then, C.P. of the carriage = Rs.(3000 - x)

$$20\% \text{ of } x - 10\% \text{ of } (3000 - x) = 2\% \text{ of } 3000$$

$$\frac{x}{5} - \frac{3000 - x}{10} = 60$$

$$2x - 3000 + x = 600$$

$$3x = 3600$$

$$x = 1200$$

Hence, C.P. of the horse = Rs.1200

Note: Here is an example to find gain in case of dishonesty.

**Problem 1:** A dishonest dealer professes to sell his goods at cost price but he uses a weight 960 grams for 1 kg. How to calculate gain percentage?

**Solution:**

$$\text{Gain percentage} = \frac{\text{Error}}{\text{True value} - \text{Error}} \times 100 = \frac{40}{960} \times 100 \text{ (Ans in \%)}$$

## **Exercise – 8**

- 7) Peter purchased a machine for Rs.80,000 and spent Rs.5000 on repair and Rs.1000 on transport and sold it with 25% profit. At what price did he sell the machine?  
a) Rs.1,05,100      b) Rs.1,06,250      c) Rs.1,07,500  
d) Rs.1,17,500      e) None of these
- 8) A shopkeeper expects a gain of  $22 - \frac{1}{2}\%$  on his cost price. If in a week, his sale was of Rs.392, what was his profit?  
a) Rs.18.20      b) Rs.70      c) Rs.72  
d) Rs.88.25      e) None of these
- 9) By selling a pen for Rs.15, a man loses one sixteenth of what it costs him. The cost price of the pen is  
a) Rs.16      b) Rs.18      c) Rs.20  
d) Rs.21      e) None of these
- 10) A shopkeeper professes to sell his goods at cost price but uses a weight of 800 gm instead of kilogram weight. Thus, he make a profit of  
a) 20%      b) 22%      c) 25%  
d) Data inadequate      e) None of these
- 11) Samant bought a microwave oven and paid 10% less than the original price. He sold it with 30% profit on the price he had paid. What percentage of profit did Samant earn on the original price?  
a) 17%      b) 20%      c) 27%  
d) 32%      e) None of these
- 12) If a man reduces the selling price of a fan from Rs.400 to Rs.380, his loss increases by 2%. The cost price of the fan is  
a) Rs.480      b) Rs.500      c) Rs.600  
d) Rs.1000      e) None of these
- 13) A shopkeeper fixes the marked price of an item 35% above its cost price. The percentage of discount allowed to gain 8% is  
a) 20%      b) 27%      c) 31%  
d) 43%      e) None of these
- 14) Kunal bought a suitcase with 15% discount on the labeled price. He sold the suitcase for Rs.2880 with 20% profit on the labeled price. At what price did he buy the suitcase?  
a) Rs.2040      b) Rs.2400      c) Rs.2604  
d) Rs.2640      e) None of these
- 15) I gain 70 paise on Rs.70. My gain percent is  
a) 0.1%      b) 1%      c) 7%  
d) 10%      e) None of these





- 34) Each of A and B sold their article at Rs.1818 but A incurred a loss of 10% while B gained by 1%. What is the ratio of cost price of the articles of A to that of B?
- a) 101 : 90      b) 85 : 89      c) 81 : 75  
d) 75 : 81      e) None of these
- 35) Abhinav saves Rs.25 by getting 6.66% discount on a textbook. What is the amount of money (in Rs.) paid by him?
- a) 450      b) 350      c) 225  
d) 375      e) None of these
- 36) A trader sells goods to a customer at a profit of k% over the cost price, besides it he cheats his customer by giving 880 g only instead of 1 kg. Thus, his overall profit percentage is 25%. Find the value of k?
- a) 8.33%      b) 8.25%      c) 10%  
d) 12.52%      e) None of these
- 37) DSNL charges a fixed rental of Rs.350 per month. It allows 200 calls free per month. Each call is charged at Rs.1.4 when the number of calls exceeds 200 per month and it charges Rs.1.6 when the number of calls exceeds 400 per month and so on. A customer made 150 calls in February and 250 calls in March. By how much percent the each call is cheaper in March than each call in February?
- a) 28%      b) 25%      c) 18.5%  
d) Data inadequate      e) None of these
- 38) Pratibha printers prepares diaries expecting to earn a profit of 40% by selling on the marked price. But during transportation 8% diaries were got spoiled due to at random rain and 32% could be sold only at 75% of the cost price. Thus the remaining 60% diaries could be sold at the expected price. What is the net profit or loss in the whole consignment?
- a) 6%      b) 10%      c) 8%  
d) Data inadequate      e) None of these
- 39) At kul-kul petrol pump the operator gives 5% less petrol but he sells it at the cost price. What is his profit in this way?
- a) 5%      b) 5.6%      c) 5.26%  
d) 4.78%      e) None of these
- 40) A bookseller procures 40 books for Rs.3200 and sells them at a profit equal to the selling price of 8 books. What is the selling price of one dozen books, if the price of each book is same?
- a) 720      b) 960      c) 1200  
d) 1440      e) None of these
- 41) Rahul went to purchase a Nokia mobile handset, the shopkeeper told him to pay 20% tax if he asked the bill. Rahul manages to get the discount of 5% on the actual sale price of the mobile and he paid the shopkeeper Rs.3325 without tax. Besides he

manages to avoid to pay 20% tax on the already discounted price, what is the amount of discount that he has gotten?



57) Titan sells a wrist watch to a wholesaler making a profit of 10%. The wholesaler, in turn, sells it to the retailer making a profit of 10%. A customer purchases it by paying Rs.990. Thus, the profit of retailer is  $2\frac{3}{11}\%$ . What is the cost incurred by the Titan to produce it?



## Solutions:

- ### 1. Option C

$$\begin{aligned} \text{S.P.} &= 85\% \text{ of Rs.}1400 \\ &= \text{Rs.} \left[ \frac{85}{100} \times 1400 \right] \\ &= \text{Rs.}1190 \end{aligned}$$

2. Option D

$$\text{C.P.} = \text{Rs.} \left[ \frac{100}{75} \times 34.80 \right] \\ \equiv \text{Rs.} 46.40$$

- ### 3. Option C

C.P. of toy	= Rs. $\left[ \frac{375}{12} \right]$
	= Rs.31.25
S.P. of 1 toy	= Rs.33
Therefore, profit	= $\left[ \frac{1.75}{31.25} \times 100 \right] \%$
	= $\left[ \frac{28}{5} \right] \%$
	= 5.6%

- #### 4. Option A

$$85 : 9 = 105 : x$$

$$x = \left[ 9 \times \frac{105}{80} \right]$$

$$= \text{Rs.} 11.81$$

Hence, S.P. per kg      = Rs.11.81

- ## 5. Option C

Let the labeled price be Rs.x  
 88% of 80% of x = 704

$$= 1000$$

6. Option A

$$\begin{aligned}\text{Loss \%} &= \left(\frac{5}{10}\right)^2\% \\ &= (0.5)^2\% \\ &= 0.25\%\end{aligned}$$

7. Option C

$$\begin{aligned}\text{C.P.} &= \text{Rs.} [80000 + 5000 + 1000] \\ &= \text{Rs.} 86000 \\ \text{Profit} &= 25\% \\ \text{S.P.} &= 12.5\% \text{ of Rs.} 86000 \\ &= \text{Rs.} \left[ \frac{125}{100} \times 86000 \right] \\ &= \text{Rs.} 107500\end{aligned}$$

8. Option C

$$\begin{aligned}\text{C.P.} &= \text{Rs.} \left[ \frac{100}{122.50} \times 392 \right] \\ &= \text{Rs.} \left[ \frac{1000}{1225} \times 392 \right] \\ &= \text{Rs.} 320 \\ \text{Therefore, profit} &= \text{Rs.} (392 - 320) \\ &= \text{Rs.} 72\end{aligned}$$

9. Option A

$$\begin{aligned}\text{Let the C.P. be Rs.} x. \text{ Then } x - 15 &= \frac{x}{16} \\ &= x - \frac{x}{16} = 15 \\ &= \frac{15x}{16} = 15 \\ x &= 16\end{aligned}$$

Therefore, C.P. = Rs.16

10. Option C

$$\begin{aligned}\text{Therefore, profit} &= \left[ \frac{200}{800} \times 100 \right]\% \\ &= 25\%\end{aligned}$$

11. Option A

$$\begin{aligned}\text{Let the original price} &= \text{Rs.} 100 \\ &= 125\end{aligned}$$

$$\begin{aligned}
 \text{Then, C.P.} &= \text{Rs.}90 \\
 \text{S.P.} = 130\% \text{ of Rs.}90 &= \text{Rs.} \left[ \frac{130}{100} \times 90 \right] \\
 &= \text{Rs.}117 \\
 \text{Required percentage} &= (117 - 100)\% \\
 &= 17\%
 \end{aligned}$$

12. Option D

$$\begin{aligned}
 \text{Let C.P. be Rs.}x \\
 \text{Then, } 2\% \text{ of } x &= (400 - 380) \\
 &= 20 \\
 \frac{x}{50} &= 20 \\
 x &= 1000
 \end{aligned}$$

13. Option A

$$\begin{aligned}
 \text{Let C.P.} &= \text{Rs.}100 \\
 \text{Then, marked price} &= \text{Rs.}135 \\
 \text{S.P.} &= \text{Rs.}108 \\
 \text{Discount \%} &= \left[ \frac{27}{135} \times 100 \right]\% \\
 &= 20\%
 \end{aligned}$$

14. Option A

Let the labeled price be Rs.  $x$ . Then,  $120\% \text{ of } x = 2880$

$$\begin{aligned}
 \text{Therefore} & \quad x = \left[ 2880 \times \frac{100}{120} \right] \\
 & \quad = 2400 \\
 \text{C.P.} = 85\% \text{ of Rs.}2400 & \quad = \text{Rs.} \left[ \frac{85}{100} \times 2400 \right] \\
 & \quad = \text{Rs.}2040
 \end{aligned}$$

15. Option B

$$\begin{aligned}
 \text{Gain \%} &= \left[ \frac{0.70}{70} \times 100 \right]\% \\
 &= 1\%
 \end{aligned}$$

16. Option B

$$\begin{aligned}
 \text{S.P.} &= \text{Rs.}27.50 \\
 \text{Then profit} &= 10\% \\
 \text{So, C.P.} &= \text{Rs.} \left[ \frac{100}{110} \times 27.50 \right] \\
 &= \text{Rs.}25 \\
 \text{When S.P.} &= \text{Rs.}25.75
 \end{aligned}$$

$$\begin{aligned}\text{Profit} &= \text{Rs.}(25.75 - 25) \\ &= \text{Rs.}0.75\end{aligned}$$

$$\begin{aligned}\text{Profit} &= \left[ \frac{0.75}{25} \times 100 \right] \% \\ &= 3\%\end{aligned}$$

17. Option A

$$\begin{aligned}\text{Cost price of all eggs} &= \text{Rs.}100 \times 1.2 = \text{Rs.}120 \\ \text{Selling price of one egg} &= \frac{15}{12} = 1.25 \\ \text{So, selling price of 96 eggs} &= 96 \times \frac{15}{12} = \text{Rs.}120\end{aligned}$$

18. Option B

$$\begin{aligned}\text{SP} &= \text{Rs.}220, \text{Loss} = 12\% \\ \text{Let } CP &= \text{Rs.}x \\ \text{Then } SP &= 88\% \text{ of } CP \\ 220 &= \frac{88}{100} \times x \\ x &= 250\end{aligned}$$

Therefore cost price = Rs.250

19. Option C

$$\begin{aligned}MP &= CP + \% \text{ markup on } CP \\ &= 300 + 300 \times \frac{20}{100} \\ MP &= \text{Rs.}360\end{aligned}$$

20. Option D

$$\begin{aligned}\text{Let the SP of 1 chocolate} &= \text{Rs.}1 \\ \text{SP of 18 chocolates} &= \text{Rs.}18 \\ \text{Loss} &= \text{Rs.}2 \\ CP &= SP + Loss \\ &= 18 + 2 = \text{Rs.}20 \\ \text{So, percentage loss} &= \frac{\text{loss}}{CP} \times 100 \\ &= \frac{2}{20} \times 100 = 10\%\end{aligned}$$

21. Option A

$$\text{Profit}(\%) = \frac{\text{goods left}}{\text{goods sold}} \times 100 = \frac{15 - 12}{12} \times 100 = 25\%$$

22. Option B

CP of 15 apples = SP of 20 apples

$$CP \times 15 = SP \times 20$$

$$\frac{CP}{SP} = \frac{4}{3}$$

So, you can see that CP > SP, therefore, there will be loss.

Now consider CP = 4, then SP = 3

So, loss = 1

$$\begin{aligned} \text{Loss(%) } &= \frac{\text{loss}}{CP} \times 100 \\ &= \frac{1}{4} \times 100 = 25\% \end{aligned}$$

Loss = 25%

23. Option B

Let CP of each article be Rs.1

Then, CP of 18 articles = Rs.18, SP of 18 articles = Rs.21

$$\text{So, gain \%} = \left[ \frac{3}{18} \times 100 \right] \% = 16\frac{2}{3}\%$$

24. Option A

Let marked price be Rs.100

Then, Net S.P. = 95% of 90% of 80% of Rs.100

$$= \text{Rs.} \left[ \frac{95}{100} \times \frac{90}{100} \times \frac{80}{100} \times 100 \right] = \text{Rs.} 68.40$$

So, required discount = (100 - 68.40) = 31.6%

25. Option C

Suppose, number of bananas bought = L.C.M. of 6 and 4 = 12

$$\text{So, C.P.} = \text{Rs.} \left[ \frac{10}{6} \times 12 \right] = \text{Rs.} 20; \text{S.P.} = \text{Rs.} \left[ \frac{6}{4} \times 12 \right] = \text{Rs.} 18$$

$$\text{So, Loss\%} = \left[ \frac{3}{20} \times 100 \right] \% = 10\%$$

26. Option C

Let C.P. of whole be Rs. x

$$\text{C.P. of } \frac{3}{4} \text{th} = \text{Rs.} \frac{3x}{4}, \text{C.P. of } \frac{1}{4} \text{th} = \text{Rs.} \frac{x}{4}$$

$$\text{Total S.P.} = \text{Rs.} \left[ \left( 120\% \text{ of } \frac{3x}{4} \right) + \frac{x}{4} \right] = \text{Rs.} \left[ \frac{9x}{10} + \frac{x}{4} \right] = \text{Rs.} \frac{23x}{20}$$

$$\text{Gain} = \text{Rs.} \left[ \frac{23x}{20} - x \right] = \text{Rs.} \frac{3x}{20}$$

$$\text{So, gain\%} = \left[ \frac{3x}{20} \times \frac{1}{x} \times 100 \right] \% = 15\%$$

27. Option C

C.P. of 200 kg of mixture = Rs.(80 × 13.50 + 120 × 16) = Rs.3000

$$\text{S.P.} = 116\% \text{ of Rs.3000} = \text{Rs.} \left[ \frac{116}{100} \times 3000 \right] = \text{Rs.}3480$$

$$\text{So, rate of S.P. of the mixture} = \text{Rs.} \left[ \frac{3480}{200} \right] \text{ per kg} = \text{Rs.}17.40 \text{ per kg}$$

28. Option A

Let the original price of the jewel be Rs.P and let the profit earned by the third seller be x%

$$\text{Then, } (100 + x)\% \text{ of } 125\% \text{ of } 120\% \text{ of P} = 165\% \text{ of P}$$

$$\left[ \frac{(100 + x)}{100} \times \frac{125}{100} \times \frac{120}{100} \times P \right] = \left[ \frac{165}{100} \times P \right]$$

$$(100 + x) = \left[ \frac{165 \times 100 \times 100}{125 \times 120} \right] = 110$$

$$x = 10\%$$

29. Option D

Let C.P. be Rs. x. Then,

$$(105\% \text{ of } x) - (80\% \text{ of } x) = 100 \text{ or } 25\% \text{ of } x = 100$$

$$\text{So, } \frac{x}{4} = 100 \text{ or } x = 400$$

So, C.P. = Rs.400

30. Option B

10% of x = 15% of y , where x + y = 30000

$$\frac{x}{y} = \frac{3k}{2k}$$

Hence, the difference = k = 6000

31. Option C

$$\text{Profit} = \text{Rs.}(2602.58 - 2090.42) = \text{Rs.}512.16$$

$$\text{Profit\%} = \left[ \frac{512.16}{2090.42} \times 100 \right]\% = \left[ \frac{512160}{209042} \times 10 \right]\% = 24.5\% = 25\%$$

32. Option B

$$\frac{CP}{SP} = \frac{2}{3}$$

$$\text{So, profit\%} = \frac{1}{2} \times 100 = 50\%$$

33. Option C

Let the MP of 1 kg tea be Rs.1, then CP of 20 kg with discount =  $20 \times 0.9 = \text{Rs.}18$

Also 1 kg tea is free. So the retailer gets tea worth Rs.21 by paying Rs.18 only.

$$\text{Profit\%} = \frac{\frac{\text{goods left}}{\text{goods sold}}}{\frac{21 - 18}{18}} \times 100 = 16.66\%$$

34. Option A

$$\text{CP of A} = \frac{1818}{0.9} = 2020$$

$$\text{CP of B} = \frac{1818}{1.01} = 1800$$

$$\frac{\text{CP of A}}{\text{CP of B}} = \frac{2020}{1800} = \frac{101}{90}$$

35. Option B

$$6.66\% \text{ of MP} = 25$$

$$\text{MP} = 375$$

$$\text{SP} = \text{MP} - 25 = 350$$

36. Option C

$$\text{Profit\%} = \frac{25}{100} = \frac{120 + k}{880} \quad k = 100$$

$$\text{Therefore, net profit\%} = \frac{100}{1000} \times 100 = 10\%$$

37. Option A

$$\text{Charge of 1 call in February} = \frac{350}{150} = \frac{7}{3}$$

$$\text{Charge of 1 call in March} = \frac{\frac{350 + 50 \times 1.4}{250}}{\frac{420}{250}} = \frac{42}{25}$$

$$\% \text{ cheapness of a call in March} = \frac{\frac{7}{3} - \frac{42}{25}}{\frac{7}{3}} \times 100 = 28\%$$

38. Option C

Let the number of diaries (produced) be 100 and the cost price of a diary be Rs.1  
then, total cost incurred =  $100 \times 1 = 100$

$$\text{Total sale price} = 32 \times 0.75 + 60 \times 1.4 = 108$$

Therefore, profit = Rs.8

Thus, there is 8% profit

39. Option C

$$\text{Profit\%} = \frac{5}{95} \times 100 = 5.26\%$$

40. Option C

$$CP = \text{Rs.}80 \left[ = \frac{3200}{40} \right]$$

Now SP of 40 books = CP of 40 books + SP of 8 books

SP of 32 books = 3200

SP of 1 book = Rs.100

So, required SP of 1 dozen books = Rs.1200

41. Option C

CP = 100, SP (with tax) = 120

New SP = 100 - 5 = 95

So, effective discount = 120 - 95 = 25

So, at SP of 95 → discount = 25

And at SP of 3325 → discount =  $\frac{25}{95} \times 3325 = 875$

42. Option B

You must know that the company is able to deliver only 90% of the manufactured pens. So let k be the manufacturing price of a pen, then

Total income (including 25% profit) =  $(8000 \times k) \times 1.25$

Also this same income is obtained by selling 90% manufactured pens at Rs.10 which is equal to  $7200 \times 10$

Thus,  $(8000 \times k) 1.25 = 7200 \times 10$

$K = \text{Rs.}7.2 \quad (90\% \text{ of } 8000 = 7200)$

43. Option C

Let the CP of one article be Rs.1

Then the SP be Rs.1.25

Again the new SP be  $(1.25) \times 1.2 = 1.5$

Now, if he sell initially 100 articles, then

$CP = 100 \times 1 = \text{Rs.}100$

$SP = 100 \times 1.25 = \text{Rs.}125$

New SP =  $75 \times 1.5 = 112.5$  (since 25% articles were abducted)

So, new profit percentage = 12.5%

44. Option B

C.P. =  $\text{Rs.} (4700 + 800) = \text{Rs.}5500$ ; S.P. =  $\text{Rs.}5800$

Gain % =  $\left[ \frac{300}{5500} \times 100 \right] \% = 5 \frac{5}{11}\%$

45. Option B

$S.P. = C.P. + \frac{1}{4} C.P. = \frac{5}{4} C.P.$

$$\text{So, } \frac{5}{4} \text{ C.P.} = 375$$

$$\text{C.P.} = \text{Rs.} \left[ 375 \times \frac{4}{5} \right] = \text{Rs.} 300$$

46. Option A

Let C.P. of each mango be Rs.1

C.P. of 110 mangoes = Rs.110; S.P. of 110 mangoes = Rs.120

$$\text{So, gain \%} = \left[ \frac{10}{110} \times 100 \right] \% = 9\frac{1}{11}\%$$

47. Option C

Suppose, number of fruits bought = L.C.M. of 16 and 8 = 16

$$\text{C.P. of 16 fruits} = \text{Rs.} 24 \text{ S.P. of 16 fruits} = \text{Rs.} \left[ \frac{18}{8} \times 16 \right] = \text{Rs.} 36$$

$$\text{So, profit \%} = \left[ \frac{12}{24} \times 100 \right] \% = 50\%$$

48. Option C

Suppose he bought 2 kg, 4 kg and 3 kg of the three varieties.

C.P. of 9 kg = Rs.  $(2 \times 50 + 4 \times 20 + 3 \times 30) = \text{Rs.} 270$

S.P. of 9 kg = Rs.  $(9 \times 33) = \text{Rs.} 297$

$$\text{So, profit \%} = \left[ \frac{27}{270} \times 100 \right] \% = 10\%$$

49. Option B

110% of 90% of 120% of A = 1188

$$\frac{110}{100} \times \frac{90}{100} \times \frac{120}{100} A = 1188$$

$$\frac{1188}{1000} A = 1188$$

$$A = 1000$$

So, A purchased it for Rs.  $(1000 - 110)$  Rs.890

50. Option A

Let the C.P. be Rs. x

$$\text{Then, S.P.} = 120\% \text{ of Rs. } x = \text{Rs.} \left[ x \times \frac{120}{100} \right] = \text{Rs.} \frac{6x}{5}$$

$$\text{So, } \frac{6x}{5} - x = 240$$

$$x = 1200$$

$$\text{So, C.P.} = \text{Rs.} \left[ \frac{6}{5} \times 1200 \right] = \text{Rs.} 1200$$

$$\text{S.P.} 1200 + 240 = 1440$$

51. Option C

Let C.P. of whole be Rs. x. C.P. of  $\frac{2}{3}$ rd = Rs.  $\frac{2x}{3}$ , C.P. of  $\frac{1}{3}$ rd = Rs.  $\frac{x}{3}$

Total S.P. = Rs.  $\left[ (120\% \text{ of } \frac{2x}{3}) + (114\% \text{ of } \frac{x}{3}) \right] = \text{Rs. } \left[ \frac{4x}{5} + \frac{19x}{50} \right] = \text{Rs. } \frac{59x}{50}$

Gain = Rs.  $\left[ \frac{59x}{50} - x \right] = \text{Rs. } \frac{9x}{50}$

So, Gain % =  $\left[ \frac{9x}{50} \times \frac{1}{x} \times 100 \right] \% = 18\%$

52. Option B

S.P. =  $97\frac{1}{2}\%$  of Rs.650 = Rs.  $\left[ \frac{195}{2} \times \frac{1}{100} \times 650 \right] = \text{Rs. } 633.75$

53. Option B

Let marked price be Rs.100

Then, Final S.P. = 70% of 80% of Rs.100 = Rs.  $\left[ \frac{70}{100} \times \frac{80}{100} \times 100 \right] = \text{Rs. } 56$

So, single discount =  $(100 - 56) = 44\%$

54. Option A

Let C.P. be Rs.100. Then, marked price = Rs.125

S.P. = 84% of Rs.125 = Rs.  $\left[ \frac{84}{100} \times 125 \right] = \text{Rs. } 105$

So, profit % =  $(105 - 100) = 5\%$

55. Option D

Let the C.P. of each article be Rs.100

Then, C.P. of 16 articles = Rs.  $(100 \times 16) = \text{Rs. } 1600$

S.P. of 15 articles = Rs.  $\left[ 1600 \times \frac{135}{100} \right] = \text{Rs. } 2160$

S.P. of each article = Rs.  $\frac{2160}{15} = \text{Rs. } 144$

If S.P. is Rs.96, marked price = Rs.100

If S.P. is Rs.144, marked price = Rs.  $\left[ \frac{100}{96} \times 144 \right] = \text{Rs. } 150$

So, marked price = 50% above C.P.

56. Option A

Let the actual cost price of an article be Rs.1 (in place of x)

Now, he purchases goods worth Rs.120 and pays Rs.80, since 20% discount is allowed.

So, the CP =  $\frac{80}{120} = \frac{2}{3}$

Again MP = 180, SP = 135 (since 25% discount)

Thus, the trader sells goods worth Rs.90 instead of 100 g and charges Rs.135.

Therefore the effective SP =  $\frac{135}{90} = \frac{3}{2}$

So, profit % =  $\frac{\frac{3}{2} - \frac{2}{3}}{2/3} \times 100 = 125\%$

57. Option C

$$\left[ ((x \times 1.1) \times 1.1) \times \frac{1125}{1100} \right] = 990$$

$$x = 800$$

## Chapter - 10

# Sequence and Series

Sequence and Series problems just follow a particular pattern. Usually, series completion problems are asked in most of the quantitative aptitude exams. You just need to study the set relationship to complete the series. Once you recognize the pattern of the series, you will be able to solve the problem.

Remember, Study the set relationship first.

In quantitative aptitude exam, four or five options are given, to make the questions easy, always try to eliminate the options. This will help you to save your precious time. Coming to the point, I'm going to discuss some standard patterns of series. Go through these rules and try to solve the problems related to this.

### Some standard patterns of series

#### Addition or Subtraction

Some number (or pattern of numbers) may be added or subtracted in each term to get the next term.

**Example 1:** Study the following series and try to find the next term,

3, 6, 9, 12, 15?

Solution: This is very simple pattern. You can easily find that `3` is added to each term, and we are getting next term.

$$3 + 3 = 6$$

$$6 + 3 = 9$$

$$9 + 3 = 12$$

Similarly,

$15 + 3 = 18$ . So, 18 will be the next term.

**Example 2:** Complete the following series

4, 6, 9, 13, 18?

Solution: Pattern used in series:

$$4 + 2 = 6$$

$$6 + 3 = 9$$

$$9 + 4 = 13$$

$$13 + 5 = 18$$

Therefore,  $18 + 6 = 24$ . So, 24 will be next term.

**Example 3:** Study one more term and find the next term of series.

13, 11, 9, 7, 5?

**Solution:** As this is decreasing pattern, you can easily find that 2 is subtracted from each term to get the next term.

$$13 - 2 = 11$$

$$11 - 2 = 9$$

$$9 - 2 = 7$$

Similarly,  $5 - 2 = 3$  So, 3 will be the last term.

## 2. Multiplication or Division

Another pattern may be related to multiplication or division of some number to each term to get the next term.

**Example 4:** Study the pattern of series and try to find next term

$$4, 8, 24, 96?$$

**Solution:** A particular pattern of numbers is multiplied to each term of series

$$4 \times 2 = 8$$

$$8 \times 3 = 24$$

$$24 \times 4 = 96$$

So,  $96 \times 5 = 480$ . 480 will be the last term.

**Example 5:** Complete the following series

$$480, 96, 24, 8?$$

**Solution:** Study the pattern and note that it is a decreasing pattern and a particular series of number is divided from previous term

$$480 / 5 = 96$$

$$96 / 4 = 24$$

$$24 / 3 = 8$$

Continuing,  $8 / 2 = 4$ . Therefore, 4 will be the next term.

Squaring or cubing

Another rule may be of squaring or cubing of the terms of series.

**Example 6:** Complete the following series

$$4, 9, 16, 25?$$

**Solution:** This is a very simple pattern i.e. a square of some pattern of numbers

$$2^2 = 4$$

$$3^2 = 9$$

$$4^2 = 16$$

$$5^2 = 25$$

Continuing  $6^2 = 36$ . 36 is the next term.

**Example 7:** Study the following series and try to complete 1, 27, 125, 343?

**Solution:** The series is based on following pattern:

$$1^3 = 1$$

$$3^3 = 27$$

$$5^3 = 125$$

$$7^3 = 343$$

Continuing,  $9^3 = 729$ , so, 729 will be the next term.

### 3. Mixed Patterns

In some questions, combinations of above discussed patterns are used. For example, some number is multiplied with first term of series and then some other number is subtracted to get the next term. I will give you some examples for more understanding. Firstly try to solve it yourself.

**Example 8:** Try to find the next term of following series:

1, 2, 6, 21, 88?

**Solution:** Study this series, you will find out that more than one rule is applied on it.

Following pattern is used in it:

$$1 \times 1 + 1 = 2$$

$$2 \times 2 + 2 = 6$$

$$6 \times 3 + 3 = 21$$

$$21 \times 4 + 4 = 88$$

Series (1, 2, 3,...) multiplied to term and then same series is added to get the next term

Therefore,  $88 \times 5 + 5 = 445$ . 445 is the next term.

**Example 9:** Find the next term of following series:

276, 140, 68, 36?

**Solution:** Following pattern is used in the series:

$$\frac{276}{2} + 2 = 140 \text{ (Term is divided by 2 then added by 2)}$$

$$\frac{140}{2} - 2 = 68 \text{ (Term is divided by 2 then subtracted by 2)}$$

$$\frac{68}{2} + 2 = 36$$

Therefore, each term is divided by 2 then alternately added and subtracted by 2 to get the next term.

So,  $\frac{36}{2} - 2 = 16$ . 16 is the next term.

Thus, there are large numbers of techniques to form number of series. The only thing is the pattern of the series.

### Examples with Solutions

**Example 1:** In the following given series, find out the wrong number.

1, 3, 10, 21, 64, 129, 356

**Solution:** As we have discussed in previous session, operations applied on series can be: Addition or subtraction, multiplication or division, squaring or cubing and combination of any.

Series	1	3	10	21	64	129	356
Difference		2	7	11	43	65	227

By studying the above series, you'll come to know that, this is a combination of operations. Operation used is discussed as follows:

Alternately using:  $(\times 2 + 1)$  and  $(\times 3 + 1)$

$$1 \times 2 + 1 = 3$$

$$3 \times 3 + 1 = 10$$

$$10 \times 2 + 1 = 21$$

$$21 \times 3 + 1 = 64$$

$$64 \times 2 + 1 = 129$$

$$129 \times 3 + 1 = 388$$

Therefore, last number of series is wrong i.e. 356

**Example 2:** Find the next number of the following series:

672, 560, 448, 336, 224?

**Solution:** Check out the difference of each number first:

Series: 672 560 448 336 224

Difference: 112 112 112 112

Difference between all the terms is same i.e. 112

Therefore, next term will be  $= 224 - 112 = 112$  Ans.

**Example 3:** Find the next term of following series:

82, 67, 54, 43, 34

**Solution:** The operation used in series is discussed as follow:

$$9^2 + 1 = 82$$

$$8^2 + 3 = 67$$

$$7^2 + 5 = 54$$

$$6^2 + 7 = 43$$

$$5^2 + 9 = 34$$

Continuing like this;

$$4^2 + 11 = 27$$

Therefore, 27 is the next term.

**Example 4:** What should come in place of question mark?

1721, 2190, 2737, 3368?

**Solution:** As we can see, first term is approximately equal to the cube of 12, so firstly we will try to solve it with the cubes.

$$12^3 - 7 = 1721$$

$$13^3 - 7 = 2190$$

$$14^3 - 7 = 2737$$

$$15^3 - 7 = 3368$$

Now you can find that there is some pattern. So, continuing like this, we get

$$16^3 - 7 = 4089$$
 Ans.

**Example 5:** Find the next term of following series:

8, 24, 12, 36, 18?

**Solution:** Relation between the terms is as follows:

$$8 \times 3 = 24$$

$$\frac{24}{2} = 12$$

$$12 \times 3 = 36$$

$$\frac{36}{2} = 18$$

Continuing like this:

$$18 \times 3 = 54$$

Therefore, next term is 54.

**Example 6:** Find the next term of the following series:

47, 33, 21, 11?

**Solution:** The pattern used in the series is as follows:

$$7^2 - 2 = 47$$

$$6^2 - 3 = 33$$

$$5^2 - 4 = 21$$

$$4^2 - 5 = 11$$

By continuing, we get

$$3^2 - 6 = 3$$

Therefore, 3 is the next term.

## **Exercise - 10**

- 1) Find the common ratio of the G.P. whose first and last terms are 5 and  $\frac{32}{625}$  respectively and the sum off the G.P. is  $\frac{5187}{625}$  :

  - a)  $\frac{1}{5}$
  - b)  $\frac{2}{5}$
  - c)  $\frac{5}{3}$
  - d)  $\frac{4}{5}$
  - e) None of these

2) Vibhor joined as an Area Manager of Quick Corporation in the pay scale of Rs.12,500 – 500 – 18,500. Minimum how many years he has to work in the corporation to avail the salary of Rs.18,500 per month :

  - a) 12 years
  - b) 10 years
  - c) 13 years
  - d) 11 years
  - e) None of these

3) How many terms are common in two arithmetic progression 1, 4, 7, 10 .... Upto 63 terms and 3, 7, 11, 15 .... Upto 47 terms :

  - a) 12
  - b) 16
  - c) 15
  - d) Data inadequate
  - e) None of these

4) Let  $a_n$  be the  $n$ th term of an A.P. and  $a_7 = 22$ , then the value of the common difference (d) that would make  $a_3 \cdot a_7 \cdot a_{11}$  greatest is :

  - a) 4
  - b) 2
  - c) 0



- a)  $\frac{n(n - 1)}{2} - 1$       b)  $n(n + 1) + 2^n - 1$       c)  $n(n + 2) + 1$   
d)  $3(2n + 1) - 2^n$       e) None of these

- 14) In an A.P. consisting of 23 terms, the sum of the three terms in the middle is 114 and that of the last three is 204. Find the sum of first three terms :  
 a) 14                      b) 42                      c) 24  
 d) 69                      e) None of these

## Solutions:

- ### 1. Option B

Since  $a > 1$ , therefore  $r < 1$

Now, since  $S_n = \frac{a - lr}{1 - r}$  if  $r < 1$

$$\text{So, } \frac{5187}{5} = \frac{5 - \frac{32}{625}r}{}$$

$$(1 - r) \frac{625}{5187} = 5 - \frac{32r}{625}$$

$$r = \frac{2}{625}$$

5

- ## 2. Option C

$$\frac{18500 - 12000}{500} = 13 \text{ years}$$

He has to work minimum 13 years to reach the highest scale of 18500.

- ### 3. Option B

1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, .... 187

3, 7, 11, 15, 19, 23, 27, 31, 35, 39, .... 187

The common terms are 7, 19, 31, 43, .... 187

Therefore number of such terms =  $\left[ \frac{187 - 7}{12} \right] + 1 = 16$

- #### 4. Option C

Let  $d$  be the common difference of the A.P.

$$\text{Then } a_3 \cdot a_7 \cdot a_{11} = (22 - 4d) \cdot 22 \cdot (22 + 4d) \\ = 88(121 - 4d^2)$$

Obviously, R.H.S. is greatest for  $d = 0$

- ### 5. Option B

$$(1 - 2) + (3 - 4) + (5 - 6) + (7 - 8) + \dots + (99 - 100) \\ = (-1) + (-1) + (-1) + (-1) + \dots \text{ 50 times} = -50$$

## 6. Option B

$$\text{Sum of odd terms} - \text{sum of even terms} = 72 - 63$$

$$\frac{\text{number of terms}}{2} \times \text{common difference} = 9$$

$$nd = 18 \quad \dots \text{(i)}$$

(n → number of terms, d → common difference)

$$\text{Again } 1 - a = 16.5$$

$$(n - 1)d = 16.5 \quad \dots \text{(ii)}$$

So, from (i) and (ii), we get

$$d = 1.5$$

$$n = 12$$

## 7. Option C

$$1 + 4 + 9 + 16 + \dots + n^2$$

$$= 1^2 + 2^2 + 3^2 + 4^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$

## 8. Option B

$$a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$$

$$a_1 + (a_1 + 4d) + (a_1 + 9d) + (a_1 + 14d) + (a_1 + 19d) + (a_1 + 23d) = 225$$

$$6a_1 + 69d = 225 \quad \dots \text{(i)}$$

$$\text{Now, } a_1 + a_2 + a_3 + a_4 + \dots + a_{23} + a_{24} = 24a_1 + 276d = 4(6a_1 + 69d) \\ = 4 \times 225 = 900$$

## 9. Option B

The two sequences are 17, 21, 25, 29, 33, 37, 41 .... 417

16, 21, 26, 31, 36, 41 .... 466

The common terms are 21, 41, 61, 81 .... 381, 401

So, number of terms (which are common) = 20

## 10. Option C

$$1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + 7^2 - 8^2 + \dots$$

$$= (1 - 2)(1 + 2) + (3 - 4)(3 + 4) + (5 - 6)(5 + 6) + (7 - 8)(7 + 8) + \dots$$

$$= -(1 + 2) - (3 + 4) - (5 + 6) \dots$$

$$= -[(1 + 2) + (3 + 4) + (5 + 6) + \dots]$$

$$= -[1 + 2 + 3 + 4 + 5 + 6 + \dots] = -\frac{n(n+1)}{2}$$

## 11. Option D

$$\begin{aligned}
 S_n &= \frac{1}{\sqrt{1} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{5}} + \dots + \frac{1}{\sqrt{2n-1} + \sqrt{2n+1}} \\
 &= \frac{1}{2} \left[ (\sqrt{3} - \sqrt{1}) + (\sqrt{5} - \sqrt{3}) + (\sqrt{7} - \sqrt{5}) + (\sqrt{2n+1} - \sqrt{2n-1}) \right] \\
 &= \frac{1}{2} (\sqrt{2n+1} - 1)
 \end{aligned}$$

12. Option B

Since 913952088 is divisible by 7

**Alternatively:**  $a = 119$

$$a + d = 119 + 7 = 126$$

$$a + 2d = 119 + 14 = 133$$

So, the numbers which are divisible by 7 are 119, 126, 133 .... 113113 ....

$$\text{So, number of terms} = \left[ \frac{113113 - 119}{7} \right] + 1 = 16143$$

$$S_{16143} = \left[ \frac{119 + 113113}{2} \right] \times 16143 = 913952088$$

**Hint:** The unit digit will be 8 as  $\left[ \frac{9+3}{2} \right] \times 3$

$$6 \times 3 = 8$$

Hence, only choice (b) is appropriate.

13. Option B

Let  $n = 2$ , then

$$S_n = 3 + 6 = 9$$

at  $n = 3$ ,

$$S_n = 2(3) + 2^2 - 1 = 9$$

So,

$$S_n = 19$$

$$S_n = 3 \times 4 + 2^3 - 1 = 19$$

Hence choice (b) is correct

**Alternatively :**  $3 + 6 + 10 + 16 + \dots$

$$= (2 + 4 + 6 + 8 + \dots) + (1 + 2 + 4 + 8 + \dots)$$

$$= n(n+1) + (2^n - 1)$$

14. Option C

$$T_{11} + T_{12} + T_{13} = 114$$

$$T_{12} = \frac{114}{3} = 38$$

$$a + 11d = 38 \quad \dots \text{(i)}$$

$$\text{and } T_{21} + T_{22} + T_{23} = 204$$

$$T_{22} = 68$$

$$a + 21d = 68 \quad \dots \text{(ii)}$$

from equations (i) and (ii)

$$10d = 30$$

$$d = 3$$

So,  $a = 5$

$$T_1 + T_2 + T_3 = 5 + 8 + 11 = 24$$

## Chapter - 11

# Time and Distance

### Concepts

- 1) There is a relationship between speed, distance and time:

Speed = Distance / Time OR

Distance = Speed \* Time

- 2) Average Speed =  $\frac{2xy}{x + y}$

where x km/hr is a speed for certain distance and y km/hr is a speed at for same distance covered.

\*\*\*\* Remember that average speed is not just an average of two speeds i.e.  $\frac{x + y}{2}$ .

It is equal to  $\frac{2xy}{x + y}$

- 3) Always remember that during solving questions units must be same. Units can be km/hr, m/sec etc.

\*\*\*\* Conversion of km/ hr to m/ sec and m/ sec to km/ hr

$x \text{ km/ hr} = (x \times \frac{5}{18}) \text{ m/sec}$  i.e. u just need to multiply  $\frac{5}{18}$

Similarly,  $x \text{ m/sec} = \left[ x \times \frac{18}{5} \right] \text{ km/sec}$

- 4) As we know, Speed = Distance/ Time. Now, if in questions Distance is constant then speed will be inversely proportional to time i.e. if speed increases, time taken will decrease and vice versa.

### Time and Distance Questions:-

**Example 1:** A man covers a distance of 600m in 2min 30sec. What will be the speed in km/hr?

**Solution:** Speed =  $\frac{\text{distance}}{\text{time}}$

$\Rightarrow$  Distance covered = 600m, Time taken = 2min 30sec = 150sec

Therefore, Speed =  $\frac{600}{150} = 4 \text{ m/sec}$

$\Rightarrow 4 \text{ m/sec} = (4 \times \frac{18}{5}) \text{ km/hr} = 14.4 \text{ km/ hr.}$

**Example 2:** A boy travelling from his home to school at 25 km/hr and came back at 4 km/hr. If whole journey took 5 hours 48 min. Find the distance of home and school.

**Solution:** In this question, distance for both speed is constant.

$$\Rightarrow \text{Average speed} = \frac{2xy}{x+y} \text{ km/hr, where } x \text{ and } y \text{ are speeds}$$

$$\Rightarrow \text{Average speed} = (2 \times 25 \times 4) / 25 + 4 = 200/29 \text{ km/hr}$$

$$\text{Time} = 5 \text{ hours } 48 \text{ min} = \frac{29}{5} \text{ hours}$$

Now, Distance travelled = Average speed × Time

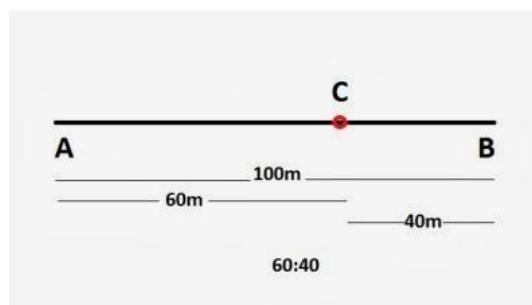
$$\Rightarrow \text{Distance Travelled} = \frac{200}{29} \times \frac{29}{5} = 40 \text{ km}$$

$$\text{Therefore distance of school from home} = \frac{40}{2} = 20 \text{ km.}$$

**Example 3:** Two men start from opposite ends A and B of a linear track respectively and meet at point 60m from A. If AB= 100m. What will be the ratio of speed of both men?

**Solution:** According to this question, time is constant. Therefore, speed is directly proportional to distance.

Speed  $\propto$  Distance



$$\Rightarrow \text{Ratio of distance covered by both men} = 60:40 = 3:2$$

$$\Rightarrow \text{Therefore, Ratio of speeds of both men} = 3:2$$

**Example 4:** A car travels along four sides of a square at speeds of 200, 400, 600 and 800 km/hr. Find average speed.

**Solution:** Let  $x$  km be the side of square and  $y$  km/hr be average speed  
Using basic formula, Time = Total Distance / Average Speed

$$\frac{x}{200} + \frac{x}{400} + \frac{x}{600} + \frac{x}{800} = \frac{4x}{y} \Rightarrow \frac{25x}{2400} = \frac{4x}{y} \Rightarrow y = 384$$

$$\Rightarrow \text{Average speed} = 384 \text{ km/hr}$$

### Exercise - 11

- 1) An express train travelled at an average speed of 100 km/hr, stopping for 3 minutes after every 75 km. How long did it take to reach its destination 600 km from the starting point?

- a) 6 hrs. 21 min.      b) 6 hrs. 24 min.      c) 6 hrs. 27 min.  
d) 6 hrs. 30 min.      e) None of these
- 2) Sound is said to travel in air at about 1100 feet per second. A man hears the axe striking the tree,  $1\frac{1}{5}$  seconds after he sees it strike the tree. How far is the man from the wood chopper?  
a) 2197 ft      b) 2420 ft      c) 2500 ft  
d) 2629 ft      e) None of these
- 3) The speed of a car increases by 2kms after every one hour. If the distance travelling in the first one hour was 35kms. What was the total distance travelled in 12hours?  
a) 456kms      b) 482kms      c) 552kms  
d) 556kms      e) None of these
- 4) A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?  
a) 3.6      b) 7.2      c) 8.4  
d) 10      e) None of these
- 5) A train travels at an average of 50 miles per hour for  $2\frac{1}{2}$  hours and then travels at a speed of 70 miles per hour for  $1\frac{1}{2}$  hours. How far the train did travels in the entire 4 hours?  
a) 120 miles      b) 150 miles      c) 200 miles  
d) 230 miles      e) None of these
- 6) An aero plane covers a certain distance at a speed of 240kmph in 5 hours. To cover the same distance in  $1\frac{2}{3}$  hours, it must travel at a speed of  
a) 300kmph      b) 360kmph      c) 600kmph  
d) 720kmph      e) None of these
- 7) A truck covers a distance of 550 meters in 1 minute whereas a bus covers a distance of 33 km in 45 minutes. The ratio of their speed is  
a) 3:4      b) 4:3      c) 3:5  
d) 5:3      e) None of these
- 8) A boy goes to his school from his house at a speed of 3 km.hr and return at a speed of 2 km/hr. If he takes 5 hours in going and coming, the distance between his house and school is  
a) 5km      b) 5.5km      c) 6km  
d) 6.5 km      e) None of these
- 9) A man on tour travels first 160 km at 64 km/hr and the next 160 km at 80 km/hr. The average speed for the first 320 km of the tour is  
a) 35.55 km/hr      b) 36 km/hr      c) 71.11km/hr  
d) 71km/hr      e) None of these
- 10) An athlete runs 200 meters race in 24 seconds. His speed is

- a) 20 km/hr                    b) 24 km/hr                    c) 28.5km/hr  
d) 30km/hr                    e) None of these
- 11) A person has to cover a distance of 6 km in 45 minutes. If he covers one-half of the distance in two-thirds of the total time; to cover the remaining distance in the remaining time, his speed (in Km/hr) must be  
a) 6                            b) 8                            c) 12  
d) 15                            e) None of these
- 12) A person travels from P to Q at a speed of 40 km/hr and returns by increasing his speed by 50%. What is his average speed for both the trips?  
a) 35kmph                    b) 45kmph                    c) 48kmph  
d) 50kmph                    e) None of these
- 13) A car moves at the speed of 80 km/hr. what is the speed of the car in meters per second?  
a) 8m/sec                    b)  $20 \times 1\text{m}/9\text{sec}$                     c)  $21 \times 2/9\text{m/sec}$   
d)  $22 \times 2/9\text{m/sec}$             e) None of these
- 14) A and B walk a circulate track. They start at 8a.m from the same point in the opposite directions. A and B walk at a speed of 2 rounds per hour and 3 rounds per hour respectively. How many times shall they cross each other before 9.30a.m?  
a) 5                            b) 7                            c) 9  
d) 11                            e) None of these
- 15) The distance between two cities A and B is 330 Km. A train starts from A at 8 a.m. and travel towards B at 60 km/hr. Another train starts from B at 9a.m and travels towards A at 75 Km/hr. At what time do they meet?  
a) 10 a.m                    b) 10:30a.m                    c) 11a.m  
d) 11:30a.m                    e) None of these
- 16) A man in a train notices that he can count 21 telephone posts in one minute. If they are known to be 50 meters apart, then at what speed is the train travelling?  
a) 55km/hr                    b) 57km/hr                    c) 60km/hr  
d) 63km/hr                    e) None of these
- 17) A man walking at the rate of 5 km/hr crosses a bridge in 15 minutes. The length of the bridge in meters is  
a) 600                            b) 750                            c) 1000  
d) 1250                            e) None of these
- 18) A cyclist covers a distance of 750 m in 2 min. 30 sec. What is the speed in km/hr of the cyclist?  
a) 18 km/hr                    b) 9 km/hr                            c) 17 km/hr  
d) 20 km/hr                    e) None of these

- 19) A train crosses a man coming from the opposite direction in 7.5 seconds. If the speed of man be 10 m/s and speed of train is 20 m/s, find the length of the train?
- a) 225 m                    b) 125m                    c) 150 m  
d) 180 m                    e) None of these
- 20) An aeroplane flies along the four sides of a square at the speeds of 200, 400, 600 and 800 km/hr. Find the average speed of the plane around the field.
- a) 390 km/hr                b) 384 km/hr                c) 400 km/hr  
d) 205 km/hr                e) None of these
- 21) In a 1 km race A wins over B by 80 m or 20second. B can give a start of 100 m to C in 1 km race. Find out that by how much time A will win over C?
- a) 47.77                    b) 45.90                    c) 46.80  
d) 47.95                    e) None of these
- 22) A goods train leaves a station at a certain time and at a fixed speed. After 6 hours, an express train leaves the same station and moves in the same direction at a uniform speed of 90 kmph. This train catches up the goods train in 4 hours. Find the speed of the goods train.
- a) 60 kmph                b) 36 kmph                c) 12 kmph  
d) 24 kmph                e) None of these
- 23) A can run 1 km in 2 min 20 second and B can run the same distance in 3 min. What is the distance travelled by B in the same time as A travels, when they start simultaneously in the race of 4.5 km?
- a) 5 km                    b) 6 km                    c) 3.5 km  
d) 5.6 km                    e) None of these
- 24) A thief is spotted by a policeman from a distance of 100 metres. When the policeman starts the chase, the thief also starts running. If the speed of the thief be 8 km/hr and that of the policeman 10 km/hr how far the thief will have run before he is overtaken?
- a) 200 m                    b) 100 m                    c) 300 m  
d) 400 m                    e) None of these
- 25) An athlete runs 200 metres race in 24 seconds. His speed is
- a) 20 km/hr                b) 24 km/hr                c) 28.5 km/hr  
d) 30 km/hr                e) None of these
- 26) A train M leaves Meerut at 5 a.m. and reaches Delhi at 9 a.m. Another train leaves Delhi at 7 a.m. and reaches Meerut at 10.30 a.m. At what time do the two trains cross each other?
- a) 7.36 a.m.                b) 7.56 a.m.                c) 8 a.m.  
d) 8.26 a.m.                e) None of these
- 27) A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?



- d) 5.15 p.m.                    e) None of these
- 36) A covered half of his journey at 20 km/h and rest at  $x$  km/h, then his average speed is 24 km/h. What is the value of  $x$ ?  
a) 30                            b) 32                            c) 36  
d) 40                            e) None of these
- 37) When do the hands of a clock coincide between 5 and 6?  
a) 5 : 30 : 16                    b) 5 : 27 : 16                    c) 5 : 32 : 16  
d) 5 : 28 : 56                    e) None of these
- 38) A train goes with a speed of 20 m/s. What is the speed of train in km/h?  
a) 57 km/h                            b) 72 km/h                            c) 80 km/h  
d) 120 km/h                            e) None of these
- 39) Vinay and Versha run a race with their speeds in the ratio of 5 : 3. They prefer to run on a circular track of circumference 1.5 km. What is the distance covered by Vinay when he passes Versha for the seventh time?  
a) 25.25 km                            b) 26.25 km                            c) 132 m  
d) Data inadequate                            e) None of these
- 40) A is twice fast as B and B is thrice as fast as C. The journey covered by C in 78 minutes will be covered by A in :  
a) 12 min                            b) 13 min                            c) 15.5 min  
d) Data inadequate                            e) None of these
- 41) A beats B by 100 m in a race of 1200 m and B beats C by 200 m in a race of 1600 m. Approximately by how many metres can A beat C in a race of 9600 m?  
a) 1600 m                            b) 1800 m                            c) 1900 m  
d) 2400 m                            e) None of these
- 42) A motor car starts with the speed of 70 km/hr with its speed increasing every two hours by 10 kmph. In how many hours will it cover 345 kms?  
a)  $2\frac{1}{4}$  hrs.                            b) 4 hrs. 5 min.                            c)  $4\frac{1}{2}$  hrs.  
d) Data inadequate                            e) None of these
- 43) Two men starting from the same place walk at the rate of 5 kmph and 5.5 kmph respectively. What time will they take to be 8.5 km apart, if they walk in the same direction?  
a) 4 hrs 15 min                            b) 8 hrs 30 min                            c) 16 hrs.  
d) 17 hrs.                                    e) None of these
- 44) A train covers a distance of 10 km in 12 minutes. If its speed is decreased by 5 km/hr the time taken by it to cover the same distance will be :  
a) 10 min                                    b) 11 min 20 s                            c) 13 min  
d) 13 min 20 s                            e) None of these



is 10 kmph and my walking speed is 1 kmph, then on my bicycle I covered a distance of :

- a)  $4\frac{61}{66}$  km      b)  $13\frac{4}{9}$  km      c)  $14\frac{3}{8}$  km  
d)  $15\frac{10}{21}$  km      e) None of these

53) Walking  $\frac{6}{7}$ -th of his usual speed, a man is 12 minutes too late. The usual time taken by him to cover that distance is :

- a) 1 hour      b) 1 h 12 min      c) 1 h 15 min  
d) 1 h 20 min      e) None of these

54) Mariya was travelling in her boat when the wind blew her hat off and the hat started floating back downstream. The boat continued to travel upstream for twelve more minutes before Mariya realized that her hat had fallen off and turned back downstream. She caught up with that as soon as it reached the starting point. Find the speed of river if Mariya's hat flew off exactly 3 km from where she started :

- a) 5 km/h      b) 6 km/h      c) 7.5 km/h  
d) Data inadequate      e) None of these

55) Einstein walks on an escalator at a rate of 5 steps per second and reaches the other end in 10 seconds. While coming back, walking at the same speed he reaches the starting point in 40 seconds. What is the number of steps on the escalator?

- a) 40      b) 60      c) 120  
d) 80      e) None of these

56) In a 200 metres race A beats B by 35 m or 7 seconds. A's time over the course is :

- a) 40 sec      b) 47 sec      c) 33 sec  
d) Data inadequate      e) None of these

57) In a 500 m race, the ratio of the speeds of two contestants A and B is 3 : 4. A has a start of 140 m. Then, A wins by :

- a) 60 m      b) 40 m      c) 20 m  
d) 10 m      e) None of these

58) A and B take part in a 100 m race. A runs at 5 km per hour. A gives B a start of 8 m and still beats him by 8 seconds. The speed of B is :

- a) 5.15 kmph      b) 4.14 kmph      c) 4.25 kmph  
d) 4.4 kmph      e) None of these

59) In a 100 m race, A runs at 8 km per hour. If A gives B a start of 4 m and still beats him by 15 seconds, what is the speed of B?

- a) 5.76 km/hr      b) 6 km/hr      c) 4.3 km/hr  
d) 9 km/hr      e) None of these

60) In a 300 m race A beats B by 22.5 m or 6 seconds. B's time over the course is :

- a) 86 sec.      b) 80 sec.      c) 76 sec.

## Solutions:

- ## 1. Option A

$$\text{Time taken to cover } 600 \text{ km.} = \left[ \frac{600}{100} \right] \text{ hrs.} \\ = 6 \text{ hrs.}$$

$$\text{Number of stoppages} = \frac{600}{75} - 1$$

$$\text{Total time of stoppages} = (3 \times 7) \text{ min} \\ \equiv 21 \text{ min}$$

Hence, total time taken = 6 hrs. 21 min.

- ## 2. Option B

$$\text{Distance} = \left[ 1100 \times \frac{11}{5} \right] \text{ feet}$$

$= 2420 \text{ feet}$

- ### 3. Option C

Total distance travelled in 12 hours =  $(35 + 37 + 39 + \dots)$  Upto  
12 terms)

This is an A.P. with first term,  $a = 35$ , number of terms,  
 $n = 12$ ,  $d = 2$

$$\begin{aligned}\text{Required distance} &= \frac{12}{2} [2 \times 35 + \{12 - 1\} \times 2] \\ &= 6(70 + 23) \\ &= 552 \text{ kms.}\end{aligned}$$

4. Option B

$$\begin{aligned}\text{Speed} &= \left[ \frac{600}{5} \times 60 \right] \text{ m/sec} \\ &= 2 \text{ m/sec} \\ &= \left[ 2 \times \frac{18}{5} \right] \text{ km/hr.} \\ &= 7.2 \text{ km/hr.}\end{aligned}$$

5. Option D

$$\begin{aligned}\text{Total distance travelled} &= \left[ (50 \times 2 \times \frac{1}{2}) \right] + \left[ 70 \times 1 \times \frac{1}{2} \right] \\ &= (125 + 105) \text{ miles} \\ &= 230 \text{ miles}\end{aligned}$$

6. Option D

$$\begin{aligned}\text{Distance} &= 1200 \text{ km.} \\ \text{Required speed} &= \left[ 1200 \times \frac{3}{5} \right] \text{ km./hr.} \\ &= 720 \text{ km./hr.}\end{aligned}$$

7. Option A

$$\begin{aligned}\text{Ratio of speeds} &= \left[ \frac{550}{60} \times \frac{18}{5} \right] : \left[ \frac{33}{45} \times 60 \right] \\ &= 33 : 44 \\ &= 3 : 4\ 3:4\end{aligned}$$

8. Option C

$$\begin{aligned}\text{Average speed} &= \left[ 2 \times 3 \times \frac{2}{3} + 2 \right] \text{ km./hr.} \\ &= \frac{12}{5} \text{ km./hr.} \\ \text{Distance travelled} &= \left[ \frac{12}{5} \times 5 \right] \text{ km.} \\ &= 12 \text{ km.}\end{aligned}$$

$$\begin{aligned}\text{Distance between house and school} &= \left[ \frac{12}{2} \right] \text{ km} \\ &= 6 \text{ km.}\end{aligned}$$

9. Option C

Total time taken  $= \left[ \frac{160}{64} + \frac{160}{8} \right] \text{ hrs.}$   
 $= \frac{9}{2} \text{ hrs.}$

Average speed  $= \left[ 320 \times \frac{2}{9} \right] \text{ km.hr}$   
 $= 71.11 \text{ km./hr.}$

10. Option D

Speed  $= \frac{200}{24} \text{ m/sec}$   
 $= \frac{25}{3} \text{ m/sec}$   
 $= \frac{25}{3} \times \frac{18}{5} \text{ km./hr.}$   
 $= 30 \text{ km./hr.}$

11. Option C

Remaining distance  $= 3 \text{ km./hr.}$   
 Remaining time  $= \left[ \frac{1}{3} \times 45 \right] \text{ min}$   
 $= 15 \text{ min}$   
 $= \frac{1}{4} \text{ hr.}$   
 Required speed  $= (3 \times 4) \text{ km./hr.}$   
 $= 12 \text{ km./hr.}$

12. Option C

Speed on return trip  $= 150\% \text{ of } 40 = 60 \text{ kmph.}$   
 Average speed  $= 2 \times 40 \times \frac{60}{40} + 60 \text{ km./hr.}$   
 $= \left[ \frac{4800}{100} \right] \text{ km./hr.}$   
 $= 48 \text{ km./hr.}$

13. Option D

Speed  $= \left[ 80 \times \frac{5}{18} \right] \text{ m/sec}$   
 $= \frac{200}{9} \text{ m/sec}$   
 $= 22 \times \frac{2}{9} \text{ m/sec}$

14. Option B

Relative speed  $= (2 + 3)$   
 $= 5 \text{ rounds per hour}$

So, they cross each other 5 times in an hour and 2 times in half an hour.

Hence, they cross each other 7 times before 9.30 a.m.

15. Option C

Suppose they meet  $x$  hrs. after 8 a.m. then  
(Distance moved by first in  $x$  hrs.) +  $= 300$

$\left[ \text{Distance moved by second in } (x - 1) \text{ hrs.} \right]$

$$\text{Therefore } 60x + 75(x - 1) \quad \Leftrightarrow 330 \\ x = 3$$

So, they meet at  $(8 + 3)$  i.e. 11 a.m.

16. Option C

Number of gaps between 21 telephone posts = 20

$$\begin{aligned} \text{Distance travelled in 1 minute} &= (50 \times 20) \text{ m} \\ &= 1000 \text{ m} \\ &= 1 \text{ km.} \end{aligned}$$

Speed of the train travelling is = 60 km./hr.

17. Option D

$$\begin{aligned} \text{Speed} &= \left[ 5 \times \frac{5}{18} \right] \text{ m/sec} \\ &= \frac{25}{18} \text{ m/sec} \end{aligned}$$

$$\begin{aligned} \text{Distance covered in 15 minutes} &= \left[ \frac{25}{18} \times 15 \times 60 \right] \text{ m} \\ &= 1250 \text{ m.} \end{aligned}$$

18. Option A

$$\text{Speed} = \left[ \frac{750}{150} \right] \text{ m/sec} = 5 \text{ m/sec} = \left[ 5 \times \frac{18}{5} \right] \text{ km/hr} = 18 \text{ km/hr}$$

19. Option A

$$\begin{aligned} \text{Length of train} &= \text{Time} \times \text{Relative speed} \\ &= 7.5 \times (10 + 20) = 7.5 \times 30 = 225 \text{ m} \end{aligned}$$

20. Option B

Let each side of the square be  $x$  km and let the average speed of the plane around the field be  $y$  km/hr. Then,

$$\frac{x}{200} + \frac{x}{400} + \frac{x}{600} + \frac{x}{800} = \frac{4x}{y} \quad y = \left[ \frac{2400 \times 4}{25} \right] = 384$$

So, average speed = 384 km./hr.

21. Option A

Ratio of speeds of A : B = 100 : 92

Ratio of speeds of B : C = 10 : 9

So, Ratio of speeds of A : B : C = 1000 : 920 : 828

Also, speed of B =  $\frac{80}{20} = 4$  m/s

Therefore, speed of C = 3.6 m/s

Now, C has to cover 172 m distance in extra time. So, the time taken by C to cover the remaining distance =  $\frac{172}{3.6} = 47.77$  s

22. Option B

Let the speed of the goods train be x kmph.

Distance covered by goods train in 10 hours = Distance covered by express train in 4 hours

So,  $10x = 4 \times 90$  or  $x = 36$ .

So, speed of goods train = 36 kmph

23. Option C

$$\frac{\text{time taken by } A}{\text{time taken by } B} = \frac{140 \text{ s}}{180 \text{ s}} = \frac{7}{9}$$

$$\text{So, } \frac{\text{speed of } A}{\text{speed of } B} = \frac{\text{Distance travelled by } A}{\text{Distance travelled by } B} = \frac{9}{7}$$

Therefore, B travels  $\frac{7}{9} \times 4.5 = 3.5$  km

24. Option D

Relative speed of the policeman =  $(10 - 8)$  km/hr = 2 km/hr

Time taken by policeman to cover 100 m =  $\left[ \frac{100}{1000} \times \frac{1}{2} \right] \text{ hr} = \frac{1}{20} \text{ hr}$

In  $\frac{1}{20}$  hrs., the thief covers a distance of  $\left[ 8 \times \frac{1}{20} \right] \text{ km} = \frac{2}{5} \text{ km} = 400 \text{ m}$

25. Option D

Speed =  $\frac{200}{24} \text{ m/sec} = \frac{25}{3} \text{ m/sec} = \left[ \frac{25}{3} \times \frac{18}{5} \right] \text{ km/hr} = 30 \text{ km/hr}$

26. Option B

Let the distance between Meerut and Delhi be x km and let the trains meet y hours after 7 a.m.

Clearly, M covers x km in 4 hrs. and N covers x km in  $(7/2)$  hrs.)

So, Speed of M =  $\frac{x}{4}$  kmph, Speed of N =  $\frac{2x}{7}$  kmph

Distance covered by M in  $(y + 2)$  hrs. + Distance covered in  $y$  hrs. =  $x$

$$\text{So, } \frac{x}{4}(y+2) + \frac{2x}{7} \times y = x \quad \frac{(y+2)}{4} + \frac{2y}{7} = 1$$

$$y = \frac{14}{15} \text{ hrs.} = \left[ \frac{14}{15} \times 60 \right] \text{ min.} = 56 \text{ min.}$$

Hence, the trains meet at 7.56 a.m.

27. Option B

$$\text{Speed} = \left[ \frac{600}{5 \times 60} \right] \text{ m/sec} = 2 \text{ m/sec} = \left[ 2 \times \frac{18}{5} \right] \text{ km/hr} = 7.2 \text{ km/hr}$$

28. Option D

At the time of meeting, let the distance travelled by the second train be  $x$  km.  
Then, distance covered by the first train is  $(x + 100)$  km

$$\text{So, } \frac{x}{40} = \frac{x + 100}{50} \quad 50x = 40x + 4000 \quad x = 400$$

So, distance between P and Q =  $(x + x + 100)$  km = 900 km

29. Option D

$$\text{Speed} = 9 \text{ km/hr} = \left[ 9 \times \frac{5}{18} \right] \text{ m/sec} = \frac{5}{2} \text{ m/sec}$$

$$\text{Distance} = (35 \times 4) \text{ m} = 140 \text{ m}$$

$$\text{So, time taken} = \left[ 140 \times \frac{2}{5} \right] \text{ sec} = 56 \text{ sec}$$

30. Option B

Let their speeds be  $x$  kmph and  $y$  kmph respectively.

$$\text{Then, } \frac{120}{x+y} = 1 \quad x + y = 120 \quad \dots \text{ (i)}$$

Now, when they move in same direction :

(Distance travelled by P in 6 hours) - (Distance traveled by Q in 6 hours) = 120 km

$$6x - 6y = 120 \quad x - y = 20 \quad \dots \text{ (ii)}$$

Solving (i) and (ii),  $x = 70$ ,  $y = 50$

So, P's speed = 70 kmph

31. Option C

$$\text{Ratio of speeds} = \left[ 300 \times \frac{2}{15} \right] : \left[ \frac{450}{9} \right] = 40 : 50 = 4 : 5$$

32. Option B

Clearly, the two will meet when they are 726 m apart.  
To be  $(4.5 + 3.75) = 8.25$  km apart, they take 1 hour.

$$\text{To be } 726 \text{ m apart, they take } \left[ \frac{\frac{100}{825}}{\frac{726}{1000}} \right] \text{ hrs.} = \left[ \frac{\frac{242}{2750}}{60} \right] \text{ min} = 5.28 \text{ min}$$

33. Option D

Let the speeds of two trains be  $7x$  and  $8x$  km/hr.

$$\text{Then, } 8x = \frac{400}{4} = 100 \quad x = \left[ \frac{100}{8} \right] = 12.5$$

So, speed of first train =  $(7 \times 12.5)$  km/hr = 87.5 km/hr

34. Option C

Number of gaps between 21 telephone posts = 20  
Distance travelled in 1 minute =  $(50 \times 20)$  m = 1000 m = 1 km.  
So, speed = 60 km/hr

35. Option C

Suppose the thief is overtaken  $x$  hrs. after 2.30 p.m.

The, distance covered by the thief in  $x$  hrs. = distance covered by the owner in  $\left[ x - \frac{1}{2} \right]$  hrs.

$$\text{So, } 60x = 75 \left[ x - \frac{1}{2} \right] \quad 15x = \frac{75}{2} \quad x = \frac{5}{2} \text{ hrs.}$$

So, the thief is overtaken at 5 p.m.

36. Option A

$$\frac{\frac{2 \times 20 \times x}{(20+x)}}{24} = \frac{2}{24}$$

$$x = 30 \text{ km/h}$$

37. Option B

$$\frac{5 \times 30}{\frac{11}{2}} = \frac{300}{11} = 27 \frac{3}{11} \text{ min.} = 27 \text{ min } 16 \text{ s}$$

Therefore, required time = 5 : 27 : 16

38. Option B

$$\text{Speed} = 20 \text{ m/s} = 20 \times \frac{18}{5} = 72 \text{ km/h}$$

39. Option B

Since, the speeds of Vinay and Versha are in the ratio of 5 : 3 i.e., when Vinay covers 5 rounds, then Versha covers 3 rounds, but first time Vinay and Versha meet when Vinay completes  $2 \frac{1}{2}$  round and Versha completes  $1 \frac{1}{2}$  round. For Vinay to

pass Versha 7<sup>th</sup> time, Vinay would have completed  $7 \times 2 \frac{1}{2}$  rounds. Since, each round is  $1 \frac{1}{2}$  km, the distance covered by Vinay is

$$7 \times 2 \frac{1}{2} \times 1 \frac{1}{2} = 7 \times \frac{5}{2} \times \frac{3}{2} = 26 \frac{1}{4} = 26.25 \text{ km}$$

40. Option B

The ratio of speeds of A, B, C = 6 : 3 : 1

So, the ratio of time taken by A, B, C = 1 : 2 : 6

So, time taken by A = 13 min

41. Option C

Ratio of speeds of A : B = 12 : 11

And ratio of speeds of B : C = 8 : 7

Therefore, ratio of speeds of A : B : C = 96 : 88 : 77

So, in 9600 m race A will beat C by 1900 m.

42. Option C

Distance covered in first 2 hours =  $(70 \times 2)$  km = 140 km

Distance covered in next 2 hours =  $(80 \times 2)$  km = 160 km

Remaining distance =  $345 - (140 + 160) = 45$  km

Speed in the fifth hour = 90 km/hr

Time taken to cover 45 km =  $\left[ \frac{45}{90} \right]$  hr. =  $\frac{1}{2}$  hr.

So, total time taken =  $\left[ 2 + 2 + \frac{1}{2} \right] = 4 \frac{1}{2}$  hrs.

43. Option D

To be 0.5 km apart, they take 1 hour.

To be 8.5 km apart, they take  $\left[ \frac{1}{0.5} \times 8.5 \right]$  hrs. = 17 hrs.

44. Option D

Speed =  $\left[ 10 \times \frac{60}{12} \right]$  km/hr = 50 km/hr

New speed =  $(50 - 5)$  km/hr = 45 km/hr

So, time taken =  $\left[ \frac{10}{15} \right]$  hr =  $\left[ \frac{2}{9} \times 60 \right]$  min =  $13 \frac{1}{3}$  min = 13 min 20 sec

45. Option C

Let the speed of the train be x km/hr and that of the car be y km/hr

$$\text{Then, } \frac{\frac{120}{x}}{y} + \frac{\frac{480}{y}}{x} = 8 \text{ or } \frac{1}{x} + \frac{4}{y} = \frac{1}{15} \quad (\text{i})$$

$$\text{And, } \frac{\frac{200}{x}}{y} + \frac{\frac{400}{y}}{x} = \frac{25}{3} \text{ or } \frac{1}{x} + \frac{2}{y} = \frac{1}{24} \quad (\text{ii})$$

Solving (i) and (ii), we get  $x = 60$  and  $y = 80$

So, Ratio of speeds =  $60 : 80 = 3 : 4$

46. Option C

Remaining distance = 3 km and Remaining time =  $\left[\frac{1}{3} \times 45\right] \text{ min} = 15 \text{ min} = \frac{1}{4} \text{ hour}$   
 So, required speed =  $(3 \times 4) \text{ km/hr} = 12 \text{ km/hr}$

47. Option B

Let the distance be  $x$  km. Then,

$$\frac{x}{7\frac{1}{2}} - \frac{x}{8} = 4 \quad \frac{2x}{15} - \frac{x}{8} = 4 \quad x = 480 \text{ km}$$

48. Option B

Let the total distance be  $x$  km. Then,

$$\frac{\frac{1}{2}x}{21} + \frac{\frac{1}{2}x}{24} = 10 \quad \frac{x}{21} + \frac{x}{24} = 20$$

$$15x = 168 \times 20 \quad x = \left[ \frac{168 \times 20}{15} \right] = 224 \text{ km}$$

49. Option A

Let Abhay's speed be  $x$  km/hr

$$\text{Then, } \frac{30}{x} - \frac{30}{2x} = 3 \quad 6x = 30 \quad x = 5 \text{ km/hr}$$

50. Option C

Let the original speed be  $x$  km/hr. Then,

$$\frac{715}{x} - \frac{715}{x+10} = 22x \quad (x+10) = 7150 \quad x^2 + 10x - 3575 = 0 \\ (x+65)(x-55) = 0 \quad x = 55 \text{ km/hr}$$

51. Option D

Total distance travelled =  $[(50 \times 2\frac{1}{2}) + (70 \times 1\frac{1}{2})]$  miles =  $(125 + 105)$  miles = 230 miles

52. Option A

Time taken = 5 hrs. 25 min. =  $\frac{65}{12}$  hrs.

Let the required distance be  $x$  km.

$$\text{Then, } \frac{x}{10} + \frac{x}{1} = \frac{65}{12} \quad 11x = \frac{650}{12} \quad x = \frac{325}{66} = 4 \frac{61}{66} \text{ km}$$

53. Option B

$$\text{New speed} = \frac{6}{7} \text{ of usual speed}$$

$$\text{New time} = \frac{7}{6} \text{ of usual time}$$

$$\text{So, } \left[ \frac{7}{6} \text{ of usual time} \right] - (\text{usual time}) = \frac{1}{5} \text{ hr.}$$

$$\frac{1}{6} \text{ of usual time} = \frac{1}{5} \text{ hr.} \quad \text{usual time} = \frac{6}{5} \text{ hr.} = 1 \text{ hr. } 12 \text{ min.}$$

54. Option C

Let the speed of boat be  $B$  and that of river be  $R$ . In 12 minutes the distance between boat and hat =  $12(B - R) + 12R = 12B$

$$\text{Now time taken by boat to reach to the hat} = \frac{12B}{(B + R) - R} = 12 \text{ min}$$

$$\text{Total time} = 24 \text{ min}$$

$$\text{In 24 minutes had flown off} = 3 \text{ km}$$

$$\text{So, } \frac{24}{60} \times R = 3$$

$$R = 7.5 \text{ km/h}$$

55. Option D

Let there be  $L$  steps in the escalator and  $x$  be the speed (in steps/second) of escalator, then

$$\frac{L}{(5 + x)} = 10 \text{ and } \frac{L}{(5 - x)} = 40$$

$$\text{Then, } \frac{(5 + x)}{(5 - x)} = \frac{40}{10} \quad x = 3$$

$$\text{So, number of steps in the escalator} = L = 8 \times 10 = 80$$

56. Option C

B runs 35 m in 7 sec.

$$\text{So, B covers 200 m in } \left[ \frac{7}{35} \times 200 \right] = 40 \text{ sec.}$$

B's time over the course = 40 sec.

$$\text{So, A's time over the course} = (40 - 7) = 33 \text{ sec.}$$

57. Option C

To reach the winning post A will have to cover a distance of (500-140) m, i.e 360 m

While A covers 3 m, B covers 4 m

While A covers 360 m, B covers  $\left[ \frac{4}{3} \times 360 \right] \text{ m} = 480 \text{ m} \right]$

Thus, when A reaches the winning post, B covers 480 m and therefore remains 20 m behind.

So, A wins by 20 m.

58. Option B

$$\text{A's speed} = \left[ 5 \times \frac{5}{18} \right] \text{ m/sec} = \frac{25}{18} \text{ m/sec}$$

$$\text{Time taken by A to cover 100 m} = \left[ 100 \times \frac{18}{25} \right] \text{ sec} = 72 \text{ sec.}$$

$$\text{So, time taken by B to cover 92 m} = (72 + 8) \text{ sec} = 80 \text{ sec}$$

$$\text{So, B's speed} = \left[ \frac{92}{80} \times \frac{18}{5} \right] \text{ kmph} = 4.14 \text{ kmph}$$

59. Option A

$$\text{Time taken by A to cover 100 m} = \left[ \frac{60 \times 60}{8000} \times 100 \right] \text{ sec.} = 45 \text{ sec.}$$

$$\text{So, B covers } (100 - 4) \text{ m} = 96 \text{ m in } (45 + 15) \text{ sec} = 60 \text{ sec.}$$

$$\text{So, B's speed} = \left[ \frac{96 \times 60 \times 60}{60 \times 1000} \right] \text{ km/hr} = 5.76 \text{ km/hr}$$

60. Option B

$$\text{B runs } \frac{45}{2} \text{ m in 6 sec.}$$

$$\text{So, B covers } 300 \text{ m in } \left[ 6 \times \frac{2}{45} \times 300 \right] \text{ sec.} = 80 \text{ sec.}$$

61. Option C

$$A : B = 60 : 45 \text{ and } A : C = 60 : 40$$

$$\text{So, } \frac{B}{C} = \left[ \frac{B}{A} \times \frac{A}{C} \right] = \left[ \frac{45}{60} \times \frac{60}{40} \right] = \frac{45}{40} = \frac{90}{80} = 90 : 80$$

So, B can give C 10 points in a game of 90.

62. Option A

$$\text{When B runs 25 m, A runs } \frac{45}{2} \text{ m}$$

$$\text{When B runs 1000 m, A runs } \left[ \frac{45}{2} \times \frac{1}{25} \times 1000 \right] \text{ m} = 900 \text{ m}$$

So, B beats A by 100 m

63. Option B

While A covers 1000 m, B covers  $(1000 - 40)$  m = 960 m and C covers  $(1000 - 64)$  m or 936 m

When B covers 960 m, C covers 936 m

When B covers 1000 m, C covers  $\left[ \frac{936}{960} \times 1000 \right]$  m = 975 m

So, B can give C a start of  $(1000 - 975)$  or 25 m

64. Option A

Ratio of the speeds of A and B =  $\frac{5}{3} : 1 = 5 : 3$

Thus, in a race of 5 m, A gains 2 m over B.

2 m are gained by A in a race of 5 m.

80 m will be gained A in a race of  $\left[ \frac{5}{2} \times 80 \right]$  m = 200 m

So, winning post is 200 m away from the starting point.

65. Option D

A : B = 100 : 90 and A : C = 100 : 87

$$\frac{B}{C} = \frac{B}{A} \times \frac{A}{C} = \frac{90}{100} \times \frac{100}{87} = \frac{30}{29}$$

When B runs 30 m, C runs 29 m

When B runs 180 m, C runs  $\left[ \frac{29}{30} \times 180 \right]$  m = 174 m

So, B beats C by  $(180 - 174)$  m = 6 m

## Chapter - 12

# Time and Work

### Three main factors of Time and Work

There is a definite relationship between Time and Work. In this concept, there are only three factors:

- Time taken to complete a certain job
- Unit of work done
- Number of persons doing the job

There is a Factsmental relationship between these three, discussed as follows:

Work done (W) = Number of days (Time taken) (T or D) × Number of men (M)

$$W = D \times M$$

### Some basic points

More number of men can do more work i.e. both are directly proportional

More number of men take less time to complete certain job i.e. both are inversely proportional

By summarizing, we get

$$\frac{W_1}{W_2} = \frac{M_1}{M_2} \times \frac{D_1}{D_2}$$

Let us start solving some examples:

**Example 1:** 10 men can cut 8 trees in 16 days. In how many days can 6 men cut 10 trees?

**Solution:** This is a very simple example. You are given:

$$W_1 = 8$$

$$W_2 = 10$$

$$M_1 = 10$$

$$M_2 = 6$$

$$D_1 = 16$$

$$D_2 = ?$$

Using formula,

$$\frac{W_1}{W_2} = \frac{M_1}{M_2} \times \frac{D_1}{D_2}$$

$$\frac{8}{10} = \frac{10}{6} \times \frac{16}{D_2}$$

$$\Rightarrow D_2 = 33.3$$

### Concept of efficiency

This means, "How much work one person can do in one day (expressed in percentage)"

For example: A person can do a job in 2 days

⇒ He can do 50% work in one day

Therefore, his efficiency will be 50%

Just a 2-step concept

This concept involves two steps to calculate efficiency:

- Convert into fraction i.e. per day work
- Multiply with 100 i.e. convert into percentage

Try the following example first, then re-read above points

**Example 2:** If a person can complete his work in 5 days. What will be his efficiency?

Solution: Number of days a person take to complete his work = 5

⇒ He is doing  $1/5$  th work per day (converted into fraction)

Convert it into percentage:

$$100/5 = 20\%$$

Therefore, his efficiency is 20%.

Summarizing, If a person can do his job in n days, efficiency will be

$$\text{Efficiency} = \frac{100}{n}\%$$

Note: Negative efficiency cancels the positive efficiency

For Example: Positive efficiency = 5%

Negative efficiency = 1.5%

$$\text{Net efficiency} = 5 - 1.5 = 3.5\%$$

As we all know, in competitive exams time management is very important. I suggest you to learn the fractions till 15.

Number of days required to complete work	Work/Day	Efficiency (%)
N	1/n	100/n
1	1	100
2	1/2	50
3	1/3	33.33
4	1/4	25
5	1/5	20
6	1/6	16.66
7	1/7	14.28
8	1/8	12.5
9	1/9	11.11
10	1/10	10
11	1/11	9.09
12	1/12	8.25
13	1/13	7.69
14	1/14	7.14
15	1/15	6.66

**Example 3:** A can do a job in 10 days. B can do a job in 5 days. In how many days they can complete the job if they work together?

**Solution:** Consider the above table

$$\text{A's efficiency} = 10\%$$

$$\text{B's efficiency} = 20\%$$

$$\text{A+B efficiency} = 10 + 20 = 30\%$$

This means, In one day A and B together can do 30% of work.

$$\text{Therefore, Number of days A and B together take to do 100% of work} = \frac{100}{3}$$

$$\Rightarrow 3.33 \text{ days}$$

**Example 4:** A and B together can do a job in 4 days. If A can do job in 12 days if he works alone, then how many days B alone take to complete the job?

**Solution:** A+B take = 4 days

$$\Rightarrow \text{A+B's efficiency} = 25\% \text{ i.e. they together do } 25\% \text{ of work in one day}$$

$$\text{A takes} = 12 \text{ days}$$

$$\Rightarrow \text{A's efficiency} = 8.33\%$$

$$\text{B's efficiency} = (\text{A+B}) - (\text{A})$$

$$\Rightarrow 25\% - 8.33\% = 16.66\%$$

This means, B can do 16.66% work in one day

$$\text{Therefore, to complete the job he will take} = \frac{100}{16.66} \text{ days}$$

$$\Rightarrow 6 \text{ days}$$

**Example 5:** A and B can do job in 8 days. B and C can do same job in 12 days. A, B and C together can do same job in 6 days. In how many days A and C together can complete the job?

**Solution:** You are given that:

$$\text{A+B's efficiency} = 12.5\%$$

$$\text{B+C's efficiency} = 8.33\%$$

$$\text{A+B+C's efficiency} = 16.66\%$$

we need to find A+C

$$\text{Consider, } 2(\text{A+B+C}) = (\text{A+B}) + (\text{B+C}) + (\text{C+A})$$

$$\Rightarrow 2(16.66) = 12.5 + 8.33 + (\text{C+A})$$

$$\Rightarrow \text{C+A} = 12.49 = 12.5\%$$

$$\text{Therefore, A and C takes} = \frac{100}{12.5} = 8 \text{ days}$$

Hope you all understand this topic. I will soon update questions for your practice.

## Trick

One simple technique is using days in denominator while solving questions. For example, A can do a job in 3 days and B can do the same job in 6 days. In how much time they can do the job together.

**Solution** -  $\frac{1}{3} + \frac{1}{6} = \frac{1}{2}$ , hence 2 days is the answer.

Examiner can set the question in opposite way and can ask you how much time A or B alone will take to complete the job. It is quite easy to calculate said question by putting values in equation we arrived in above question.

You need to understand one simple concept - If A can do a job in 10 day then in one day A can do 1/10th of job.

Now let's solve questions with this trick

**Question 1** - A take 5 days to complete a job and B takes 10 days to complete the same job. In how much time they will complete the job together?

**Solution** - A's efficiency = 20%, B's efficiency = 10%. If they work together they can do 30% of the job in a day. To complete the job they need 3.33 days.

**Question 2** - A is twice as efficient as B and can complete a job 30 days before B. In how much they can complete the job together?

**Solution** - Let efficiency percentage as x

A's efficiency =  $2x$  and B's efficiency =  $x$

A is twice efficient and can complete the job 30 days before B. So,

A can complete the job in 30 days and B can complete the job in 60 days

A's efficiency =  $1/30 = 3.33\%$

B's efficiency =  $1/60 = 1.66\%$

Both can do 5% ( $3.33\% + 1.66\%$ ) of the job in 1 day.

So the can complete the whole job in 20 days ( $100/5$ )

**Question 3** - A tank can be filled in 20 minutes. There is a leakage which can empty it in 60 minutes. In how many minutes tank can be filled?

**Solution** -

**Method 1**

⇒ Efficiency of filling pipe = 20 minutes =  $1/3$  hour = 300%

⇒ Efficiency of leakage = 60 minutes = 100%

We need to deduct efficiency of leakage so final efficiency is 200%. We are taking 100% = 1 Hour as base so answer is 30 minutes.

**Method 2**

⇒ Efficiency of filling pipe =  $100/20 = 5\%$

⇒ Efficiency of leakage pipe =  $100/60 = 1.66\%$

⇒ Net filling efficiency = 3.33%

So, tank can be filled in =  $100/3.33\% = 30$  minutes

You can change the base to minutes or even seconds.

**Question 4** - 4 men and 6 women working together can complete the work within 10 days. 3 men and 7 women working together will complete the same work within 8 days. In how many days 10 women will complete this work?

**Solution** - Let number of men =  $x$ , number of women =  $y$

$$\Rightarrow \text{Efficiency of 4 men and 6 women} = 100/10 = 10\%$$

$$\Rightarrow \text{So, } 4x+6y = 10$$

Above equation means 4 men and 6 women can do 10% of a the job in one day.

$$\Rightarrow \text{Efficiency of 3 men and 7 women} = 100/8 = 12.5\%$$

$$\text{So, } 3x+7y = 12.5$$

By solving both equations we get,  $x = -0.5$  and  $y = 2$

$$\Rightarrow \text{Efficiency of 1 woman}(y) = 2\% \text{ per day}$$

$$\Rightarrow \text{Efficiency of 10 women per day} = 20\%$$

So 10 women can complete the job in  $100/20 = 5$  days

**Question 5** - A and B together can complete a task in 20 days. B and C together can complete the same task in 30 days. A and C together can complete the same task in 30 days. What is the respective ratio of the number of days taken by A when completing the same task alone to the number of days taken by C when completing the same task alone?

**Solution** -  $\Rightarrow \text{Efficiency of A and B} = 1/20 \text{ per day} = 5\% \text{ per day}$  \_\_\_\_\_ 1

$\Rightarrow \text{Efficiency of B and C} = 1/30 \text{ per day} = 3.33\% \text{ per day}$  \_\_\_\_\_ 2

$\Rightarrow \text{Efficiency of C and A} = 1/30 \text{ per day} = 3.33\% \text{ per day}$  \_\_\_\_\_ 3

Taking equation 2 and 3 together

$$\Rightarrow B + C = 3.33\% \text{ and } C + A = 3.33\%$$

$$\Rightarrow C \text{ and } 3.33\% \text{ will be removed. Hence } A = B$$

$$\Rightarrow \text{Efficiency of } A = B = 5\%/2 = 2.5\% = 1/40$$

$$\Rightarrow \text{Efficiency of } C = 3.33\% - 2.5\% = 0.833\% = 1/120$$

$\Rightarrow A$  can do the job in 40 days and  $C$  can do the job in 120 days he they work alone.

$\Rightarrow$  Ratio of number of days in which A and C can complete the job 1:3.

## Exercise - 12

- 1) A can do a work in 15 days and B in 20 days. If they work on it together for 4 days, then the fraction of the work that is left is:
  - a) 1/4
  - b) 1/10
  - c) 7/15
  - d) 8/15
  - e) None of these
  
- 2) A can lay railway track between two given stations in 16 days and B can do the same job in 12 days, with help of C, they did the job in 4 days only. Then, C alone can do the job in:

- a)  $9\frac{1}{5}$       b)  $9\frac{2}{5}$       c)  $9\frac{3}{5}$   
d) 10      e) None of these
- 3) A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day?  
a) 12 days      b) 15 days      c) 16 days  
d) 18 days      e) None of these
- 4) A is thrice as good as workman as B and therefore is able to finish a job in 60 days less than B. Working together, they can do it in:  
a) 20 days      b)  $22\frac{1}{2}$       c) 25 days  
d) 30 days      e) None of these
- 5) A alone can do a piece of work in 6 days and B alone 8 days. A and B undertook to do it for Rs.3200. With the help of C, they completed the work in 3 days. How much is to be paid to C?  
a) Rs.375      b) Rs.400      c) Rs.600  
d) Rs.800      e) None of these
- 6) If 6 men and 8 boys can do a piece of work in 10 days while 26 men and 48 boys can do the same in 2 days, the time taken by 15 men and 20 boys in doing the same type of work will be:  
a) 4 days      b) 5 days      c) 6 days  
d) 7 days      e) None of these
- 7) A can do a piece of work in 4 hours; B and C together can do it in 3 hours, while A and C together can do it in 2 hours. How long will B alone take to do it?  
a) 8 hours      b) 10 hours      c) 12 hours  
d) 24 hours      e) None of these
- 8) A can do a certain work in the same time in which B and C together can do it. If A and B together could do it in 10 days and C alone in 50 days, then B alone could do it in:  
a) 15 days      b) 20 days      c) 25 days  
d) 30 days      e) None of these
- 9) A does 80% of a work in 20 days. He then calls in B and they together finish the remaining work in 3 days. How long B alone would take to do the whole work?  
a) 23 days      b) 37 days      c)  $37\frac{1}{2}$   
d) 40 days      e) None of these
- 10) A machine P can print one lakh books in 8 hours, machine Q can print the same number of books in 10 hours while machine R can print them in 12 hours. All the machines are started at 9 A.M. while machine P is closed at 11 A.M. and the

remaining two machines complete work. Approximately at what time will the work (to print one lakh books) be finished?

- a) 11:30 A.M.      b) 12 noon      c) 12:30 P.M.  
d) 1:00 P.M.      e) None of these

11) A can finish a work in 18 days and B can do the same work in 15 days. B worked for 10 days and left the job. In how many days, A alone can finish the remaining work?

- a) 5      b)  $5\frac{1}{2}$       c) 6  
d) 8      e) None of these

12) 4 men and 6 women can complete a work in 8 days, while 3 men and 7 women can complete it in 10 days. In how many days will 10 women complete it?

- a) 35      b) 40      c) 45  
d) 50      e) None of these

13) A and B can together finish a work 30 days. They worked together for 20 days and then B left. After another 20 days, A finished the remaining work. In how many days A alone can finish the work?

- a) 45      b) 50      c) 54  
d) 60      e) None of these

14) P can complete a work in 12 days working 8 hours a day. Q can complete the same work in 8 days working 10 hours a day. If both P and Q work together, working 8 hours a day, in how many days can they complete the work?

- a)  $5\frac{5}{11}$       b)  $5\frac{6}{11}$       c)  $6\frac{5}{11}$   
d)  $6\frac{6}{11}$       e) None of these

15) 10 women can complete a work in 7 days and 10 children take 14 days to complete the work. How many days will 5 women and 10 children take to complete the work?

- a) 3      b) 5      c) 7  
d) Data inadequate      e) None of these

16) X and Y can do a piece of work in 20 days and 12 days respectively. X started the work alone and then after 4 days Y joined him till the completion of the work. How long did the work last?

- a) 6 days      b) 10 days      c) 15 days  
d) 20 days      e) None of these

17) A is 30% more efficient than B. How much time will they, working together, take to complete a job which A alone could have done in 23 days?

- a) 11 days      b) 13 days      c)  $20\frac{3}{17}$   
d) Data inadequate      e) None of these

- 18) Ravi and Kumar are working on an assignment. Ravi takes 6 hours to type 32 pages on a computer, while Kumar takes 5 hours to type 40 pages. How much time will they take, working together on two different computers to type an assignment of 110 pages?
- a) 7 hours 30 minutes    b) 8 hours    c) 8 hours 15 minutes  
d) 8 hours 25 minutes    e) None of these
- 19) A, B and C can complete a piece of work in 24, 6 and 12 days respectively. Working together, they will complete the same work in:
- a)  $\frac{1}{24}$  day    b)  $\frac{7}{24}$  day    c)  $3\frac{3}{7}$  days    d) 4 days    e) None of these
- 20) Sakshi can do a piece of work in 20 days. Tanya is 25% more efficient than Sakshi. The number of days taken by Tanya to do the same piece of work is:
- a) 15    b) 16    c) 18  
d) 25    e) None of these
- 21) A takes twice as much time as B or thrice as much time as C to finish a piece of work. Working together, they can finish the work in 2 days. B can do the work alone in:
- a) 4 days    b) 6 days    c) 8 days  
d) 12 days    e) None of these
- 22) A and B can complete a work in 15 days and 10 days respectively. They started doing the work together but after 2 days B had to leave and A alone completed the remaining work. The whole work was completed in:
- a) 8 days    b) 10 days    c) 12 days  
d) 15 days    e) None of these
- 23) A and B can do a piece of work in 30 days, while B and C can do the same work in 24 days and C and A in 20 days. They all work together for 10 days when B and C leave. How many days more will A take to finish the work?
- a) 18 days    b) 24 days    c) 30 days  
d) 36 days    e) None of these
- 24) A works twice as fast as B. If B can complete a work in 12 days independently, the number of days in which A and B can together finish the work in:
- a) 4 days    b) 6 days    c) 8 days  
d) 18 days    e) None of these
- 25) Twenty women can do a work in sixteen days. Sixteen men can complete the same work in fifteen days. What is the ratio between the capacity of a man and a woman?
- a) 3 : 4    b) 4 : 3    c) 5 : 3  
d) Data inadequate    e) None of these



a)  $7\frac{1}{5}$   
d)  $10\frac{1}{5}$

b) 8.5  
e) None of these

c) 5

35) Karan can do a work in 10 days while Sohan can do the same work in 20 days. They started work together. After 3 days Karan left the work and Sohan completed it. For how many days Sohan worked alone more than the number of days required when both worked together?

a)  $4\frac{1}{3}$   
d)  $3\frac{2}{3}$

b)  $3\frac{1}{4}$   
e) None of these

c)  $2\frac{3}{5}$

36) A and B undertook a work for Rs.350. A got Rs.150 more than that of B, when they worked together. B takes 9 days more than A, when they work individually. In how many days A and B working together can do the whole work:

a) 5  
d)  $5\frac{4}{7}$

b)  $4\frac{2}{7}$   
e) None of these

c)  $4\frac{5}{7}$

37) When A, B and C are deployed for a task, A and B together do 70% of the work and B and C together do 50% of the work. Who is most efficient?

a) a  
d) Data inadequate

b) b  
e) None of these

c) c

38) A contractor undertook a work to complete in 60 days. But just after 20 days he observed that only  $\frac{1}{5}$ -th of the project work had been completed. To complete the work in time (i.e., in rest days) minimum how many workers he had to increase, if there were initially 75 workers were deployed for the task?

a) 25  
d) Data inadequate

b) 50  
e) None of these

c) 75

39) If 2 men or 3 women or 4 boys can do a piece of work in 52 days, then the same piece of work will be done by 1 man, 1 woman and 1 boy in :

a) 48 days  
d) Data inadequate

b) 36 days  
e) None of these

c) 45 days

40) A contractor undertook to complete the work in 40 days and he deployed 20 men for his work. 8 days before the scheduled time he realized that  $\frac{1}{3}$ rd of the work was still to be done. How many more men were required to complete the work in stipulated time?

a) 16  
d) 25

b) 15  
e) None of these

c) 20

41) B and C are equally efficient, but the efficiency of A is half of each B and C. A and B started a work and 3 days later C joined them. If A alone can do the work in 14 days, then in how many more days the work will be completed?

- a) 1  
d) 4.5

- b) 2  
e) None of these

- c) 3

42) A and B together can complete a piece of work in 4 days. If A alone can complete the same work in 12 days, in how many days can B alone complete that work?

- a) 6 days  
d) 9 days

- b) 12  
e) None of these

- c) 8 days

43) 4 men and 2 boys can finish a piece of work in 5 days. 3 women and 4 boys can finish the same work in 5 days. Also 2 men and 3 women can finish the same work in 5 days. In how many days 1 man, 1 woman and one boy can finish the work, at their double efficiency?

- a)  $4\frac{8}{13}$   
d) Data inadequate

- b)  $4\frac{7}{13}$   
e) None of these

- c)  $3\frac{7}{13}$

44) A and B undertake to do a piece of work for Rs.600. A alone can do it in 6 days while B alone can do it in 8 days. With the help of C, they finish it in 3 days. Find the share of each.

- a) Rs.80  
d) Rs.82

- b) Rs.75  
e) None of these

- c) Rs.90

45) Tap A can fill the empty tank in 12 hours, but due to a leak in the bottom it is filled in 15 hours, if the tank is full and then tap A is closed then in how many hours the leak can empty it?

- a) 45 hours  
d) 60 hours

- b) 48 hours  
e) None of these

- c) 52 hours

46) A is twice as good a workman as B and together they finish a piece of work in 18 days. In how many days will A alone finish the work?

- a) 72 days  
d) 32 days

- b) 30 days  
e) None of these

- c) 27 days

47) Pipe A basically used as inlet pipe and pipe B is used as outlet pipe. Pipes A and B both are opened simultaneously, all the time. When pipe A fills the tank and B empty the tank, it will take double the time than when both the pipes fill the tank. When pipe B is used for filling the tank, its efficiency remains constant. What is the ratio of efficiency of pipe A and pipe B respectively?

- a) 3 : 1  
d) 3 : 2

- b) 5 : 2  
e) None of these

- c) 1 : 3

48) 45 men can complete a work in 16 days. Six days after they started working. 30 more men joined them. How many days will they now take to complete the remaining work?

- a) 18 days  
d) 6 days

- b) 12 days  
e) None of these

- c) 9 days





## Solutions:

- ### 1. Option D

## A's 1 day's work

$$= \frac{1}{15}$$

## B's 1 day's work

$$= \frac{1}{20}$$

(A + B)'s 1 day's work

$$= \left[ \frac{1}{15} + \frac{1}{15} \right] = \frac{7}{15}$$

(A + B)'s 4 day's work

$$= \left[ \frac{7}{4} \times 4 \right] = \frac{7}{1}$$

Therefore, Remaining work

$$= \left[ 1 - \frac{7}{15} \right] = \frac{8}{15}$$

2. Option C

$$(A + B + C)'s \ 1 \ day's \ work = \frac{1}{4}$$

$$\begin{aligned}
 \text{A's 1 day's work} &= \frac{1}{16} \\
 \text{B's 1 day's work} &= \frac{1}{12} \\
 \text{C's 1 day's work} &= \frac{1}{4} - \left[ \frac{1}{16} + \frac{1}{12} \right] = \left[ \frac{1}{4} - \frac{7}{48} \right] = \frac{5}{48} \\
 \text{So, C alone can do the work in } \frac{48}{5} &= 9 \frac{3}{5}
 \end{aligned}$$

3. Option B

$$\begin{aligned}
 \text{A's 2 day's work} &= \left[ \frac{1}{20} \times 2 \right] = \frac{1}{10} \\
 (\text{A} + \text{B} + \text{C})'s \text{ 1 day's work} &= \left[ \frac{1}{20} + \frac{1}{30} + \frac{1}{60} \right] = \frac{6}{60} = \frac{1}{10} \\
 \text{Work done in 3 days} &= \left[ \frac{1}{10} + \frac{1}{10} \right] = \frac{1}{5} \\
 \text{Now, } \frac{1}{5} \text{ work is done in 3 days.} \\
 \text{Whole work will be done in } (3 \times 5) &= 15 \text{ days}
 \end{aligned}$$

4. Option B

Ratio of times taken by A and B = 1 : 3  
The time difference is (3 - 1) 2 days while B take 3 days and A takes 1 day.  
If difference of time is 2 days, B takes 3 days.

If difference of time is 60 days, B takes  $\left[ \frac{3}{2} \times 60 \right] = 90$  days

So, A takes 30 days to do the work.

$$\begin{aligned}
 \text{A's 1 day's work} &= \frac{1}{30} \\
 \text{B's 1 day's work} &= \frac{1}{90} \\
 (\text{A} + \text{B})'s \text{ 1 day's work} &= \left[ \frac{1}{30} + \frac{1}{90} \right] = \frac{4}{90} = \frac{2}{45} \\
 \text{A and B together can do the work in } \frac{45}{2} &= 22 \frac{1}{2} \text{ days}
 \end{aligned}$$

5. Option B

$$\begin{aligned}
 \text{C's 1 day's work} &= \frac{1}{3} - \left[ \frac{1}{6} + \frac{1}{8} \right] = \frac{1}{3} - \frac{7}{24} = \frac{1}{24} \\
 \text{A's wages : B's wages : C's wages} &= \frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1 \\
 \text{C's share (for 3 days)} &= \text{Rs.} \left[ 3 \times \frac{1}{24} \times 3200 \right] = \text{Rs.} 400
 \end{aligned}$$

6. Option A

Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y

Then,  $6x + 8y = \frac{1}{10}$  and  $26x + 48y = \frac{1}{2}$

Solving these two equations, we get :  $x = \frac{1}{100}$  and  $y = \frac{1}{200}$

$$(15 \text{ men} + 20 \text{ boy})'s \text{ 1 day's work} = \left[ \frac{15}{100} + \frac{20}{200} \right] = \frac{1}{4}$$

15 men and 20 boys can do the work in 4 days.

7. Option C

$$\begin{aligned} A's \text{ 1 hour's work} &= \frac{1}{4} \\ (B + C)'s \text{ 1 hour's work} &= \frac{1}{3} \\ (A + C)'s \text{ 1 hour's work} &= \frac{1}{2} \\ (A + B + C)'s \text{ 1 hour's work} &= \left[ \frac{1}{4} + \frac{1}{3} \right] = \frac{7}{12} \\ B's \text{ 1 hour's work} &= \left[ \frac{7}{12} - \frac{1}{2} \right] = \frac{1}{12} \end{aligned}$$

B alone will take 12 hours to do the work.

8. Option C

$$\begin{aligned} (A + B)'s \text{ 1 day's work} &= \frac{1}{10} \\ C's \text{ 1 day's work} &= \frac{1}{50} \\ (A + B + C)'s \text{ 1 day's work} &= \left[ \frac{1}{10} + \frac{1}{50} \right] = \frac{6}{50} = \frac{3}{25} \dots\dots\dots (i) \\ A's \text{ 1 day's work} &= (B + C)'s \text{ 1 day's work} \dots\dots\dots (ii) \\ \text{From (i) and (ii), we get } 2 \times (A's \text{ 1 day's work}) &= \frac{3}{25} \\ A's \text{ day's work} &= \frac{3}{50} \\ B's \text{ 1 day's work} &= \left[ \frac{1}{10} - \frac{3}{50} \right] = \frac{2}{50} = \frac{1}{25} \end{aligned}$$

So, B alone could do the work in 25 days.

9. Option C

$$\text{Whole work is done by A in } \left[ 20 \times \frac{5}{4} \right] = 25 \text{ days}$$

Now,  $\left[ 1 - \frac{4}{5} \right]$  i.e.,  $\frac{1}{5}$  work is done by A and B in 3 days.

Whole work will be done by A and B in  $(3 \times 5) = 15$  days.

$$\begin{aligned} A's \text{ 1 day's work} &= \frac{1}{25}, (A + B)'s \text{ 1 day's work} = \frac{1}{15} \\ B's \text{ 1 day's work} &= \left[ \frac{1}{15} - \frac{1}{25} \right] = \frac{4}{150} = \frac{2}{75} \\ \text{So, B alone would do the work in } \frac{75}{2} &= 37 \frac{1}{2} \text{ days} \end{aligned}$$

10. Option D

$$(P + Q + R)'s \text{ 1 hour's work} = \left[ \frac{1}{8} + \frac{1}{10} + \frac{1}{12} \right] = \frac{37}{120}$$

$$\text{Work done by P, Q and R in 2 hours} = \left[ \frac{37}{120} \times 2 \right] = \frac{37}{60}$$

$$\text{Remaining work} = \left[ 1 - \frac{37}{60} \right] = \frac{23}{60}$$

$$(Q + R)'s 1 \text{ hour's work} = \left[ \frac{1}{10} + \frac{1}{12} \right] = \frac{11}{60}$$

Now,  $\frac{11}{60}$  work is done by Q and R in 1 hour.

So,  $\frac{23}{60}$  work will be done by Q and R in  $\left[ \frac{60}{11} \times \frac{23}{60} \right] = \frac{23}{11}$  hours  $\approx 2$  hours

So, the work will be finished approximately 2 hours after 11 A.M., i.e., around 1 P.M.

11. Option C

$$B's 10 \text{ day's work} = \left[ \frac{1}{15} \times 10 \right] = \frac{2}{3}$$

$$\text{Remaining work} = \left[ 1 - \frac{2}{3} \right] = \frac{1}{3}$$

Now,  $\frac{1}{18}$  work is done by A in 1 day.

$$\frac{1}{3} \text{ work is done by A in } \left[ 18 \times \frac{1}{3} \right] = 6 \text{ days.}$$

12. Option B

Let 1 man's 1 day's work = x and 1 woman's 1 day's work = y.

$$\text{Then, } 4x + 6y = \frac{1}{8} \text{ and } 3x + 7y = \frac{1}{10}$$

Solving the two equations, we get  $x = \frac{11}{400}$ ,  $y = \frac{1}{400}$

$$1 \text{ woman's 1 day's work} = \frac{1}{400}$$

$$10 \text{ women's 1 day's work} = \left[ \frac{1}{400} \times 10 \right] = \frac{1}{40}$$

Hence, 10 women will complete the work in 40 days.

13. Option D

$$(A + B)'s 20 \text{ day's work} = \left[ \frac{1}{30} \times 20 \right] = \frac{2}{3}$$

$$\text{Remaining work} = \left[ 1 - \frac{2}{3} \right] = \frac{1}{3}$$

Now,  $\frac{1}{3}$  work is done by A in 20 days.

Therefore, the whole work will be done by A in  $(20 \times 3) = 60$  days.

14. Option A

P can complete the work in  $(12 \times 8)$  hrs. = 96 hrs.

Q can complete the work in  $(8 \times 10)$  hrs. = 80 hrs.

$$P's 1 \text{ hour's work} = \frac{1}{96} \text{ and } Q's 1 \text{ hour's work} = \frac{1}{80}$$

$$[P + Q]'s \text{ 1 hour's work} = \left[ \frac{1}{96} + \frac{1}{80} \right] = \frac{11}{480}$$

So, both P and Q will finish the work in  $\left[ \frac{480}{11} \right]$  hrs.

$$\text{Number of days of 8 hours each} = \left[ \frac{480}{11} \times \frac{1}{8} \right] = \frac{60}{11} \text{ days} = 5 \frac{5}{11} \text{ days}$$

15. Option C

$$1 \text{ woman's 1 day's work} = \frac{1}{70}$$

$$1 \text{ child's 1 day's work} = \frac{1}{140}$$

$$(5 \text{ women} + 10 \text{ children})'s \text{ day's work} = \left[ \frac{5}{70} + \frac{10}{140} \right] = \left[ \frac{1}{14} + \frac{1}{14} \right] = \frac{1}{7}$$

5 women and 10 children will complete the work in 7 days.

16. Option B

$$\text{Work done by X in 4 days} = \left[ \frac{1}{20} \times 4 \right] = \frac{1}{5}$$

$$\text{Remaining work} = \left[ 1 - \frac{1}{5} \right] = \frac{4}{5}$$

$$(X + Y)'s \text{ 1 day's work} = \left[ \frac{1}{20} + \frac{1}{12} \right] = \frac{8}{60} = \frac{2}{15}$$

Now,  $\frac{2}{15}$  work is done by X and Y in 1 day.

$$\text{So, } \frac{4}{5} \text{ work will be done by X and Y in } \left[ \frac{15}{2} \times \frac{4}{5} \right] = 6 \text{ days}$$

$$\text{Hence, total time taken} = (6 + 4) \text{ days} = 10 \text{ days}$$

17. Option B

$$\text{Ratio of times taken by A and B} = 100 : 130 = 10 : 13$$

Suppose B takes x days to do the work.

$$\text{Then, } 10 : 13 :: 23 : x \quad x = \left[ \frac{23 \times 13}{10} \right] \quad x = \frac{299}{10}$$

$$\text{A's 1 day's work} = \frac{1}{23}$$

$$\text{B's 1 day's work} = \frac{10}{299}$$

$$(A + B)'s \text{ 1 day's work} = \left[ \frac{1}{23} + \frac{10}{299} \right] = \frac{23}{299} = \frac{1}{13}$$

Therefore, A and B together can complete the work in 13 days.

18. Option C

$$\text{Number of pages typed by Ravi in 1 hour} = \frac{32}{6} = \frac{16}{3}$$

$$\text{Number of pages typed by Kumar in 1 hour} = \frac{40}{5} = 8$$

$$\begin{aligned}
 \text{Number of pages typed by both in 1 hour} &= \left[ \frac{16}{3} + 8 \right] = \frac{40}{3} \\
 \text{Time taken by both to type 110 pages} &= \left[ 110 \times \frac{3}{40} \right] \text{ hours} \\
 &= 8 \frac{1}{4} \text{ hours or } 8 \text{ hours } 15 \text{ minutes}
 \end{aligned}$$

19. Option C

$$\text{If A can do a piece of work in } n \text{ days, then A's 1 day's work} = \frac{1}{n}$$

$$(\text{A} + \text{B} + \text{C})' \text{ s 1 day's work} = \left[ \frac{1}{24} + \frac{1}{6} + \frac{1}{12} \right] = \frac{7}{24}$$

**Formula:** If A's 1 day's work =  $\frac{1}{n}$ , then A can finish the work in n days.

$$\text{So, all the three together will complete the job in } \left[ \frac{24}{7} \right] \text{ days} = 3 \frac{3}{7}$$

20. Option B

$$\begin{aligned}
 \text{Ratio of times taken by Sakshi and Tanya} &= 125 : 100 = 5 : 4 \\
 \text{Suppose Tanya takes } x \text{ days to do the work.}
 \end{aligned}$$

$$5 : 4 :: 20 : x \quad x = \left[ \frac{4 \times 20}{5} \right]$$

$$x = 16 \text{ days}$$

Hence, Tanya takes 16 days to complete the work.

21. Option B

Suppose A, B and C take  $x$ ,  $\frac{x}{2}$  and  $\frac{x}{3}$  days respectively to finish the work.

$$\text{Then, } \left[ \frac{1}{x} + \frac{2}{x} + \frac{3}{x} \right] = \frac{1}{2}$$

$$\frac{6}{x} = \frac{1}{2}$$

$$x = 12$$

So, B takes  $(12/2) = 6$  days to finish the work.

22. Option C

$$(\text{A} + \text{B})' \text{ s 1 day's work} = \left[ \frac{1}{15} + \frac{1}{10} \right] = \frac{1}{6}$$

$$\text{Work done by A and B in 2 days} = \left[ \frac{1}{6} \times 2 \right] = \frac{1}{3}$$

$$\text{Remaining work} = \left[ 1 - \frac{1}{3} \right] = \frac{2}{3}$$

Now,  $\frac{1}{15}$  work is done by A in 1 day.

$$\frac{2}{3} \text{ work will be done by A in } \left[ 15 \times \frac{2}{3} \right] = 10 \text{ days}$$

Hence, the total time taken =  $(10 + 2) = 12$  days.

23. Option A

$$2(A + B + C)'s \text{ 1 day's work} = \left[ \frac{1}{30} + \frac{1}{24} + \frac{1}{20} \right] = \frac{15}{120} = \frac{1}{8}$$

$$\text{Therefore, } (A + B + C)'s \text{ 1 day's work} = \frac{1}{2 \times 8} = \frac{1}{16}$$

$$\text{Work done by A, B, C in 10 days} = \frac{10}{16} = \frac{5}{8}$$

$$\text{Remaining work} = \left[ 1 - \frac{5}{8} \right] = \frac{3}{8}$$

$$A's \text{ 1 day's work} = \left[ \frac{1}{16} - \frac{1}{24} \right] = \frac{1}{48}$$

Now,  $\frac{1}{48}$  work is done by A in 1 day.

So,  $\frac{3}{8}$  work will be done by A in  $\left[ 48 \times \frac{3}{8} \right] = 18$  days.

24. Option A

$$\text{Ratio of rates of working of A and B} = 2 : 1$$

$$\text{So, ratio of times taken} = 1 : 2$$

$$B's \text{ 1 day's work} = \frac{1}{12}$$

$$A's \text{ 1 day's work} = \frac{1}{6}; (\text{2 times of B's work})$$

$$(A + B)'s \text{ 1 day's work} = \left[ \frac{1}{6} + \frac{1}{12} \right] = \frac{3}{12} = \frac{1}{4}$$

So, A and B together can finish the work in 4 days.

25. Option B

$(20 \times 16)$  women can complete the work in 1 day.

$$1 \text{ woman's 1 day's work} = \frac{1}{320}$$

$(16 \times 15)$  men can complete the work in 1 day.

$$1 \text{ man's 1 day's work} = \frac{1}{240}$$

$$\text{So, required ratio} = \frac{1}{240} : \frac{1}{320}$$

$$= \frac{1}{3} : \frac{1}{4}$$

$$= 4 : 3 \text{ (cross multiplied)}$$

26. Option C

$$(A + B + C)'s \text{ 1 day's work} = \frac{1}{6}$$

$$(A + B)'s \text{ 1 day's work} = \frac{1}{8}$$

$$(B + C)'s \text{ 1 day's work} = \frac{1}{12}$$

$$(A + C)'s \text{ 1 day's work} = \left[ 2 \times \frac{1}{6} \right] - \left[ \frac{1}{8} + \frac{1}{12} \right]$$

$$= \left[ \frac{1}{3} - \frac{5}{24} \right]$$

$$\begin{aligned}
 &= \frac{3}{24} \\
 &= \frac{1}{8}
 \end{aligned}$$

So, A and C together will do the work in 8 days.

27. Option C

$$(B + C)'s 1 day's work = \left[ \frac{1}{9} + \frac{1}{12} \right] = \frac{7}{36}$$

$$\text{Work done by B and C in 3 days} = \left[ \frac{7}{36} \times 3 \right] = \frac{7}{12}$$

$$\text{Remaining work} = \left[ 1 - \frac{7}{12} \right] = \frac{5}{12}$$

Now,  $\frac{1}{24}$  work is done by A in 1 day.

So,  $\frac{5}{12}$  work is done by A in  $\left[ 24 \times \frac{5}{12} \right] = 10$  days.

28. Option A

$$\text{Work done by X in 8 days} = \left[ \frac{1}{40} \times 8 \right] = \frac{1}{5}$$

$$\text{Remaining work} = \left[ 1 - \frac{1}{5} \right] = \frac{4}{5}$$

Now,  $\frac{4}{5}$  work is done by Y in 16 days.

Whole work will be done by Y in  $\left[ 16 \times \frac{5}{4} \right] = 20$  days.

$$X's 1 day's work = \frac{1}{40}, Y's 1 day's work = \frac{1}{20}$$

$$(X + Y)'s 1 day's work = \left[ \frac{1}{40} + \frac{1}{20} \right] = \frac{3}{40}$$

Hence, X and Y will together complete the work in  $\left[ \frac{40}{3} \right] = 13 \frac{1}{3}$  days.

29. Option B

$$(A's 1 day's work) : (B's 1 day's work) = \frac{7}{4} : 1 = 7 : 4$$

Let A's and B's 1 day's work be  $7x$  and  $4x$  respectively.

$$\text{Then, } 7x + 4x = \frac{1}{7} \quad 11x = \frac{1}{7} \quad x = \frac{1}{77}$$

$$A's 1 day's work = \left[ \frac{1}{77} \times 7 \right] = \frac{1}{11}$$

30. Option A

Efficiency of P : Q = 3 : 1

Required number of days of P : Q = 1 : 3

i.e., if P requires x days then Q requires  $3x$  days

but  $3x - x = 60$

$$2x = 60$$

$$x = 30 \text{ and } 3x = 90$$

Thus P can finish the work in 30 days and Q can finish the work in 90 days.

31. Option B

$$\begin{aligned} \text{Filling efficiency} &= 5\% & 5 &= \frac{100}{20} \\ \text{Emptying efficiency} &= 1.66\% & 1.66 &= \frac{100}{60} \\ \text{Net efficiency} &= 5 - 1.66 = 3.33\% \\ \text{Required time to full the tub} &= \frac{100}{3.33} = 30 \text{ minutes} \end{aligned}$$

32. Option C

$$\text{Efficiency of A} = 7.14\%$$

$$\text{Efficiency of B} = 4.76\%$$

$$\text{Efficiency of A + B} = 11.9\%$$

$$\text{Number of days required by A and B, working together} = \frac{100}{11.9} = 8.4 \text{ days}$$

33. Option A

$$\text{Efficiency of A + B} = 33.33\% \left[ = \frac{100}{3} \right]$$

$$\text{Ratio of efficiency of A and B} = 3 : 1$$

$$\text{Efficiency of A} = \frac{3}{4} \times 33.33 = 25\%$$

$$\text{Number of days taken by A} = 4 = \frac{100}{25} = 4$$

34. Option A

3 days before the completion of the work Aman left the work means in last 3 days only Suneeta has worked alone.

$$\text{So, in last 3 days worked done by Suneeta} = 3 \times \frac{1}{21} = \frac{1}{7}$$

$$\text{So, the rest} \left[ 1 - \frac{1}{7} \right] = \frac{6}{7} \text{ work was done by Aman and Suneeta both.}$$

$$\text{Number of days in which Aman and Suneeta worked together} = \frac{6/7}{5/42} = \frac{36}{5} = 7 \frac{1}{5} \text{ days}$$

35. Option A

$$\text{Karan's efficiency} = 10\%$$

$$\text{Sohan's efficiency} = 5\%$$

$$\text{Work done by Karan and Sohan together in 3 days} = 15 \times 3 = 45\%$$

$$\text{Now, number of days in which B completed rest (55%) work alone} = \frac{55}{5} = 11$$

$$\text{Total number of days in which B worked} = 3 + 11 = 14$$

$$\text{Now number of days required by B, when A and B both worked together} = \frac{100}{15} = 6 \frac{2}{3}$$

$$\text{Required difference in number of days} = (11) - \left[ 6 \frac{2}{3} \right] \\ = \frac{13}{3} = 4 \frac{1}{3} \text{ days}$$

36. Option B

$$\text{A's share} = \text{Rs.}250$$

$$\text{B's share} = \text{Rs.}100$$

It means the ratio of efficiency of A : B = 250 : 100 = 5 : 2

Ratio of days taken by A and B =  $2x : 5x$

$$\text{Now, } 5x - 2x = 9 \quad x = 3$$

Number of days taken by A = 6 (efficiency = 16.66%)

Number of days taken by B = 15 (efficiency = 6.66%)

Therefore number of days taken by A and B, working together =  $\frac{100}{23.33} = \frac{300}{70} = 4 \frac{2}{7}$  days

37. Option A

$$A + B = 70\%$$

$$B + C = 50\% \quad [A + B + B + C - (A + B + C) = B] \\ 70 + 50 - 100 = 20\%$$

$$B = 20\%$$

$$A = 50\%$$

$$C = 30\%$$

Hence, A is most efficient.

38. Option C

$$\text{Work done} = \frac{1}{5}$$

$$\text{Remaining work} = \frac{4}{5}$$

$$4(20 \times 75) = 40 \times x$$

$$x = 150$$

Therefore 75 men should be increased.

39. Option E

Work done by 2 men = 3 women = 4 boys

1 man = 2 boys

$$1 \text{ woman} = \frac{4}{3} \text{ boys}$$

Boys  $\times$  days = 4  $\times$  52 (boys - days)

$$\text{Again } 1 \text{ man} + 1 \text{ woman} + 1 \text{ boy} = 2 + \frac{4}{3} + 1 = \frac{13}{3} \text{ boys}$$

40. Option C

$$\begin{aligned}\text{Work done} &= \frac{2}{3} \\ \text{Remaining work} &= \frac{1}{3}, \text{ which is half of } \frac{2}{3} \\ \frac{1}{2} \times (20 \times 32) &= 8 \times x \\ x &= 40 \text{ men}\end{aligned}$$

Therefore, 20 more men were required.

41. Option A

$$\begin{aligned}\text{Number of days taken by A to complete work alone} &= 14 \text{ days} \\ \text{Number of days taken by B to complete work alone} &= 7 \text{ days} \\ \text{Number of days taken by C to complete work alone} &= 7 \text{ days} \\ \text{One day's work of A and B} &= \frac{1}{14} + \frac{1}{7} = \frac{3}{14} \\ \text{And one day's work of A, B and C} &= \frac{1}{14} + \frac{1}{7} + \frac{1}{7} = \frac{5}{14} \\ \text{3 day's work of A and B} &= 3 \times \frac{3}{14} = \frac{9}{14} \\ \text{Remaining work} &= \frac{5}{14} \quad \left[ 1 - \frac{9}{14} \right] \\ \text{This remaining work will be done by A, B and C} &= \frac{\frac{5}{14}}{\frac{5}{14}} = 1 \text{ day}\end{aligned}$$

42. Option A

$$\begin{aligned}(A + B)'s 1 \text{ day's work} &= \frac{1}{4}, \text{ As 1 day's work} = \frac{1}{12} \\ B's 1 \text{ day's work} &= \left[ \frac{1}{4} - \frac{1}{12} \right] = \frac{1}{6} \\ \text{Hence, B alone can complete the work in 6 days.}\end{aligned}$$

43. Option E

$$\begin{aligned}\text{Efficiency of 4 men and 2 boys} &= 20\% \\ \text{Efficiency of 3 women and 4 boys} &= 20\% \\ \text{Efficiency of 2 men and 3 women} &= 20\%\end{aligned}$$

$$\begin{aligned}\text{So, Efficiency of 6 men, 6 women and 6 boys} &= 60\% \\ \text{So, efficiency of 1 man, 1 woman and 1 boy} &= 10\% \\ \text{Now, since they will work at double their efficiency} \\ \text{Efficiency of 1 man, 1 woman and 1 boy} &= 20\% \\ \text{Required number of days} &= 5\end{aligned}$$

44. Option B

$$C's 1 \text{ day's work} = \frac{1}{3} - \left[ \frac{1}{6} + \frac{1}{8} \right] = \frac{1}{24}$$

$$A : B : C = \text{Ratio of their 1 day's work} = \frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1$$

$$A's \text{ share Rs. } \left[ 600 \times \frac{4}{8} \right] = \text{Rs.}300, B's \text{ share} = \text{Rs.} \left[ 600 \times \frac{3}{8} \right] = \text{Rs.}225$$

$$C's \text{ share} = \text{Rs.} \left[ 600 - (300 + 225) \right] = \text{Rs.}75$$

45. Option D

$$\text{Efficiency of A} = 8.33\%$$

$$\text{Effective efficiency} = 6.66\%, \text{ when there is leakage}$$

$$\text{So, efficiency of leakage} = 1.66\% = (8.33 - 6.66)$$

It means due to leakage a full tank will be empty in 60 hours.

46. Option C

$$(A's \text{ 1 day's work}) : (B's \text{ 1 day's work}) = 2 : 1$$

$$(A + B)'s \text{ 1 day's work} = \frac{1}{18}$$

$$\text{Divide } \frac{1}{18} \text{ in the ratio } 2 : 1$$

$$\text{So, A's 1 day's work} = \left[ \frac{1}{18} \times \frac{2}{3} \right] = \frac{1}{27}$$

Hence, A alone can finish the work in 27 days.

47. Option A

$$\text{Efficiency when both pipes used to fill} = A + B$$

$$\text{And efficiency when pipe A is used to fill and pipe B is used to empty the tank} = A - B$$

$$\text{So, } \frac{A + B}{A - B} = \frac{2}{1}$$

$$\frac{A}{B} = \frac{3}{1}$$

Thus, the ratio of efficiency of pipe A and B = 3 : 1

48. Option E

$$(45 \times 16) \text{ men can complete the work in 1 day.}$$

$$\text{So, 1 man's 1 day's work} = \frac{1}{720}$$

$$45 \text{ men's 6 day's work} = \left[ \frac{1}{16} \times 6 \right] = \frac{3}{8} \text{ Remaining work} = \left[ 1 - \frac{3}{8} \right] = \frac{5}{8}$$

49. Option C

$$\text{Time taken by pipes A and B to fill the whole tank} = \frac{100}{16.66} = 6 \text{ hours}$$

$$\text{Capacity filled in 2 hours by pipes A, B and C} = 2 \times 13.33 = 26.66\%$$

$$\text{Remaining capacity} = 73.33\%$$

$$\text{This remaining capacity can be filled by A and B} = \frac{73.33}{16.66} = 4 \frac{2}{5}$$

So, the total time required  $= 2 + 4 \frac{2}{5} = 6$  hours 24 minutes  
 Thus, in this case 24 minutes extra are required.

50. Option C

1 minute's work of both the punctures  $= \left[ \frac{1}{9} + \frac{1}{6} \right] = \frac{5}{18}$   
 So, both the punctures will make the tyre flat in  $\frac{18}{5} = 3 \frac{3}{5}$  min.

51. Option B

Let  $x$  litre be the per day filling and  $v$  litre be the capacity of the reservoir, then

$$90x + v = 40000 \times 90 \quad \dots \dots (1)$$

$$60x + v = 32000 \times 60 \quad \dots \dots (2)$$

Solving eq. (1) and (2), we get

$$x = 56000$$

Hence, 56000 litres per day can be used without the failure of supply.

52. Option A

(A's 1 day's work) : (B's 1 day's work) = 150 : 100 = 3 : 2

Let A's and B's 1 day's work be  $3x$  and  $2x$  respectively.

Then, C's 1 day's work  $= \left[ \frac{3x + 2x}{2} \right] = \frac{5x}{2}$

So,  $\frac{5x}{2} = \frac{1}{40}$  or  $x = \left[ \frac{1}{40} \times \frac{2}{5} \right] = \frac{1}{100}$

A's 1 day's work  $= \frac{3}{100}$ ; B's 1 day's work  $= \frac{1}{50}$ ; C's 1 day's work  $= \frac{1}{40}$

(A + B + C)'s 1 day's work  $= \left[ \frac{3}{100} + \frac{1}{50} + \frac{1}{40} \right] = \frac{15}{200} = \frac{3}{40}$

So, A, B and C together can do the work in  $\frac{40}{3} = 13 \frac{1}{3}$  days

53. Option B

Ratio of number of men, women and children  $= \frac{18}{6} : \frac{10}{5} : \frac{12}{3} = 3x : 2x : 4x$

So,  $(3x + 2x + 4x) = 18$

So,  $x = 2$

Therefore, number of women = 4

Share of all women  $= \frac{10}{40} \times 4000 = \text{Rs.}1000$

$(18 + 10 + 12 = 40)$

So, Share of each woman  $= \frac{1000}{4} = \text{Rs.}250$

54. Option A

P can complete the work in  $(12 \times 8)$  hrs. = 96 hrs.

Q can complete the work in  $(8 \times 10)$  hrs. = 80 hrs.

$$\text{So, P's 1 hour's work} = \frac{1}{96} \text{ and Q's 1 hour's work} = \frac{1}{80}$$

$$(\text{P} + \text{Q})\text{'s 1 hour's work} = \left[ \frac{1}{96} + \frac{1}{80} \right] = \frac{11}{480}$$

So, both P and Q will finish the work in  $\left[ \frac{480}{11} \right]$  hrs.

$$\text{So, Number of days of 8 hours each} = \left[ \frac{480}{11} \times \frac{1}{8} \right] = \frac{60}{11} \text{ days} = 5 \frac{5}{11} \text{ days}$$

55. Option C

$$\text{Efficiency of Eklavya} = 16.66\%$$

$$\text{Efficiency of Faizal} = 8.33\%$$

$$\text{Total efficiency of Eklavya and Faizal} = 25\%$$

So, they can do actual work in 4 days

So, 3 times work requires 12 days.

56. Option D

$$(\text{A} + \text{B})\text{'s 20 day's work} = \left[ \frac{1}{30} \times 20 \right] = \frac{2}{3} \text{ Remaining work} = [1 - \frac{2}{3}] = \frac{1}{3}$$

Now,  $\frac{1}{3}$  work is done by A in 20 days.

Whole work will be done by A in  $(20 \times 3) = 60$  days

57. Option B

$$\text{Efficiency of Aman and Raman} = 10\%$$

Aman worked for 2.5 hours and Raman worked separately 8.5 hours. Which means it can be considered that Aman and Raman worked together for 2.5 hours and Raman worked alone for 6 hours.

Thus, Aman and Raman in 2.5 hours can complete 25% work. It means the remaining  $(50 - 25) = 25\%$  of the work was done by Raman in 6 hours.

Therefore, Raman can do 100% work in 24 hours. It means the efficiency of Raman = 4.16%

Therefore, efficiency of Aman =  $(10 - 4.16) = 5.83\%$

Thus, Aman require  $\frac{100}{5.83} = 17 \frac{1}{7}$  hours to complete the work alone.

58. Option B

Let 1 man's 1 day's work = x and 1 boy's 1 day's work = y

$$\text{Then, } 5x + 2y = 4(x + y) \quad x = 2y \quad \frac{x}{y} = \frac{2}{1}$$

59. Option B

$$\text{C's 1 day's work} = \frac{1}{3} - \left[ \frac{1}{6} + \frac{1}{8} \right] = \frac{1}{3} - \frac{7}{24} = \frac{1}{24}$$

$$\text{A's wages : B's wages : C's wages} = \frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1$$

$$\text{So, C's share} = \text{Rs.} \left[ \frac{1}{8} \times 3200 \right] = \text{Rs.} 400$$

60. Option C

$$\begin{aligned}\text{Rate of leakage} &= 8.33\% \text{ per hour} \\ \text{Net efficiency} &= 50 - (16.66 + 8.33) = 25\% \\ \text{Time required} &= \frac{100}{25} = 4 \text{ hours}\end{aligned}$$

61. Option B

$$\begin{aligned}\text{Work done by A} &= \left[ 1 - \frac{8}{23} \right] = \frac{15}{23} \\ \text{So, A : (B + C)} &= \frac{15}{23} : \frac{8}{23} = 15 : 8 \\ \text{So, A's share} &= \text{Rs.} \left[ \frac{15}{23} \times 529 \right] = \text{Rs.} 345\end{aligned}$$

62. Option B

$$\begin{aligned}(\text{A's 1 day's work}) : (\text{B's 1 day's work}) &= \frac{7}{4} : 1 = 7 : 4 \\ \text{Let A's and B's 1 day's work be } 7x \text{ and } 4x \text{ respectively.} \\ \text{Then, } 7x + 4x &= \frac{1}{7} \quad 11x = \frac{1}{7} \quad x = \frac{1}{77} \\ \text{So, A's 1 day's work} &= \left[ \frac{1}{77} \times 7 \right] = \frac{1}{11}\end{aligned}$$

63. Option D

Suppose the work was finished in  $x$  days.

$$\begin{aligned}\text{Then, A's } (x - 8) \text{ day's work} + \text{B's } (x - 12) \text{ day's work} + \text{C's } x \text{ day's work} &= 1 \\ \frac{x - 8}{36} + \frac{x - 12}{54} + \frac{x}{72} &= 1 \quad 6(x - 8) + 4(x - 12) + 3x = 216 \\ \text{So, } 13x &= 312 \text{ or } x = 24\end{aligned}$$

64. Option C

$$\begin{aligned}\text{B's 1 day's work} &= \left[ \frac{1}{12} - \frac{1}{20} \right] = \frac{2}{60} = \frac{1}{30} \\ \text{Now, (A + B)'s 1 day's work} &= \left[ \frac{1}{20} + \frac{1}{60} \right] = \frac{4}{60} = \frac{1}{15} \quad [\text{B works for half day only}] \\ \text{So, A and B together will complete the work in } 15 \text{ days.}\end{aligned}$$

65. Option C

$$\begin{aligned}1 \text{ woman's 1 day's work} &= \frac{1}{70}; 1 \text{ child's 1 day's work} = \frac{1}{140} \\ (5 \text{ women} + 10 \text{ children})'s 1 \text{ day's work} &= \left[ \frac{5}{70} + \frac{10}{140} \right] = \left[ \frac{1}{14} + \frac{1}{14} \right] = \frac{1}{7} \\ \text{So, 5 women and 10 children will complete the work in } 7 \text{ days.}\end{aligned}$$

66. Option A

$$1 \text{ man's 1 day's work} = \frac{1}{108}$$

$$12 \text{ men's 6 day's work} = \left[ \frac{1}{9} \times 6 \right] = \frac{2}{3} \text{ Remaining work} = \left[ 1 - \frac{2}{3} \right] = \frac{1}{3}$$

$$18 \text{ men's 1 day's work} = \left[ \frac{1}{108} \times 18 \right] = \frac{1}{6}$$

$\frac{1}{6}$  work is done by them in 1 day.

So,  $\frac{1}{3}$  work is done by them in  $\left[ 6 \times \frac{1}{3} \right] = 2$  days

67. Option A

$$\text{B's daily earning} = \text{Rs. } (300 - 188) = \text{Rs. } 112$$

$$\text{A's daily earning} = \text{Rs. } (300 - 152) = \text{Rs. } 148$$

$$\text{C's daily earning} = \text{Rs. } \left[ 300 - (112 + 148) \right] = \text{Rs. } 40$$

## Chapter - 13

# Trigonometry

Trigonometry is one of the most interesting chapters of Quantitative Aptitude section. Basically, it is a part of SSC and other bank exams syllabus. We will tell you the easy method to learn all the basics of trigonometry i.e. Trigonometric Ratios, facts and formulas.

### **Trigonometric Ratios**

There are six trigonometric ratios. First three are the primary functions and last three are just the reciprocals of above three. Those are written as follows:

- Sin  $\theta$
- Cos  $\theta$
- Tan  $\theta$
- Cot  $\theta$
- Sec  $\theta$
- Cosec  $\theta$

$$\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{AB}{AC}$$

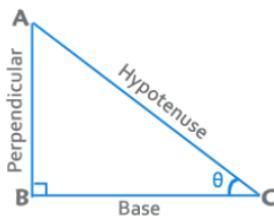
$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{BC}{AC}$$

$$\tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{BC}$$

$$\operatorname{cosec} \theta = \frac{1}{\sin \theta}$$

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\cot \theta = \frac{1}{\tan \theta}$$



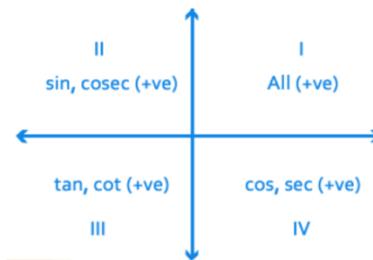
**Some basic identities**

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$

$\theta$	$0^\circ$	$30^\circ$	$45^\circ$	$60^\circ$	$90^\circ$
$\sin \theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos \theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan \theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not Defined
$\cot \theta$	Not Defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0
$\operatorname{cosec} \theta$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not Defined
$\sec \theta$	Not Defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{2}}$	1

**Signs of T-ratios in different quadrants:****Addition Formulae**

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

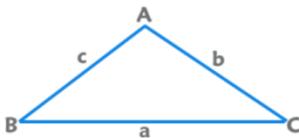
**Subtraction Formulae**

$$\sin(A - B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

## Trigonometry Rules



$$\textbf{Sine Rule : } \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} = \frac{1}{2R}$$

$$\text{Cosine Rule : } \cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

## Examples with Solution

**Example 1:** Find the value of:

$$\frac{2\tan 30^\circ}{1 + \tan^2 30^\circ}$$

$$\begin{aligned}
 \textbf{Solution:} \quad & \frac{2\tan 30^\circ}{1 + \tan^2 30^\circ} = \frac{(2/\sqrt{3})}{(1 + (\frac{1}{\sqrt{3}})^2)2)} \\
 & = \frac{(2/\sqrt{3})}{(1 + (1/\sqrt{3})^2)} \\
 & = \frac{2/\sqrt{3}}{1 + (1/\sqrt{3})^2}
 \end{aligned}$$

Solving above will give =  $\sqrt{3}$

**Example 2:** If  $\tan \theta = \frac{\sqrt{2}}{\sqrt{3}}$ , then what will be the value of  $\cos \theta$ ?

**Solution:**  $\tan \theta = \frac{P}{B}$

Therefore,  $P = \sqrt{2}$  and  $B = \sqrt{3}$

Using Pythagoras Theorem,  $H^2 = P^2 + B^2$

$$H^2 = 2 + 3 = 5$$

$$\Rightarrow H = \sqrt{5}$$

Therefore,  $\cos \theta = B/H = \sqrt{3}/\sqrt{5}$

## **Exercise – 13**

- 2) In a circle of diameter 60 m, the length of a chord is 30 m. Find the length of the minor arc on one side of the chord. What is the length of the major arc?
- a) 157.1 m      b) 160 m      c) 179 m  
 d) 199 m      e) None of these
- 3) Two arcs of two different circles are of equal lengths. If these arcs subtend angles of  $45^\circ$  and  $60^\circ$  at the centres of the circles. Find the ratio of the radii of the two circles.
- a)  $3 : 4$       b)  $5 : 1$       c)  $4 : 3$   
 d)  $6 : 2$       e) None of these
- 4)  $\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \sin \frac{7\pi}{14} \sin \frac{9\pi}{14} \sin \frac{11\pi}{14} \sin \frac{13\pi}{14} =$
- a) 0      b) 1      c)  $\frac{1}{16}$   
 d)  $\frac{1}{64}$       e)  $\frac{1}{128}$
- 5) The maximum value of  $\sin [x + \frac{\pi}{6}] + \cos [x + \frac{\pi}{6}]$  in the interval  $(0, \frac{\pi}{2})$  is attained at  $x =$
- a)  $\frac{\pi}{2}$       b)  $\frac{\pi}{3}$       c)  $\frac{\pi}{6}$   
 d)  $\frac{\pi}{12}$       e) None of these
- 6) If the circumradius of an isosceles triangle ABC is equal to AB ( $= AC$ ), then angle A is equal to
- a)  $\frac{\pi}{2}$       b)  $\frac{\pi}{3}$       c)  $\frac{\pi}{6}$   
 d)  $\frac{2\pi}{3}$       e) None of these
- 7) In a  $\Delta ABC$ , if  $\cos \frac{A}{a} = \cos \frac{B}{b} = \cos \frac{C}{c}$  and the side  $a = 2$ , then area of the triangle is:
- a) 1      b) 2      c)  $\frac{\sqrt{3}}{2}$   
 d)  $\sqrt{3}$       e) None of these
- 8)  $\tan(\cos^{-1} x) = ?$
- a)  $\sqrt{1 - x^2}$       b)  $\frac{\sqrt{1+x^2}}{x}$       c)  $\frac{\sqrt{1-x^2}}{x}$   
 d)  $\frac{x}{1+x^2}$       e) None of these
- 9) In  $\Delta ABC$ ,  $B = \frac{\pi}{3}$  and  $C = \frac{\pi}{4}$ . Let D divide BC internally in the ratio 1 : 3, then  $\frac{\sin(\angle BAD)}{\sin(\angle CAD)} =$
- a)  $\frac{1}{3}$       b)  $\frac{1}{\sqrt{6}}$       c)  $\frac{1}{\sqrt{3}}$

d)  $\sqrt{\frac{2}{3}}$

e) None of these

10) In any  $\Delta ABC$ ,  $2ac \sin \frac{A - B + C}{2} =$

a)  $a^2 + b^2 - c^2$   
d)  $c^2 - a^2 - b^2$

b)  $c^2 + a^2 - b^2$   
e) None of these

c)  $b^2 - c^2 - a^2$

11) In a  $\Delta ABC$ ,  $\angle C = \frac{\pi}{2}$ , then  $2(r + R)$  is equal to

a)  $a + b$   
d)  $a + b + c$

b)  $b + c$   
e) None of these

c)  $c + a$

12) If  $\sin x + \sin^2 x = 1$ , then  $\cos^2 x + \cos^4 x =$

a) 0  
d) 2

b) 1  
e) None of these

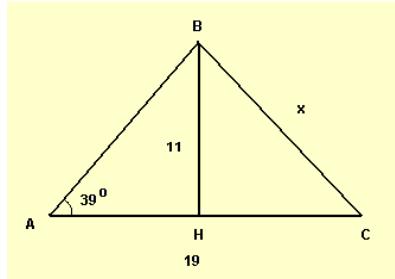
c) 1.5

13) BH is perpendicular to AC. Find x the length of BC.

a) 12.3  
d) 13.2

b) 2.3  
e) None of these

c) 3.2

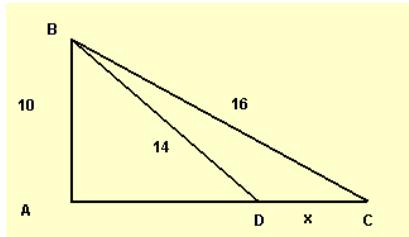


14) ABC is a right triangle with a right angle at A. Find x the length of DC?

a) 6.92  
d) 9.62

b) 9.26  
e) None of these

c) 2.69

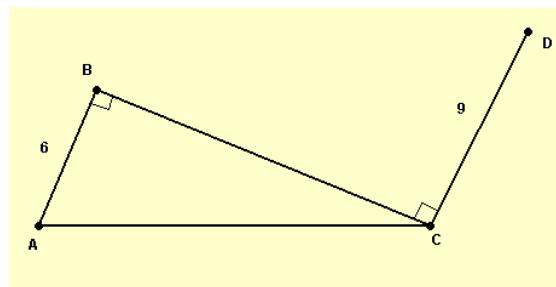


15) In the figure below AB and CD are perpendicular to BC and the size of angle ACB is 31°. Find the length of segment BD.

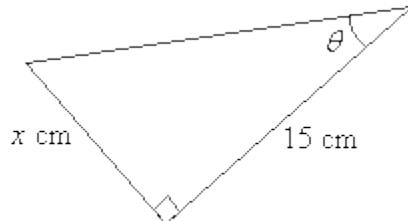
a) 14.3  
d) 3.14

b) 13.4  
e) None of these

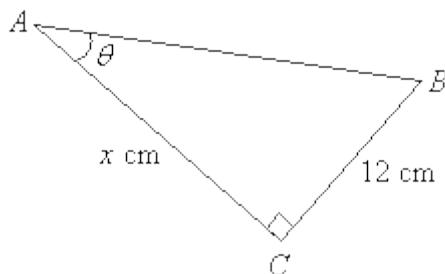
c) 14.1



- 16) A rectangle has dimensions 10 cm by 5 cm. Determine the measures of the angles at the point where the diagonals intersect.
- a)  $53^\circ$       b)  $50^\circ$       c)  $65^\circ$   
 d)  $60^\circ$       e) None of these
- 17) The lengths of side AB and side BC of a scalene triangle ABC are 12 cm and 8 cm respectively. The size of angle C is  $59^\circ$ . Find the length of side AC.
- a) 4.11      b) 11.14      c) 41.10  
 d) 14.0      e) None of these
- 18) Calculate the length of the side x, given that  $\tan \theta = 0.4$
- a) 10 cm      b) 8 cm      c) 9 cm  
 d) 6 cm      e) None of these



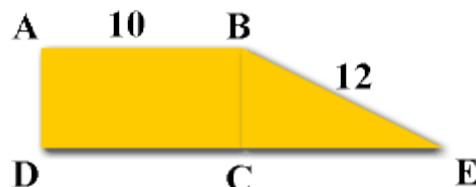
- 19) Calculate the length of the side x, given that  $\sin \theta = 0.6$
- a) 16 cm      b) 61 cm      c) 32 cm  
 d) 64 cm      e) None of these



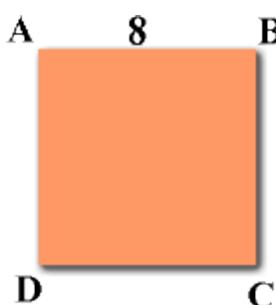
- 20) From a point on the ground 25 feet from the foot of a tree, the angle of elevation of the top of the tree is  $32^\circ$ . Find to the nearest foot, the height of the tree?
- a) 48 feet      b) 18 feet      c) 22 feet  
 d) 16 feet      e) None of these



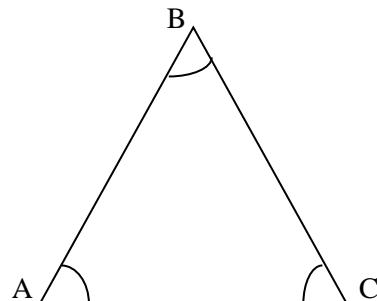
- 21) In the figure below, ABCD is a rectangle whose perimeter is 30. The length of BE is 12. Find to the nearest degree, the measure of angle E?
- a) 25      b) 32      c) 38  
 d) 41      e) None of these



- 22) In the figure ABCD is a square whose side is 8 units. Find the length of diagonal AC?
- a) 11.9      b) 9.6      c) 9.9  
 d) 11.3      e) None of these



- 23) X is in quadrant 3, approximate  $\sin(2x)$  if  $\cos(x) = -0.2$
- a) 0.39
  - b) 0.65
  - c) 0.35
  - d) 1.25
  - e) None of these
- 24) X is an angle in quadrant 3 and  $\sin(x) = \frac{1}{3}$ . Find  $\sin(3x)$  and  $\cos(3x)$
- a)  $\frac{24}{30}$
  - b)  $\frac{29}{35}$
  - c)  $\frac{23}{27}$
  - d)  $\frac{23}{29}$
  - e) None of these

**Solutions:**


1. Option A

Let  $\angle A = 54^\circ$  and  $\angle B = \frac{\pi}{4}$  rad

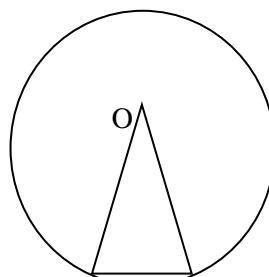
$$\therefore \angle B = 45^\circ$$

Thus,  $\angle A + \angle B = 99^\circ$

$$\therefore \angle C = 180 - 99 = 81^\circ \quad (\angle A + \angle B + \angle C = 180^\circ)$$

Now, since  $90^\circ$  100 grade

$$81^\circ = 81 \times \frac{100}{90} = 90 \text{ grade}$$





2. Option A

$$2r = 60 \text{ m} \quad r = 30 \text{ m}$$

$$OA = OB = AB = 30 \text{ m}$$

$\therefore \Delta OAB$  is an equilateral triangle.

$$\text{Thus, } \angle AOB = 60^\circ = \frac{\pi}{3} \text{ rad}$$

$$\text{Now, since } s = \theta \quad r = \frac{\pi}{3} \times 30$$

$$= 10 \times 3.142$$

$$= 31.42 \text{ m (approx.)}$$

Thus the length of minor arc ACB = 31.42 m and the length of major arc =  $(2\pi r - \text{minor arc})$

$$= 2\pi \times 30 - 31.42 = 157.1 \text{ m (approx.)}$$

3. Option C

$$45^\circ = \frac{\pi}{4} \text{ rad} \quad \text{and} \quad 60^\circ = \frac{\pi}{3} \text{ rad}$$

Let  $r_1$  and  $r_2$  be the radii of the two circles and  $s$  be the length of each arc.

$$\therefore s = r_1 \cdot \frac{\pi}{4} = r_2 \cdot \frac{\pi}{3} \quad (s = r \theta)$$

$$\frac{r_1}{r_2} = \frac{4}{3}$$

Hence the required ratio of radii = 4 : 3

4. Option D

Using  $\sin(\pi - \theta) = \sin \theta$

$$\sin \left[ \frac{9\pi}{14} \right] = \sin \left[ \frac{5\pi}{14} \right]$$

$$\sin \left[ \frac{11\pi}{14} \right] = \sin \left[ \frac{3\pi}{14} \right]$$

$$\sin \left[ \frac{13\pi}{14} \right] = \sin \left[ \frac{\pi}{14} \right]$$

$$\text{Also, } \sin \left[ \frac{7\pi}{14} \right] = \sin \left[ \frac{\pi}{2} \right] = 1$$

$$\therefore \sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \sin \frac{7\pi}{14} \sin \frac{9\pi}{14} \sin \frac{11\pi}{14} \sin \frac{13\pi}{14}$$

$$= [\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14}]$$

$$= \left( \cos \frac{6\pi}{14} \cos \frac{4\pi}{14} \cos \frac{2\pi}{14} \right)^2 \quad [\text{Using } \sin \theta = \cos(\frac{\pi}{2} - \theta)]$$

$$= \left( \cos \frac{\pi}{7} \cos \frac{2\pi}{7} \cos \frac{3\pi}{7} \right)^2$$

$$\begin{aligned}
 &= - \left( \cos \frac{\pi}{7} \cos \frac{2\pi}{7} \cos \frac{4\pi}{7} \right)^2 \quad \left[ \cos \left[ \frac{3\pi}{7} \right] = \cos \left[ \pi - \frac{4\pi}{7} \right] = -\cos \left[ \frac{4\pi}{7} \right] \right] \\
 &= \left( \frac{\sin \frac{2^3\pi}{7}}{2^3 \sin \frac{\pi}{7}} \right) \\
 &= \left( \frac{\sin \frac{8\pi}{7}}{8 \sin \frac{\pi}{7}} \right)^2 \\
 &\frac{1}{64} \left[ \sin (8\pi/7) = \sin (\pi + \pi/7) = -\sin (\pi/7) \right]
 \end{aligned}$$

5. Option D

$$\begin{aligned}
 \sin \left[ x + \frac{\pi}{6} \right] + \cos \left[ x + \frac{\pi}{6} \right] &= \sqrt{2} \quad \left[ \frac{1}{\sqrt{2}} \sin \left( x + \frac{\pi}{6} \right) + \frac{1}{\sqrt{2}} \cos \left( x + \frac{\pi}{6} \right) \right] \\
 &= \sqrt{2} \left[ \sin \left( x + \frac{\pi}{6} \right) \cos \frac{\pi}{4} + \cos \left( x + \frac{\pi}{6} \right) \sin \frac{\pi}{4} \right] \\
 &= \sqrt{2} \left[ \sin \left( x + \frac{5\pi}{12} \right) \right] \\
 \text{This is maximum when } \sin \left( x + \frac{5\pi}{12} \right) &= 1 \\
 x + \frac{5\pi}{12} &= \frac{\pi}{2} \\
 x &= \frac{\pi}{12}
 \end{aligned}$$

6. Option D

$$\begin{aligned}
 \sin B &= \frac{b}{2R} \\
 &= \frac{AC}{2} \\
 &= \frac{R}{2R} \quad \left[ \text{Given } AB = AC = R \right] \\
 &= \frac{1}{2} \\
 B &= \frac{\pi}{6} \text{ or } \frac{5\pi}{6} \\
 \text{But, when } B = \frac{5\pi}{6}, C &= \frac{5\pi}{6} \quad \left[ AB = AC \Rightarrow B = C \right] \\
 \Rightarrow B + C &> \pi \\
 \text{So, } B &= \frac{5\pi}{6} \text{ not possible} \\
 \therefore B &= \frac{\pi}{6} \\
 C &= \frac{\pi}{6} \quad \left[ AB = AC \Rightarrow B = C \right] \\
 A &= \pi - \left[ \frac{\pi}{6} + \frac{\pi}{6} \right]
 \end{aligned}$$

$$A = \frac{2\pi}{3}$$

7. Option D

$$\cos \frac{A}{a} = \cos \frac{B}{b} = \cos \frac{C}{c} \text{ [Given]}$$

$$\cos A/(2R \sin A) = \cos B/(2R \sin B) = \cos C/(2R \sin C)$$

$$\cot A = \cot B = \cot C$$

$$A = B = C$$

$\triangle ABC$  is equilateral.

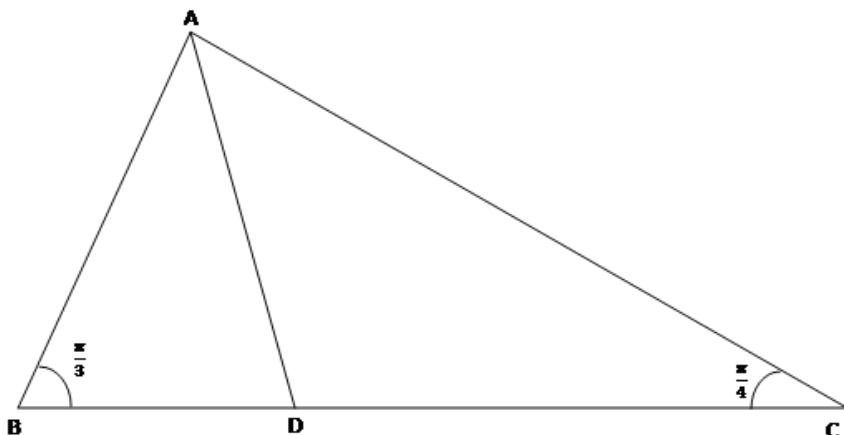
$$\text{Area} = \frac{\sqrt{3}}{4} a^2 = \sqrt{3}$$

8. Option C

$$\begin{aligned}\tan(\cos^{-1} x) &= \frac{\sin(\cos^{-1} x)}{\cos(\cos^{-1} x)} \\ &= \frac{\sqrt{1 - x^2}}{x}\end{aligned}$$

9. Option B

$$\frac{BD}{DC} = \frac{1}{3} \quad [\text{Given}]$$



From  $\triangle ABD$ ,

$$BD/\sin(\angle BAD) = AD/\sin(\pi/3) \dots (1)$$

From  $\triangle ACD$ ,

$$DC/\sin(\angle CAD) = AD/\sin(\pi/4) \dots (2)$$

Now, divide (1) by (2) and use  $BD/DC = 1/3$

$$\Rightarrow \sin(\angle BAD)/\sin(\angle CAD) = \frac{1}{\sqrt{6}}$$

10. Option B

$$2ac \sin \frac{A - B + C}{2} = 2ac \sin \frac{A + B + C - 2B}{2}$$

$$\begin{aligned}
 &= 2ac \sin \frac{180^\circ - 2B}{2} \\
 &= 2ac \sin (90^\circ - B) \\
 &= 2ac \cos B \\
 &= c^2 + a^2 - b^2
 \end{aligned}$$

11. Option A

$$\angle C = \frac{\pi}{2} \Rightarrow R = c / (2 \sin C) = c/2$$

$$\text{Now, } 2(r+R) = 2r + 2R$$

$$= 2(s - c) \tan(C/2) + 2(c/2)$$

$$= 2s - 2c + c$$

$$= 2s - c$$

$$= a + b$$

12. Option B

$$\sin x + \sin^2 x = 1 \quad [\text{Given}]$$

$$\Rightarrow \sin x = 1 - \sin^2 x = \cos^2 x$$

$$\therefore \cos^2 x + \cos^4 x = \sin x + \sin^2 x = 1$$

13. Option A

BH perpendicular to AC means that triangles ABH and HBC are right triangles. Hence

$$\tan(39^\circ) = 11/AH \text{ or } AH = 11/\tan(39^\circ)$$

$$HC = 19 - AH = 19 - 11/\tan(39^\circ)$$

Pythagora's theorem applied to right triangle HBC :  $11^2 + HC^2 = x^2$

$$\text{Solve for } x \text{ and substitute } HC : x = \sqrt{[11^2 + (19 - 11/\tan(39^\circ))^2]} \\ = 12.3$$

14. Option C

Since angle A is right, both triangles ABC and ABD are right and therefore we can apply Pythagora's theorem.

$$14^2 = 10^2 + AD^2, 16^2 = 10^2 + AC^2$$

$$\text{Also } x = AC - AD$$

$$= \sqrt{(16^2 - 10^2)} - \sqrt{(14^2 - 10^2)} = 2.69$$

15. Option B

Use right triangle ABC to write :  $\tan(31^\circ) = 6/BC$ , solve :  $BC = 6/\tan(31^\circ)$

Use Pythagora's theorem in the right triangle BCD to write:

$$9^2 + BC^2 = BD^2$$

$$\text{Solve above for } BD \text{ and substitute } BC : BD = \sqrt{[9 + (6/\tan(31^\circ))^2]}$$

$$= 13.4$$

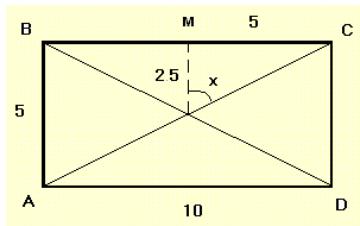
## 16. Option A

The diagram below shows the rectangle with the diagonals and half one of the angles with size  $x$ .

$$\tan(x) = \frac{5}{2.5} = 2, x = \arctan(2)$$

larger angle made by diagonals  $2x = 2 \arctan(2) = 127^\circ$

smaller angle made by diagonals  $180 - 2x = 53^\circ$



## 17. Option D

Let  $x$  be the length of side AC. Use the cosine law

$$12^2 = 8^2 + x^2 - 2 \times 8 \times x \times \cos(59^\circ)$$

Solve the quadratic equation for  $x$ :  $x = 14.0$  and  $x = -5.7$

$x$  cannot be negative and therefore the solution is  $x = 14.0$

## 18. Option D

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

$$0.4 = \frac{x}{15}$$

$$x = 0.4 \times 15 = 6 \text{ cm}$$

## 19. Option A

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$0.6 = \frac{12}{AB}$$

$$AB = \frac{12}{0.6}$$

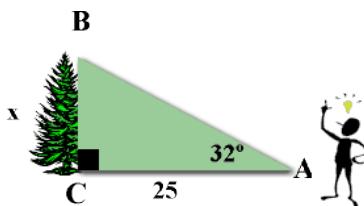
$$= 20 \text{ cm}$$

Using Pythagoras theorem:

$$x = \sqrt{20^2 - 12^2}$$

$$= 16 \text{ cm}$$

## 20. Option D

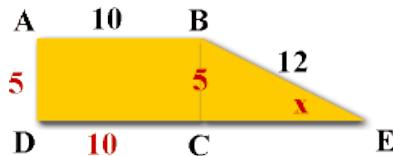


$$\tan 32 = \frac{x}{25}$$

$$.6249 = \frac{x}{25}$$

$$x = 15.6225 = 16 \text{ feet}$$

21. Option A



The opposite sides of a rectangle are equal. If the perimeter is 30, the sides are as shown above.

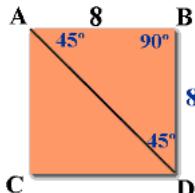
Use trigonometry to find x:

$$\sin x = \frac{5}{12}$$

$$\sin x = .4167$$

$$x = 24.6 = 25$$

22. Option D



The diagonal of a square creates two  $45^\circ - 45^\circ - 90^\circ$  triangles. You have options for a solution : the Pythagorean Theorem

$$\sin 45^\circ = \frac{8}{x}$$

$$x = 11.3$$

23. Option A

$$\sin(2x) = 2 \sin(x) \cos(x)$$

$$\sin x = -\sqrt{1 - (-0.2)^2}$$

$$\begin{aligned} \sin(2x) &= 2 \left[ -\sqrt{1 - (-0.2)^2} \right] \\ &= 0.39 \end{aligned}$$

24. Option C

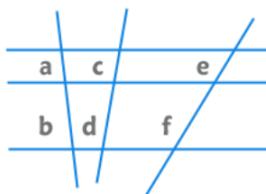
$$\begin{aligned}\sin(3x) &= 3 \sin x - 4 \sin^3 x \\&= 3 \left[\frac{1}{3}\right] - 4 \left[\frac{1}{3}\right]^3 \\&= \frac{23}{27}\end{aligned}$$

## Chapter - 14

# Geometry

Geometry is one of the most important topics of Quantitative Aptitude section.

### Lines and Angles



- Sum of the angles in a straight line is  $180^\circ$
- Vertically opposite angles are always equal.
- If any point is equidistant from the endpoints of a segment, then it must lie on the perpendicular bisector.
- When two parallel lines are intersected by a transversal, corresponding angles are equal, alternate angles are equal and co-interior angles are supplementary. (All acute angles formed are equal to each other and all obtuse angles are equal to each other)

#### Fact

- The ratio of intercepts formed by a transversal intersecting three parallel lines is equal to the ratio of corresponding intercepts formed by any other transversal.

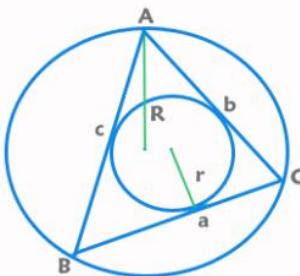
$$\frac{a}{b} = \frac{c}{d} = \frac{e}{f}$$

### Triangles

- Sum of interior angles of a triangle is  $180^\circ$  and sum of exterior angles is  $360^\circ$ .
- Exterior Angle = Sum of remote interior angles.

- Sum of two sides is always greater than the third side and the difference of two sides is always lesser than the third side.
- Side opposite to the biggest angle is longest and the side opposite to the smallest angle is the shortest.

**Area of a triangle:**



$$= \frac{1}{2} \times \text{Base} \times \text{Height}$$

$$= \frac{1}{2} \times \text{Product of sides} \times \text{Sine of included angle}$$

$$= \sqrt{s(s-a)(s-b)(s-c)} \text{ here } s \text{ is the semi perimeter}$$

$$[s = (a+b+c)/2]$$

$$= r \times s \text{ [r is radius of incircle]}$$

$$= \frac{abc}{4R} \text{ [R is radius of circumcircle]}$$

### Median

A Median of a triangle is a line segment joining a vertex to the midpoint of the opposing side. The three medians intersect in a single point, called the Centroid of the triangle. Centroid divides the median in the ratio of 2:1

### Altitude

An Altitude of a triangle is a straight line through a vertex and perpendicular to the opposite side or an extension of the opposite side. The three altitudes intersect in a single point, called the Orthocenter of the triangle.

### Perpendicular Bisector

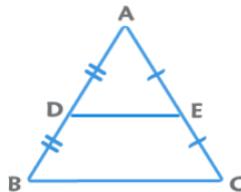
A Perpendicular Bisector is a line that forms a right angle with one of the triangle's sides and intersects that side at its midpoint. The three perpendicular bisectors intersect in a single point, called the Circumcenter of the triangle. It is the center of the circumcircle which passes through all the vertices of the triangle.

### Angle Bisector

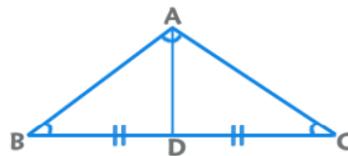
An Angle Bisector is a line that divides the angle at one of the vertices in two equal parts. The three angle bisectors intersect in a single point, called the Incenter of the triangle. It is the center of the incircle which touches all sides of a triangle.

## Theorems

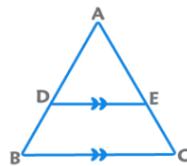
**Mid Point Theorem:** The line joining the midpoint of any two sides is parallel to the third side and is half the length of the third side.



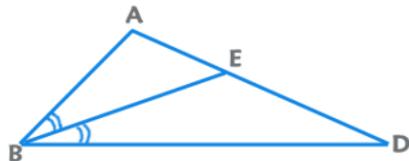
**Apollonius' Theorem:**  $AB^2 + AC^2 = 2(AD^2 + BD^2)$



**Basic Proportionality Theorem:** If  $DE \parallel BC$ , then  $AD/DB = AE/EC$



**Interior Angle Bisector Theorem:**  $AE/ED = BA/BD$

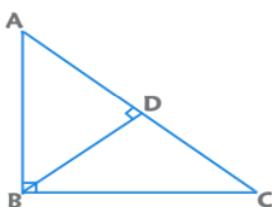


## Special Triangles

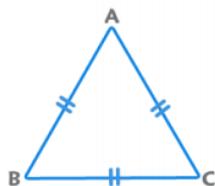
### Right Angled Triangle:

$$\angle ABC \approx \angle ADB \approx \angle BDC$$

$$BD^2 = AD \times DC \text{ and } AB \times BC = BD \times DC$$

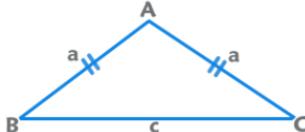
**Equilateral Triangle:**

All angles are equal to  $60^\circ$ . All sides are equal also.

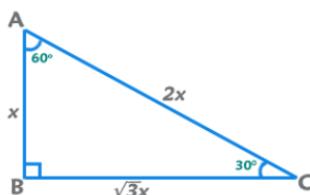
**Isosceles Triangle:**

Angles equal to opposite sides are equal.

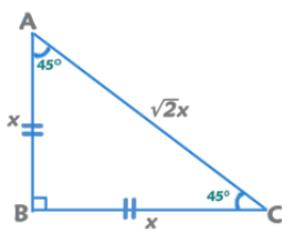
$$\text{Area} = \frac{c}{4} \sqrt{4a^2 - c^2}$$

 **$30^\circ$ - $60^\circ$ - $90^\circ$  Triangle**

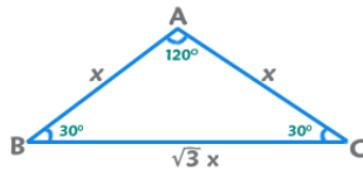
$$\text{Area} = \frac{\sqrt{3}}{2} \times x^2$$

 **$45^\circ$ - $45^\circ$ - $90^\circ$  Triangle**

$$\text{Area} = \frac{x^2}{2}$$

**30°-30°-120° Triangle**

$$\text{Area} = \frac{\sqrt{3}}{4} \times x^2$$

**Similarity of Triangles**

Two triangles are similar if their corresponding angles are congruent and corresponding sides are in proportion.

**Tests of similarity: (AA / SSS / SAS)**

- For similar triangles, if the sides are in the ratio of a:b
- Corresponding heights are in the ratio of a:b
- Corresponding medians are in the ratio of a:b
- Circumradii are in the ratio of a:b
- Inradii are in the ratio of a:b
- Perimeters are in the ratio of a:b
- Areas are in the ratio  $a^2 : b^2$

**Congruency of Triangles**

Two triangles are congruent if their corresponding sides and angles are congruent.

**Tests of congruence: (SSS / SAS / AAS / ASA)**

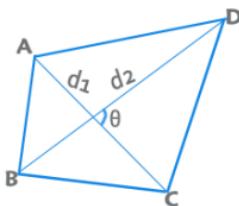
All ratios mentioned in similar triangle are now 1:1

**Polygons**

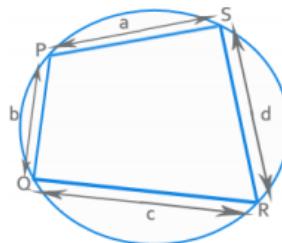
- Sum of interior angles =  $(n - 2) \times 180^\circ = (2n - 4) \times 90^\circ$
- Sum of exterior angles =  $360^\circ$
- Number of diagonals =  ${}^nC_2 - n = \frac{n(n - 3)}{2}$
- Number of triangles which can be formed by the vertices =  ${}^nC_3$

**Regular Polygon :**

- If all sides and all angles are equal, it is a regular polygon.
- All regular polygons can be inscribed in or circumscribed about a circle.
- Area =  $\frac{1}{2} \times \text{Perimeter} \times \text{Inradius}$  {Inradius is the perpendicular from centre to any side}
- Each Interior Angle =  $\frac{(n-2)180^\circ}{n}$ ; Exterior =  $\frac{360^\circ}{n}$

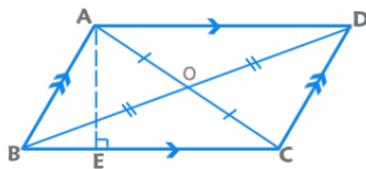
**Quadrilaterals :**

- Sum of the interior angles = Sum of the exterior angles =  $360^\circ$
- Area for a quadrilateral is given by  $\frac{1}{2} d_1 d_2 \sin \theta$

**Cyclic Quadrilateral**

- If all vertices of a quadrilateral lie on the circumference of a circle, it is known as a cyclic quadrilateral.
- Opposite angles are supplementary
- Area =  $\sqrt{(s-a)(s-b)(s-c)(s-d)}$  where  $s$  is the semi perimeter  $s = \frac{a+b+c+d}{2}$

**Parallelogram**

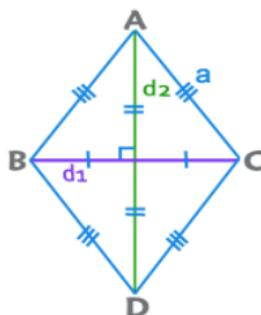


- Opposite sides are parallel and congruent.
- Opposite angles are congruent and consecutive angles are supplementary.
- Diagonals of a parallelogram bisect each other.
- Perimeter = 2(Sum of adjacent sides);
- Area = Base x Height = AD x BE

### Facts

- Each diagonal divides a parallelogram in two triangles of equal area.
- Sum of squares of diagonals = Sum of squares of four sides
  - $AC^2 + BD^2 = AB^2 + BC^2 + CD^2 + DA^2$
- A Rectangle is formed by intersection of the four angle bisectors of a parallelogram.

### Rhombus



- A parallelogram with all sides equal is a Rhombus. Its diagonals bisect at  $90^\circ$ .
- Perimeter =  $4a$ ; Area =  $\frac{1}{2} d_1 d_2$

- Area =  $d \times \sqrt{a^2 - (\frac{d}{2})^2}$

## Rectangle

A parallelogram with all angles equal ( $90^\circ$ ) is a Rectangle. Its diagonals are congruent.

- Perimeter =  $2(l+b)$
- Area =  $lb$

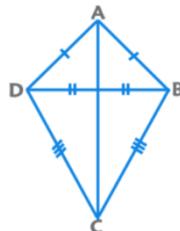
## Square

A parallelogram with sides equal and all angles equal is a square. Its diagonals are congruent and bisect at  $90^\circ$ .

- Perimeter =  $4a$
- Area =  $a^2$
- Diagonals =  $a\sqrt{2}$

**Fact:** From all quadrilaterals with a given area, the square has the least perimeter. For all quadrilaterals with a given perimeter, the square has the greatest area.

## Kite



- Two pairs of adjacent sides are congruent.
- The longer diagonal bisects the shorter diagonal at  $90^\circ$ .
- Area =  $\frac{\text{product of diagonals}}{2}$

## Trapezium / Trapezoid



- A quadrilateral with exactly one pair of sides parallel is known as a Trapezoid. The parallel sides are known as bases and the non-parallel sides are known as lateral sides.
- $\text{Area} = \frac{1}{2} \times (\text{Sum of parallel sides}) \times \text{Height}$
- Median, the line joining the midpoints of lateral sides, is half the sum of parallel sides.

**Fact**

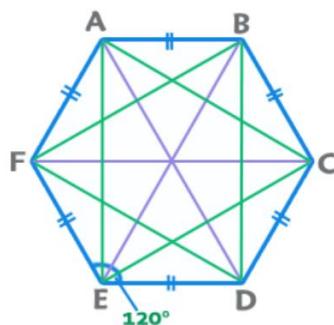
- Sum of the squares of the length of the diagonals = Sum of squares of lateral sides + 2 Product of bases.

$$AC^2 + BD^2 = AD^2 + BC^2 + 2 \times AB \times CD$$

**Isosceles Trapezium**

The non-parallel sides (lateral sides) are equal in length. Angles made by each parallel side with the lateral sides are equal.

**Facts:** If a trapezium is inscribed in a circle, it has to be an isosceles trapezium. If a circle can be inscribed in a trapezium, Sum of parallel sides = Sum of lateral sides.

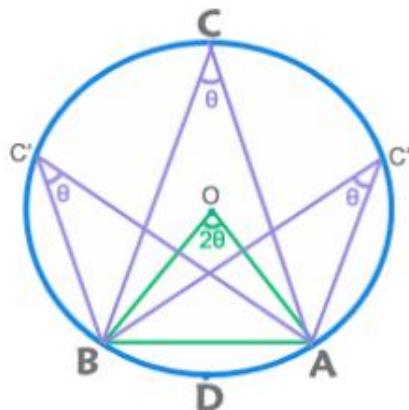
**Hexagon (Regular)**

- Perimeter =  $6a$ ;  $\text{Area} = \frac{3\sqrt{3}}{2} \times a^2$

- Sum of Interior angles =  $720^\circ$ .
- Each Interior Angle =  $120^\circ$ . Exterior =  $60^\circ$
- Number of diagonals = 9 {3 big and 6 small}
- Length of big diagonals (3) =  $2a$
- Length of small diagonals (6) =  $\sqrt{3} a$
- Area of a Pentagon =  $1.72 a^2$
- Area of an Octagon =  $2(\sqrt{2} + 1) a^2$

**Facts:** A regular hexagon can be considered as a combination of six equilateral triangles. All regular polygons can be considered as a combination of 'n' isosceles triangles.

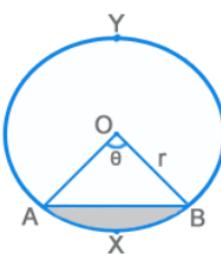
## Circles



$$\text{Diameter} = 2r; \text{Circumference} = 2\pi r; \text{Area} = \pi r^2$$

Chords equidistant from the centre of a circle are equal. A line from the centre, perpendicular to a chord, bisects the chord. Equal chords subtend equal angles at the centre. The diameter is the longest chord of a circle. A chord /arc subtends equal angle at any point on the circumference and double of that at the centre.

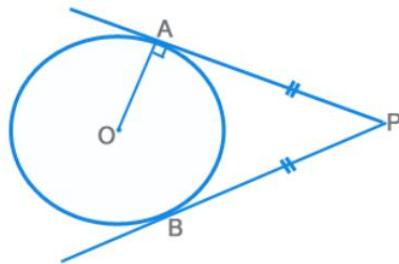
Chords / Arcs of equal lengths subtend equal angles.



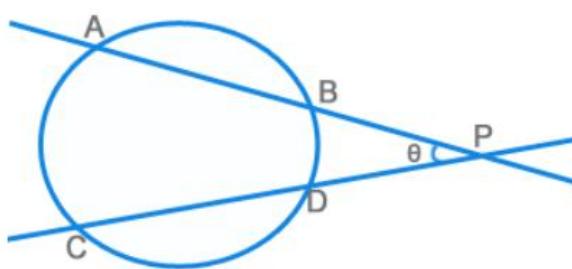
Chord AB divides the circle into two parts: Minor Arc AXB and Major Arc AYB

- Measure of arc AXB =  $\angle AOB = \theta$
- Length (arc AXB) =  $\frac{\theta}{360^\circ} \times 2\pi r$
- Area (sector OAXB) =  $\frac{\theta}{360^\circ} \times \pi r^2$
- Area of Minor Segment = Shaded Area in above figure
- Area of Sector OAXB - Area of  $\triangle OAB$
- $r^2 \left[ \frac{\pi\theta}{360^\circ} - \frac{\sin\theta}{2} \right]$

### Properties of Tangents, Secants and Chords

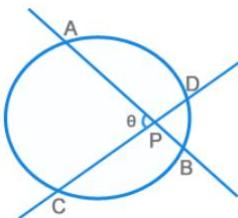


The radius and tangent are perpendicular to each other. There can only be two tangents from an external point, which are equal in length  $PA = PB$



$$PA \times PB = PC \times PD$$

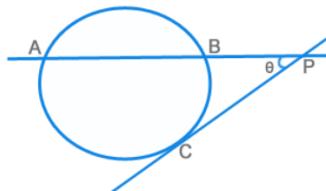
$$= \frac{1}{2} [m(\text{Arc AC}) - m(\text{Arc BD})]$$



$$PA \times PB = PC \times PD$$

$$= \frac{1}{2} [m(\text{Arc AC}) + m(\text{Arc BD})]$$

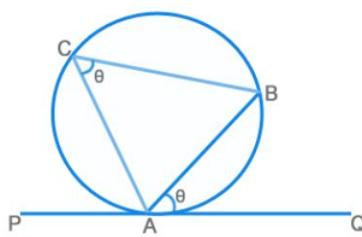
### Properties



$$PA \times PB = PC^2$$

$$= \frac{1}{2} [m(\text{Arc AC}) - m(\text{Arc BC})]$$

### Alternate Segment Theorem

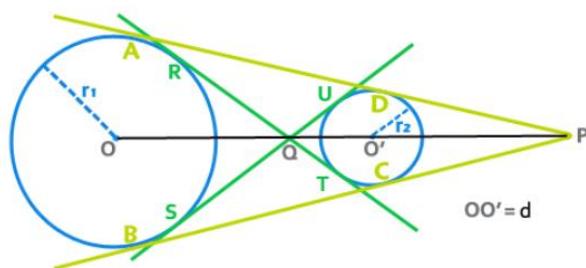


The angle made by the chord AB with the tangent at A (PQ) is equal to the angle that it subtends on the opposite side of the circumference.

$$\angle BAQ = \angle ACB$$

### Common Tangents

Two Circles	No. of Common Tangents	Distance Between Centers (d)
One is completely inside other	0	$< r_1 - r_2$
Touch internally	1	$= r_1 - r_2$
Intersect	2	$r_1 - r_2 < d < r_1 + r_2$
Touch externally	3	$= r_1 + r_2$
One is completely outside other	4	$> r_1 + r_2$



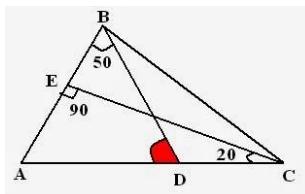
- Length of the Direct Common Tangent (DCT)  

$$AD = BC = \sqrt{d^2 - (r_1 - r_2)^2}$$
- Length of the Transverse Common Tangent (TCT)  

$$RT = SU = \sqrt{d^2 - (r_1 + r_2)^2}$$

### Example with Solution

**Example 1:** In following figure, CE is perpendicular to AB,  $\angle ACE = 20^\circ$  and  $\angle ABD = 50^\circ$ . Find  $\angle BDA$ :



**Solution:** To find: angle BDA

For this what we need,  $\angle BAD$

Because, Sum of all angles =  $180^\circ$

Consider,  $\triangle ECA$ ,

$$\angle CEA + \angle EAC + \angle ACE = 180^\circ$$

$$\text{i.e. } 90^\circ + 20^\circ + \angle EAC = 180^\circ$$

$$\text{Therefore, } \angle EAC = 70^\circ$$

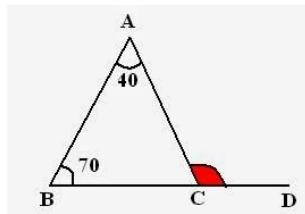
Now, come to  $\triangle ABD$ ,

$$\angle ABD + \angle BDA + \angle BAD = 180^\circ$$

$$70^\circ + 50^\circ + \angle BAD = 180^\circ$$

$$\text{Therefore, } \angle BAD = 60^\circ$$

**Example 2:** In given figure. BC is produced to D and  $\angle BAC = 40^\circ$  and  $\angle ABC = 70^\circ$ .Find  $\angle ACD$ :



**Solution:** In above figure,  $\angle ACD$  is an exterior angle, and according to property,

Exterior angle = Sum of interior angles

$$\text{Therefore, } \angle ACD = 70^\circ + 40^\circ$$

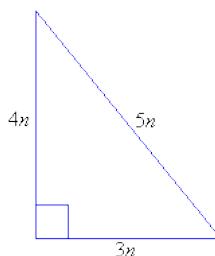
$$= 110^\circ$$

This is not the end of this chapter. These are just the basics. In next session, I will discuss some important results, properties (congruency, similarity) and much more.

Always remember, Geometry needs practice and time.

### Exercise - 14





- 10) Find the length of one side of a right triangle if the length of the hypotenuse is 15 inches and the length of the other side is 12 inches.

a) 8 inches      b) 7 inches      c) 9 inches  
d) 13 inches      e) None of these

11) Find the length of the hypotenuse of a right triangle if the lengths of the other two sides are both 3 inches.

a) 5 inches      b)  $3\sqrt{4}$  inches      c) 6 inches  
d)  $3\sqrt{2}$  inches      e) None of these

12) Find the lengths of the other two sides of a right triangle if the length of the hypotenuse is  $4\sqrt{2}$  inches and one of the angles is  $45^\circ$ .

a) 4 inches      b) 9 inches      c) 8 inches  
d) 7 inches      e) None of these

13) Find the length of the hypotenuse of a right triangle if the lengths of the other two sides are 4 inches and  $4\sqrt{3}$  inches.

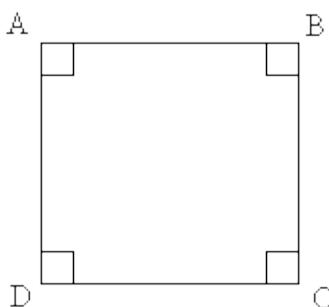
a) 8 inches      b) 9 inches      c) 10 inches  
d) 11 inches      e) None of these

14) Find the lengths of the other two sides of a right triangle if the length of the hypotenuse is 8 inches and one of the angles is  $30^\circ$ .

a) 4,  $4\sqrt{3}$  inches      b) 5, 6 inches      c) 2,  $4\sqrt{2}$   
d) 3,  $4\sqrt{2}$  inches      e) None of these

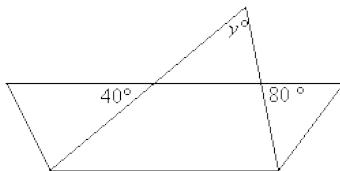
15) What is the area of the following square, if the length of BD is  $2\sqrt{2}$  ?

a) 1      b) 2      c) 3  
d) 4      e) 5



16) In the figure below, what is the value of  $y$ ?

- a) 40
- b) 50
- c) 60
- d) 100
- e) 120



17) Two circles both of radii 6 have exactly one point in common. If A is a point on one circle and B is a point on the other circle, what is the maximum possible length for the line segment AB?

- a) 12
- b) 15
- c) 18
- d) 20
- e) 24

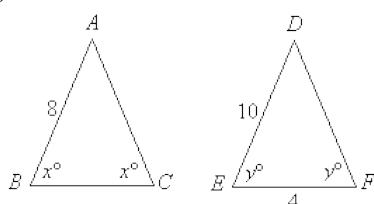
18) A right circular cylinder has a radius of 3 and a height of 5. Which of the following dimensions of a rectangular solid will have a volume closest to the cylinder?

- a) 4, 5, 5
- b) 4, 5, 6
- c) 5, 5, 5
- d) 5, 5, 6
- e) 5, 6, 6

19) Note: Figures not drawn to scale

In the figures above,  $x = 60$ , How much more is the perimeter of triangle ABC compared with the triangle DEF.

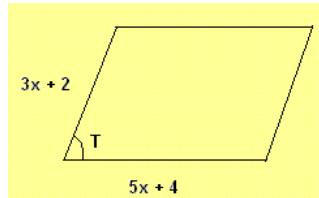
- a) 0
- b) 2
- c) 4
- d) 6
- e) 8



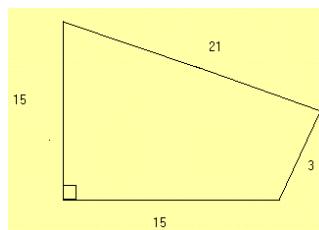
20) A right triangle has one other angle that is  $35^\circ$ . What is the size of the third angle?

- a)  $55^\circ$
- b)  $65^\circ$
- c)  $90^\circ$
- d)  $180^\circ$
- e) None of these

- 21) An equilateral triangle has one side that measures 5 in. What is the size of the angle opposite that side?
- a)  $55^\circ$       b)  $70^\circ$       c)  $110^\circ$   
 d)  $60^\circ$       e) None of these
- 22) An isosceles triangle has one angle of  $96^\circ$ . What are the sizes of the other two angles?
- a)  $24^\circ$       b)  $34^\circ$       c)  $42^\circ$   
 d)  $96^\circ$       e) None of these
- 23) Find the circumference of the circle with a diameter of 8 inches?
- a) 25 inches      b) 25.163 inches      c) 29.45 inches  
 d) 35.62 inches      e) None of these
- 24) Find the area of the circle with a diameter of 10 inches?
- a) 55.78 sq. inches      b) 99.75 sq. inches      c) 92 inches  
 d) 78.55 sq. inches      e) None of these
- 25) Find the area of the circle with a radius of 10 inches?
- a) 314.2 sq. inches      b) 115 inches      c) 320.29 sq. inches  
 d) 56.12 sq. inches      e) None of these
- 26) The parallelogram shown in the figure below has a perimeter of 44 cm and an area of  $64 \text{ cm}^2$ . Find angle T in degrees?
- a)  $43.4^\circ$       b)  $44.2^\circ$       c)  $34.8^\circ$   
 d)  $48.1^\circ$       e) None of these

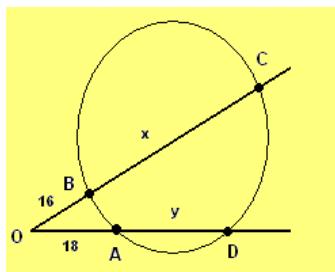


- 27) Find the area of the quadrilateral shown in the figure. (note: Figure not drawn to scale)
- a) 169      b) 185      c) 199  
 d) 144      e) None of these



- 28) In the figure below triangle OAB has an area of 72 and triangle ODC has an area of 288. Find x and y.

- a)  $x = 20, y = 14$       b)  $x = 14, y = 20$       c)  $x = 41, y = 2$   
 d)  $x = 24, y = 1$       e) None of these



- 29) Find the circumference of a circular disk whose area is  $100\pi$  square centimeters?

- a)  $40\pi$       b)  $10\pi$       c)  $20\pi$   
 d)  $30\pi$       e) None of these

- 30) The semicircle of area  $1250\pi$  centimeters is inscribed inside a rectangle. The diameter of the semicircle coincides with the length of the rectangle. Find the area of the rectangle?

- a) 4000      b) 5000      c) 3000  
 d) 2000      e) None of these

- 31) If in a triangle ABC  $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$ , then what can be said about the triangle?

- a) Right angled triangle      b) Isosceles triangle      c) Equilateral triangle  
 d) Obtuse triangle      e) None of these

### Solutions:

1. Option A

For the vertices to form a square, we know that the length of each side of the square should be equal. Therefore,

$$(x - 5)^2 + (7 - 1)^2 = (x - 3)^2 + (7 + 1)^2$$

$$[x^2 + 5^2 - 2(x)(5)] + [36] = [x^2 + 3^2 - 2(x)(3)] + [64]$$

$$[5^2 + 36] - [9 + 64] = (10 - 6)x$$

$$x = -\frac{12}{4} = -3$$

This gives the side of the square  $x = -3$ .

2. Option A

If two sides of a triangle and the included angle 'y' is known, then the area of the triangle can be found using the formula

$$\frac{1}{2} * (\text{product of sides}) * \sin y$$

Substituting the values in the formula, we get  $\frac{1}{2} * 8 * 12 * \sin 150 = 24$  sq units

3. Option D

From the measure of the length of the sides of the triangle 9, 40 and 41 we can infer that the triangle is a right angled triangle. 9, 40, 41 is a Pythagorean triplet.

In a right angled triangle, the radius of the circle that circumscribes the triangle is half the hypotenuse.

In the given triangle, the hypotenuse = 41

Therefore, the radius of the circle that circumscribes the triangle =  $\frac{41}{2} = 20.5$  units

4. Option C

The lengths of the four sides AB, BC, CD and DA are all equal to  $\sqrt{41}$

Hence, the given quadrilateral is either a Rhombus or a Square.

Now let us compute the lengths of the two diagonals AC and BD.

The length of AC is  $\sqrt{162}$  and the length of BD is  $\sqrt{2}$

As the diagonals are not equal and the sides are equal, the given quadrilateral is a **Rhombus**.

5. Option A

We know that the sum of an exterior angle and an interior angle of a polygon =  $180^\circ$

We also know that sum of all the exterior angles of a polygon =  $360^\circ$

The question states that the sum of all interior angles of the given polygon =  $1440^\circ$

Therefore, sum of all the interior and exterior angles of the polygon =  $1440 + 360 = 1800$

If there are 'n' sides to this polygon, then the sum of all the exterior and interior angles =  $180 \times n = 10$

6. Option A

The triangle given is a right angled triangle as its sides are 5, 12 and 13 which is one of the Pythagorean triplets.

**Note:** In a right angled triangle, the radius of the incircle is given by the following relation

$$\frac{\text{sum of perpendicular sides} - \text{hypotenuse}}{2}$$

As the given triangle is a right angled triangle, radius of its incircle =  $\frac{5 + 12 - 13}{2} = 2$  units

7. Option B

The number of diagonals of an n-sided convex is  $\frac{n(n-3)}{2}$

This polygon has 63 sides. Hence,  $n = 63$

Therefore, number of diagonals =  $\frac{63 \times 60}{2} = 1890$

8. Option C

For any triangle sum of any two sides must be greater than the third side.

The sides are 10, 12 and 'x'.

From Rule 2, x can take the following values : 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 – A total of 19 values.

When  $x = 3$  or  $x = 4$  or  $x = 5$  or  $x = 6$ , the triangle is an OBTUSE angled triangle.

The smallest value of x that satisfies both conditions is 7. ( $10^2 + 7^2 > 12^2$ )

The highest value of x that satisfies both conditions is 15. ( $10^2 + 12^2 + 15^2$ )

When  $x = 16$  or  $x = 17$  or  $x = 18$  or  $x = 19$  or  $x = 20$  or  $x = 21$ , the triangle is an OBTUSE angled triangle.

Hence, the values of x that satisfy both the rules are  $x = 7, 8, 9, 10, 11, 12, 13, 14, 15$ . A total of 9 values.

9. Option A

Test the ratio of the lengths to see if it fits the  $3n : 4n : 5n$  ratio.

$6 : 8 : ? = 3(2) : 4(2) : ?$

Yes, it is a 3-4-5 triangle for  $n =$

Calculate the third side  $5n = 5 \times 2 = 10$

The length of the hypotenuse is 10 inches.

10. Option C

Test the ratio of the lengths to see if it fits the  $3n : 4n : 5n$  ratio.

$? : 12 : 15 = ? : 4(3) : 5(3)$

Yes, it is a 3-4-5 triangle for  $n = 3$

Calculate the third side  $3n = 3 \times 3 = 9$

The length of the side is 9 inches.

11. Option D

This is a right triangle with two equal sides so it must be a  $45^\circ - 45^\circ - 90^\circ$  triangle.

You are given that the both the sides are 3. If the first and second value of the ratio  $n : n : n\sqrt{2}$  is 3 then the length of the third side is  $3\sqrt{2}$

The length of the hypotenuse is  $3\sqrt{2}$  inches.

12. Option A

This is a right triangle with a  $45^\circ$  so it must be a  $45^\circ - 45^\circ - 90^\circ$  triangle.

You are given that the hypotenuse is  $4\sqrt{2}$ . If the third value of the ratio  $n : n : n\sqrt{2}$  is  $4\sqrt{2}$  then the lengths of the other two sides must 4.

The lengths of the two sides are both 4 inches.

13. Option A

Test the ratio of the lengths to see if it fits the  $n : n\sqrt{3} : 2n$  ratio.

$$4 : 4\sqrt{3} : ? n : n\sqrt{3} : 2n$$

Yes, it is a  $30^\circ - 60^\circ - 90^\circ$  triangle for  $n = 4$

Calculate the third side

$$2n = 2 \times 4 = 8$$

The length of the hypotenuse is 8 inches.

14. Option A

This is a right triangle with a  $30^\circ$  angle so it must be a  $30^\circ - 60^\circ - 90^\circ$  triangle.

You are given that the hypotenuse is 8. Substituting 8 into the third value of the ratio  $n : n\sqrt{3} : 2n$ ,

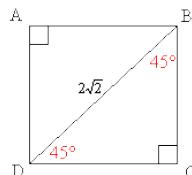
we get that  $2n = 8$

$$n = 4$$

Substituting  $n = 4$  into the first and second value of the ratio we get that the other two sides are 4 and  $4\sqrt{3}$

The lengths of the two sides are 4 inches and  $4\sqrt{3}$  inches.

15. Option D



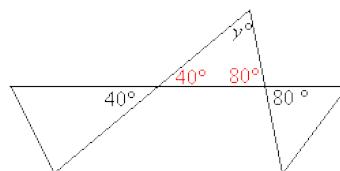
We need to find the length of the side of the square in order to get the area.

The diagonal BD makes two  $45^\circ - 45^\circ - 90^\circ$  triangles with the sides of the square.

Using the  $45^\circ - 45^\circ - 90^\circ$  special triangle ratio  $n : n : n\sqrt{2}$ . If the hypotenuse is  $2\sqrt{2}$  then the legs must be 2. So, the length of the side of the square is 2.

$$\text{Area of square} = 5^2 = 2^2 = 4$$

16. Option C



Vertical angles being equal allows us to fill in two angles in the triangle that  $y^\circ$  belongs to.

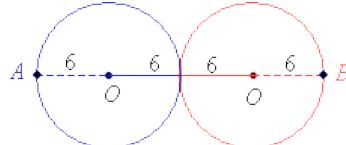
Sum of angles in a triangle =  $180^\circ$

$$\text{So, } y^\circ + 40^\circ + 80^\circ = 180^\circ$$

$$y^\circ + 120^\circ = 180^\circ$$

$$y^\circ = 60^\circ$$

17. Option E



Sketch the two circles touching at one point.

The furthest that A and B can be would be at the two ends as shown in the above diagram.

If the radius is 6 then the diameter is  $2 \times 6 = 12$  and the distance from A to B would be  $2 \times 12 = 24$

18. Option E

Write down formula for volume of cylinder

$$V = \pi r^2 h$$

Plug in the values

$$V = \pi \times 3^2 \times 5 = 45\pi$$

$$V = 45 \times 3.142 = 141.39$$

We now have to test the volume of each of the rectangular solids to find out which is the closest to 141.39

$$(A) 4 \times 5 \times 5 = 100$$

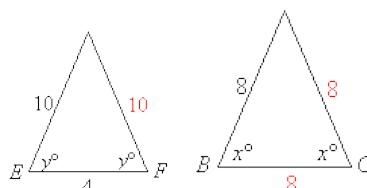
$$(B) 4 \times 5 \times 6 = 120$$

$$(C) 5 \times 5 \times 5 = 125$$

$$(D) 5 \times 5 \times 6 = 150$$

$$(E) 5 \times 6 \times 6 = 180$$

19. Option A



**Note:** Figures not drawn to scale

Since  $x = 60^\circ$ , triangle ABC is an equilateral triangle with sides all equal.

The sides are all equal to 8.

Perimeter of triangle ABC =  $8 + 8 + 8 = 24$

Triangle DEF has two angles equal, so it must be an isosceles triangle.

The two equal sides will be opposite the equal angles.

So, the length of DF = length of DE = 10

Perimeter of triangle DEF =  $10 + 10 + 4 = 24$

Subtract the two perimeters.

$$24 - 24 = 0$$

20. Option A

A right triangle has one angle =  $90^\circ$ . Sum of known angles is  $90^\circ + 35^\circ = 125^\circ$

The sum of all the angles in any triangle is  $180^\circ$ . Subtract sum of known angles from  $180^\circ$ .  $180^\circ - 125^\circ = 55^\circ$

The size of the third angle is  $55^\circ$

21. Option D

Since it is an equilateral triangle all its angles would be  $60^\circ$ . The size of the angle does not depend on the length of the side.

The size of the angle is  $60^\circ$ .

22. Option C

Since it is an isosceles triangle it will have two equal angles. The given  $96^\circ$  angle cannot be one of the equal pair because a triangle cannot have two obtuse angles.

Let  $x$  be one of the two equal angles. The sum of all the angles in any triangle is  $180^\circ$ .

$$x + x + 96^\circ = 180^\circ$$

$$2x = 84^\circ$$

$$x = 42^\circ$$

The sizes of the other two angles are  $42^\circ$  each.

23. Option B

Formula  $C = \pi d$

$$C = 8\pi$$

The circumference of the circle is  $8\pi = 25.163$  inches

24. Option D

Formula

$$A = \pi r^2$$

Change diameter to radius

$$r = \frac{1}{2} d = \frac{1}{2} \times 10 = 5$$

Plug in the value:

$$A = \pi 5^2 = 25\pi$$

The area of the circle is  $25\pi$

$78.55$  sq. inches

25. Option A

Formula

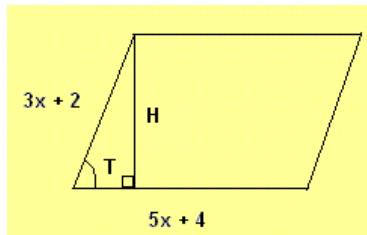
$$A = \pi r^2$$

Plug in the value  $A = \pi 10^2 = 100\pi$

The area of the circle is  $100\pi$

314.2 sq. inches

26. Option C



$$44 = 2(3x + 2) + 2(5x + 4), \text{ solve for } x$$

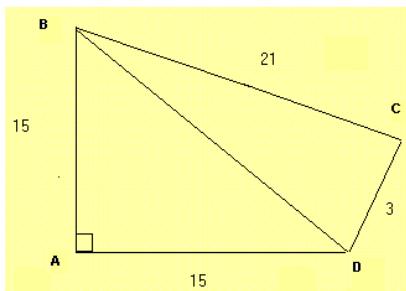
$$x = 2$$

$$\text{height} = \frac{\text{area}}{\text{base}} \\ = \frac{64}{14} = \frac{32}{7} \text{ cm}$$

$$\sin(T) = \frac{32/7}{8} = \frac{32}{56} = \frac{4}{7}$$

$$T = \arcsin\left(\frac{4}{7}\right) = 34.8^\circ$$

27. Option D



ABD is a right triangle: hence  $BD^2 = 15^2 + 15^2 = 450$

Also  $BC^2 + CD^2 = 21^2 + 3^2 = 450$

The above means that triangle BCD is also a right triangle and the total area of the quadrilateral is the sum of the areas of the two right triangles.

$$\text{Area of quadrilateral} = \left[\frac{1}{2}\right] \times 15 \times 15 + \left[\frac{1}{2}\right] \times 21 \times 3 = 144$$

28. Option A

$$\text{Area of OAB} = 72 = \left[\frac{1}{2}\right] \sin(AOB) * OA * OB$$

$$\text{Solve the above for } \sin(AOB) \text{ to find } \sin(AOB) = \left[\frac{1}{2}\right]$$

$$\text{Area of ODC} = 288 = \left[ \frac{1}{2} \right] \sin(\text{DOC}) * \text{OD} * \text{OD}$$

Note that  $\sin(\text{DOC}) = \sin(\text{AOB}) = \left[ \frac{1}{2} \right]$ ,  $\text{OD} = 18 + y$  and  $\text{OC} = 16 + x$  and substitute in the above to obtain the first equation in x and y

$$1152 = (18 + y)(16 + x)$$

We now use the theorem of the intersecting lines outside a circle to write a second equation in x and y

$$16 \times (16 + x) = 14 \times (14 + y)$$

Solve the two equations simultaneously to obtain

$$x = 20 \text{ and } y = 14$$

29. Option C

Let r be the radius of the disk. Area is known and equal to  $100\pi$ ; hence

$$100\pi = \pi r^2$$

$$r.r = 10$$

$$\text{Circumference} = 2\pi r = 20\pi$$

30. Option B

Let the radius of the semicircle. Area of the semicircle is known; hence

$$1250\pi = \frac{1}{2} \pi r^2$$

$$r.r = 50$$

$$\text{Length of rectangle} = 2r = 100$$

$$\text{Width of rectangle} = r = 50$$

$$\text{Area} = 100 \times 50 = 5000$$

31. Option C

The sine rule of triangle says that  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = k$

Therefore,  $a = k(\sin A)$ ,  $b = k(\sin B)$  and  $c = k(\sin C)$

Hence, we can rewrite  $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$  as

$$\frac{\cos A}{k \sin A} = \frac{\cos B}{k \sin B} = \frac{\cos C}{k \sin C}$$

Or  $\cot A = \cot B = \cot C$

Or  $A = B = C$

Or the triangle is an equilateral triangle.

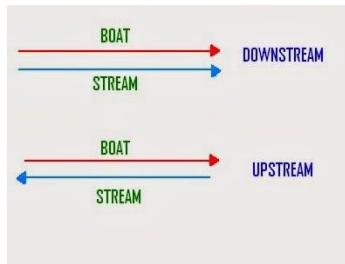
## Chapter - 15

# Boats and Streams

Boats and Streams is just a logical extension of motion in a straight line. One or two questions are asked from this chapter in almost every exam. Here is discussion of some important facts and terminologies which will help you to make better understanding about this topic.

### **Basic Concept**

If direction of boat is same as direction of the stream, then it is known as DOWNSTREAM and if directions are opposite, then it is known as UPSTREAM. Following figure is representing the same:



i.e. if boat is moving with stream then it is known as Downstream and if opposite to stream, then it is Downstream.

### **Downstream Speed and Upstream Speed**

In case of Downstream, as you can see the direction is same, speeds of stream and boat will be added to get Down stream speed.

If Speed of boat in still water =  $u$  km/hr

Speed of stream =  $v$  km/hr, then

Downstream Speed =  $(u+v)$  km/hr

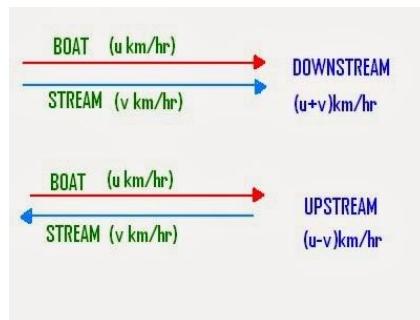
Similarly, if I talk about upstream speed, as the direction of boat and stream is opposite, speed of both will be subtracted.

i.e. Upstream Speed =  $(u-v)$  km/hr

Study the following figure, notice the directions and try to remember this i.e.

If directions are same then speeds will be added and

If directions are opposite then speeds will be subtracted



Speeds of Boat and Stream if Downstream and Upstream Speeds are given

$$\text{Speed of Boat} = \frac{1}{2} (\text{Downstream Speed} + \text{Upstream Speed})$$

$$\text{Speed of Stream} = \frac{1}{2} (\text{Downstream Speed} - \text{Upstream Speed})$$

### Problems with Solution

**Example 1:** Speed of boat in still water is 5 km/hr and speed of stream is 1 km/hr. find the downstream speed and upstream speed.

**Solution:** Given that,  $u = 5$  km/hr

$$v = 1 \text{ km/hr}$$

$$\text{Downstream speed} = u + v \text{ km/hr}$$

$$\Rightarrow 5 + 1 = 6 \text{ km/hr}$$

$$\text{Upstream speed} = u - v \text{ km/hr}$$

$$\Rightarrow 5 - 1 = 4 \text{ km/hr}$$

**Example 2:** A man takes 3 hours to row a boat 15 km downstream of river and 2 hours 30 min to cover a distance of 5 km upstream. Find speed of river or stream.

**Solution:** We need to find speed of stream from downstream speed and upstream speed. See how we calculate it:

As you know, Speed = Distance/ Time

$$\text{So, Downstream Speed} = \frac{15}{3} = 5 \text{ km/hr}$$

$$\text{Upstream Speed} = \frac{5}{2.5} = 2 \text{ km/hr}$$

Now, as we have discussed, Speed of stream =  $\frac{1}{2}$  (Downstream Speed - Upstream Speed)

$$\Rightarrow \text{Speed of stream} = \frac{1}{2} (5-2)$$

$$\Rightarrow \frac{3}{2} = 1.5 \text{ km/hr}$$

**Example 3:** A man can row 7km/hr in still water. If in a river running at 2km/hr, it takes him 50 minutes to row to his place and back, how far off is the place?

**Solution:** Given,  $u = 7\text{km/hr}$

$$v = 2 \text{ km/hr}$$

From u and v, we can calculate downstream speed and upstream speed.

$$\text{Downstream Speed} = (u + v) = 7+2 = 9 \text{ km/hr}$$

$$\text{Upstream Speed} = (u-v) = 7-2 = 5 \text{ km/hr}$$

Now, we need to find DISTANCE and time is given,

$$\text{Time} = \text{Distance} / \text{Speed}$$

Let required distance = x km

Time taken in downstream + Time taken in upstream = Total Time

$$\Rightarrow \frac{x}{9} + \frac{x}{5} = \frac{50}{60} \quad (50 \text{ minutes} = \frac{50}{60} \text{ hrs})$$

⇒ Calculating the above equation:  $x = 2.68\text{ km}$

## Exercisxe - 15

- a) 12 kmph                    b) 13 kmph                    c) 15 kmph  
d) 16 kmph                    e) None of these
- 7) A man's speed with the current is 15 km/hr and the speed of the current is 2.5 km/hr. The man's speed against the current is  
a) 8.5 km/hr                    b) 9 km/hr                    c) 10 km/hr  
d) 12.5 km/hr                    e) None of these
- 8) A man can row upstream at 7 kmph and downstream at 10 kmph. Find man's rate in still water and the rate of current?  
a) 6.5, 1.2 km/hr                    b) 8.5, 1.5 km/hr                    c) 1.5, 1.6 km/hr  
d) 7.5, 1.8 km/hr                    e) None of these
- 9) A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in stationary water?  
a) 40 minutes                    b) 1 hour                    c) 1 hour 15 min  
d) 1 hour 30 min                    e) None of these
- 10) There is a road beside a river. Two friends started from a place A, moved to a temple situated at another place B and then returned to A again. One of them moves on a cycle at a speed of 12 km/hr, while the other sails on a boat at a speed of 10 km/hr. If the river flows at the speed of 4 km/hr, which of the two friends will return to place A first ?  
a) 5.4 km /hr, boat                    b) 12 km /hr, cycle                    c) 8.4 km/hr, boat  
d) 9.6 km /hr, cycle                    e) None of these
- 11) In one hour, a boat goes 11 km along the stream and 5 km against the stream. The speed of the boat in still water in ( km/hr) is  
a) 3                            b) 5                            c) 8  
d) 9                            e) None of these
- 12) If a man rows at the rate of 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate along the current is  
a) 4.25 kmph                    b) 6 kmph                    c) 6.5 kmph  
d) 8.5 kmph                    e) None of these
- 13) Speed of a boat in standing water is 9 kmph and the speed of the stream is 1. 5 kmph. A man rows to a place at a distance of 105 km and comes back to the starting point. The total time taken by him is  
a) 16 hours                    b) 18 hours                    c) 20 hours  
d) 24 hours                    e) None of these
- 14) A boat takes 90 minutes less to travel 36 miles downstream than to travel the same distance upstream. If the speed of the boat in still water is 10 mph, the speed of the stream is  
a) 2 mph                            b) 2.5 mph                    c) 3 mph

- d) 4mph e) None of these

15) A man takes 3 hours 45 minutes to row a boat 15 km downstream of a river and 2 hours 30 minutes to cover a distance of 5 km upstream. Find the speed of the river current in km/hr.  
a) 1 km/hr b) 2 km/hr c) 3 km/hr  
d) 4 km/hr e) None of these

16) A man can row  $7\frac{1}{2}$  kmph in still water. If in a river running at 1.5 km an hour, it takes him 50 minutes to row to a place and back, how far off in the place?  
a) 3 km b) 7 km c) 8 km  
d) 6 km e) None of these

17) A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in stationary water?  
a) 40 minutes b) 1 hour c) 1 hr 15 min  
d) 1 hr 30 min e) None of these

18) If a man rows at the rate of 5 kmph in still water and his rate against the current is 3.5 kmph, then the man's rate along the current is :  
a) 4.25 kmph b) 6 kmph c) 6.5 kmph  
d) 8.5 kmph e) None of these

19) A man rows to a place 48 km distant and back in 14 hours. He finds that he can row 4 km with the stream in the same time as 3 km against the stream. The rate of the stream is :  
a) 1 km/hr b) 1.5 km/hr c) 1.8 km/hr  
d) 3.5 km/hr e) None of these

20) A man can row 9 km/h in Still water. It takes him twice as long as to row up as to row down. Find the rate of stream of the river.  
a) 3 km/h b) 9 km/h c) 5 km/h  
d) 6 km/h e) None of these

21) A man can row 5 km/h in still water. If the rate of current is 1 km/h , it takes  $\frac{5}{4}$  hours to row to a place and back. How far is the place?  
a) 2 km b) 2.5 km c) 3 km  
d) 4 km e) None of these

22) A boat which sails at 10 km/h in still water starts chasing from 10 km behind, another one which sails at 4 km/h in the upstream direction. After how long will it catch up if the stream is flowing at 2 km/h

- a) 4 h  
d) 3.5 h

- b) 2.5 h  
e) None of these

- c) 2 h

23) A boat sails 15 km of a river towards upstream in 5 hours. How long will it take to cover the same distance downstream, if the speed of current is one-fourth the speed of the boat in still water :

- a) 1.8 h  
d) 5 h

- b) 3 h  
e) None of these

- c) 4 h

24) A man can row upstream at 8 kmph and downstream at 13 kmph. The speed of the stream is :

- a) 2.5 km/hr  
d) 10.5 km/hr

- b) 4.2 km/hr  
e) None of these

- c) 5 km/hr

25) A boat can travel with a speed of 13 km/hr in still water. If the speed of the stream is 4 km/hr, find the time taken by the boat to go 68 km downstream.

- a) 2 hours  
d) 5 hours

- b) 3 hours  
e) None of these

- c) 4 hours

26) If a boat goes 7 km upstream in 42 minutes and the speed of the stream is 3 kmph, then the speed of the boat in still water is :

- a) 4.2 km/hr  
d) 21 km/hr

- b) 9 km/hr  
e) None of these

- c) 13 km/hr

27) A motor boat whose speed is 15 km/hr in still water goes 30 km downstream and comes back in a total of 4 hours 30 minutes. The speed of the stream (in km/hr) is :

- a) 4  
d) 10

- b) 5  
e) None of these

- c) 6

### Solutions:

1. Option C

$$\begin{aligned} \text{Speed Downstream} &= (13 + 4) \text{ km./hr.} \\ &= 17 \text{ km./hr.} \end{aligned}$$

$$\begin{aligned} \text{Time taken to travel 68 km. downstream} &= \left[ \frac{68}{17} \right] \text{ hrs.} \\ &= 4 \text{ hrs.} \end{aligned}$$

2. Option D

$$\begin{aligned} \text{Speed Downstream} &= (15 + 3) \text{ km./hr.} \\ &= 18 \text{ km./hr.} \end{aligned}$$

$$\begin{aligned} \text{Distance travelled} &= \left[ 18 \times \frac{12}{60} \right] \text{ hrs.} \\ &= 3.6 \text{ km.} \end{aligned}$$

## 3. Option B

$$\begin{aligned}\text{Speed Downstream} &= (14 + 4) \text{ km./hr.} \\ &= 18 \text{ km./hr.}\end{aligned}$$

$$\begin{aligned}\text{Speed upstream} &= (14 - 4) \text{ km./hr.} \\ &= 10 \text{ km./hr.}\end{aligned}$$

$$\begin{aligned}\text{Let the distance b/w A and B be } x\text{ km. Then} &= \left[ \frac{x}{18} + \frac{x}{10} \right] \\ &= 19 \\ &= \frac{19x}{180} = 19 \\ x &= 180\end{aligned}$$

## 4. Option B

$$\begin{aligned}\text{Rate Downstream} &= \left[ \frac{\frac{16}{2}}{2} \right] \text{ kmph} \\ &= 8 \text{ kmph}\end{aligned}$$

$$\begin{aligned}\text{Rate upstream} &= \left[ \frac{\frac{16}{4}}{2} \right] \text{ kmph} \\ &= 4 \text{ kmph}\end{aligned}$$

$$\begin{aligned}\text{Speed in still water} &= \frac{1}{2} (8 + 4) \text{ kmph} \\ &= \frac{1}{2} \times 12 \\ &= 6 \text{ kmph}\end{aligned}$$

## 5. Option A

$$\begin{aligned}\text{Speed of stream} &= \frac{1}{2} (13 - 8) \text{ kmph} \\ &= \frac{1}{2} \times 5 \\ &= \frac{5}{2} \\ &= 2.5\end{aligned}$$

## 6. Option C

Let the speed of the boat in still water be  $x$  kmph.

Then, speed downstream =  $(x + 3)$  kmph

$$\begin{aligned}\text{Speed upstream} &= (x - 3) \text{ kmph} \\ &= (x + 3) \times 1 \\ &= (x - 3) \times 3/2 \text{ kmph} \\ &= 2x + 6 = 3x - 9 \\ x &= 15 \text{ kmph}\end{aligned}$$

## 7. Option C

$$\text{Man's rate in still water} = (15 - 2.5) \text{ km./hr.}$$

$$\begin{aligned}
 &= 12.5 \text{ km./hr.} \\
 \text{Man's rate against the current} &= (12.5 - 2.5) \text{ km./hr.} \\
 &= 10 \text{ km./hr.}
 \end{aligned}$$

8. Option B

$$\begin{aligned}
 \text{Rate in still water} &= \frac{1}{2} (10 + 7) \text{ km./hr.} \\
 &= 8.5 \text{ km./hr.} \\
 \text{Rate of current} &= \frac{1}{2} (10 - 7) \text{ km./hr.} \\
 &= 1.5 \text{ km./hr.}
 \end{aligned}$$

9. Option C

$$\begin{aligned}
 \text{Rate downstream} &= \left[ \frac{1}{\frac{1}{10}} \times 60 \right] \text{ km./hr.} \\
 &= 6 \text{ km./hr.} \\
 \text{Rate upstream} &= 2 \text{ km./hr.} \\
 \text{Speed in still water} &= \frac{1}{2} (6 + 2) \text{ km./hr.} \\
 &= 4 \text{ km.} \\
 \text{Required time} &= \frac{5}{4} \text{ km./hr.} \\
 &= 1 \times \frac{1}{4} \text{ km./hr.} \\
 &= 1 \text{ hr. } 15 \text{ min.}
 \end{aligned}$$

10. Option C

Clearly, the cyclist moves both ways at a speed of 12 km./hr.

So, average speed of the cyclist = 12 km./hr.

$$\begin{aligned}
 \text{Average speed} &= (2 \times 14 \times \frac{6}{14} + 6) \text{ km./hr.} \\
 &= \frac{42}{5} \text{ kmph} \\
 &= 8.4 \text{ kmph}
 \end{aligned}$$

Since the average speed of the cyclist is greater, he will return to A first.

11. Option C

$$\begin{aligned}
 \text{Speed in still water} &= \frac{1}{2} (11 + 5) \text{ km./hr.} \\
 &= 8 \text{ km./hr.}
 \end{aligned}$$

12. Option C

$$\begin{aligned}
 \text{Let the rate along the current be } x \text{ kmph.} &= \left[ \frac{1}{2} (x + 3.5) \right] = 5 \\
 \text{Then,} &x = 6.5 \text{ kmph.}
 \end{aligned}$$

13. Option D

$$\begin{aligned}
 \text{Speed upstream} &= 7.5 \text{ kmph} \\
 \text{Speed downstream} &= 10.5 \text{ kmph} \\
 \text{Total time taken} &= \left[ \frac{10.5}{7.5} + \frac{105}{10.5} \right] \text{ hours} \\
 &= 24 \text{ hours}
 \end{aligned}$$

14. Option A

$$\begin{aligned}
 \text{Speed downstreams} &= (10 + x) \text{ mph.} \\
 \text{Speed upstreams} &= (10 - x) \text{ mph.} \\
 &= 18 \text{ kmph.} \\
 \frac{36}{10 - x} - \frac{36}{10 + x} &= \frac{90}{60} \\
 &= 72x \times 60 \\
 &= 90(100 - x^2) \\
 &= x^2 + 48x + 100 = 0 \\
 x &= 2 \text{ mph.}
 \end{aligned}$$

15. Option A

$$\begin{aligned}
 \text{Rate downstream} &= \left[ \frac{\frac{15}{3}}{\frac{3}{4}} \right] \text{ km/hr} = \left[ 15 \times \frac{4}{15} \right] \text{ km/hr} = 4 \text{ km/hr} \\
 \text{Rate upstream} &= \left[ \frac{\frac{5}{2}}{\frac{1}{2}} \right] \text{ km/hr} = \left[ 5 \times \frac{2}{5} \right] \text{ km/hr} = 2 \text{ km/hr} \\
 \text{So, speed of current} &= \frac{1}{2}(4 - 2) \text{ km/hr} = 1 \text{ km/hr}
 \end{aligned}$$

16. Option A

$$\begin{aligned}
 \text{Speed downstream} &= (7.5 + 1.5) \text{ kmph} = 9 \text{ kmph} \\
 \text{Speed upstream} &= (7.5 - 1.5) \text{ kmph} = 6 \text{ kmph} \\
 \text{Let the required distance be } x \text{ km. Then,} \\
 \frac{x}{9} + \frac{x}{6} &= \frac{50}{60} \\
 2x + 3x &= \left[ \frac{5}{6} \times 18 \right] \\
 5x &= 15 \\
 x &= 3 \\
 \text{Hence, the required distance is } 3 \text{ km}
 \end{aligned}$$

17. Option C

$$\text{Rate downstream} = \left[ \frac{1}{10} \times 60 \right] \text{ km/hr} = 6 \text{ km/hr}, \text{ Rate upstream} = 2 \text{ km/hr}$$

$$\text{Speed in still water} = \frac{1}{2}(6 + 2) \text{ km/hr} = 4 \text{ km/hr}$$

$$\text{So, required time} = \left[ \frac{5}{4} \right] \text{ hrs} = 1 \frac{1}{4} \text{ hrs} = 1 \text{ hr } 15 \text{ min}$$

18. Option C

Let the rate along the current be  $x$  kmph. Then,  $\frac{1}{2}(x + 3.5) = 5$  or  $x = 6.5$  kmph

19. Option A

Suppose he moves 4 km downstream in  $x$  hours. Then,

$$\text{Speed downstream} = \left[ \frac{4}{x} \right] \text{ km/hr, speed upstream} = \left[ \frac{3}{x} \right] \text{ km/hr}$$

$$\text{So, } \frac{48}{4/x} + \frac{48}{3/x} = 14 \text{ or } x = \frac{1}{2}$$

So, speed downstream = 8 km/hr, Speed upstream = 6 km/hr

$$\text{Rate of the stream} = \frac{1}{2} (8 - 6) \text{ km/hr} = 1 \text{ km/hr}$$

20. Option A

$$\frac{\text{time taken in upstream}}{\text{time taken in downstream}} = \frac{2}{1}$$

$$\frac{\text{downstream speed}}{\text{upstream speed}} = \frac{2}{1} \quad \text{where } \frac{B+R}{B-R} = \frac{2}{1}$$

$B \rightarrow$  Speed of boat in still water

$R \rightarrow$  speed of current

$$\frac{B}{R} = \frac{3}{1} \quad (\text{By componendo and dividend})$$

$$\frac{9}{R} = \frac{3}{1}$$

$$R = 3 \text{ km/h}$$

21. Option C

Let the required distance be  $D$  km, then

$$\frac{D}{6} + \frac{D}{4} = \frac{5}{4}$$

$$D \left[ \frac{10}{24} \right] = \frac{5}{4}$$

$$D = 3 \text{ km}$$

22. Option B

Upstream speed of first boat = 8 km/h

Upstream speed of second boat = 4 km/h

So, relative speed = 4 km/h  $(8 - 4)$

$$\text{So, required time} = \frac{10}{4} = 2.5 \text{ h}$$

23. Option B

$$\begin{aligned}\text{Upstream speed} &= B - S \\ \text{Downstream speed} &= B + S \\ B - S &= \frac{15}{5} = 3 \text{ km/h}\end{aligned}$$

Again  $B = 4S$

$$\begin{aligned}\text{So, } B - S &= 3 = 3S \\ S &= 1 \text{ and } B = 4 \text{ (km/h)}\end{aligned}$$

$$\text{So, } B + S = 5 \text{ km/h}$$

$$\text{So, time during downstream} = \frac{15}{5} = 3 \text{ h}$$

24. Option A

$$\text{Speed of stream} = \frac{1}{2} (13 - 8) \text{ kmph} = 2.5 \text{ kmph}$$

25. Option C

$$\text{Speed downstream} = (13 + 4) \text{ km/hr} = 17 \text{ km/hr}$$

$$\text{Time taken to travel 68 km downstream} = \left[ \frac{68}{17} \right] \text{ hrs.} = 4 \text{ hrs.}$$

26. Option C

$$\text{Rate upstream} = \left[ \frac{7}{42} \times 60 \right] \text{ kmph} = 10 \text{ kmph}$$

$$\text{Speed of stream} = 3 \text{ kmph}$$

Let speed in still water be  $x$  km/hr. Then, speed upstream =  $(x - 3)$  km/hr

$$\text{So, } x - 3 = 10 \text{ or } x = 13 \text{ km/hr}$$

27. Option B

Let the speed of the stream be  $x$  km/hr. Then,

$$\text{Speed downstream} = (15 + x) \text{ km/hr. Speed upstream} = (15 - x) \text{ km/hr}$$

$$\text{So, } \frac{30}{15 + x} + \frac{30}{15 - x} = 4 \frac{1}{2}$$

$$\frac{900}{225 - x^2} = \frac{9}{2}$$

$$9x^2 = 225$$

$$x^2 = 25$$

$$x = 5 \text{ km/hr}$$

**Chapter - 16**

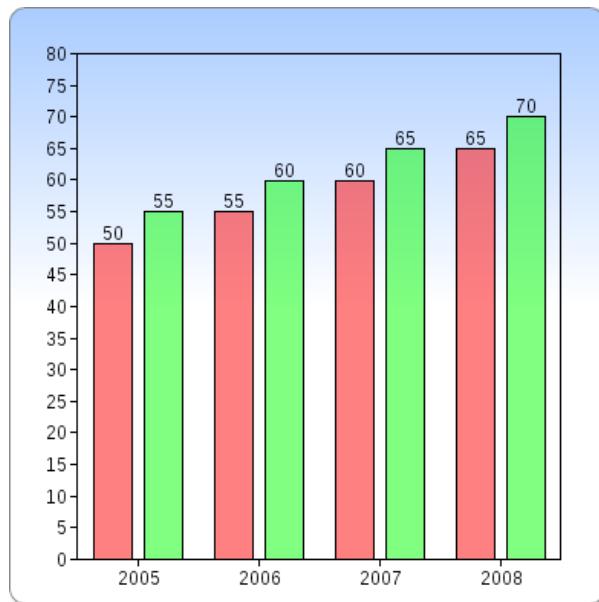
# Data Interpretation

Data interpretation is the most scoring and time consuming section in IBPS and other competitive examinations. In quantitative aptitude section you can see at least 2 data interpretation sets each having 5 questions. In IBPS PO there are 50 questions in Quantitative aptitude section and the cutoff remains 18-19. So if you solve those two sets correctly you need to solve 10 questions out of remaining 40 questions. Here are three important techniques to make Data Interpretation calculations fast.

**Visual Estimation**

It is a well known fact that it is near to impossible to solve 200 questions in 120 minutes accurately. Term "Accurately" is important here because I have seen many candidates attempting 190+ questions and fails to qualify. The reason behind failure is low accuracy and many times accuracy level falls below 40%. Important point to be noted down here is by attempting 190+ with low accuracy you gets less time for questions you are sure about and there is negative marking in most of the competitive exams.

Now lets come to our topic. How to use visual estimation technique to solve Data Interpretation questions. Let's take an visual example:-



**Example** - Red bars states wheat production state and Green bars states rice production.

**Question** - In which year percentage increase Wheat production was highest?

As you can see there is increase of 5 tonnes in production both wheat and rice production every year.

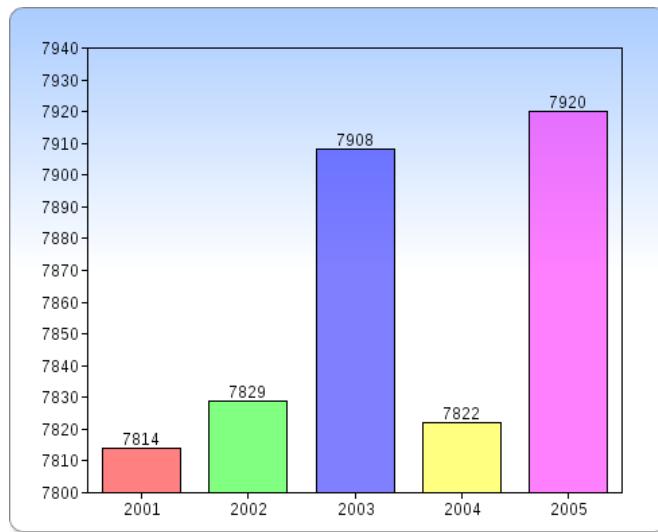
10% of 50 = 5

10% of 70 = 7

So answer should 2006.

### Finding averages

Many times in Data Interpretation, questions are asked to find average of 5-6 big numbers. As all these numbers are from a same graph, there is high probability that these number will be close to each other. Take a look to following visual example:-



In the above example you can find average of above number in just 5 seconds:-

$$7800 (14 + 29 + 108 + 22 + 120/5) = 7800 + 58.6 = 7858.6$$

I always try to find answers by approximation, in my mind I calculated answer 7860. Try it yourself.

### Solve the fractions quickly

Learn the value of fractions in percentages. Please read Time and work chapter in my previous post in which I explained via a table.

### Faster calculations

Only thing that you require to score well in data interpretation questions is fast calculation. Try to find tricks and shortcuts. You can find multiplication tricks from my previous post.

Let's take an example:- How much 468 of 21428?

Let me make this simple for you.

$$1\% \text{ of } 21428 = 214$$

$$2\% \text{ of } 21428 = 428$$

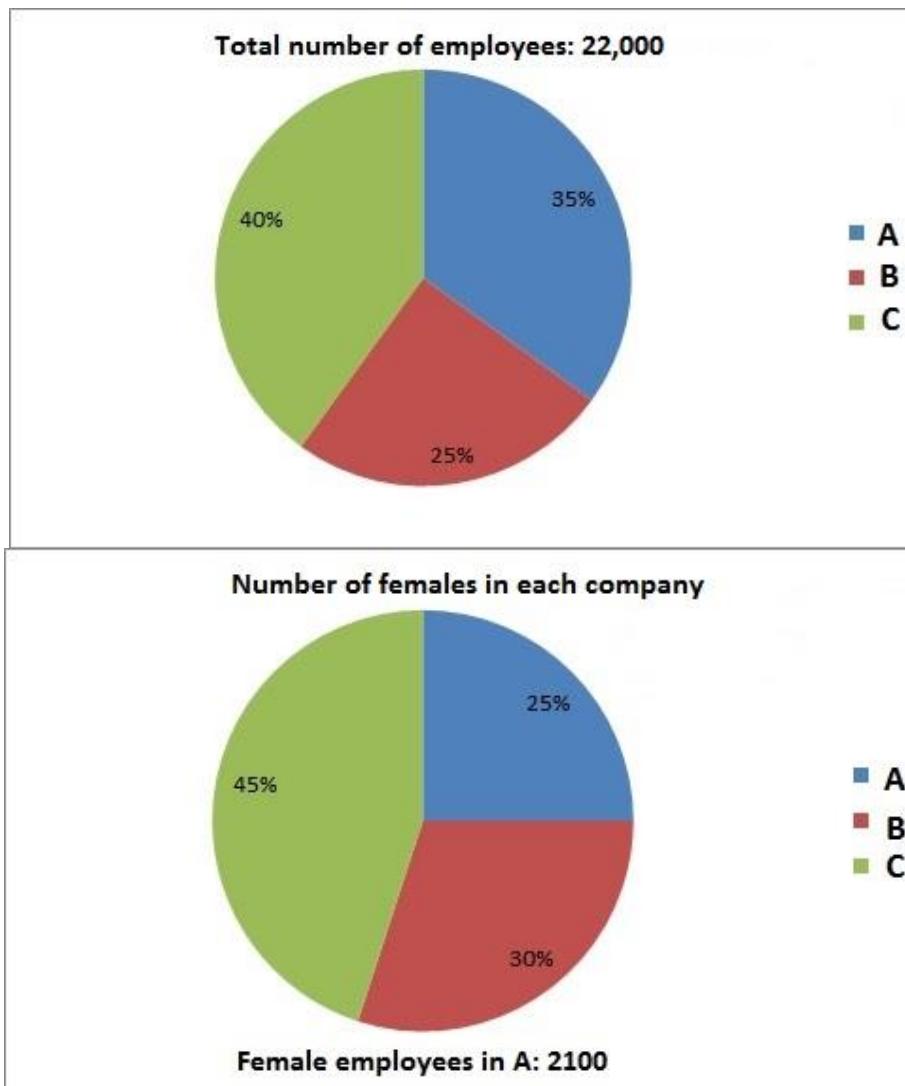
$$0.1\% \text{ of } 21428 = 21$$

for me answer should be around 2.2%

There are tonnes of such techniques which makes calculations easy.

## **Exercise - 16**

Following pie charts shows the distribution of employees in three companies A, B, and C in 2014.



- 1) Number of female employees in B and C constitutes what percentage of the total number of employees in B and C? (Rounded off figure)

a) 40%                  b) 42%                  c) 44%

d) 46%                  e) 48%

2) If 40% of the female employees in company A are married. What percentage of the male employees are unmarried provided that the total number of married people working in the company A is 2500? (Rounded off figure)

a) 68%                  b) 70%                  c) 72%

d) 76%                  e) 78%

Use the table to answer the following questions.

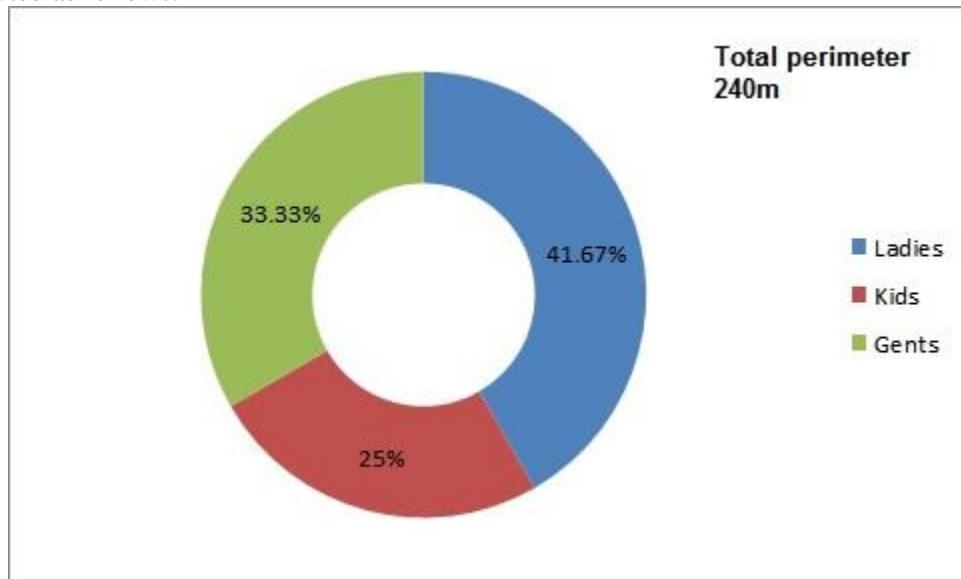
<b>Plan</b>	<b>A (Simple interest)</b>	<b>B (Simple interest)</b>	<b>C (Compounded annually)</b>	<b>D(Compoundded annually)</b>
<b>Principle</b>	Rs.15,000	Rs..... ...	Rs.10,000	Rs.25,000
<b>Term</b>	42 months	30 months	24 months	..... months
<b>Interest rate</b>	..... %	7.5%	9%	12.50%
<b>Interest</b>	Rs.5250	Rs.3750	Rs..... ...	Rs.3125

- 6) Suppose the interest rate of plan C is changed to that of plan A, how much more or less one can earn as interest on a principle amount of Rs.10, 000?  
a) Rs. 229                  b) Rs. 219                  c) Rs. 239  
d) Rs. 199                  e) Rs. 189

7) If the investment term under plan D is tripled, what will be the interest earned underthe new plan?  
a) Rs.10,595.70            b) Rs.10,585.70            c) Rs.10,955.70  
d) Rs.10,575.90            e) Rs.10,585.90

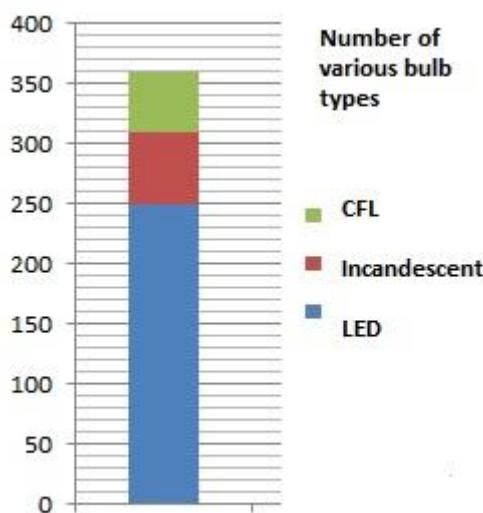
- 8) After maturity of plan B if the amount along with interest is reinvested in plan A. What will be the maturity amount after a period of 24 months?
- a) Rs.27,500      b) Rs.27,850      c) Rs.28,500  
 d) Rs.28,750      e) Rs.28,775
- 9) What is the ratio between interest earned under plan C (Compounded annually) and plan C (If the interest is not compounded)?
- a) 68:63      b) 200:209      c) 210:219  
 d) 209:200      e) 219:210
- 10) A minimum of how many months should one invest Rs.25,000 in plan D so that the interest earned is not less than Rs.6,600.
- a) 48      b) 36      c) 30  
 d) 24      e) 12

An exhibition featuring traditional clothes consists of mens, ladies and kids sections. Each section is allotted a square area and the perimeter of 3 sections adds upto 240m and is distributed as follows.

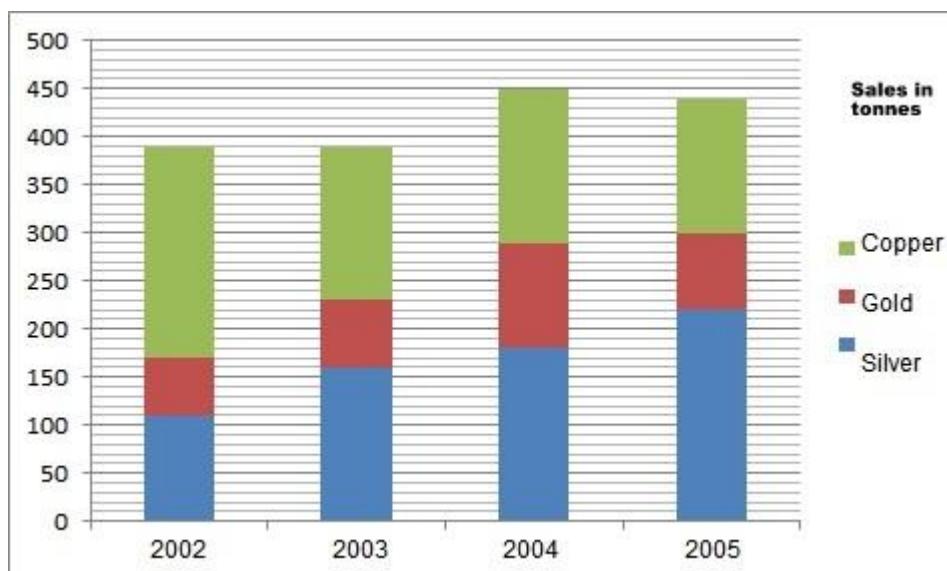


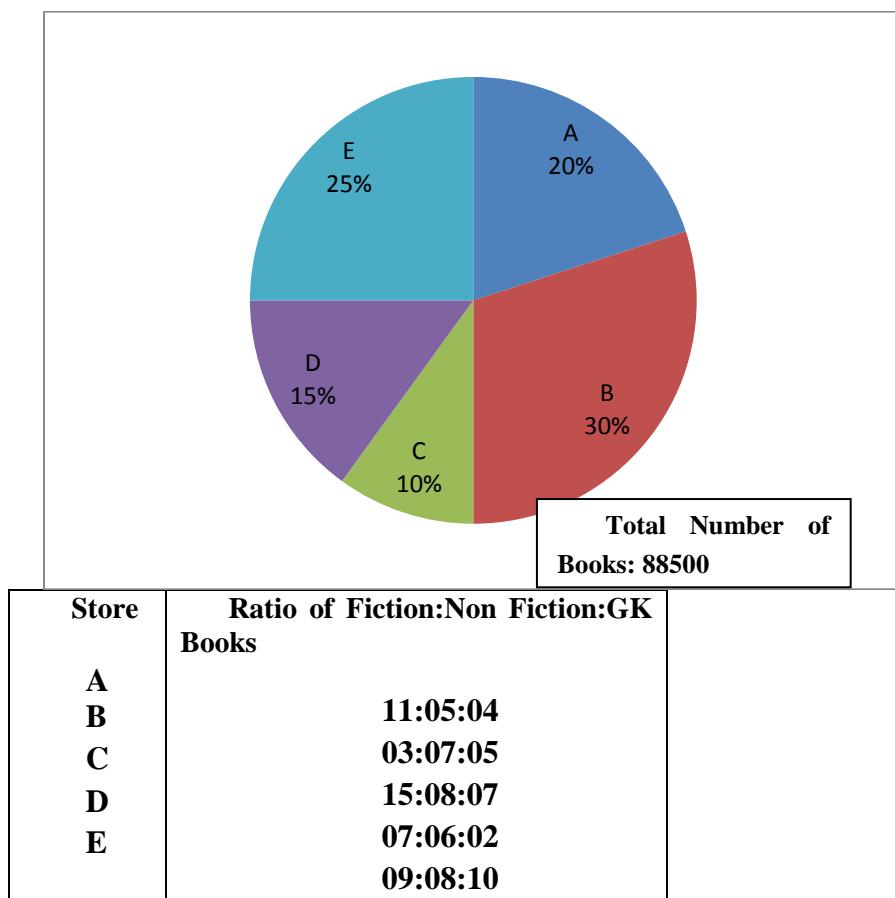
Three types of bulbs are used to light up the entire area and they are distributed in accordance with the following criteria.

Bulb type	Distribution
LED	1 per $5\text{ m}^2$
CFL	1 per $25\text{ m}^2$
Incandescent	1 per each 4m of perimeter



- 11) What is the ratio between the areas of ladies, kids and gents sections?  
a) 41.67:33.33:25      b) 20:16:12      c) 25:9:16  
d) 16:9:25      e) Cannot be determined
- 12) If the furnishing of each square meter requires Rs.125, How much more money is required to furnish the gents area than the kids section?  
a) Rs.22875      b) Rs.28175      c) Rs.21875  
d) Rs.21975      e) RS.22250
- 13) What will be cost for lighting up the ladies section provided that each LED costs Rs.80, CFL Rs.75 and incandescent bulb Rs.12?  
a) Rs.12175      b) Rs.12225      c) Rs.12715  
d) Rs.12525      e) Rs.12515
- 14) What percentage of the LED bulbs is utilised to light up the kids section?  
a) 16%      b) 17%      c) 14%  
d) 20%      e) 18%
- 15) What will the total electricity consumption of the ladies and gents section together in a day provided that consumption of each LED is 0.2units/day, CFL is 0.4units/day, and incandescent bulbs 1unit/day respectively?  
a) 102.5      b) 102.4      c) 105.5  
d) 115.5      e) 112.5



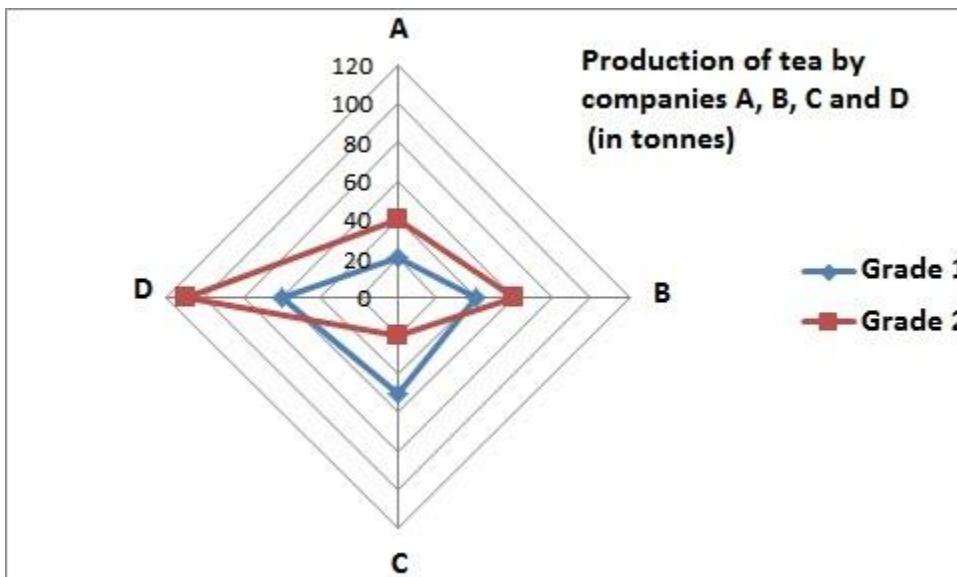


- 21) Average number of Fiction and GK Books sold by Store A, B, and D together constitutes what percentage of the total number of books sold by Stores C, D, and E?
- a) 27.65%      b) 26.67%      c) 26.16%  
d) 25.67%      e) 25.16%
- 22) How many stores sold more than 5000 copies of non-fiction?
- a) 3      b) 2      c) 4  
d) 1      e) None of these
- 23) If each fiction costs 15.50 rupees and GK costs 12.50 rupees, what is the cost of each non-fiction book provided that total the total business of C is Rs. 120,360.
- a) 12      b) 13      c) 10  
d) 11      e) 9

- 24) What will be the total business of store C If the price of fiction and non-fiction is increased by 10% and that of GK is unchanged?

a) 129,814.75      b) 134,977.25      c) 124,225.50  
 d) 140,550.25      e) 150,515.50

Use the given data to answer the following questions.



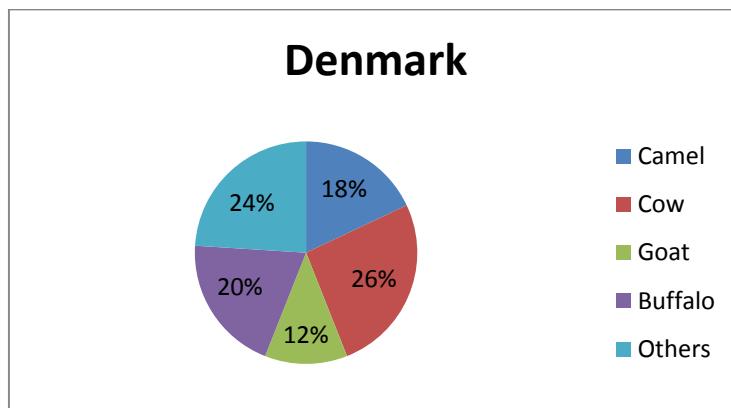
Grade	Rate/Tonne
1	Rs.75,000
2	Rs.60,000

- 25) What is the difference between the average sales of grade 1 and 2 in all 4 companies?  
 a) 5 tonnes      b) 10 tonnes      c) 15 tonnes  
 d) 20 tonnes      e) 25 tonnes
- 26) What is the difference between the total income of companies C and A?  
 a) Rs. 1.05 million      b) Rs. 10.05 million      c) Rs.1005 million  
 d) Rs. 1.05 crores      e) Rs. 10.05 crores
- 27) What percentage of the net income of company A is constituted by grade 1 tea?  
 a) 50%      b) 33.33%      c) 25%  
 d) 40%      e) 38.46%
- 28) Total production by company D is what percentage of that of company B?  
 a) 140%      b) 150%      c) 160%  
 d) 170%      e) 180%

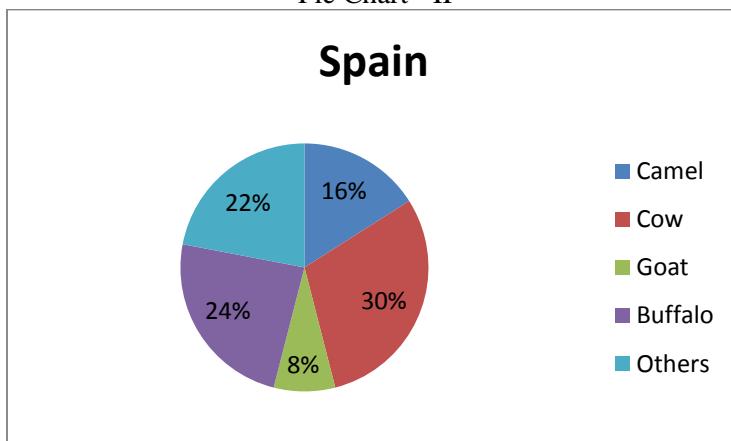
**Study the following pie-charts carefully to answer the given questions.**

Pie-chart I and pie-chart II show the percentage of various types of cattle in Denmark and Spain respectively.

Pie Chart – I



Pie Chart - II



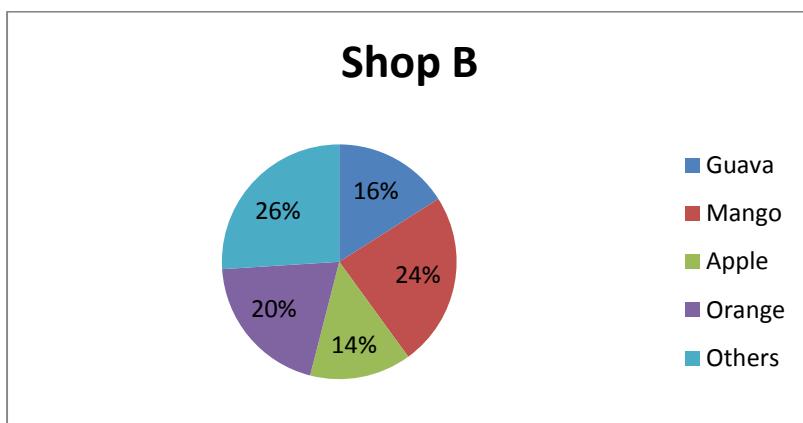
- 29) If the total cattle in Denmark is 1200000 and the ratio of cows in Denmark to that in Spain is 3 : 5, then what is the total number of cattle in Spain? (You are not expected to calculate the exact value.)
- a) 16.2 lakh                  b) 20.8 lakh                  c) 19.2 lakh  
d) 17.3 lakh                  e) 20.14 lakh
- 30) If the total cattle in Spain is 1000000 then what is the difference between the number of camels and that of goats in Spain?
- a) 44000                  b) 72000                  c) 60000

**Study the pie-chart carefully to answer the questions given below:**

The pie-charts shows the percentage quantity of fruits at two fruit shops A and B.



Total quantity = 1200 kg



Total quantity = 1000 kg

- 34) What is the difference between the quantity of Guava at Shop B and that at Shop A?
- a) 40 kg
  - b) 45 kg
  - c) 35 kg
  - d) 30 kg
  - e) 50 kg
- 35) If the price of Mango is Rs.30 per kg, Apple Rs.40 per kg and Orange Rs.20 per kg, then what is the ratio of their costs at Shop A?
- a) 1 : 4 : 6
  - b) 9 : 8 : 5
  - c) 3 : 7 : 8
  - d) 5 : 4 : 1
  - e) 2 : 5 : 7
- 36) The quantity of Mango at Shop B is what percent of the quantity of Mango at Shop A?
- a) 20%
  - b) 220%
  - c) 120%
  - d) 80%
  - e) 180%
- 37) If the price of Mango is Rs.30 per kg, Apple Rs.40 per kg and Orange Rs.20 per kg, other fruits Rs.15 per kg and Guava Rs. 18 per kg for both Shop A and B then what is the difference between the cost of all fruits at Shop A and that at Shop B?
- a) Rs.7200
  - b) Rs.3500
  - c) Rs.6400
  - d) Rs.5100
  - e) Rs.4600
- 38) The quantity of Orange at Shop A is what percent more than that of Apple at Shop B?
- a) 161.52%
  - b) 195.5%
  - c) 182%
  - d) 190%
  - e) 171.42%

**Study the given table carefully to answer the following questions:**

Following table shows the investment (In Rs. Crore) in various sectors in different years

	2011		2012		2013		2014	
	Domest	Foreig	Domest	Foreig	Domest	Foreig	Domest	Foreig

	<b>c</b>	<b>n</b>	<b>c</b>	<b>n</b>	<b>c</b>	<b>n</b>	<b>c</b>	<b>n</b>
Industry	5000	2000	1000	1500	4000	3000	6000	1500
Cement	3000	1600	3000	2500	5000	2800	4000	1800
Metals	4000	2800	3500	2000	3200	2200	1500	500
Machinery	2000	3000	2500	3000	3600	6000	1000	1500
Transport	2500	2000	1500	3200	3000	1600	4000	1000
Fuel	1500	2500	1000	2800	1500	5000	1200	2000
Chemical	3500	1000	500	4000	2400	3200	2000	3000

- 39) What is the difference between the total domestic investment and the total foreign investment in the year 2011?
- a) Rs.6400 Crore      b) Rs.6200 Crore      c) Rs.6600 Crore  
d) Rs.7000 Crore      e) Rs.7100 Crore
- 40) What is the ratio of the total investment in Metals to that in Machinery?
- a) 135 : 302      b) 24 : 49      c) 2 : 4  
d) 197 : 226      e) 123 : 233
- 41) What is the average domestic investment in the year 2014? (You are not expected to calculate the exact value?)
- a) Rs.2814.28 Crore      b) Rs.2519.75 Crore      c) Rs.2234.82 Crore  
d) Rs.3151.51 Crore      e) Rs.3329.79 Crore
- 42) Domestic investment in 2013 is what percent of foreign investment in 2011?
- a) 176.5%      b) 179.7%      c) 181.6%  
d) 183.5%      e) 152.3%
- 43) The average domestic investment in the year 2011 is what percent of the average investment in Transport during the given four years?
- a) 201%      b) 65.34%      c) 125.45%  
d) 147.97%      e) 167.23%

**Study the following information carefully to answer the questions given below:**

There are 64 members of parliament (MPs) in a standing committee. Of these, three-fourths are males and the remaining are females. Among male members two-thirds belong to the Congress and 75% of the remaining belong to the BJP. Three-fourths of female members belong to the BJP and two belong to the BSP. The remaining female members belong to the Samajwadi Party (SP).

- 44) What is the number of male members who do not belong either to Congress or to BJP?
- a) 12      b) 16      c) 8  
d) 2      e) 4

45) What is the ratio of female SP members to female BJP members in the committee?

- a) 2 : 3
- b) 1 : 4
- c) 1 : 6
- d) 2 : 5
- e) 3 : 1

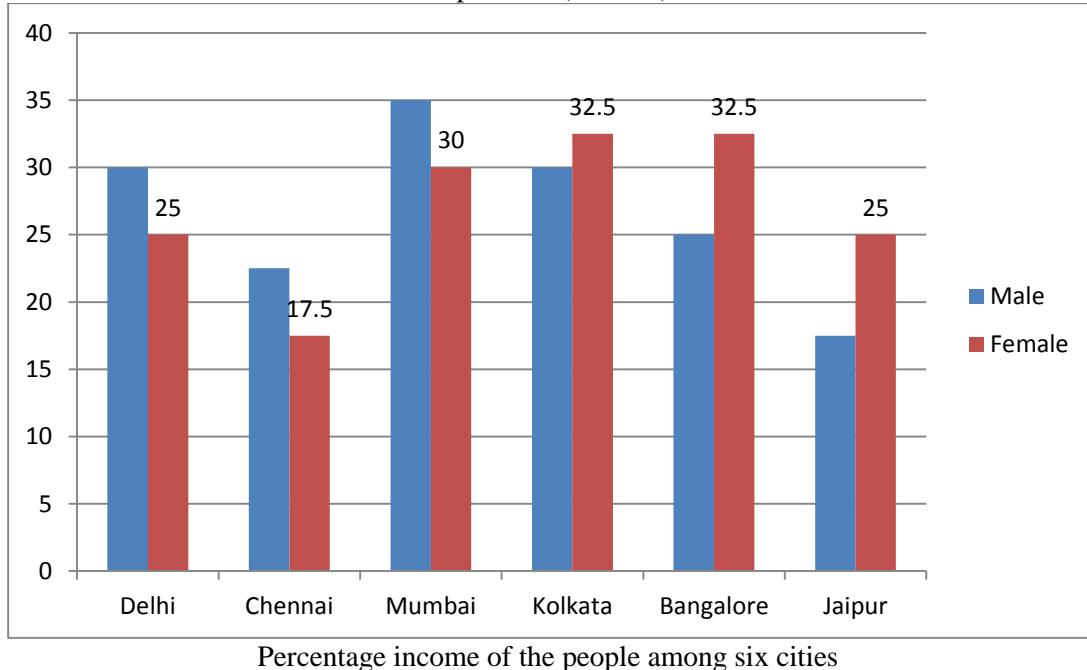
46) The female members of the BJP in the committee is what percent of the male members of the BJP in the committee?

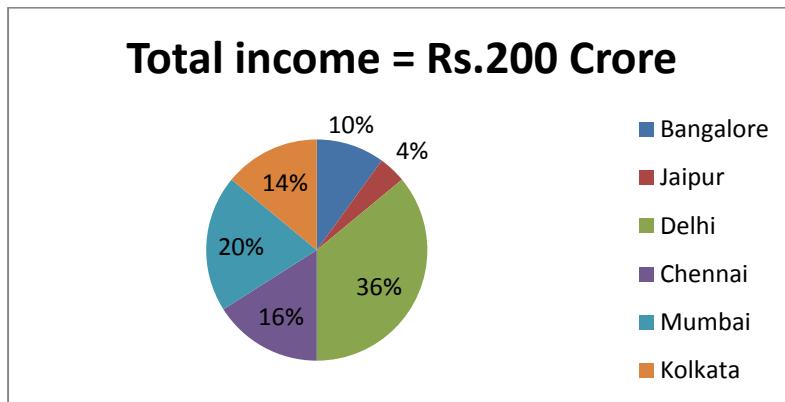
- a) 90%
- b) 80%
- c) 75%
- d) 100%
- e) 50%

**Study the bar-chart and pie-chart carefully to answer the given questions.**

Working male and female population (in lakh) in various cities

Population (in Lakh)

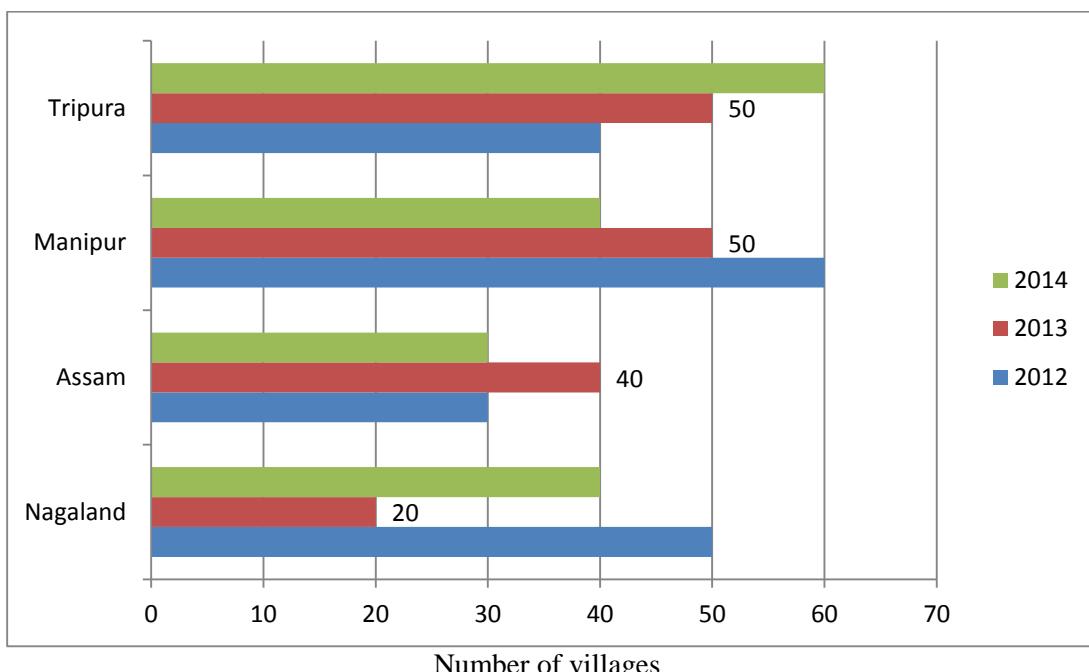




- 47) What is the difference between the number of working females in Bangalore and the number of working males in Chennai?
- a) 12.5 lakh                          b) 11 lakh                          c) 9 lakh  
d) 12 lakh                              e) 10 lakh
- 48) In which city is the income per working person the minimum?
- a) Delhi                                b) Jaipur                                c) Bangalore  
d) Chennai                             e) Mumbai
- 49) What is the sum of the average working male and average working female population of the given six cities (calculate approximate value)?
- a) 63.35 lakh                        b) 49.96 lakh                        c) 51.48 lakh  
d) 53.75 lakh                        e) 65.51 lakh
- 50) In Delhi, what is the difference between the income of males and that of females?  
[ Assume each person (male/female) has equal income.]
- a) Rs.6.545 Crore                    b) Rs.5.055 Crore                    c) Rs.2.935 Crore  
d) Rs.3.455 Crore                    e) Rs.4.565 Crore
- 51) The number of working females in Mumbai is what percent of the number of working males in Bangalore?
- a) 95%                                b) 110%                                c) 120%  
d) 132%                              e) 144%

**Study the given bar-chart carefully and answer the following questions.**

The graph shows the number of villages in four different states where electrification was done in different years.



- 52) The number of villages in Nagaland where electrification was done in 2013 is what percentage of the number of villages in Tripura where electrification was done in 2014?
- a) 55.5%
  - b) 44.4%
  - c) 77.7%
  - d) 66.6%
  - e) 33.3%
- 53) What is the ratio of the villages in Assam to those in Manipur where electrification was done in 2013?
- a) 1 : 4
  - b) 3 : 4
  - c) 1 : 2
  - d) 4 : 5
  - e) 3 : 2
- 54) In which state was the electrification work done in maximum villages during the given three years?
- a) Assam
  - b) Manipur
  - c) Manipur and Tripura
  - d) Nagaland
  - e) Manipur and Assam
- 55) If the cost of electrification of a village is Rs.75 lakh then what is the cost of electrification in four states during the given period?
- a) Rs.4319000000
  - b) Rs.3825000000
  - c) Rs.4143000000
  - d) Rs.355700000
  - e) Rs.272100000
- 56) In which year was the electrification work done in maximum number of villages?
- a) 2012
  - b) 2013
  - c) 2014
  - d) 2013 and 2012
  - e) 2012 and 2014

**Study the given table carefully to answer the following questions.**

Field Name	Shape	Side (in m)	Base (in m)	Height (in m)	Radius (in m)	Cost of flooring (in Rs. per sq. metre)	Cost of fencing (in Rs. per m)
A	Triangle		16	12		50	20
B	Rectangle	$10 \times 20$				30	15
C	Square	15				40	18
D	Parallelogram		20	12		60	25
E	Circle				10	45	22

- 57) What is the cost of flooring of A?
- a) Rs.4000      b) Rs.4600      c) Rs.4800  
d) Rs.5000      e) Rs.4400
- 58) What is the difference between the cost of fencing of C and that of B?
- a) Rs.180      b) Rs.120      c) Rs.240  
d) Rs.360      e) Rs.480
- 59) What is the ratio of the cost of flooring to that of fencing of field D?
- a) 4 : 1      b) 6 : 1      c) 8 : 1  
d) 9 : 1      e) 5 : 1
- 60) The cost of fencing of field E is approximately what percent of the cost of flooring of field C?
- a) 10.5%      b) 19.46%      c) 18.71%  
d) 15.36%      e) 13.82%
- 61) The cost of fencing of field C is what percent of the cost of fencing of field D?
- a) 87.54%      b) 67.5%      c) 72.13%  
d) 54.36%      e) 46.5%

**Study the given chart carefully and answer the following questions.**

Train A

Station	Arrival time	Departure time	Distance from origin (in km)	Number of passengers boarding at each station	Fare (in Rs.)
Ahmedabad	Starting	5:00 pm	--	400	--
Vadodara	6:30 pm	6:35 pm	100	100	50

Bharuch	8:50 pm	9:00 pm	250	90	120
Mumbai	4:00 am	4:10 am	800	300	400
Pune	7:30 am	7:45 am	1050	150	500
Solapur	10:20 am	Terminates	1280	--	620

## Train B

<b>Station</b>	<b>Arrival time</b>	<b>Departure time</b>	<b>Distance from origin</b>	<b>Number of passengers boarding at each station</b>	<b>Fare (in Rs.)</b>
Solapur	Starting	6:00 pm	--	300	--
Pune	7:40 pm	7:45 pm	230	150	120
Mumbai	9:30 pm	9:35 pm	480	270	220
Bharuch	5:40 am	5:55 am	1030	50	500
Vadodara	9:00 am	9:10 am	1180	100	570
Ahmedabad	12:00 noon	Terminates	1280	--	620

- 62) The number of passengers boarding Train A at Vadodara is what percent of the number of passengers boarding Train B at Mumbai?

a) 37.03%      b) 47.03%      c) 27.03%  
d) 47.30%      e) None of these

63) What is the difference between the speed of Train A and that of Train B?

a) 2.73 kmph      b) 1.97 kmph      c) 3.6 kmph  
d) 2.62 kmph      e) 3.9 kmph

64) What is the ratio of the total passengers of Train A to that of Train B?

a) 102 : 79      b) 104 : 87      c) 103 : 87  
d) 110 : 79      e) 113 : 87

65) The total income of Train A is what percent of the total income of Train B?

a) 180%      b) 159.51%      c) 123.29%  
d) 125%      e) 127.64%

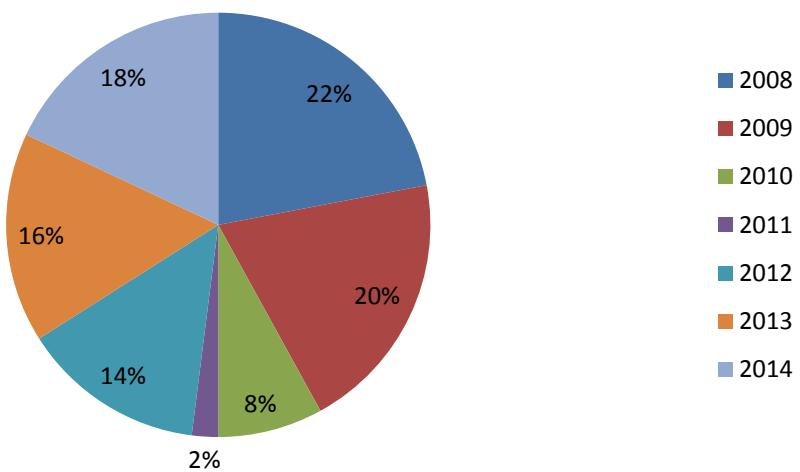
66) If the average speed of Train A increases by 10% then when will it reach to its destination?

a) 7:45 am      b) 9:45 am      c) 8:45 am  
d) 10:45 am      e) 11:45 am

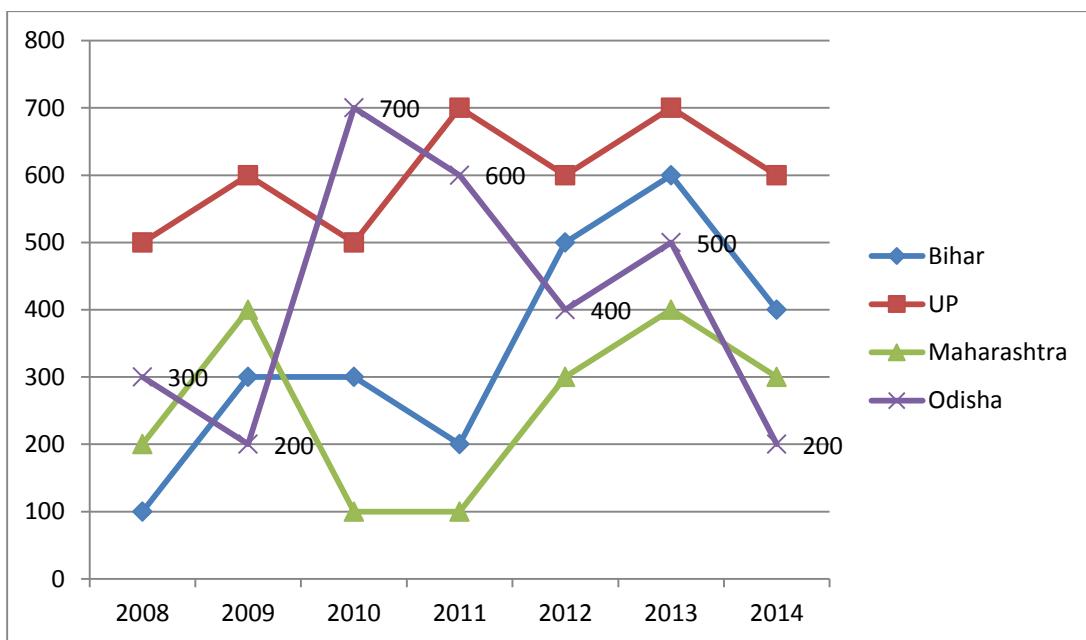
**Study the pie-chart and line graph carefully to answer the given questions.**

The pie-chart shows the percentage of train accidents in different years

## Total number of train accidents = 200



The line graph shows the number of persons who died in train accidents in various states in different years



- 67) The number of persons who died in train accidents in 2013 is how much percent more than the number of persons who died in the train accident in 2011?

- a) 143.5%  
d) 127.5%

- b) 137.5%  
e) 147.5%

- c) 37.5%

68) What is the average of the number of persons who died in train accidents in 2008 in all states together?

- a) 182  
d) 284

- b) 290  
e) 307

- c) 275

69) In which state is the number of persons who died in the train accidents the maximum during the given period?

- a) Odisha  
d) Only a) and b)

- b) UP  
e) Maharashtra

- c) Bihar

70) What is the difference between the number of train accidents in 2014 and that in 2012?

- a) 5  
d) 8

- b) 6  
e) 9

- c) 7

71) What is the ratio of the number of persons who died in train accidents in 2010 to that in 2014?

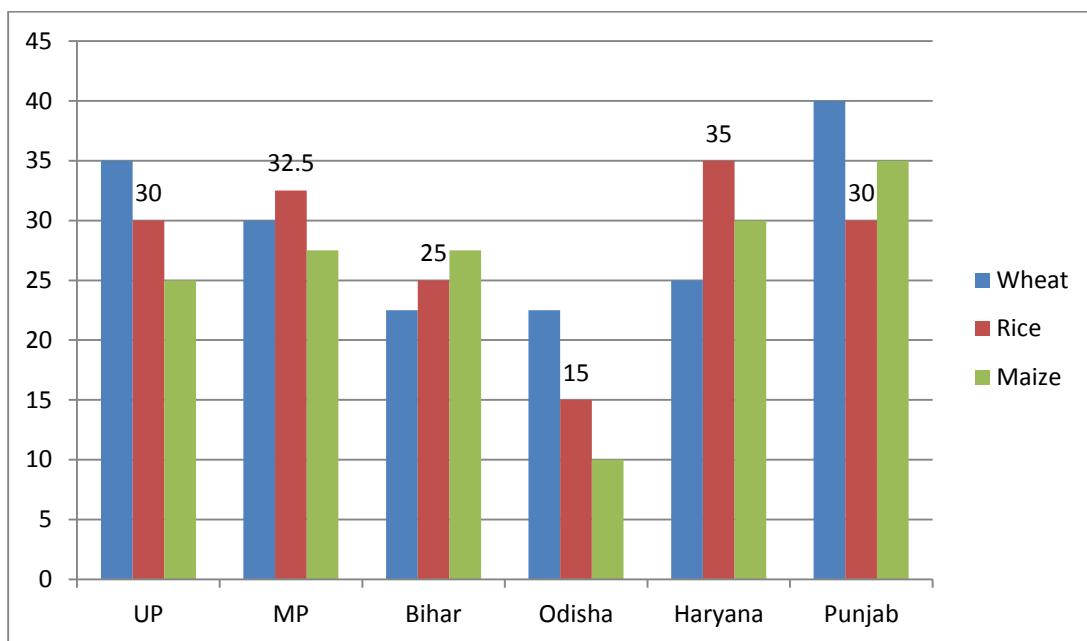
- a) 8 : 7  
d) 14 : 13

- b) 10 : 9  
e) 16 : 15

- c) 12 : 11

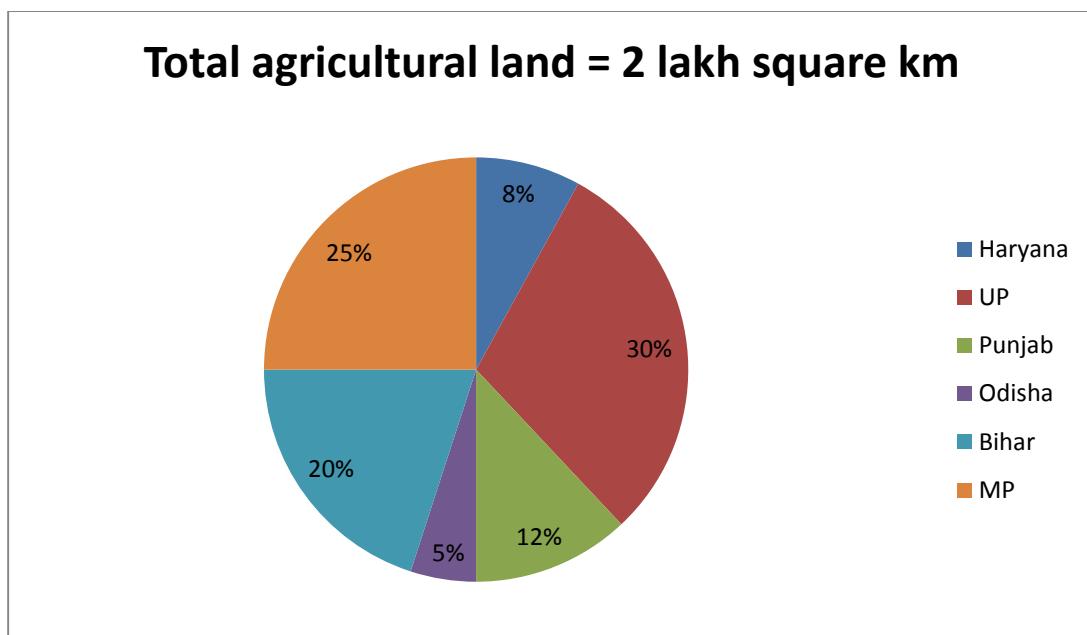
**Study the given bar graph and pie chart to answer the following questions.**

The bar graph shows the production (in thousand tones) of Wheat, Rice and Maize in different states.



The pie-chart shows the percentage of agricultural land in the given six states.

$$\text{Productivity} = \frac{\text{Total production}}{\text{Area of agricultural land}}$$



72) The productivity of which state is the maximum?

- a) Bihar
- b) Haryana
- c) Punjab
- d) UP
- e) MP

73) The production of which state is the maximum?

- a) Bihar
- b) MP
- c) Haryana
- d) UP
- e) Punjab

74) The production of wheat in Punjab is what percent more than the production of Maize in Odisha?

- a) 350%
- b) 250%
- c) 300%
- d) 200%
- e) 400%

75) What is the ratio of the production of Rice in Bihar to the production of Wheat in Haryana?

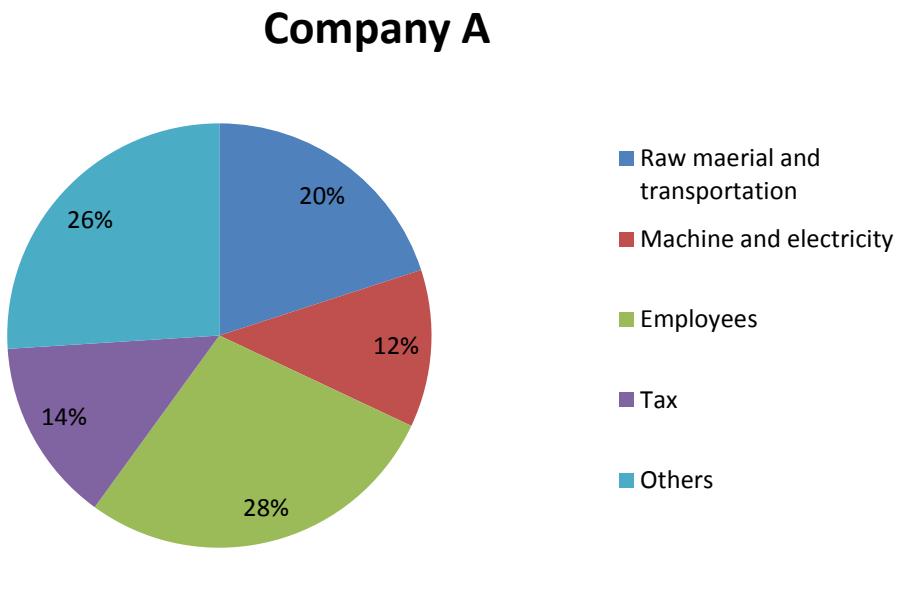
- a) 2 : 3
- b) 3 : 2
- c) 2 : 1
- d) 1 : 1
- e) 1 : 2

76) If MP exports 40% of Rice at the rate of Rs.30 per kg and UP exports 30% of Rice at the rate of Rs.32 per kg, then what is the ratio of the incomes from the exports?

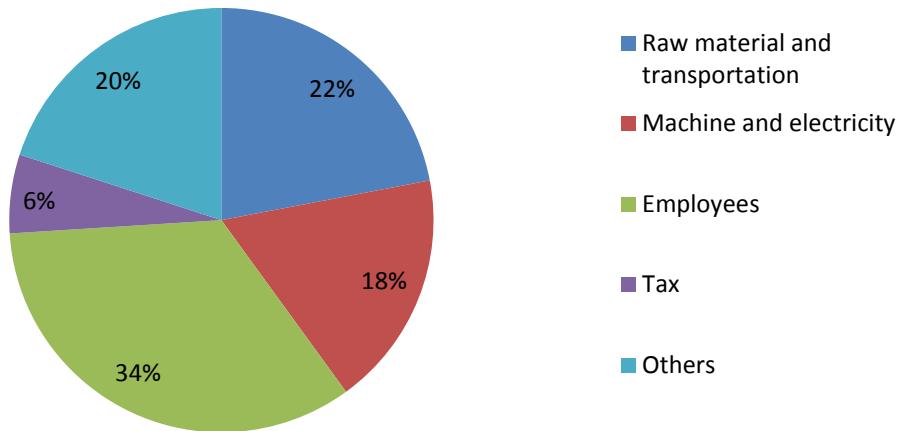
- a) 65 : 48
- b) 31 : 42
- c) 43 : 54
- d) 57 : 62
- e) 1 : 2

**Study the following pie charts to answer the following questions.**

The pie charts show the expenditure of two companies A and B, which are Rs.50 Lakh and Rs.60 Lakh respectively.



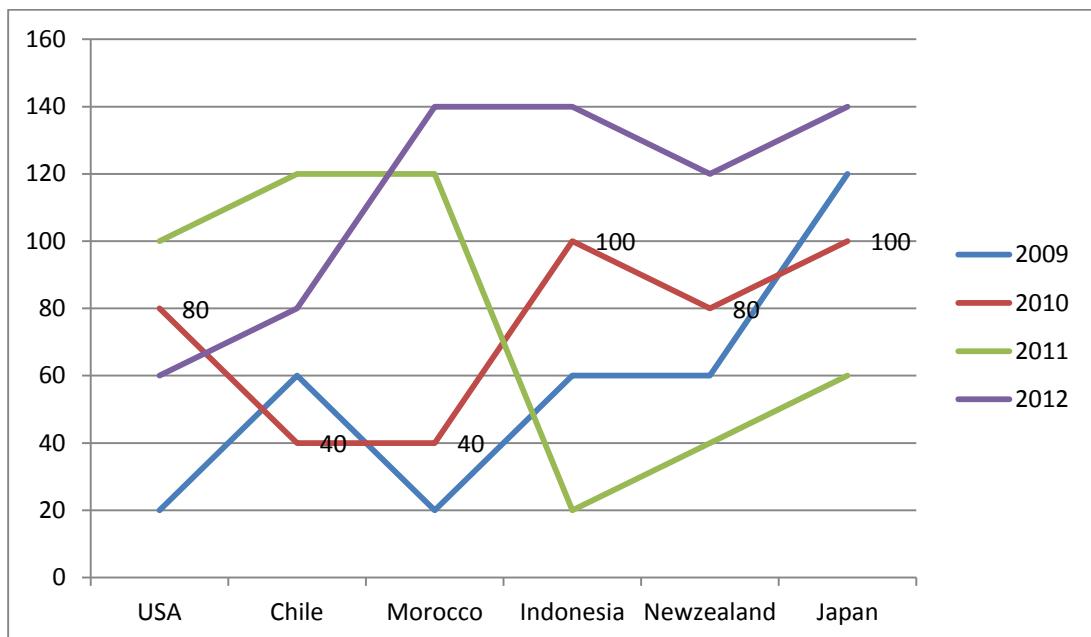
## Company B



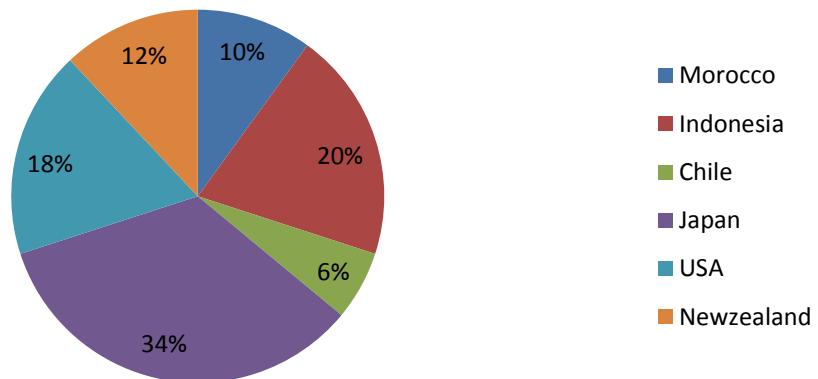
- 77) If the incomes of the Company A and B are in the ratio of 4 : 5 and the income of Company B is 180% of its expenditure, then what is the difference between the income of Company B and the income of Company A?
- a) Rs.2200000      b) Rs.1900000      c) Rs.2160000  
 d) Rs.1850000      e) Rs.2250000
- 78) If the number of employees in Company A is a hundred then what is the average salary of the employees in Company A?
- a) Rs.14,000      b) Rs.16,000      c) Rs.13,000  
 d) Rs.15,000      e) Rs.15,500
- 79) What is the ratio of tax paid by Company A to that by Company B?
- a) 35 : 18      b) 34 : 37      c) 42 : 41  
 d) 31 : 27      e) 27 : 25
- 80) What is the difference between the expenditure on employees of Company B and that of Company A?
- a) Rs.4300000      b) Rs.640000      c) Rs.5900000  
 d) Rs.8700000      e) Rs.7800000
- 81) The expenditure on Machine and Electricity of Company B is what percent more than that on the same item of Company A?
- a) 67%      b) 84%      c) 75%  
 d) 77%      e) 80%

**Study the following graph and pie chart carefully to answer the given questions.**

### Number of volcano eruptions in various countries in different years



### Percentage of the number of volcanoes in the given six countries



Total number of volcanoes = 1000

- 82) What is the ratio of the number of volcanic eruptions in the year 2009 to that in 2011?

- a) 31 : 47  
d) 47 : 43

- b) 23 : 31  
e) 43 : 39

- c) 17 : 23

83) The total number of volcanic eruptions in Japan during the given four years is what percent of the total number of volcanoes in Japan?

- a) 139.5%  
b) 137.78%  
c) 132.91%  
d) 123.52%  
e) 104.2%

84) What is the difference between the number of volcanoes in Indonesia and the number of volcanoes in Morocco?

- a) 120  
b) 100  
c) 150  
d) 80  
e) 170

85) The total number of volcanic eruptions in Chile is what percent of the total number of volcanic eruptions in USA during the given four years?

- a) 109.5%  
b) 95.51%  
c) 80.42%  
d) 115.38%  
e) 125.78%

86) What is the ratio of the total volcanoes in Newzealand during the given four years?

- a) 5 : 3  
b) 7 : 5  
c) 2 : 5  
d) 3 : 4  
e) 4 : 7

**Study the table carefully to answer the following questions.**

The percentage profit is given on total cost price.

Cost price = cost of production + transportation cost + packaging cost

Name of goods	Cost of production per kg	Cost of transportation	Cost of packaging	Selling price per kg	Profit/loss	Percentage of profit/loss
Ghee	Rs.80	Rs.8		Rs.120		
Rice	Rs.40	0	0			5% profit
Sugar	Rs.45		Rs.5		Rs.50	
Milk	Rs.20	Rs.3	Rs.1			
Pulse	Rs.70	Rs.10		Rs.90		6% loss

87) If the percentage of profit on sold Ghee is 10%, then what is its cost of packaging?

- a) Rs.24.90  
b) Rs.23.50  
c) Rs.22  
d) Rs.21.09  
e) Rs.27.80

88) What is the difference between the selling price of Sugar and that of Rice, if the cost of transportation is zero for both?

- a) Rs.56  
b) Rs.52  
c) Rs.48  
d) Rs.36  
e) Rs.72

89) What is the cost of packaging of pulse?

- a) Rs.22.5                    b) Rs.20.04                    c) Rs.19.91  
 d) Rs.18.71                    e) Rs.15.74

90) What is the percentage profit of milk if its selling price is 80% of the cost price of Rice?

- a) 28%                    b) 30%                    c) 32%  
 d) 34%                    e) 38%

91) 4 kg Ghee, 3 kg Rice and 5 kg Milk are sold. What is profit or loss percentage? (The packing cost is zero for all goods) and selling price of Milk is Rs.32 per kg?

- a) 36%                    b) 32%                    c) 30.49%  
 d) 34.2%                    e) 31.5%

**Study the information carefully to answer these questions.**

There are 960 books in a library in which 40% are in Hindi; one-fourth are in English; and the remaining are in other languages. In Hindi books one-fourth are novels and 50% are epics while in English books one-third are novels and 40% are epics.

92) What is the ratio of Hindi to English books which are neither novels nor epics?

- a) 2 : 5                    b) 8 : 7                    c) 3 : 2  
 d) 5 : 7                    e) 3 : 7

93) What is the number of books which are in other languages?

- a) 84                    b) 192                    c) 330  
 d) 336                    e) 96

94) What is the difference between the number of Hindi novels and that of English epics?

- a) 10                    b) 20                    c) 0  
 d) 40                    e) 60

**Study the chart carefully to answer the following questions.**

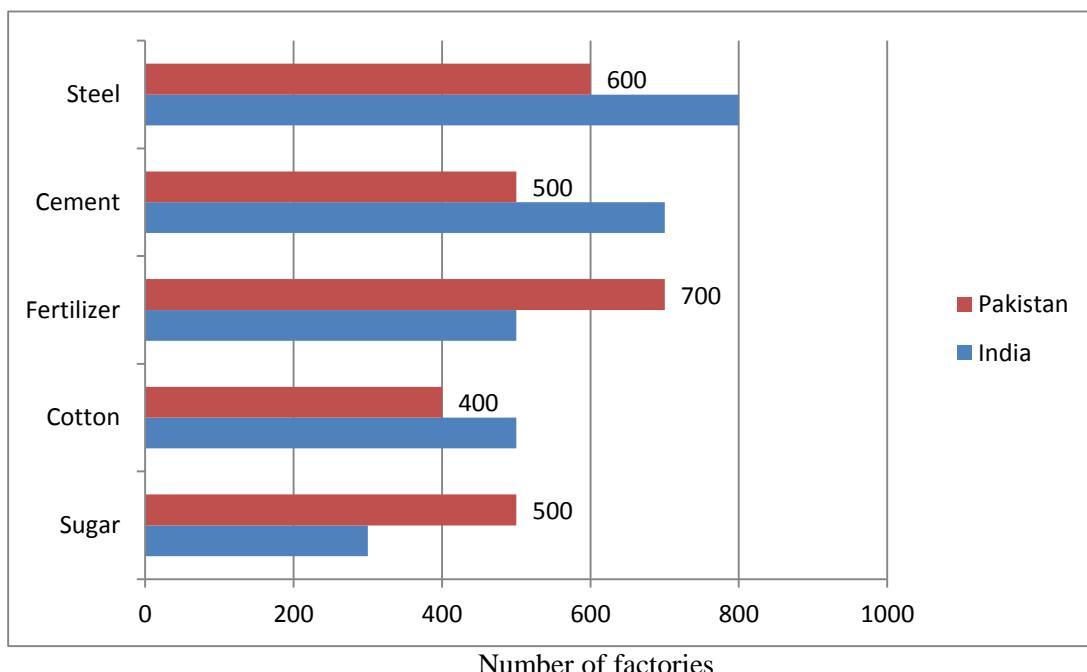
	Temperature				
	Durban	Quito	Columbus	Lisbon	Riyadh
January	20°C	15°C	20°C	22°C	35°C
February	21°C	16°C	18°C	20°C	30°C
March	22°C	18°C	16°C	22°C	32°C
April	25°C	20°C	15°C	25°C	36°C
May	28°C	22°C	14°C	18°C	38°C

95) What is the difference between the average temperature of Durban and that of Quito?

- a) 8°C                    b) 11°C                    c) 9°C

**Study the bar chart carefully to answer the questions given below:**

## The number of factories of various industries in India and Pakistan



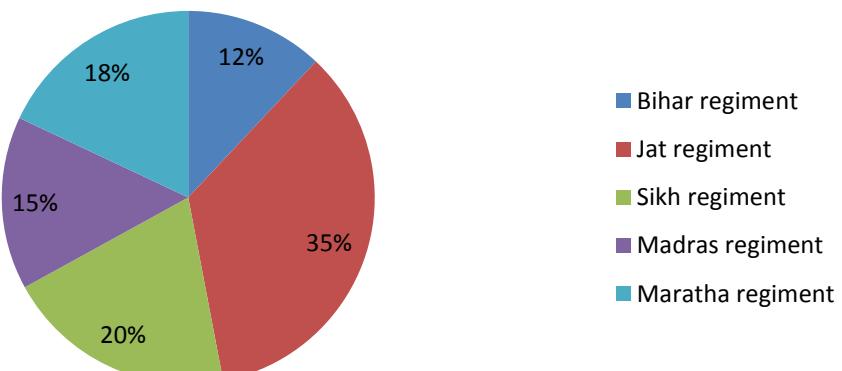
- 100) If the ratio of production of Steel in India to that in Pakistan is 5 : 3 and the production of Steel in India is 1000 tonnes, what is the ratio of the productivity (production/no. of factories) of Steel in India to that of Pakistan?
- a) 5 : 4      b) 4 : 3      c) 3 : 2  
 d) 2 : 1      e) 1 : 9
- 101) What is the difference between the total number of factories in India and that in Pakistan?
- a) 250      b) 150      c) 50  
 d) 5      e) 100
- 102) The number of Cotton factories in Pakistan is what percent of the total number of Cement factories in India?
- a) 53.5%      b) 59.9%      c) 57.14%  
 d) 50%      e) 48.7%
- 103) If Pakistan and India export 40% and 30% respectively of their production of Fertilizer, then what is the difference between the amounts of Fertilizer they used for themselves? (The production of Pakistan is 50 tonnes per factory and that of India is 60 tonnes per factory)
- a) 15 tonnes      b) 0 tonne      c) 35 tonnes  
 d) 32 tonnes      e) 11 tonnes
- 104) If the production of Cement in India is 24500 tonnes and that in Pakistan is 14500 tonnes, then what is the difference between their productivity (production/number of factories)?
- a) 4.3 tonnes      b) 6 tonnes      c) 5.714 tonnes  
 d) 8.2 tonnes      e) 7.9 tonnes

**Study the following table and pie chart carefully to answer the given questions.**

The table shows the ratio of Hindi religion soldiers to soldiers of other religions

Name of regiment	Hindi	Other religions
Jat regiment	4	1
Sikh regiment	3	5
Madras regiment	2	1
Maratha regiment	3	2
Bihar regiment	5	3

## Percentage of various regiments in the Army



**Total number of soldiers in the Army = 10000**

- 105) What is the number of Hindu soldiers in Jat regiment?
- a) 2600
  - b) 2700
  - c) 3200
  - d) 2800
  - e) 2350
- 106) What is the difference between Hindu soldiers in Madras regiment and soldiers of other religions in Bihar regiment?
- a) 485
  - b) 550
  - c) 520
  - d) 510
  - e) 490
- 107) The number of Hindu soldiers in Sikh regiment is what percent of the number of other soldiers in Maratha regiment?
- a) 97.12%
  - b) 99.56%
  - c) 102%
  - d) 104.16%
  - e) 25%
- 108) In which regiment is the number of non-Hindu soldiers the maximum?
- a) Maratha regiment
  - b) Sikh regiment
  - c) Madras regiment
  - d) Jat regiment
  - e) Bihar regiment
- 109) What is the ratio of the number of Hindu soldiers in Bihar regiment to the number of non-Hindu soldiers in Jat regiment?
- a) 11 : 10
  - b) 12 : 11
  - c) 13 : 12
  - d) 14 : 13
  - e) 15 : 14

**Study the given table carefully to answer the following questions:**

Station	Arrival time	Departure time	Halt time (in minutes)	Distance travelled from origin (in km)	Fare (Rs.)	Number of passengers boarding the train at each station	Number of passengers deboarding the train at each station
Delhi	Starting	5:45 pm	--	0 km	--	500	--
Mathura	7:00 pm	7:05 pm	5	100	60	200	80
Agra	8:30 pm	8:35 pm	5	210	130	350	50
Jhansi	11:45 pm	12:00 night	15	400	250	250	100
Bhopal	3:58 am	4:05 am	7	720	375	180	200
Itarsi	7:35 am	7:48 am	13	1000	425	150	150
Nagpur	12:00 noon	Terminates	--	1350	510	--	

- 110) How many passengers deboard the train at Nagpur?  
a) 2050                    b) 1340                    c) 1170  
d) 1050                    e) 150

111) What is the total fare of an eight-membered family who board at Mathura and deboard the train at Itarsi? Four members out of eight are children and each child's fare is 55% of the fare for an adult?  
a) Rs.2635                b) Rs.2051                c) Rs.2192  
d) Rs.1818                e) Rs.2590

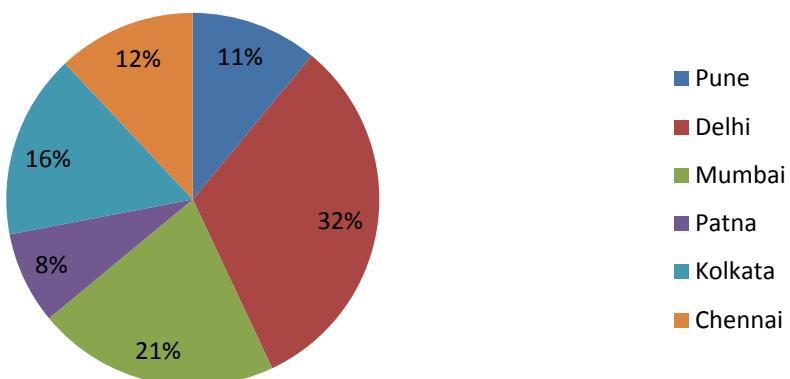
112) What is difference between the speed of the train from Jhansi to Nagpur and that from Delhi to Jhansi?  
a) 11 kmph                b) 10.5 kmph                c) 12.5 kmph  
d) 18 kmph                e) None of these

113) The total halt time is what percent of the total travel time?  
a) 8.6%                    b) 2.4%                    c) 7.8%  
d) 5.6%                    e) 4.1%

114) What is the total revenue from this train between Agra and Itarsi? (Assume all passengers pay full fare)  
a) Rs.300000              b) Rs.296650              c) Rs.326610  
d) Rs.349000              e) Rs.151500

**Study the following pie chart carefully to answer the questions:**

## Percentage breakup of employees of company X across different cities

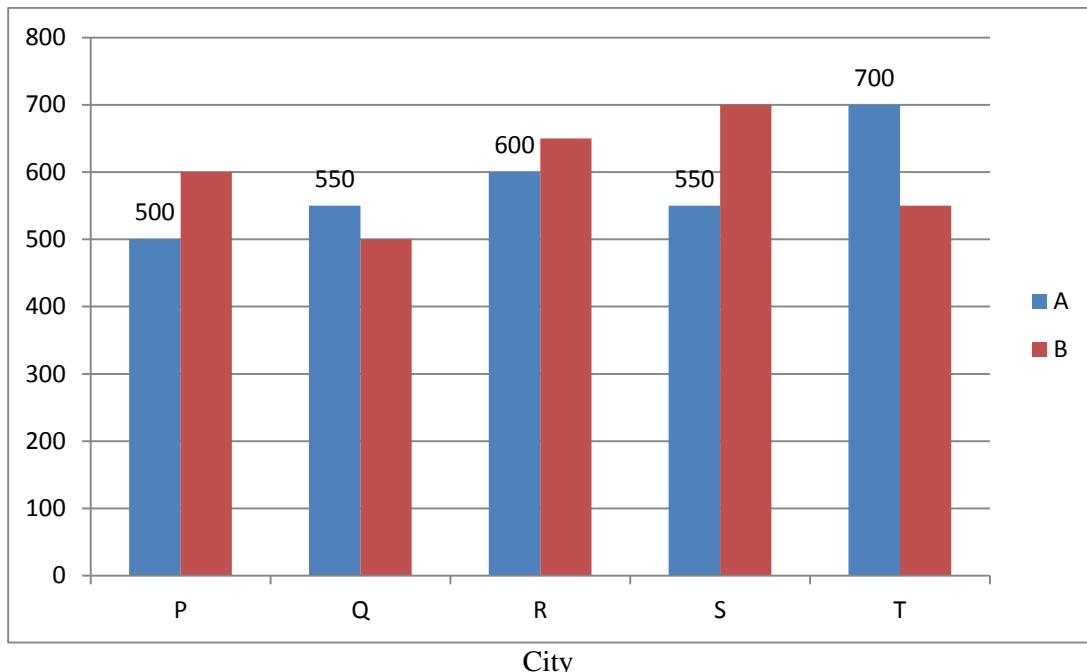


Total no. of employees of Company X = 1800

- 115) If 25% of the total number of employees working in Delhi are females, how many employees working in Delhi are males?
- a) 436                          b) 324                          c) 438  
 d) 398                           e) None of these
- 116) If  $\frac{2}{9}$ -th of the total number of employees working in Chennai were transferred to Patna, how many employees would there be in Patna?
- a) 192                            b) 168                            c) 202  
 d) 198                            e) None of these
- 117) Total number of employees working in Kolkata forms **approximately** what percent of the total number of employees working in Mumbai?
- a) 76                            b) 82                            c) 69  
 d) 85                            e) 58
- 118) Fill in the black space in order to make the sentence correct as per the given information:  
 Total number of employees working in \_\_\_\_\_ is more than the total number of employees working in Pune and Chennai together.
- a) Mumbai                        b) Pune and Patna together            c) Kolkata  
 d) Delhi                            e) Patna and Chennai together
- 119) What is the respective ratio between the total number of employees working in Patna to the total number of employees working in Delhi?
- a) 2 : 3                            b) 1 : 5                            c) 1 : 4  
 d) 3 : 4                            e) None of these

**Study the following graph carefully and answer the questions the follow:**

The graph given below represents the number of users of two broadband services A and B across 5 cities P, Q, R, S and T.



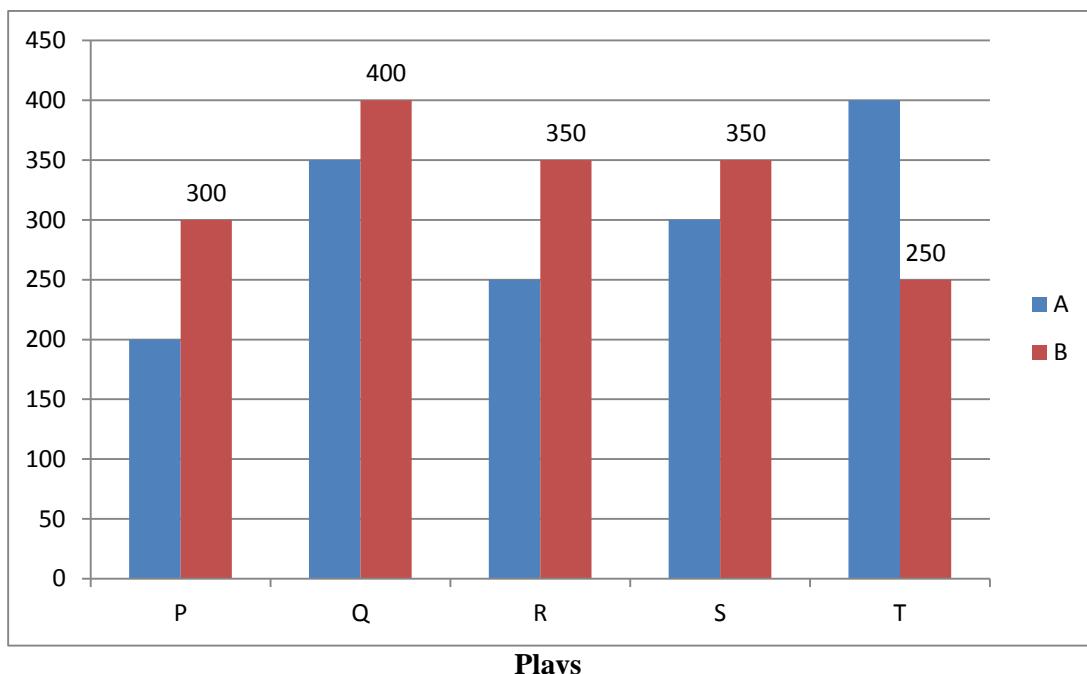
- 120) What is the total number of users of brand B across all give cities together?
- a) 2700
  - b) 3000
  - c) 3100
  - d) 2900
  - e) 3200
- 121) The number of users of brand A in city T is what percent of the number of users of brand B in city Q?
- a) 150
  - b) 110
  - c) 140
  - d) 160
  - e) 120
- 122) What is the average number of users of brand A across all five cities together?
- a) 560
  - b) 570
  - c) 580
  - d) 590
  - e) 550
- 123) What is the difference between the total number of users of brand A and B together in city R and the ottal number of users of brand A and B together in city P?
- a) 170
  - b) 140
  - c) 130
  - d) 150
  - e) 160

124) What is the respective ratio of the number users of brand A in city P to the number of users of brand B in city S?

- a) 5 : 7                          b) 4 : 7                          c) 2 : 5  
 d) 3 : 4                           e) 5 : 6

**Study the following graph carefully and answer the question that follow:**

The graph represents the total number of tickets sold of five plays P, Q, R, S and T across two auditoriums A and B on a particular day



125) The number of tickets sold of play T at auditorium A is what percent of the number of tickets of play P sold at auditorium A?

- a) 220                                  b) 200                                  c) 210  
 d) 190                                   e) 180

126) What is the total number of tickets sold of plays Q and R together at both the auditoriums A and B together?

- a) 1050                                  b) 1200                                  c) 1250  
 d) 1350                                   e) 1300

127) What is the respective ratio of the number of tickets sold of play P at auditorium B to the number of tickets sold of play Q at auditorium B?

- a) 2 : 3                                   b) 3 : 4                                   c) 1 : 2  
 d) 3 : 5                                   e) 4 : 5

**Study the following table carefully and questions that follow:**

The table represents the total sales value (in lakhs) of five books P, Q, R, S and T, across eight bookstores A, B, C, D, E, F, G and H.

	Bookstores							
	A	B	C	D	E	F	G	H
P	560	590	210	670	560	680	420	460
Q	550	560	890	230	820	610	520	230
R	450	290	540	530	500	520	560	410
S	230	240	560	400	430	200	210	480
T	230	400	410	240	200	360	500	470

- 130) What is the respective ratio between the total sales values of Book P across all the bookstores and Book S across all the bookstores?  
a) 83 : 55      b) 85 : 53      c) 83 : 53  
d) 89 : 55      e) None of these

131) The sale of the book R from bookstore H is what percent of the total sale of book R across all the bookstores (Rounded off to two places after the decimal)?  
a) 21.12      b) 17.19      c) 7.43  
d) 3.04      e) 10.79

132) What is the average sale (in lakhs) of bookstore E?  
a) 502      b) 504      c) 512  
d) 540      e) None of these

133) Book Q of bookstore C constituted **approximately** what percent of the total sales of bookstore C?  
a) 34      b) 39      c) 32  
d) 23      e) 28

134) What is the total sales value (in lakhs) of bookstore D?  
a) 2510      b) 2670      c) 2900  
d) 2070      e) None of these

**Study the following table carefully and answer the questions that follow.**

The table represents the total number of students studying courses, P, Q, R, S and T across eight institutes i.e., A, B, C, D, E, F, G and H.

Courses	Institutes							
	A	B	C	D	E	F	G	H
P	520	410	550	450	570	210	750	450
Q	410	540	610	580	380	550	570	310
R	430	210	590	530	730	510	530	480
S	350	280	570	320	410	480	610	460
T	370	480	380	250	180	370	590	660

- 135) What is the respective ratio between the total number of students studying in institute A and the total number of students studying in institute H?

a) 52 : 59      b) 52 : 55      c) 55 : 59  
d) 59 : 61      e) None of these

136) The number of students studying course Q in institute B forms what percent of the total number of students in institute C?

a) 14      b) 17      c) 11  
d) 8      e) 20

137) What is the total number of students who are studying course T across all institutes?

a) 3480      b) 3280      c) 3420  
d) 3840      e) None of these

138) The number of students studying course P in institute A forms what percent of the total number of students in institute A?

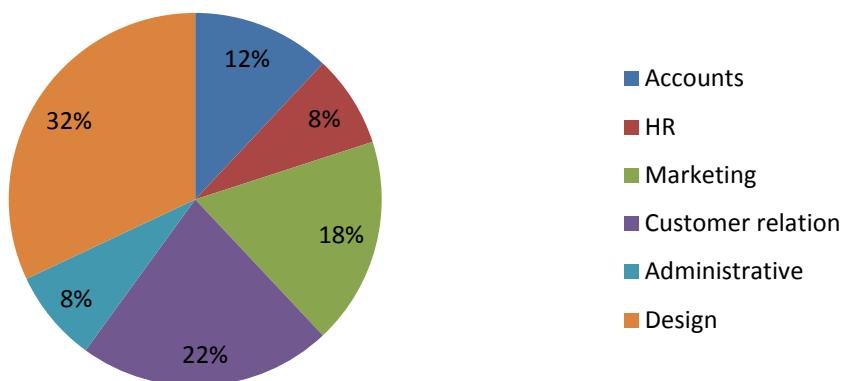
a) 27      b) 23      c) 25  
d) 20      e) 29

139) What is the average number of students studying in institute D?

a) 446      b) 426      c) 540  
d) 454      e) None of these

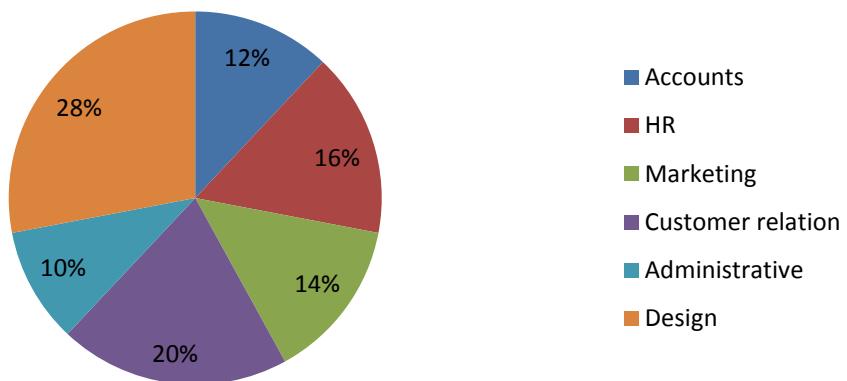
**Study the following graph carefully and answer the questions that follow:**

# Percentage of employees in different departments of a company



Total Number of employees = 4500

# **Percentage of females in each department in the same company**



Total number of female in the organization = 2000

- 140) The number of females in the Marketing department are **approximately** what percent of the total employees in Marketing and Customer Relation Departments together?

  - a) 26
  - b) 36
  - c) 6
  - d) 46
  - e) 16

- 141) The total number of females are what percent of the total number of males in the organization?  
a) 90                          b) 70                          c) 80  
d) 60                          e) None of these

142) What is the ratio of number of males in HR department to the number of males in Accounts department respectively?  
a) 3 : 7                          b) 4 : 5                          c) 2 : 15  
d) 2 : 3                          e) None of these

143) What is the total number of males from Design, Customer Relation and HR departments together?  
a) 1550                          b) 1510                          c) 1540  
d) 1580                          e) None of these

144) What is the respective ratio of number of employees in Administrative department to the number of males in the same department?  
a) 9 : 4                          b) 8 : 3                          c) 7 : 2  
d) 8 : 5                          e) None of these

**Study the following table carefully and answer the questions that follow:**

Number of employees from six different banks located in different cities,  
M = Males, F = Females

City	Agra		Delhi		Mumbai		Chennai		Patna		Kolkata	
Name of Bank	M	F	M	F	M	F	M	F	M	F	M	F
A	553	224	254	456	457	388	114	378	234	120	353	325
B	673	116	346	256	346	456	124	235	241	156	348	174
C	443	500	366	345	124	456	235	388	350	234	399	439
D	534	454	478	285	235	235	255	175	124	165	358	234
E	256	235	256	166	574	599	324	198	124	334	125	235
F	556	357	346	287	589	190	189	256	155	181	278	192

- 145) What is the ratio of number of males to the number of females respectively in Bank D from all the cities together?

a) 496 : 387      b) 487 : 356      c) 422 : 385  
d) 486 : 397      e) None of these

146) What is the ratio of the number of males to the number of females respectively in Patna from Bank A, Bank C and Bank E together?

a) 175 : 173      b) 177 : 173      c) 177 : 172

d) 175 : 172                    e) None of these

147) What is the **approximate** average of the number of males working in all the banks together in Kolkata?

- |        |        |        |
|--------|--------|--------|
| a) 350 | b) 310 | c) 340 |
| d) 380 | e) 360 |        |

148) The number of females in all the banks together in Delhi are **approximately** what percent of the number of males from all the banks together in the same city?

- |       |       |       |
|-------|-------|-------|
| a) 88 | b) 98 | c) 78 |
| d) 68 | e) 58 |       |

149) The number of females in Bank B from Agra are what percent of the females in Bank C from the same city?

- |         |                  |         |
|---------|------------------|---------|
| a) 33.2 | b) 23.2          | c) 13.2 |
| d) 28.2 | e) None of these |         |

cv

Name of college	Specialization											
	Economics		Marketing		HRM		Sociology		Psychology		Pol. Sc.	
	M	F	M	F	M	F	M	F	M	F	M	F
K	53	45	34	47	18	36	25	45	21	34	24	56
L	62	65	34	14	15	58	18	56	56	65	58	86
M	18	28	67	25	26	85	25	35	64	85	68	46
N	33	24	23	19	45	54	24	34	54	75	57	86
O	28	10	45	25	14	47	48	54	21	36	46	56
P	53	34	34	30	27	20	32	78	21	96	79	35

150) What is the average number of females specializing in HRM from all the colleges together?

- |       |                  |       |
|-------|------------------|-------|
| a) 30 | b) 45            | c) 50 |
| d) 55 | e) None of these |       |

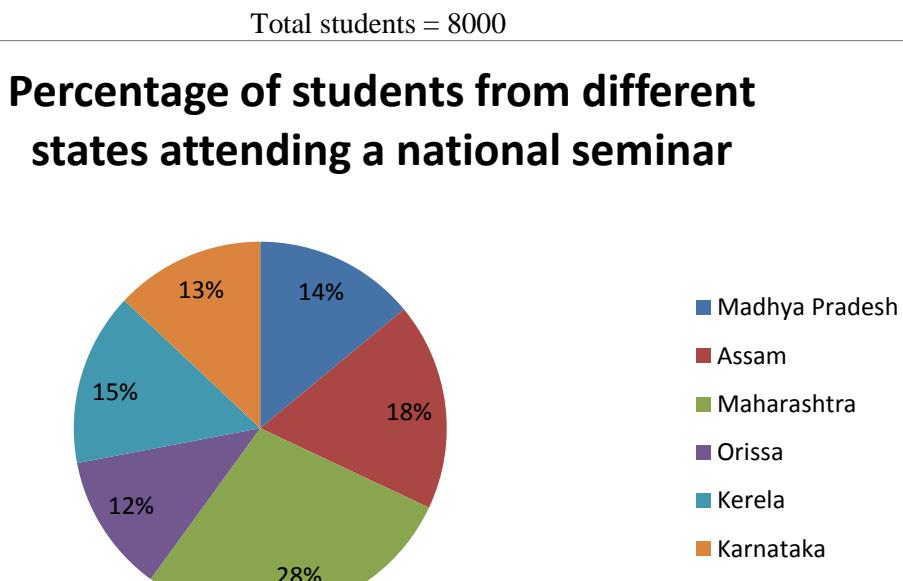
151) The total number of males in college L are **approximately** what percent of total females from the same college?

- |        |       |       |
|--------|-------|-------|
| a) 10  | b) 80 | c) 50 |
| d) 110 | e) 70 |       |

152) What is the respective ratio between the total number of students specializing in Economics from college P and the total number of students specializing in Psychology from the same college?

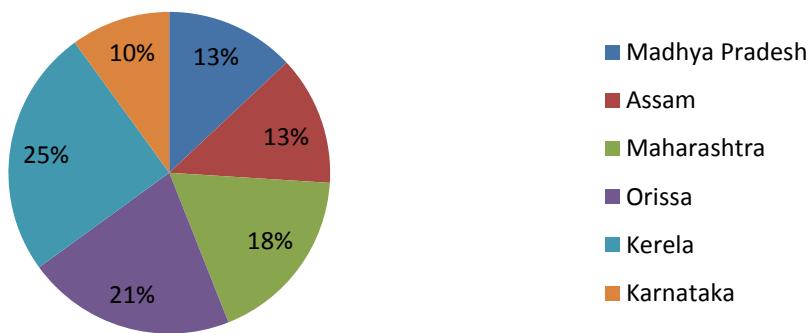
- |            |                  |            |
|------------|------------------|------------|
| a) 29 : 31 | b) 25 : 34       | c) 28 : 39 |
| d) 25 : 39 | e) None of these |            |

**Study the following pie charts carefully and answer the questions that follow:**



Total students = 3500

## Percentage of female students from different states attending a national seminar



- 155) What is the respective ratio between the number of female students from Karnataka to the number of female students from Kerela?
- a) 2 : 7      b) 2 : 5      c) 2 : 3  
 d) 3 : 7      e) None of these
- 156) What is the total number of male students from Maharashtra and Madhya Pradesh together?
- a) 2175      b) 2725      c) 2527  
 d) 2275      e) None of these
- 157) What is the respective ratio between the number of male students from Assam and the number of male students from Madhya Pradesh?
- a) 197 : 134      b) 197 : 135      c) 197 : 133  
 d) 199 : 133      e) None of these
- 158) What is the respective ratio between the number of female students from Karnataka and the number of male students from the same state?
- a) 35 : 69      b) 32 : 69      c) 38 : 69  
 d) 35 : 67      e) None of these
- 159) The number of female students from Assam are approximately what percent of the male students from the same state?
- a) 14      b) 28      c) 96  
 d) 66      e) 46

**Study the following table carefully to answer the questions that follow:**

Number of students appeared (A) and failed (F) in five classes of a school over the years.

Years	Classes									
	VI		VII		VIII		IX		X	
	A	F	A	F	A	F	A	F	A	F
2003	75	13	77	08	85	11	74	08	68	08
2004	67	17	80	09	83	06	79	06	69	15
2005	65	08	72	15	79	09	70	07	75	14
2006	69	06	66	11	77	12	71	04	84	09
2007	73	11	67	10	72	10	74	10	83	11
2008	72	12	76	07	84	05	80	05	72	05
2009	70	07	80	08	77	03	81	09	85	08

- 160) What is the number of passed students for all the classes together, in the year 2008?  
a) 358                    b) 317                    c) 350  
d) 327                    e) None of these

161) What is the average number of failed students from Class VIII for the given years?  
a) 9                      b) 7                      c) 6  
d) 8                      e) None of these

162) What is the ratio of the total number of passed students to total number of failed students for the year 2006?  
a) 139 : 24              b) 325 : 42              c) 90 : 11  
d) 233 : 35              e) None of these

163) What is the total percentage of passed students of Class IX from all the years together? (Rounded off to two digits after decimal)  
a) 68.95                  b) 71.36                  c) 81.08  
d) 86.94                  e) 90.74

164) Which of the following class has the minimum number of passed students over the year?  
a) VI                      b) VII                      C) VIII  
d) IX                      e) None of these

**Study the following information carefully to answer the question.**

The teacher's colony has 2800 members. Out of which 650 members read only English newspaper 550 members read only Hindi newspaper and 450 members read only Marathi newspaper. Reading all the 3 newspapers is 100. Reading Hindi as well as English newspaper are 200. 400 members read Hindi as well as Marathi newspaper and 400 read English as well as Marathi newspaper.

165) How many members read atleast 2 newspapers?

- a) 600
- b) 800
- c) 500
- d) 1000
- e) None of these

166) Find the number of members reading Hindi newspaper.

- a) 750
- b) 980
- c) 1000
- d) 1020
- e) None of these

167) Find the number of members reading no newspaper.

- a) 150
- b) 460
- c) 550
- d) 750
- e) None of these

168) Find the difference between number of members reading English as well as Marathi newspaper and the number of member reading English as well as Hindi newspaper.

- a) 300
- b) 200
- c) 100
- d) 50
- e) None of these

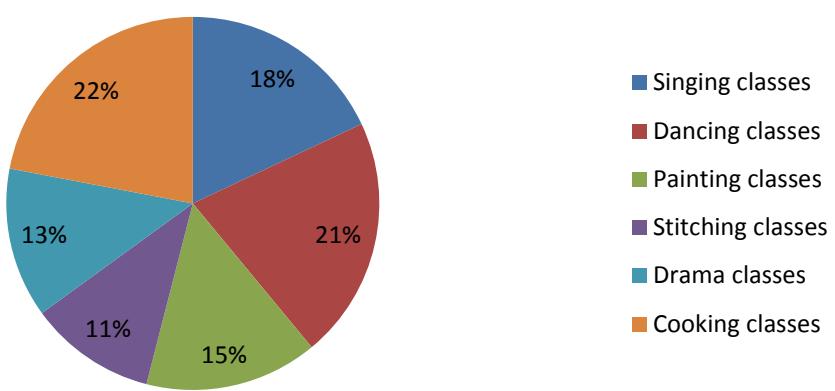
169) How many members read only one newspaper?

- a) 1560
- b) 1650
- c) 1640
- d) 1540
- e) None of these

**Study the pie chart carefully to answer the questions that follow:**

Total number of students = 3600

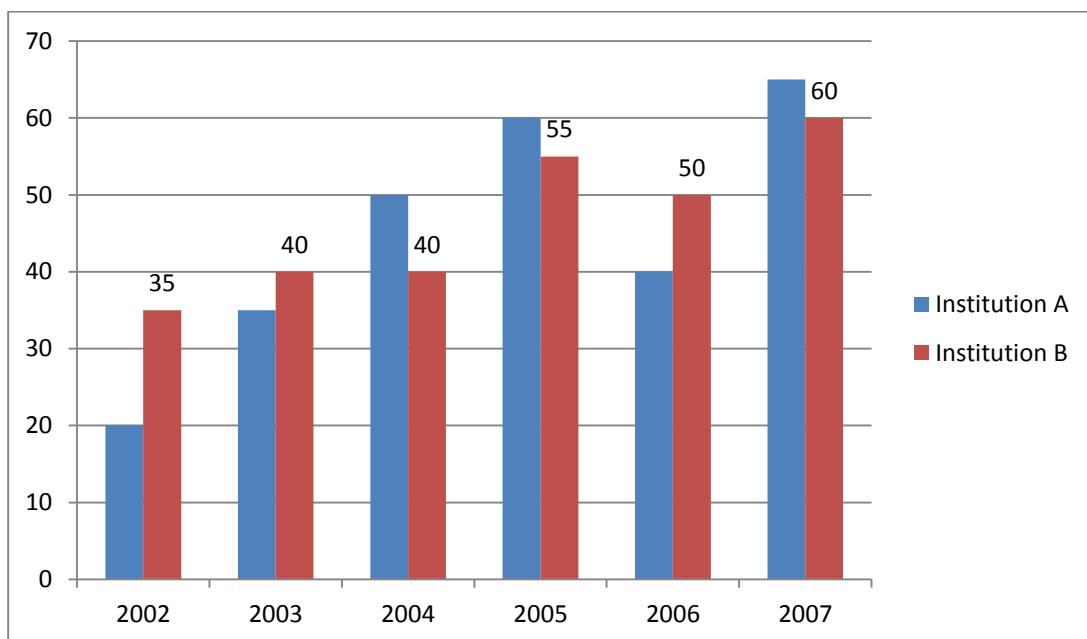
## Percentage of students enrolled in different Hobby classes in a School



- 170) The number students enrolled in those Cooking Classes is what percent of those enrolled in Dancing Classes? (Rounded off to two digits after decimal)  
a) 101.45                  b) 104.76                  c) 113.84  
d) 110.28                  e) None of these
- 171) What is the total number of students enrolled in Stitching and Drama Classes together?  
a) 684                  b) 846                  c) 648  
d) 864                  e) None of these
- 172) How many students are enrolled in Painting Classes?  
a) 550                  b) 480                  c) 450  
d) 520                  e) None of these
- 173) Number of students enrolled in Painting classes are approximately what percent of those enrolled in Singing classes?  
a) 78                  b) 92                  c) 83  
d) 66                  e) 72
- 174) What is the ratio of number of students enrolled in Singing and Dancing classes together to these enrolled in Drama classes respectively?  
a) 3 : 1                  b) 4 : 7                  c) 7 : 5  
d) 3 : 5                  e) None of these

**Study the graph and answer the questions that follow:**

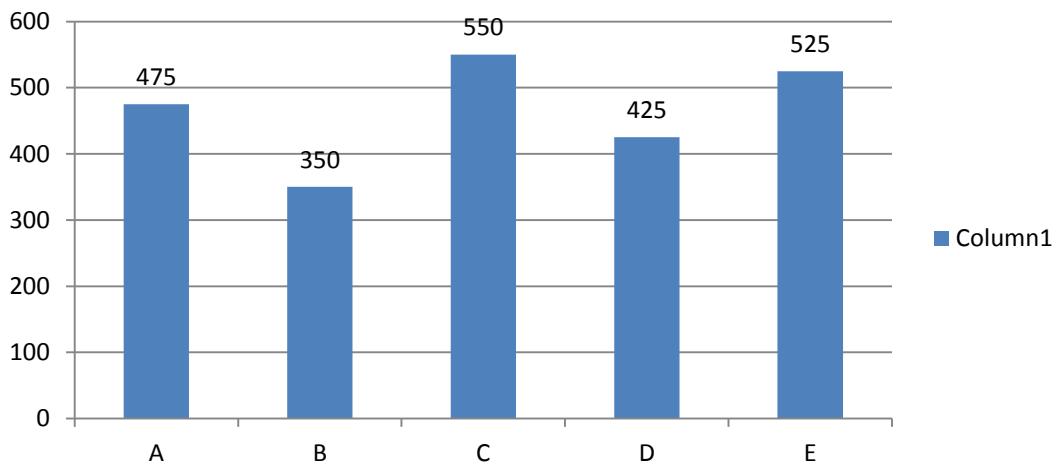
Number of candidate (in thousands) qualified in the written test for admission to two different institutions



- 175) What was the respective ratio between the number of candidates qualified in the written test in the year 2002 for admission in institution B and the number of candidates qualified in the written test in the year 2006 for admission to institute A?
- a) 8 : 5                          b) 7 : 4                          c) 7 : 8  
 d) 7 : 5                           e) 8 : 7
- 176) What was the approximate average number of candidates qualified in the written test for admission to institution B over all the years?
- a) 45555                        b) 42000                        c) 41600  
 d) 48888                        e) 46667
- 177) In which year was the total number of candidates qualified in the written test for admission to both the institutions together the second highest?
- a) 2003                        b) 2004                        c) 2005  
 d) 2006                        e) 2007
- 178) What is the difference between the total number of candidates qualified in written test in year 2006 for admission to institution A and B together and the number of candidates qualified in written test in year 2003 for admission to institution A?
- a) 5000                        b) 3500                        c) 1500  
 d) 5500                        e) None of these
- 179) What was the total number of candidates qualified in the written test for admission to institution A over all the years together?
- a) 27,000                        b) 26,500                        c) 26,000  
 d) 27,500                        e) None of these

Study the following graph carefully to answer the question that follow:

### Distance (in km) travelled by five different trucks in day

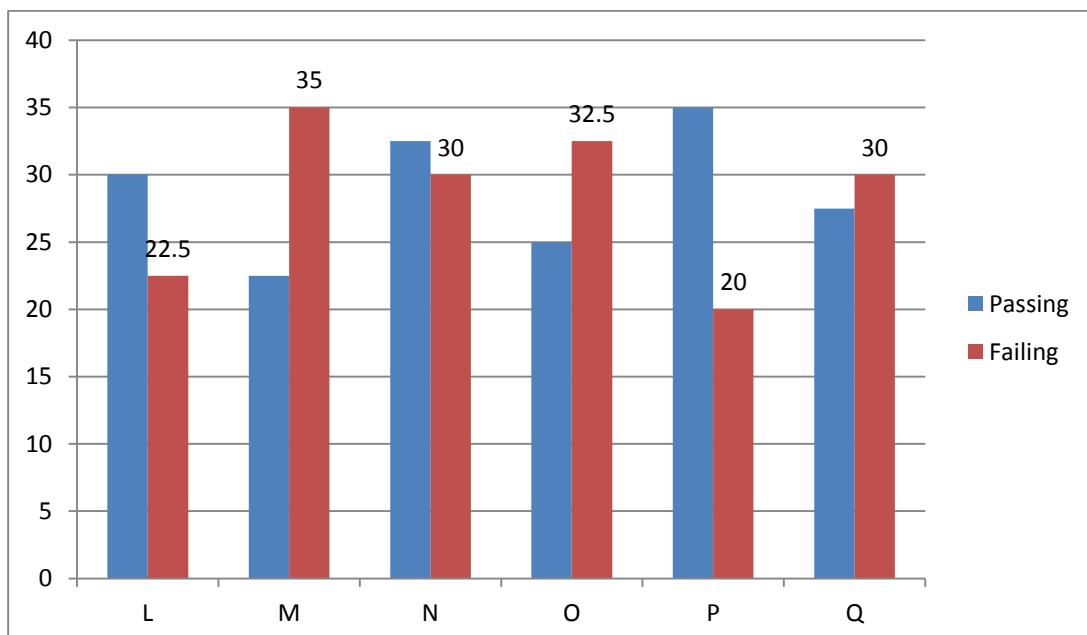


- 180) What is the respective ratio of the distance travelled by Truck A to the distance travelled by Truck D?
- a) 17 : 19      b) 11 : 15      c) 19 : 17  
d) 15 : 11      e) None of these
- 181) What is the average distance travelled by all the trucks together?
- a) 510 km      b) 515 km      c) 425 km  
d) 475 km      e) None of these
- 182) If truck A covered the given distance at the average speed of 47.5 km/hr, what is the time taken by it to cover this distance?
- a) 12 hours      b) 10 hours      c) 8 hours  
d) 6 hours      e) None of these
- 183) The distance travelled by truck E is approximately what percent of the total distance travelled by truck B and C together?
- a) 58      b) 60      c) 52  
d) 62      e) 55
- 184) If the time taken by truck C to cover the given distance was 8 hours, what was the average speed of the truck?
- a) 54.75 km/hr      b) 65.25 km/hr      c) 52.25 km/hr  
d) 68.75 km/hr      e) None of these

**Study the following graph carefully to answer the questions that follow:**

Number of students (in thousands) passing and failing in an entrance exam from six different cities

The total number of students in each city comprises the number of students passing and the number of students failing in the entrance exam.



185) Number of students passing in the examination from city O is approximately what percent of the total number of students pass in the examination from all cities together?

- a) 4
- b) 26
- c) 21
- d) 9
- e) 14

186) Number of students failing in the entrance exam from city P is what percent of the total number of students from that city? (rounded off to two digits after decimal)

- a) 29.75%
- b) 32.48%
- c) 36.36%
- d) 27.19%
- e) None of these

187) What is the total number of students failing in the entrance exam from all the cities together?

- a) 175000
- b) 16800
- c) 217500
- d) 168000
- e) None of these

188) What is the average number of students failing in the examination from cities L and M together?

- a) 22570
- b) 20180
- c) 21650
- d) 28750
- e) None of these

**Study the following table carefully to answer these questions.**

The giving number of candidates appeared in the information and percentage of students passed from various institutes over the years

Ins.	A		B		C		D		E		F	
Year	App	% pass										
2001	450	60	540	40	300	65	640	50	600	45	680	60
2002	520	50	430	70	350	60	620	40	580	70	560	70
2003	430	60	490	70	380	50	580	50	680	70	700	66
2004	400	65	600	75	450	70	600	75	720	60	780	70
2005	480	50	570	50	400	75	700	65	700	48	560	50
2006	550	40	450	60	500	68	750	60	450	50	650	60
2007	500	58	470	60	470	60	720	70	560	60	720	50

- 189) What is the total number of students passed from all institutes together in the year 2006?  
a) 1895                    b) 1985                    c) 1295  
d) 1465                    e) None of these

190) **Approximately**, what is the overall percentage of students passed from institute C for all the years?  
a) 60                      b) 70                      c) 75  
d) 55                      e) 65

191) What is the ratio of the number of students passed from institute F in 2003 to the number of students passed from institute B in 2005?  
a) 95 : 154                b) 154 : 95                c) 94 : 155  
d) 155 : 94                e) None of these

192) What is the ratio of the average number of students appeared from institute A for all the years to that from institute D?  
a) 463 : 353                b) 353 : 463                c) 461 : 333  
d) 333 : 461                e) None of these

193) What is the overall percentage of students passed from all the institutes together in 2004? (rounded off to the nearest integer)  
a) 68                      b) 70                      c) 69  
d) 71                      e) None of these

**Solutions:**

1. Option C

$$\text{Number of female employees in B and C} = 2100 \times \frac{75}{25} = 6300$$

$$\text{Total number of employees in B and C} = 22000 \times \frac{65}{100} = 14,300$$

$$\text{Percentage} = \frac{6300}{14300} \times 100 = 44\% \text{ (Approx.)}$$

2. Option B

$$\text{Number of married female employees in company A} = \frac{40}{100} \times 2100 = 840$$

$$\text{Total number of people working in company A} = 7700$$

$$\text{Total number of married people working in company A} = 2500$$

$$\text{So, Number of married male employees} = 2500 - 840 = 1660$$

$$\text{Total males in company A} = 7700 - 2100 = 5600$$

$$\text{Number of unmarried male employees} = 5600 - 1660 = 3940$$

$$\text{Percentage} = 70\% \text{ (Approx.)}$$

3. Option C

$$1/3^{\text{th}} \text{ of the female employees are living with their husbands} = 2800$$

$$34\% \text{ of the females are unmarried or } 66\% \text{ are married.}$$

$$\text{Married females} = 8400 \times \frac{66}{100} = 5544$$

$$\text{Female employees who are married but not living with their husbands} = 5544 - 2800 = 2744$$

4. Option E

Employees in the age group 30 years and above is as follows

$$\text{A- } 7700 - 20\% \text{ of } 7700 = 6160$$

$$\text{B- } 5500 - 25\% \text{ of } 5500 = 4125$$

$$\text{C- } 8800 - 30\% \text{ of } 8800 = 6160$$

Answer is both A and C

5. Option B

Present staff strength of C = 8800

After 20% increase in 2015 :  $1.20 \times 8800 = 10560$

After 10% decrease in 2016 :  $0.90 \times 10560 = 9504$

Increase in staff strength of C =  $9504 - 8800 = 704$

Plan	A (Simple interest)	B (Simple interest)	C (Compounded)	D(Compound ded annually)
------	---------------------	---------------------	----------------	--------------------------

			<b>annually)</b>	
<b>Principle</b>	Rs.15,000	<b>Rs.20,000</b>	Rs.10,000	Rs.25,000
<b>Term</b>	42 months	30 months	24 months	<b>12 months</b>
<b>Interest rate</b>	<b>10%</b>	7.5%	9%	12.50%
<b>Interest</b>	Rs.5250	Rs.3750	<b>Rs.1881</b>	Rs.3125

6. Option B

Interest earned under default plan C = Rs.1881

Interest rate of plan A=10%

Interest earned under plan C at 10% p.a compounded annually = Rs.2100

Difference in interest earned = 2100 - 1881= Rs.219

7. Option A

Original term is 12 and when it is tripled it becomes 36 months.

Interest on Rs.25,000@12.50p.a (Compounded annually) for 36 months is Rs.10,595.70

8. Option C

Maturity amount of plan B = Rs.23,750

Rs.23,750 deposited for 2 years in plan A gives Rs.28,500 on maturity.

9. Option D

Interest earned under plan C (Compounded annually) = Rs.1881

Interest earned under plan C (If the interest is not compounded) = Rs.1800

Ratio will be 1881:1800=209 : 200

10. Option D

Investment of Rs.25,000 in plan D will earn Rs.6640.25 in 24 months.

Perimeter of a square=  $4 \times$  length of its one side

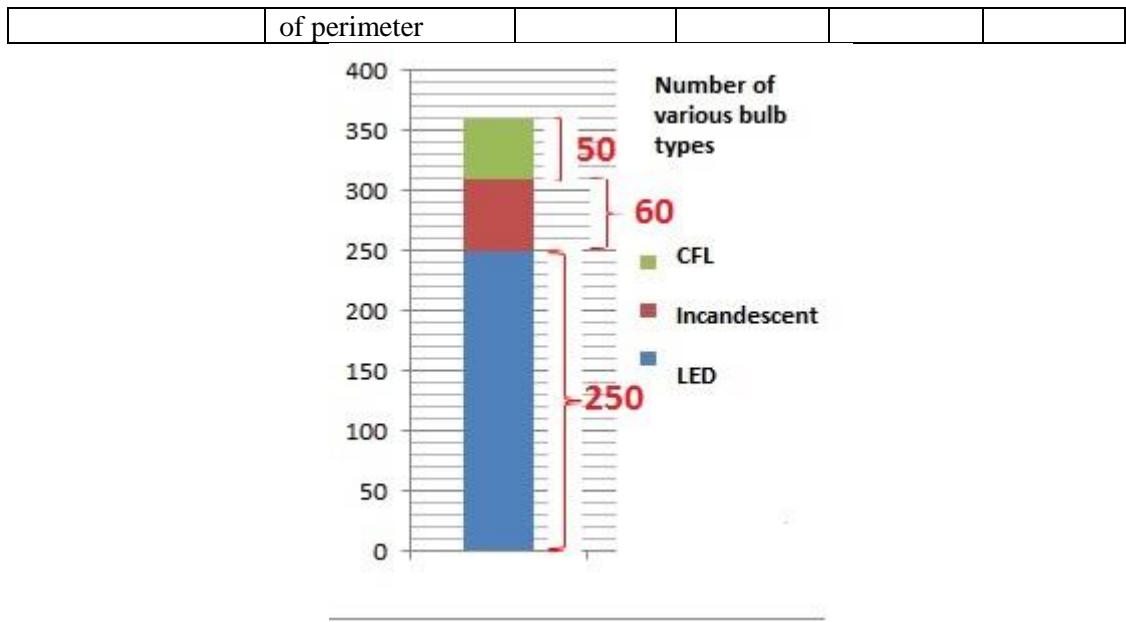
Ladies: 41.67% of 240= 100m (each side is 25m and area is  $625\text{m}^2$ )

Gents: 33.33% of 240= 80m (each side is 20m and area is  $400\text{m}^2$ )

Kids: 25% of 240= 60m (each side is 15m and area is  $225\text{m}^2$ )

From the above data we can arrive create the following table.

<b>Bulb type</b>	<b>Distribution</b>	Ladies	Gents	Kids	Total
LED	1 per $5\text{ m}^2$	125	80	45	250
CFL	1 per $25\text{ m}^2$	25	16	9	50
Incandescent	1 per each 4m	25	20	15	60



11. Option C

Ratio between the areas of ladies, kids and gents sections is  $625 : 225 : 400 = 25 : 9 : 16$

12. Option C

Area of gents section - Area of kids section =  $400 - 225 = 175 \text{ m}^2$

Furnishing charge is Rs.125/m<sup>2</sup>

Expense for furnishing extra  $175 \text{ m}^2 = 175 \times 125 = 21875$

13. Option A

Cost for lighting up the ladies section =  $125 \times 80 + 25 \times 75 + 25 \times 12 = \text{Rs.}12175$

14. Option E

Percentage of the LED bulbs utilised to light up the kids section =  $\frac{45}{250} \times 100 = 18\%$

15. Option B

Total number of LED, CFL, and incandescent bulbs in ladies and gents section together is 205, 41, and 45 respectively.

Therefore the total electricity consumption in a day =  $205 \times 0.2 + 41 \times 0.4 + 45 \times 1 = 102.4$  (b)

16. Option B

Total sales of copper in 2003 and 2004 =  $160 + 160 = 320$  tonnes

Average sales of silver in 2004 and 2005 =  $\frac{180 + 220}{2} = 200$  tonnes

Percentage =  $\frac{320}{200} \times 100 = 160\%$

17. Option B

Average sales of gold in 2002, 2004 and 2005 together =  $\frac{60 + 110 + 80}{3} = \frac{250}{3} = 83 \frac{1}{3}$

18. Option C

Sum of average sales of silver in 2002-2003 and copper in 2003-2004

$$= \frac{110 + 160}{2} + \frac{160 + 160}{2}$$

$$= 135 + 160 = 295$$

$$1.5 \text{ times } 295 = 1.5 \times 295 = 442.50$$

19. Option D

Sales of silver in all four years = 670 tonnes

Total sales of gold and copper in 2003-2004 = 500 tonnes

Percentage =  $\frac{670}{500} \times 100 = 134\%$

20. Option A

Sales of silver in 2003 – 2004 = 340

Difference between the average sales of copper and gold in 2002 - 2003 is  
 $\frac{220 + 160}{2} - \frac{60 + 80}{2}$   
 $= 190 - 65 = 125$

Ratio is  $340 : 125 = 68 : 25$

21. Option B

Average number of Fiction and GK Books sold by Store A, B, and D together  
 $= \frac{\text{total}}{3}$   
 $= \frac{35400}{3} = 11,800$

Total number of books sold by Stores C, D, and E =  $10\% + 15\% + 25\%$  of total sales  
 $= 50\%$  of 88,500  
 $= 44,250$

Percentage =  $\frac{11800}{44250} \times 100 = 26.67\%$

## 22. Option A

Non-fiction sold by

$$A = \frac{5}{20} \times 20\% \text{ of } 88500 = 4425$$

$$B = \frac{7}{15} \times 30\% \text{ of } 88500 = 12390$$

$$C = \frac{8}{30} \times 10\% \text{ of } 88500 = 2360$$

$$D = \frac{6}{15} \times 15\% \text{ of } 88500 = 5310$$

$$E = \frac{8}{27} \times 25\% \text{ of } 88500 = 6556 \text{ (Appox)}$$

Answer is B,D and E= 3 stores

## 23. Option D

Total business of C=Rs.120,360

Total number of books sold by Store C= 10% of 88500= 8850

Number of fiction=  $\frac{15}{30} \times 8850 = 4425$  (Total Cost=  $4425 \times \text{Rs.15.50} = \text{Rs.68587.5}$ )

(1)

Number of non-fiction=  $\frac{8}{30} \times 8850 = 2360$  (Total Cost= Unknown) (2)

Number of GK books=  $(7/30)*8850 = 2065$  (Total Cost=  $2065 \times \text{Rs.12.50} = \text{Rs.25812.5}$ ) (3)

Total Cost of non-fiction= Total business - (1) - (3)

Rs.120,360-Rs.68587.5-Rs.25812.5= 25960

$\frac{\text{total cost of non-fiction}}{\text{number of non-fiction}} = \text{Price per copy} = \frac{25960}{2360} = \text{Rs. 11}$

## 24. Option A

Price of fiction and non-fiction is increased by 10%

Now fiction will cost Rs. 17.05, non-fiction Rs.12.1, and GK Rs.12.5 (Unchanged)

Total business of C will be equal to  $(4425 \times 17.05 + 2360 \times 12.1 + 2065 \times 12.5) = \text{RS. 129,814.75}$

## 25. Option C

Average sales of grade 1=  $\frac{20 + 40 + 50 + 60}{4} = 42.5$  tonnes

Average sales of grade 2=  $\frac{40 + 60 + 20 + 110}{4} = 57.5$  tonnes

Difference=  $57.5 - 42.5 = 15$  tonnes.

## 26. Option A

Total income of companies A=  $(75000 \times 20) + (60000 \times 40) = \text{Rs.3900000}$

Total income of companies C=  $(75000 \times 50) + (60000 \times 20) = \text{Rs.4950000}$

Difference=  $\text{Rs.1050000} = \text{Rs. 1.05 million.}$

Company	Grade 1 (tonnes)	Grade 2 (tonnes)
A	20	40
B	40	60
C	50	20
D	60	110

27. Option E

$$\text{Net income of company A} = (75000 \times 20) + (40 \times 60000) = \text{Rs.}3900000$$

$$\text{Grade 1 constitutes } 38.46\% \left[ \frac{150000}{3900000} \times 100 \right]$$

28. Option D

$$\text{Total production by company D} = 60+110 = 170 \text{ tonnes}$$

$$\text{Total production by company B} = 40+60 = 100 \text{ tonnes}$$

$$\text{Total production by company D is } 170 \% \text{ that of company B. } (170/100)*100$$

29. Option D

$$\text{Total cattle in Denmark} = 1200000$$

$$\text{So, cows in Denmark} = 1200000 \times \frac{26}{100} = 312000$$

$$\text{Cows in Spain} = 312000 \times \frac{5}{3} = 520000$$

$$\text{So, total cattle in Spain} = 520000 \times \frac{100}{30} = 1733333.3 \\ = 1733333 = 17.3 \text{ lakh}$$

30. Option D

The difference between the number of Camels and that of Goats in Spain =

$$1000000 (16 - 8) \times \frac{1}{100} = 80000$$

31. Option A

$$\text{The total number of other animals in Denmark after 2 years} = 1.5 [1 + \frac{10}{100}]^2 \\ \text{lakh} = 181500$$

32. Option E

$$\text{The total number of buffaloes two years ago in Spain} = \frac{25}{(1 + \frac{5}{100})^2} = 226757.38 = 226757$$

## 33. Option B

The total number of Goats in Spain = 50000

$$\text{The total number of Goats in Denmark} = 50000 \times \frac{3}{2} = 75000$$

$$\text{Total number of cattle in Denmark} = 75000 \times \frac{100}{12} = 625000$$

## 34. Option A

$$\text{Quantity of Guava at Shop A} = 1200 \times \frac{10}{100} = 120 \text{ kg}$$

$$\text{Quantity of Guava at Shop B} = 1000 \times \frac{16}{100} = 160 \text{ kg}$$

$$\text{So, required difference} = 160 - 120 = 40 \text{ kg}$$

## 35. Option B

$$\text{Cost of Mango at Shop A} = 30 \times 1200 \times \frac{24}{100} = \text{Rs.}8640$$

$$\text{Cost of apple} = 40 \times 1200 \times \frac{16}{100} = \text{Rs.}7680$$

$$\text{Cost of Orange} = 20 \times 1200 \times \frac{20}{100} = \text{Rs.}4800$$

$$\text{So, required ratio} = 8640 : 7680 : 4800 \\ = 9 : 8 : 5$$

## 36. Option C

$$\text{Quantity of Mango at Shop B} = 1000 \times \frac{24}{100} = 240 \text{ kg}$$

$$\text{Quantity of Mango at Shop A} = 1200 \times \frac{24}{100} = 288 \text{ kg}$$

$$\text{So, required \%} = 288 \times \frac{100}{240} = 120\% \text{ of the quantity of Mango at Shop A}$$

## 37. Option D

Cost of total fruits at Shop A = Cost of Mango + Cost of Apple + Cost of Guava  
+ cost of orange + cost of other fruits

$$(1200 \times \frac{24}{100} \times 30 + 1200 \times \frac{16}{100} \times 40 + 1200 \times \frac{10}{100} \times 18 + 1200 \times \frac{20}{100} \times 20 + 1200 \times \frac{30}{100} \times 15) \\ = 8640 + 7680 + 2160 + 4800 + 5400 = \text{Rs.}28680$$

$$\text{Cost of total fruits at Shop B} = (1000 \times \frac{24}{100} \times 30 + 1000 \times \frac{14}{100} \times 40 + 1000 \times \frac{16}{100} \times 18 + 1000 \times \frac{20}{100} \times 20 + 1000 \times \frac{26}{100} \times 15) \\ = 7200 + 5600 + 2880 + 4000 + 3900 = \text{Rs.}23580$$

$$\text{So, required difference} = 28680 - 23580 = \text{Rs.}5100$$

## 38. Option E

Quantity of Orange at Shop A =  $1200 \times \frac{20}{100} = 240$  kg

Quantity of Apple at Shop B =  $1000 \times \frac{14}{100} = 140$  kg

So, required % =  $\frac{240 \times 100}{140} \% = 171.42\%$  more than the quantity of Apple at Shop B.

39. Option C

Total domestic investment in 2011 =  $5000 + 3000 + 4000 + 2000 + 2500 + 1500 + 3500 =$  Rs.21500 Crore

Total foreign investment in 2011 =  $2000 + 1600 + 2800 + 3000 + 2000 + 2500 + 1000 =$  Rs.14900 Crore

So, required difference =  $21500 - 14900 =$  Rs.6600 Crore

40. Option D

Total investment in Metals =  $4000 + 2800 + 3500 + 2000 + 3200 + 2200 + 1500 + 500 =$  Rs.19700 Crore

Total investment in Machinery =  $2000 + 3000 + 2500 + 3000 + 3600 + 6000 + 1000 + 1500 =$  Rs.22600 Crore

So, required ratio =  $19700 : 22600 = 197 : 226$

41. Option A

$$\begin{aligned} & \text{Average domestic investment in 2014} \\ & \frac{6000 + 4000 + 1500 + 1000 + 4000 + 1200 + 2000}{7} \\ & = \frac{19700}{7} = \text{Rs.2814.28 Crore} \end{aligned}$$

42. Option E

Domestic investment in 2013 =  $4000 + 5000 + 3200 + 3600 + 3000 + 1500 + 2400 =$  Rs.22700 Crore

Foreign investment in 2011 =  $2000 + 1600 + 2800 + 3000 + 2000 + 2500 + 1000 =$  Rs.14900 Crore

$$= \frac{22700 \times 100}{14900} = 152.3\%$$

43. Option B

Average domestic investment in 2011 = Rs.  $\frac{21500}{7}$  Crore

Average investment in transport =

$$\frac{2500 + 2000 + 1500 + 3200 + 3000 + 1600 + 4000 + 1000}{4} = \text{Rs.4700 Crore}$$

$$\text{So, required \%} = \frac{21500}{7 \times 4700} \times 100 = 65.34\%$$

Total members = 64

$$\text{Males} = 64 \times \frac{3}{4} = 48, \text{ Females} = (64 - 48) = 16$$

$$\text{Male congress members} = 48 \times \frac{2}{3} = 32$$

$$\text{Male BJP members} = (48 - 32) \times \frac{75}{100} = 12$$

$$\text{Female BJP members} = 16 \times \frac{3}{4} = 12$$

Female BSP members = 2

$$\text{Female SP members} = 16 - (12 + 2) = 2$$

44. Option E

Number of male members who do not belong either to congress or to BJP =  
 $48 - (32 + 12) = 4$

45. Option C

Ratio of female SP members to female BJP members =  $2 : 12 = 1 : 6$

46. Option D

$$\text{Required \%} = \frac{12 \times 100}{12} = 100\%$$

47. Option E

The difference between the working females in Bangalore and the working males in Chennai =  $32.5 - 22.5 = 10$  lakh

48. Option B

$$\text{Income per working person} = \frac{\text{Total income of city}}{\text{Number of working people in city}}$$

$$\text{Income per working person in Delhi} = \frac{200 \text{ Crore} \times \frac{36}{100}}{(30+25)\text{lakh}} = \frac{720000000}{5500000} = \text{Rs.}130.9$$

$$\text{In Chennai} = \frac{200 \times \frac{16}{100}}{(22.5+17.5)\text{lakh}} = \text{Rs.}80.$$

$$\text{In Mumbai} = \frac{200 \times \frac{20}{100}}{(35+30)\text{lakh}} = \text{Rs.}61.53.$$

$$\text{In Kolkata} = \frac{200 \times \frac{14}{100}}{(30+32.5)\text{lakh}} = \text{Rs.}44.8.$$

$$\text{In Bangalore} = \frac{200 \times \frac{10}{100}}{(25+32.5)\text{lakh}} = \text{Rs.}34.78.$$

$$\text{In Jaipur} = \frac{200 \times \frac{4}{100}}{(17.5+25)\text{lakh}} = \text{Rs.}18.82.$$

The income per working person in Jaipur is the minimum.

49. Option D

$$\text{Average number of working males} = \frac{1}{6} \times (30 + 22.5 + 35 + 30 + 25 + 17.5) = 26.66 \text{ lakh}$$

$$\text{Average number of working females} = \frac{1}{6} \times (25 + 17.5 + 30 + 32.5 + 32.5 + 25) = 27.08 \text{ lakh}$$

$$\text{So, required sum} = 26.66 + 27.08 = 53.75 \text{ lakh}$$

50. Option A

$$\text{Total income of Delhi} = \left[ 200 \times \frac{36}{100} \right] = \text{Rs.72 Crore}$$

$$\text{Income per person} = \frac{72 \text{ Crore}}{55 \text{ Lac}} = \text{Rs.130.9}$$

$$\text{So, required difference of income} = 5 \text{ lakh} \times 130.9 = \text{Rs.654.5 lakh} \\ = \text{Rs.6.545 Crore}$$

51. Option C

$$\text{Required \%} = \frac{30}{25} \times 100 = 120\%$$

52. Option E

$$\text{Required \%} = \frac{20}{60} \times 100 = 33.3\% \text{ of electrification of villages in Tripura in the year 2014}$$

53. Option D

Number of villages in Assam where electrification was done in 2013 = 40

Number of villages in Manipur where electrification was done in 2013 = 50

So, required ratio = 4 : 5

54. Option C

In Assam, the number of villages where electrification was done =  $30 + 40 + 30 = 100$

In Manipur =  $40 + 50 + 60 = 150$

In Tripura =  $40 + 50 + 60 = 150$

In Nagaland =  $40 + 20 + 50 = 110$

So, maximum electrification in both Tripura and Manipur.

55. Option B

Total number of villages in four states where electrification was done =  $100 + 150 + 150 + 110 = 510$

So, cost of electrification =  $7500000 \times 510 = \text{Rs.}3825000000$

56. Option A

Number of villages where electrification was done in 2012 =  $50 + 30 + 60 + 40 = 180$

Number of villages where electrification was done in 2013 =  $20 + 40 + 50 + 50 = 160$

Number of villages where electrification was done in 2014 =  $40 + 30 + 40 + 60 = 170$

In 2012 maximum electrification work was done.

57. Option C

A is a triangle

So, area of A =  $\frac{1}{2} \times 16 \times 12 = 96 \text{ sqm}$

So, cost of flooring of A =  $96 \times 50 = \text{Rs.}4800$

58. Option A

Perimeter of B =  $2(10 + 20) = 60 \text{ m}$

So, cost of fencing of B =  $60 \times 15 = 900$

Perimeter of C =  $4 \times 15 = 60 \text{ m}$

So, cost of fencing of C =  $60 \times 18 = \text{Rs.}1080$

So, required difference =  $1080 - 900 = \text{Rs.}180$

59. Option D

Area of D = Base  $\times$  Height

=  $20 \times 12 = 240 \text{ m}^2$

So, cost of flooring of D =  $240 \times 60 = \text{Rs.}14400$

Perimeter of D =  $2(20 + 12) = 64 \text{ m}$

So, cost of fencing of D =  $64 \times 25 = \text{Rs.}1600$

So, required ratio =  $14400 : 1600 = 9 : 1$

60. Option D

Perimeter of E =  $2\pi r = 2 \times \frac{22}{7} \times 10 = \frac{440}{7} \text{ m}$

Cost of fencing of E =  $\frac{440}{7} \times 22 = \text{Rs.}1382.85$

Area of C =  $(15)^2 = 225 \text{ m}^2$

So, cost of flooring of C =  $225 \times 40 = \text{Rs.}9000$

So, required % =  $\frac{1382.85 \times 100}{9000}$

= 15.36% of flooring cost of C.

61. Option B

Fencing cost of C = Rs.1080

Fencing cost of D = Rs.1600

$$\text{Required \%} = \frac{1080}{1600} \times 100 = 67.5\%$$

62. Option A

$$\text{Required percentage} = \frac{100}{270} \times 100 = 37.03\%$$

63. Option A

$$\text{Speed of Train A} = \frac{1280}{10:20 \text{ am} - 5:00 \text{ pm}}$$

$$= \frac{1280}{17 \text{ hours } 20 \text{ minutes}} \\ = \frac{1280 \times 3}{52} = 73.84 \text{ kmph}$$

$$\text{Speed of train B} = \frac{1280}{12:00 \text{ noon} - 6:00 \text{ pm}} \\ = \frac{1280}{18} \text{ hours} = 71.11 \text{ kmph}$$

So, difference between the speed of train A and train B =  $73.84 - 71.11 = 2.73$  kmph

64. Option B

$$\text{Total passengers in train A} = 400 + 100 + 90 + 300 + 150 = 1040$$

$$\text{Total passengers in train B} = 300 + 150 + 270 + 50 + 100 = 870$$

$$\text{So, required ratio} = 1040 : 870 = 104 : 87$$

65. Option E

$$\text{Total income of train A} = (400 \times 50) + (500 \times 70) + (590 \times 280) + (890 \times 100) + (1040 \times 120) = \text{Rs.}434000$$

$$\text{Total income of train B} = (300 \times 120) + (450 \times 100) + (620 \times 280) + (670 \times 70) + (770 \times 50) = \text{Rs.}340000$$

$$\text{So, required \%} = \frac{434000 \times 100}{340000} \\ = 127.64\% \text{ of the total income of train B.}$$

66. Option C

If the average speed of train A increases by 10%

$$\text{then its new speed} = 73.84 \times \frac{110}{100} \\ = 81.22 \text{ kmph}$$

$$\text{Time taken by train A during the journey} = \frac{1280}{81.22} = 15.75 \text{ hours} = 15 \text{ hours } 45 \text{ minutes}$$

The time when the train will reach its destination = 5 pm + 15 hours 45 minutes  
 = 8:45 am

67. Option C

The number of people who died in train accidents in 2013 =  $400 + 500 + 600 + 700 = 2200$

The number of people who died in train accidents in 2011 =  $100 + 200 + 600 + 700 = 1600$

$$\text{So, required \%} = \frac{(2200 - 1600) \times 100}{1600} = 37.5\%$$

68. Option C

$$\begin{aligned} \text{Average number of people who died in train accidents in all states in 2008} &= \frac{1}{4} \\ &\times (100 + 200 + 300 + 500) \\ &= \frac{1100}{4} = 275 \end{aligned}$$

69. Option B

The number of deaths in train accidents in Bihar =  $100 + 300 + 300 + 200 + 500 + 600 + 400 = 2400$

Similarly, in UP =  $500 + 600 + 500 + 700 + 600 + 700 + 600 = 4200$

In Maharashtra =  $200 + 400 + 100 + 100 + 300 + 400 + 300 = 1800$

In Odisha =  $300 + 200 + 700 + 600 + 400 + 500 + 200 = 2900$

In UP the number of people who died in train accidents is the maximum.

**Quicker method** it is clear from the graph that the highest number of people died in UP.

70. Option D

The number of train accidents in 2014 =  $200 \times \frac{18}{100} = 36$

The number of train accidents in 2012 =  $200 \times \frac{14}{100} = 28$

$$\text{So, required difference} = 36 - 28 = 8$$

71. Option E

The ratio of the number of deaths in 2010 to that in 2014 =  $(100 + 300 + 500 + 700) : (200 + 300 + 400 + 600) = 1600 : 1500 = 16 : 15$

72. Option B

$$\text{Productivity} = \frac{\text{Total production}}{\text{Area of agricultural land}}$$

$$\text{Productivity of UP} = \frac{(35+30+25) \times 1000}{2 \text{ lakh} \times \frac{30}{100}} = \frac{90000}{60000} = 1.5 \text{ tonnes per sq km}$$

$$\text{Productivity of MP} = \frac{(30+32.5+27.5) \times 1000}{2 \text{ lakh} \times \frac{25}{100}} = \frac{90000}{50000} = 1.8 \text{ tonne per sq km}$$

$$\text{Productivity of Bihar} = \frac{(22.5+25+27.5) \times 1000}{2 \text{ lakh} \times \frac{20}{100}} = \frac{75000}{40000} = 1.875 \text{ tonnes per sq km}$$

$$\text{Productivity of Odisha} = \frac{(22.5+15+10) \times 1000}{2 \text{ lakh} \times \frac{5}{100}} = \frac{47.5 \times 1000}{10000} = 4.75 \text{ tonnes per sq km}$$

$$\text{Productivity of Haryana} = \frac{(25+35+30) \times 1000}{2 \text{ lakh} \times \frac{8}{100}} = \frac{90000}{16000} = 5.625 \text{ tonnes per sq km}$$

$$\text{Productivity of Punjab} = \frac{(40+30+35) \times 1000}{2 \text{ lakh} \times \frac{12}{100}} = \frac{105000}{24000} = 4.375 \text{ tonnes per km}^2$$

So, productivity of Haryana is the maximum

73. Option E

Production of Punjab is maximum = 105000 tonnes

74. Option C

Production of Wheat in Punjab = 40000 tonnes

Production of Maize in Odisha = 10000 tonnes

$$\text{So, required \%} = \frac{40000 - 10000}{10000} \times 100\% = 300\%$$

75. Option D

The ratio of production of Rice in Bihar to the production of Wheat in Haryana  
= 25000 tonnes : 25000 tonnes = 1 : 1

76. Option A

Income of MP from export of 40% of Rice at the rate of Rs.30 per kg = 32500  
 $\times \frac{40}{100} \times 1000 \times 30 = \text{Rs.39 Crore}$

Income of UP from export of 30% of Rice at the rate of Rs.32 per kg = 30000 ×  
 $1000 \times \frac{30}{100} \times 32 = \text{Rs.28.8 Crore}$

So, required ratio = 39 : 28.8 = 390 : 288 = 65 : 48

77. Option C

Expenditure of Company B = 60 lakh

Income of Company B = 60 lakh  $\times \frac{180}{100} = 108 \text{ lakh} = 1 \text{ Crore } 8 \text{ lakh}$

Income of Company A =  $10800000 \times \frac{4}{5} = \text{Rs.8640000}$

So, required difference =  $10800000 - 8640000 = \text{Rs.2160000}$

78. Option A

Total expenditure on the employees of Company A =  $5000000 \times \frac{28}{100} =$   
Rs.1400000

Average salary of the employees =  $\frac{1400000}{100} =$  Rs.14000

79. Option A

Tax paid by Company A : Tax paid by Company B  
 $= 5000000 \times \frac{14}{100} : 6000000 \times \frac{6}{100} = 700000 : 360000 = 35 : 18$

80. Option B

Difference =  $6000000 \times \frac{34}{100} - 5000000 \times \frac{28}{100} = 2040000 - 1400000 =$   
Rs.640000

81. Option E

Expenditure on Machine and Electricity of Company B =  $6000000 \times \frac{18}{100} =$   
Rs.1080000 = 10.8 lakh

Expenditure on Machine and Electricity of Company A =  $5000000 \times \frac{12}{100} =$   
Rs.600000 = 6 lakh

So, required % =  $\frac{1080000 - 600000}{600000} \times 100\% =$   
 $= \frac{48}{60} \times 100\% = 80\%$

Hence, expenditure of Company B is 80% more than Company A.

82. Option C

Total number of volcanic eruptions in the year 2009 =  $20 + 60 + 20 + 60 + 60 + 120 = 340$

Total number of volcanic eruptions in the year 2011 =  $100 + 120 + 120 + 20 + 40 + 60 = 460$

So, required ratio =  $340 : 460 = 17 : 23$

83. Option D

Total number of volcanic eruptions in Japan during the given four years =  $60 + 100 + 120 + 140 = 420$

Total number of volcanoes in Japan =  $1000 \times \frac{34}{100} = 340$

So, required % =  $\frac{420 \times 100}{340} = 123.52\%$

84. Option B

Difference between the number of volcanoes in Indonesia and the number of volcanoes in Morocco =  $1000 \times \frac{20}{100} - 1000 \times \frac{10}{100} = 200 - 100 = 100$

85. Option D

Total number of volcanic eruptions in Chile =  $40 + 60 + 80 + 120 = 300$

Total number of volcanic eruptions in USA =  $20 + 60 + 80 + 100 = 260$

$$\text{So, required \%} = \frac{300 \times 100}{260} = 115.38\%$$

Hence, volcanic eruptions in Chile is 115.38% of the total number of volcanic eruptions in USA.

86. Option C

Total volcanoes in Newzealand =  $1000 \times \frac{12}{100} = 120$

Total number of volcanic eruptions in Newzealand =  $40 + 60 + 80 + 120 = 300$

So, required ratio =  $120 : 300 = 2 : 5$

87. Option D

Selling price of Ghee = Rs.120 per kg

Profit = 10%

So, total cost price =  $120 \times \frac{100}{110} = \text{Rs.}109.09$

So, cost of packing = Cost price - Cost of production - Cost of transportation  
 $= 109.09 - 80 - 8 = \text{Rs.}21.09$

88. Option C

Selling price of Rice =  $40 \times \frac{105}{100} = \text{Rs.}42$

Selling price of Sugar =  $45 + 5 + 50 = \text{Rs.}100$

So, required difference =  $100 - 42 = 48$

89. Option E

Selling price of Pulse = Rs.90

Loss = 6%

Total cost price =  $90 \times \frac{100}{94} = \text{Rs.}95.74$

So, cost of packaging of pulse = Total cost price - Cost of production - Cost of transportation =  $95.74 - 70.10 = \text{Rs.}15.74$

90. Option A

Cost price of Rice = Rs.40

Selling price of Milk =  $40 \times \frac{80}{100} = \text{Rs.}32$

Cost price of Milk = Cost of production + transportation + packaging =  $20 + 3 + 2 = \text{Rs.}25$

$$\text{So, \% profit} = \frac{32 - 25}{25} \times 100 = 28\%$$

91. Option C

Cost price of 4 kg Ghee + 3 kg Rice + 5 kg Milk

$$= [4 \times (80 + 8) + 3 \times 40 + 5 \times (20 + 3)]$$

$$= 352 + 120 + 115 = \text{Rs.} 587$$

Selling price of 4 kg Ghee + 3 kg Rice + 5 kg Milk =  $4 \times 120 + 3 \times 42 + 5 \times 32$

$$= 480 + 126 + 160 = \text{Rs.} 766$$

$$\text{So, \% profit} = \frac{766 - 587}{587} \times 100 = 30.49\%$$

92. Option C

Total books = 960

$$\text{Number of Hindi books} = 960 \times \frac{40}{100} = 384$$

$$\text{Number of English books} = 960 \times \frac{1}{4} = 240$$

$$\text{Number of books in other languages} = 960 - (384 + 240) = 336$$

$$\text{Number of Hindi novels} = 384 \times \frac{1}{4} = 96$$

$$\text{Number of Hindi epics} = 384 \times \frac{50}{100} = 192$$

$$\text{Number of English novels} = 240 \times \frac{1}{3} = 80$$

$$\text{Number of English epics} = 240 \times \frac{40}{100} = 96$$

$$\text{Number of Hindi books that are neither novels nor epics} = 384 - (96 + 192) = 96$$

$$\text{Number of English books that are neither epics nor novels} = 240 - (80 + 96) = 64$$

$$\text{Required ratio} = 96 : 64 = 3 : 2$$

93. Option D

Number of books in other languages = 336

94. Option C

Difference between Hindi novels and English epics =  $96 - 96 = 0$

95. Option E

$$\text{Average temperature of Durban} = \frac{(20+21+22+25+28)}{5} = 23.2^\circ\text{C}$$

$$\text{Average temperature of Quito} = \frac{(15+16+18+20+22)}{5} = 18.2^\circ\text{C}$$

$$\text{So, required difference} = (23.2^\circ - 18.2^\circ\text{C}) = 5^\circ\text{C}$$

96. Option C

$$\text{Average temperature in May} = \frac{(28^\circ + 22^\circ + 14^\circ + 18^\circ + 38^\circ)C}{5} = 24^\circ\text{C}$$

$$\text{Average temperature in Feb.} = \frac{(21^\circ + 16^\circ + 18^\circ + 20^\circ + 30^\circ)C}{5} = 21^\circ\text{C}$$

$$\text{So, required difference} = (24^\circ\text{C} - 21^\circ\text{C}) = 3^\circ\text{C}$$

97. Option B

$$\text{Average temperature of Riyadh} = \frac{(35^\circ + 30^\circ + 32^\circ + 36^\circ + 38^\circ)C}{5} = 34.2^\circ\text{C}$$

$$\text{Average temperature of Columbus} = \frac{(20^\circ + 18^\circ + 16^\circ + 15^\circ + 14^\circ)C}{5} = 16.6^\circ\text{C}$$

$$\text{So, required \%} = \frac{34.2^\circ - 16.6^\circ}{16.6^\circ} \times 100\%$$

$$= 106.02\%$$

106% more than average temperature of Columbus

98. Option B

$$\text{Average temperature of Lisbon} = \frac{(22^\circ + 20^\circ + 22^\circ + 25^\circ + 18^\circ)C}{5} = 21.4^\circ\text{C}$$

$$\text{Average temperature of Quito} = \frac{15^\circ + 16^\circ + 18^\circ + 20^\circ + 22^\circ}{5} = 18.2^\circ\text{C}$$

$$\text{So, required ratio} = 21.4 : 18.2 = 107 : 91$$

99. Option D

$$\text{Average temperature in May} = 24^\circ\text{C}$$

$$\text{Average temperature in March} = \frac{22^\circ + 18^\circ + 16^\circ + 22^\circ + 32^\circ}{5} = 22^\circ\text{C}$$

$$\text{So, average temperature in May is } \frac{24 \times 100}{22} = 109.09\% \text{ of average temperature in March}$$

100. Option A

$$\text{Production of Steel in India} = 1000 \text{ tonnes}$$

$$\text{Productivity of Steel in India} = \frac{1000}{800} = 1.25 \text{ tonnes per factory}$$

$$\text{Production of Steel in Pakistan} = 1000 \times \frac{3}{5} = 600 \text{ tonnes}$$

$$\text{Productivity of Steel in Pakistan} = \frac{600}{600} = 1 \text{ tonne per factory}$$

$$\text{So, required ratio} = 1.25 : 1 = 125 : 100 = 5 : 4$$

101. Option E

$$\text{Total factories in India} = 300 + 500 + 500 + 700 + 800 = 2800$$

$$\text{Total factories in Pakistan} = 500 + 400 + 700 + 500 + 600 = 2700$$

$$\text{So, required difference} = 2800 - 2700 = 100$$

102. Option C

$$\text{Total number of Cotton factories in Pakistan} = 400$$

Total number of Cement factories in India = 700

So, required % =  $\frac{400 \times 100}{700} = 57.14\%$  of the number of Cement factories in India.

103. Option B

Production of Fertilizer in Pakistan =  $50 \times 700 = 35000$  tonnes

Export of Pakistan is 40% of its production. Then, the Fertilizer used by Pakistan itself =  $35000 \times \frac{60}{100} = 21000$  tonnes

Production of Fertilizer in India =  $60 \times 500 = 30000$  tonnes

India exports 30% of its production

So, Fertilizer used by India itself =  $30000 \times \frac{70}{100} = 21000$  tonnes

So, required difference =  $21000 - 21000 = 0$  tonne

104. Option B

Productivity of Cement = Production per factory

Productivity of Cement in India =  $\frac{24500}{700} = 35$  tonnes

Productivity of Cement in Pakistan =  $\frac{14500}{500} = 29$  tonnes

So, required difference =  $35 - 29 = 6$  tonnes

105. Option D

Number of soldiers in Jat regiment =  $10000 \times \frac{35}{100} = 3500$

Number of Hindu soldiers in Jat regiment =  $3500 \times \frac{4}{5} = 2800$

106. Option B

Number of Hindu soldiers in Madras regiment =  $10000 \times \frac{15}{100} \times \frac{2}{3} = 1000$

Number of soldiers of other religions in Bihar regiment =  $10000 \times \frac{12}{100} \times \frac{3}{8} = 450$

So, difference =  $1000 - 450 = 550$

107. Option D

Number of Hindu soldiers in Sikh regiment =  $10000 \times \frac{20}{100} \times \frac{3}{8} = 750$

Number of soldiers of other religions in Maratha regiment =  $10000 \times \frac{18}{100} \times \frac{2}{5} = 720$

So, required % =  $\frac{750 \times 100}{720} = 104.16\%$

108. Option A

Number of non-Hindu soldiers in Jat regiment =  $3500 - 2800 = 700$

Similary in Sikh regiment =  $10000 \times \frac{10}{100} \times \frac{5}{8} = 125$

In Madras regiment =  $10000 \times \frac{15}{100} \times \frac{1}{3} = 500$

In Maratha regiment =  $10000 \times \frac{18}{100} \times \frac{2}{5} = 720$

In Bihar regiment =  $10000 \times \frac{12}{100} \times \frac{2}{8} = 450$

In Maratha regiment the number of non-Hindu soldiers is the maximum.

109. Option E

Number of Hindu soldiers in Bihar regiment =  $10000 \times \frac{12}{100} \times \frac{5}{8} = 750$

Number of non-Hindu soldiers in Jat regiment = 700

So, required ratio =  $750 : 700 = 15 : 14$

110. Option D

Passengers deboarding the train at Nagpur = Total passengers boarding at various stations from Delhi to Itarsi – Total passengers deboarding the train at various stations from Mathura to Itarsi =  $(500 + 200 + 350 + 250 + 180 + 150) - (80 + 50 + 100 + 200 + 150) = 1630 - 580 = 1050$

111. Option A

Total fare of family = fare of adults + fare of children =  $4 \times 425 + 4 \times 425 \times \frac{55}{100} = 1700 + 935 = \text{Rs.}2635$

112. Option C

Speed of train from Delhi to Jhansi =  $\frac{400}{11:45 - 5:45} = \frac{400}{6} = 66.67 \text{ kmph}$

Speed of train from Jhansi to Nagpur =  $\frac{1350}{12:00 \text{ night} - 12:00 \text{ noon}} = \frac{950}{12} = 76.16 \text{ kmph}$

So, required difference =  $79.16 - 66.67 = 12.50 \text{ kmph}$

113. Option E

Total travel time = 12:00 noon - 5:45 pm (one day before) = 18 hours 15 minutes =  $18 + \frac{15}{60} \text{ hours} = \frac{73}{4} \text{ hours}$

Total halt time =  $5 + 5 + 15 + 7 + 13 = 45 \text{ minutes}$

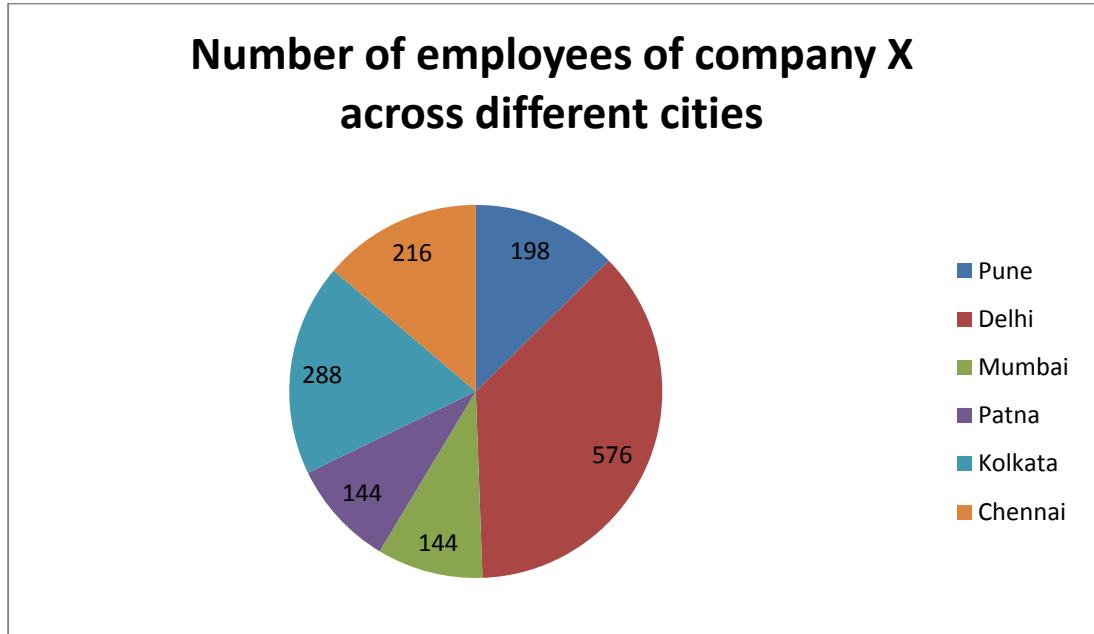
Total halt time is  $\frac{45}{60} = \frac{3}{4} \text{ hours}$

So, required % =  $\frac{3}{4} \times \frac{4}{73} \times 100 = 4.10\% \text{ of the total travel time.}$

114. Option B

$$\begin{aligned}
 \text{Total revenue between Agra to Itarsi} &= (\text{Fare of Railway from Agra to Itarsi} \times \\
 &\text{Number of passengers between stations}) = \text{Total revenue from Agra to Jhansi} + \\
 &\text{Total revenue from Jhansi to Bhopal} + \text{Total revenue from Bhopal to Itarsi} = \\
 &(500 + 200 + 350 - 80 - 50) \times (250 - 130) + (500 + 200 + 350 + 250 - 100 - 80 - \\
 &50) \times (375 - 250) + (500 + 200 + 350 + 250 + 180 - 200 - 100 - 50 - 80) \times (425 \\
 &- 375) \\
 &= [(920 \times 120) + (1070 \times 125) + (1050 \times 50)] \\
 &= [110400 + 133750 + 52500] = \text{Rs.}296650
 \end{aligned}$$

dfg



115. Option E

$$\text{Required no. of male employees in Delhi} = 576 \times \frac{75}{100} = 432$$

116. Option A

$$\text{Total no. of employees in Patna} = 144 + \frac{2}{9} \times 216 = 144 + 48 = 192$$

117. Option A

$$\text{Required percentage} = \frac{288}{378} \times 100 = 76\%$$

118. Option D

119. Option C

$$\text{Required ratio} = 144 : 576 = 1 : 4$$

120. Option B

$$\text{Total users of brand B across five cities} = 600 + 500 + 650 + 700 + 550 = 3000$$

121. Option C

$$\text{Brand A users in city T} = 700$$

$$\text{Brand B users in city Q} = 500$$

$$\text{Required \%} = \frac{700}{500} \times 100 = 140\%$$

122. Option C

$$\text{Total users of brand A across five cities} = 500 + 550 + 600 + 550 + 700 = 2900$$

$$\text{Average} = \frac{2900}{5} = 580$$

123. Option D

$$\text{Brand A and B users in city R} = 600 + 650 = 1250$$

$$\text{Brand A and B users in city P} = 500 + 600 = 1100$$

$$\text{Required difference} = 1250 - 1100 = 150$$

124. Option A

$$\text{Brand A users in city P} = 500$$

$$\text{Brand B users in city S} = 700$$

$$\text{Ratio} = \frac{500}{700} = \frac{5}{7} = 5 : 7$$

125. Option B

$$\text{Tickets sold of play T at auditorium A} = 400$$

$$\text{Tickets sold of play P at auditorium A} = 200$$

$$\text{Required \%} = \frac{400}{200} \times 100 = 200\%$$

126. Option D

$$\text{Tickets sold of play Q at auditorium A and B} = 350 + 400 = 750$$

$$\text{Tickets sold of play R at auditorium A and B} = 250 + 350 = 600$$

$$\text{Total tickets} = 750 + 600 = 1350$$

127. Option B

Tickets sold of play P at auditorium B = 300

Tickets sold of play Q at auditorium B = 400

$$\text{So, required ratio} = \frac{300}{400} = \frac{3}{4} = 3 : 4$$

128. Option C

Total tickets of all plays at auditorium A =  $200 + 350 + 250 + 300 + 400 = 1500$

Total tickets of all plays at auditorium B =  $300 + 400 + 350 + 350 + 250 = 1650$

So, required difference =  $1650 - 1500 = 150$

129. Option C

Tickets of play S and T at auditorium B =  $350 + 250 = 600$

$$\text{Average} = \frac{600}{2} = 300$$

130. Option A

$$\text{Required ratio} = \frac{\text{Sales values of book P across all book stores}}{\text{Sales values of book S across all book stores}} = \frac{4150}{2750} = \frac{83}{55} = 83:55$$

131. Option E

$$\begin{aligned}\text{Required percentage} &= \frac{\text{Sale of book R from bookstore H}}{\text{Sale of book R across all bookstores}} \times 100 \\ &= \frac{410}{3800} \times 100 = 10.789 = 10.79\%\end{aligned}$$

132. Option A

$$\text{Average sale of bookstore E} = \frac{2510}{5} = 502$$

133. Option A

$$\text{Required percentage (approx.)} = \frac{890}{2610} \times 100 = 34.09 = 34\% \text{ (approx.)}$$

134. Option D

Total sales value of bookstore D = 2070

135. Option A

$$\text{Ratio} = \frac{\text{Students studying in institute A}}{\text{Students studying in institute H}} = \frac{2080}{2360}$$

$$\text{Ratio} = \frac{52}{59} = 52 : 59$$

136. Option E

Students studying in course Q in institute B = 540

Students studying in institute C = 2700

$$\text{Required percentage} = \frac{540}{2700} \times 100 = 20\%$$

137. Option B

Total number of students studying in course T = 3280

138. Option C

Students studying in course P in institute A = 520

Students studying in institute A = 2080

$$\text{Required percentage} = \frac{520}{2080} \times 100 = 25\%$$

139. Option B

Number of students studying in institute D = 2130

Total number of courses in institute D = 5

$$\text{Average} = \frac{2130}{5} = 426$$

sdg

Department	Male	Female	Total
Accounts	300	240	540
HR	40	320	360
Marketing	530	280	810
Customer relation	590	400	990
Administrative	160	200	360
Design	880	560	1440
Total	2500	2000	4500

140. Option E

$$\text{Aggregate \%} = \frac{280 \times 100}{1800} = 15.5\% = 16\%$$

141. Option C

$$\text{Required \%} = \frac{2000 \times 100}{2500} = 80\%$$

142. Option C

Males in HR department = 40

Males in Accounts department = 300

$$\text{Ratio} = \frac{40}{300} = \frac{2}{15} = 2 : 15$$

143. Option B

$$\begin{aligned}\text{Total males in Design, Customer Relation and HR department} &= 880 + 590 + 40 \\ &= 1510\end{aligned}$$

144. Option A

$$\text{Employees in Administrative department} = 360$$

$$\text{Males in Administrative department} = 160$$

$$\text{Ratio} = \frac{360}{160} = \frac{9}{4} = 9 : 4$$

145. Option A

$$\text{Males in Bank D} = 534 + 478 + 235 + 255 + 124 + 358 = 1984$$

$$\text{Females in Bank D} = 454 + 285 + 235 + 175 + 165 + 234 = 1548$$

$$\text{Respective ratio} = 1984 : 1548 = 496 : 387$$

146. Option C

$$\text{Males in Patna from Bank A, C and E} = 234 + 350 + 124 = 708$$

$$\text{Females in Patna from Bank A, C and E} = 120 + 234 + 334 = 688$$

$$\text{Respective ratio} = 708 : 688 = 177 : 172$$

147. Option B

$$\begin{aligned}\text{Average males in all banks in Kolkata} &= \frac{353 + 348 + 399 + 358 + 125 + 278}{6} \\ &= \frac{1861}{6} = 310.1 = 310\end{aligned}$$

148. Option A

$$\text{Females of all banks in Delhi} = 456 + 256 + 345 + 285 + 166 + 287 = 1795$$

$$\text{Males of all banks in Delhi} = 254 + 346 + 366 + 478 + 256 + 346 = 2046$$

$$\text{Approx \%} = \frac{1795 \times 100}{2046} = 87.73 = 88\%$$

149. Option B

$$\text{Females in Bank B from Agra} = 116$$

$$\text{Females in Bank C from Agra} = 500$$

$$\text{Required percentage} = \frac{116 \times 100}{500} = 23.2\%$$

150. Option C

$$\text{Average} = \frac{36 + 58 + 85 + 54 + 47 + 20}{6} = 50$$

151. Option E

Total males from college

$$L = 62 + 34 + 15 + 18 + 56 + 58 = 243$$

Total females from college

$$L = 65 + 14 + 58 + 56 + 65 + 86 = 344$$

$$\text{Required percentage} = \frac{243}{344} \times 100 = 70.63\% = 70\%$$

152. Option E

Total students in Economics from college P = 53 + 34 = 87

Total students in Psychology from college P = 21 + 96 = 117

$$\text{Ratio} = \frac{87}{117} = \frac{29}{39} = 29 : 39$$

153. Option E

Total females in Political Science from college K, N, and P = 56 + 86 + 35 = 177

Total males in Political Science from college K, N and P = 24 + 57 + 79 = 160

$$\text{Required percentage} = \frac{177}{160} \times 100 = 110.625\% = 110\%$$

154. Option C

Students in College M from all specializing = 572

sdf

States	Males	Females	Total
Madhya Pradesh	665	455	1120
Assam	985	455	1440
Maharashtra	1610	630	2240
Orissa	225	735	960
Kerala	325	875	1200
Karnataka	690	350	1040
Total	4500	3500	8000

155. Option B

$$\text{Ratio} = \frac{350}{875} = \frac{2}{5} = 2 : 5$$

156. Option D

Total male students from Maharashtra and Madhya Pradesh = 1610 + 665 = 2275

157. Option C

$$\text{Ratio} = \frac{985}{665} = \frac{197}{133} = 197 : 133$$

158. Option A

$$\text{Ratio} = \frac{350}{690} = \frac{35}{69} = 35 : 69$$

159. Option E

$$\text{Approx. \%} = \frac{455}{985} \times 100 = 46.19\% = 46\%$$

Number of students passed in five classes of a school over the years.

Years	Classes					Total
	VI	VII	VIII	IX	X	
2003	62	69	74	66	60	331
2004	50	71	77	73	54	325
2005	57	57	70	63	61	308
2006	63	55	65	67	75	325
2007	62	57	62	64	72	317
2008	60	69	79	75	67	350
2009	63	72	74	72	77	358
<b>Total</b>	<b>417</b>	<b>450</b>	<b>501</b>	<b>480</b>	<b>466</b>	<b>2314</b>

160. Option C

161. Option D

$$\text{Required average} = \frac{11 + 6 + 9 + 12 + 10 + 5 + 3}{7} = \frac{56}{7} = 8$$

162. Option B

$$\text{Required ratio} = 325 : 42$$

163. Option E

Total number of students appeared in class IX over the years =  $74 + 79 + 70 + 71 + 74 + 80 + 81 = 529$

$$\text{Required percentage} = \frac{480}{529} \times 100 = 90.74\%$$

164. Option A

165. Option B

Required number of members =  $300 + 300 + 100 + 100 = 800$

166. Option E

Required number of members =  $550 + 300 + 100 + 100 = 1050$

167. Option E

168. Option B

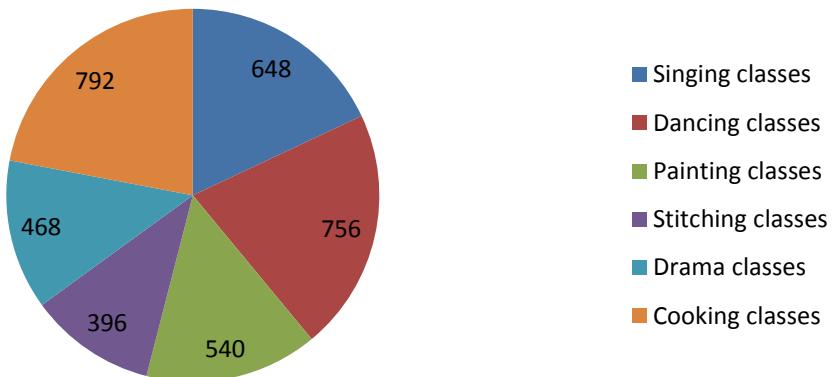
Required difference =  $300 - 100 = 200$

169. Option B

Required number of members =  $550 + 450 + 650 = 1650$

XCG

### Number of students enrolled in different Hobby classes in a School



170. Option B

Required percentage =  $\frac{792}{756} \times 100 = 104.76\%$

171. Option D

Required number of students =  $396 + 468 = 864$

172. Option E

$$\text{Required number of students} = 3600 \times \frac{15}{100} = 540$$

173. Option C

$$\text{Required percentage} = \frac{540}{648} \times 100 = 83.33 = 83\%$$

174. Option A

$$\begin{aligned}\text{Required ratio} &= 648 : 756 : 468 \\ &= 1404 : 468 = 3 : 1\end{aligned}$$

175. Option C

$$\text{Required ratio} = 35 : 40 = 7 : 8$$

176. Option E

$$\text{Average number} = \frac{280000}{6} = 46666.67$$

177. Option C

$$\text{Total number of students in year 2005} = 115$$

178. Option D

$$\text{Required difference} = 90 - 35 = 55 \text{ thousand} = 55000$$

179. Option A

$$\text{Total number of students} = 27000$$

180. Option C

$$\text{Required ratio} = 475 : 425 = 19 : 17$$

181. Option E

$$\text{Required average} = \frac{2325}{5} = 465 \text{ km}$$

182. Option B

$$\text{Required time} = \frac{475}{47.5} = 10 \text{ hours}$$

183. Option A

$$\text{Required percentage} = \frac{525}{900} \times 100 = 58\% \text{ (approx.)}$$

184. Option D

$$\text{Required percentage} = \frac{550}{8} = 68.75 \text{ km/hr}$$

185. Option E

$$\text{Required percentage} = \frac{25000}{172500} \times 100 = 14$$

186. Option C

$$\text{Required percentage} = \frac{20000}{55000} \times 100 = 36.36\%$$

187. Option A

$$\begin{aligned} \text{Total number of students failing in the entrance exam} &= 22500 + 35000 + 30000 \\ &+ 37500 + 20000 + 30000 = 175000 \end{aligned}$$

188. Option D

$$\text{Required average number of students} = \frac{57500}{2} = 28750$$

The number of candidates passed and failed in the various institute.

Ins.	A		B		C		D		E		F	
	Year	Pass	Fail	Pass								
2001	270	180	216	324	195	105	320	320	270	330	408	272
2002	260	260	301	129	210	140	248	372	406	174	392	168
2003	258	172	343	147	190	190	290	290	476	204	462	238
2004	260	140	450	150	315	135	450	150	432	288	546	234
2005	240	240	285	285	300	100	455	195	336	364	280	280
2006	220	330	270	180	340	160	450	300	225	225	390	260
2007	290	210	282	188	282	188	504	216	336	224	360	360

189. Option A

$$\text{Required number of students} = 220 + 270 + 340 + 450 + 225 + 390 = 1895$$

190. Option E

Total number of applying students =  $300 + 350 + 380 + 450 + 400 + 500 + 470 = 2850$

Total number of pass students =  $195 + 210 + 190 + 315 + 300 + 340 + 282 = 1832$

$$\text{Required percentage} = \frac{1832}{2850} \times 100 = 65\%$$

191. Option B

$$\begin{aligned}\text{Required ratio} &= 462 : 285 \\ &= 154 : 95\end{aligned}$$

192. Option D

Average number of students appeared from institute A =  $\frac{450+520+430+400+480+550+500}{7} = \frac{3330}{7}$

Average number of students appeared from institute D =

$$\frac{640+620+580+600+700+750+720}{7} = \frac{4610}{7}$$

$$\text{Required ratio} = \frac{3330}{7} : \frac{4610}{7} = 333 : 461$$

193. Option C

Total number of applying students in 2004 =  $400 + 600 + 450 + 600 + 720 + 780 = 3550$

Total number of pass students in 2004 =  $260 + 450 + 315 + 450 + 432 + 546 = 2453$

$$\text{Required percentage} = \frac{2453}{3550} \times 100 = 69$$

## Chapter - 17

# Calendar

### Leap Year :

A year, occurring once every four years, which has 366 days including 29 February as an intercalary day.

Eg. 1976, 1840 are leap year as they are divisible by 4

(2)= Each fourth century is a leap year , no other century is a year

Eg. 400, 800, 1200, 1600, 2000, 2400 are leap years, but 700, 1300, 1900 are not leap years

---

**Odd Days :** For a given number of days, number of days more than complete week are called odd days.

Eg. in 10 days, there is one week and 3 odd days.

### Counting of weeks and days in year:

(a) 1 ordinary year has 365 days = 52 weeks + 1 odd day

(b) 1 leap year has 366 days = 52 weeks + 2 odd days

### **Example 1:**

How many years have 29 days in February from 2001 to 2100

### **Solution:**

100<sup>th</sup> year is not a leap year. So 24 February's has 29 days.

### **Example 2:**

March 1<sup>st</sup> is Wednesday. Which month of the same year starts with the same day?

### **Solution:**

Month	March	April	May	June	July	Aug.	Sept.	Oct.
Odd days	3	2	3	2	3	3	2	3

Total 21 odd days.  $21/7 = 0$

### **Example 3:**

If Arun's birthday is on May 25 which is Monday and his sister's birthda is on July 13. Which day of the week is his siter's birthday?

**Solution:**

Reference day = May 25<sup>th</sup> Monday

Days from May 25<sup>th</sup> to July 13 = 6 + 30 + 13 = 49

Number of odd days = 49/7 = 0

**Exercise - 17**

1. January 1, 2008 is Tuesday. What day of the week lies on Jan. 1, 2009?  
a) Monday                  b) Wednesday                  c) Thursday  
d) Sunday                  e) None of these
  
2. The calendar for the year 2007 will be the same for the year :  
a) 2014                  b) 2016                  c) 2017  
d) 2018                  e) None of these
  
3. The last day of a century cannot be  
a) Monday                  b) Wednesday                  c) Tuesday  
d) Friday                  e) None of these
  
4. What was the day of the week on 4<sup>th</sup> June, 2002?  
a) Tuesday                  b) Wednesday                  c) Thursday  
d) Friday                  e) Saturday
  
5. What was the day of the week on 28<sup>th</sup> May 2006?  
a) Thursday                  b) Friday                  c) Saturday  
d) Sunday                  e) None of these
  
6. What was the day of the week on 17<sup>th</sup> June 1998?  
a) Monday                  b) Tuesday                  c) Wednesday  
d) Thursday                  e) None of these
  
7. On 8<sup>th</sup> Dec. 2007 Saturday falls. What day of the week was it on 8 Dec. 2006?  
a) Sun                  b) Thursday                  c) Tuesday  
d) Friday                  e) None of these
  
8. On 6<sup>th</sup> March 2005 Monday falls. What was the day of the week on 6<sup>th</sup> March 2004?  
a) Sunday                  b) Saturday                  c) Tuesday  
d) Wednesday                  e) None of these
  
9. It was Sunday on Jan. 1, 2006. What was the day of the week on Jan. 1, 2010?  
a) Sunday                  b) Saturday                  c) Friday  
d) Wednesday                  e) None of these
  
10. Today is Monday. After 61 days it will be

- a) Wednesday      b) Saturday      c) Tuesday  
 d) Thursday      e) None of these
11. On 8<sup>th</sup> Feb. 2005 it was Tuesday. What was the day of the week on 08<sup>th</sup> Feb. 2004?  
 a) Tuesday      b) Monday      c) Sunday  
 d) Wednesday      e) None of these
12. On what dates of April 2001 did Wednesday fall?  
 a) 1<sup>st</sup>, 2<sup>th</sup>, 15<sup>th</sup>, 22<sup>nd</sup>, 29<sup>th</sup>      b) 2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup>, 23<sup>rd</sup>, 30<sup>th</sup>  
 c) 3<sup>rd</sup>, 10<sup>th</sup>, 17<sup>th</sup>, 24<sup>th</sup>      d) 4<sup>th</sup>, 11<sup>th</sup>, 18<sup>th</sup>, 25<sup>th</sup>  
 e) None of these
13. Which of the following is not a leap year?  
 a) 700      b) 800      c) 1200  
 d) 200      e) None of these
14. January 1, 2007 was Monday. What day of the week lies on Jan. 1, 2008?  
 a) Monday      b) Tuesday      c) Wednesday  
 d) Sunday      e) None of these

**Solutions:**

1. Option C

The year 2008 is a leap year. So, it has 2 odd days.

1<sup>st</sup> day of the year 2008 is Tuesday (Given)

So, 1<sup>st</sup> day of the year 2009 is 2 days beyond Tuesday.

Hence, it will be Thursday.

2. Option D

Count the number of odd days from the year 2007 onwards to get the sum equal to 0 odd day.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Odd day	1	2	1	1	1	2	1	1	1	2	1

Sum = 14 odd days = 0 odd day

So, calendar for the year 2018 will be the same as for the year 2007.

3. Option C

100 years contain 5 odd days

So, last day of 1<sup>st</sup> century is Friday

200 years contain  $(5 \times 2) = 3$  odd days

So, last day of 2<sup>nd</sup> century is Wednesday

300 years contain  $(5 \times 3) = 15 = 1$  odd day

So, last day of 3<sup>rd</sup> century is Monday

400 years contain 0 odd day

So, last day of 4<sup>th</sup> century is Sunday

This cycle is repeated

So, last day of a century cannot be Tuesday or Thursday or Saturday.

4. Option A

4th June 2002 = (2001 years + period from 1.1.2002 to 4.6.2002)

Odd days in 1600 years = 0

Odd days in 400 years = 0

Odd days in 1 ordinary year = 1

Odd days in 2001 years =  $(0 + 0 + 1) = 1$

Jan.	Feb.	March	April	May	June
(31)	+ 28	+ 31	+ 30	+ 31	+ 4)

= 155 days  
= 22 weeks + 1 day = 1 odd day

Total number of odd days =  $(1 + 1) = 2$

So, required day is Tuesday

5. Option D

28 May 2006 = (2005 years + period from 1.1.2006 to 28.5.2006)

Odd days in 1600 years = 0

Odd days in 400 years = 0

5 years =  $(4 \text{ ordinary years} + 1 \text{ leap year}) = (4 \times 1 + 1 \times 2) = 6$  odd days

Jan.	Feb.	March	April	May	
(31)	+ 28	+ 31	+ 30	+ 28)	= 148 days

So, 148 days =  $(21 \text{ weeks} + 1 \text{ day}) = 1$  odd day

Total number of odd days =  $(0 + 0 + 6 + 1) = 7 = 0$  odd day.

Given day is Sunday

6. Option C

17<sup>th</sup> June 1998 = (1997 years + period from 01.01.1998 to 17.06.1998)

Odd days in 1600 years = 0

Odd days in 300 years =  $(5 \times 3) = 1$

97 years has 24 leap years + 73 ordinary years.

Number of odd days in 97 years  $(24 \times 2 + 73) = 121 = 2$  odd days

Jan.	Feb.	March	April	May	June
(31)	+ 28	+ 31	+ 30	+ 31	+ 17) = 168 days

So, 168 days = 24 weeks = 0 odd day

Total number of odd days =  $(0 + 1 + 2 + 0) = 3$   
 Given day is Wednesday.

7. Option D

The year 2006 is an ordinary year. So, it has 1 odd day.  
 So, the day on 8<sup>th</sup> Dec. 2007 will be 1 day beyond the day on 8<sup>th</sup> Dec., 2006.  
 But 8<sup>th</sup> Dec. 2007 is Saturday.  
 So, 8<sup>th</sup> Dec. 2006 is Friday.

8. Option B

The year 2004 is a leap year. So, it has 2 odd days.  
 So, the day on 6<sup>th</sup> March 2005 will be 2 days beyond the day on 6<sup>th</sup> March 2004.  
 But 6<sup>th</sup> March 2005 is Monday  
 So, 6<sup>th</sup> March 2004 is Saturday.

9. Option C

On 31<sup>st</sup> December 2005 it was Saturday  
 Number of odd days from the year 2006 to the year 2009  
 $= (1 + 1 + 2 + 1) = 5$  days  
 So, on 31<sup>st</sup> December 2009, it was Thursday  
 Thus, on 01<sup>st</sup> Jan. 2010 it is Friday.

10. Option B

Each day of the week is repeated after 7 days.  
 So, after 63 days, it will be Monday.  
 So, after 61 days, it will be Saturday.

11. Option C

The year 2004 is a leap year. It has 2 odd days.  
 So, the day on 8<sup>th</sup> Feb. 2004 is 2 days before the day on 8<sup>th</sup> Feb. 2005  
 Hence, this day is Sunday.

12. Option D

We shall find the day on 01<sup>st</sup> April 2001.  
 1<sup>st</sup> April 2001 = (2000 years + period from 01.01.2001 to 01.04.2001)  
 Odd days in 1600 years = 0  
 Odd days in 400 years = 0

Jan.	Feb.	March	April	
(31)	+ 28	+ 31	+ 1)	= 91 days = 0 odd days

Total number of odd days =  $(0 + 0 + 0) = 0$

On 1<sup>st</sup> April 2001 it was Sunday.

In April 2001, Wednesday falls on 4<sup>th</sup>, 11<sup>th</sup>, 18<sup>th</sup>, 25<sup>th</sup>.

13. Option A

The century divisible by 400 is a leap year.

So, the year 700 is not a leap year.

14. Option B

The year 2007 is an ordinary year. So, it has 1 odd day.

1<sup>st</sup> day of the year 2007 was Monday.

1<sup>st</sup> day of the year 2008 will be 1 day beyond Monday.

Hence, it will be Tuesday.

**Chapter - 18****Clocks****Clocks**

A clock has two hands, the smaller one is called the hour hand while the larger one is called minute hand.

**Important points**

- (i). In every 60 minutes, the minute hand gains 55 minutes on the hour hand on the hour hand.
- (ii) In every hour, both the hands coincide once.
- (iii) When the two hands are at right angles, they are 15 minute spaces apart.
- (iv) When the hands are in opposite directions, they are 30 minute spaces apart.

**Example 1:**

Find the angle between the hour hand and the minute hand of a clock when the time is 3.25

**Solution:**

Angle traced by the hour hand in 12 hours =  $360^\circ$

$$\text{Angle traced by it in 3 hours } 25 \text{ min. i.e. } \frac{41}{12} \text{ hours} = \left[ \frac{360}{12} \times \frac{41}{12} \right]^\circ = 102 \frac{1}{2}^\circ$$

Angle traced by minute hand in 60 min. =  $360^\circ$

$$\text{Angle traced by it in 25 min.} = \left[ \frac{360}{60} \times 25 \right]^\circ = 150^\circ$$

$$\text{Required angle} = \left[ 150^\circ - 102 \frac{1}{2}^\circ \right] = 47 \frac{1}{2}^\circ$$

**Example 2:**

Find at what time between 8 and 9 o'clock will the hands of a clock be in the same straight line but not together

**Solution:**

At 8 o'clock, the hour hand is at 8 and the minute hand is at 12, i.e. the two hands are 20 min. spaces apart.

To be in the same straight line but not together they will be 30 minute spaces apart. So, the minute hand will have to gain  $(30 - 20) = 10$  minute spaces over the hour hand.

55 minute spaces are gained in 60 min.

$$10 \text{ minute spaces will be gained in } \left[ \frac{60}{55} \times 10 \right] \text{ min.} = 10 \frac{10}{11} \text{ min.}$$

The hands will be in the same straight line but not together at  $10 \frac{10}{11}$  min. past 8

**Exercise – 18**

- 1) An accurate clock shows 8 o'clock in the morning. Through how many degrees will the hour hand rotate when the clock shows 2 o'clock in the afternoon?  
a)  $144^\circ$       b)  $150^\circ$       c)  $168^\circ$   
d)  $180^\circ$       e) None of these
  
- 2) The angle between the minute hand and the hour hand of a clock when the time is 4.20, is  
a)  $0^\circ$       b)  $10^\circ$       c)  $5^\circ$   
d)  $20^\circ$       e) None of these
  
- 3) How many times in a day, are the hands of a clock in straight line but opposite in direction?  
a) 20      b) 22      c) 24  
d) 48      e) None of these
  
- 4) At 3.40, the hour hand and the minute hand of a clock form an angle of :  
a)  $120^\circ$       b)  $125^\circ$       c)  $130^\circ$   
d)  $135^\circ$       e) None of these
  
- 5) At what time, in minutes, between 3 o'clock and 4 o'clock, both the needles will coincide each other?  
a)  $5\frac{1}{11}$       b)  $12\frac{4}{11}$       c)  $13\frac{4}{11}$   
d)  $16\frac{4}{11}$       e) None of these
  
- 6) The angle between the minute hand and the hour hand of a clock when the time is 8.30, is :  
a)  $80^\circ$       b)  $75^\circ$       c)  $60^\circ$   
d)  $105^\circ$       e) None of these
  
- 7) At what time between 9 and 10 o'clock will the hands of a watch be together?  
a) 45 min past 9      b) 50 min past 9      c)  $49\frac{1}{11}$  min past 9  
d)  $48\frac{2}{11}$  min past 9      e) None of these
  
- 8) At what angle the hands of a clock are inclined at 15 minutes past 5?  
a)  $58\frac{1}{2}^\circ$       b)  $64^\circ$       c)  $67\frac{1}{2}^\circ$   
d)  $72\frac{1}{2}^\circ$       e) None of these
  
- 9) At what time between 4 and 5 o'clock will the hands of a watch point in opposite directions?  
a) 45 min. past 4      b) 40 min. past 4      c)  $50\frac{4}{11}$  min past 4  
d)  $54\frac{6}{11}$  min. past 4      e) None of these

## Solutions:

- ### 1. Option D

$$\text{Angle traced by the hour hand in 6 hours} = \left[ \frac{360}{12} \times 6 \right]^\circ = 180^\circ$$

- ## 2. Option B

$$\text{Angle traced by hour hand in } \frac{13}{3} \text{ hrs.} = \left[ \frac{360}{12} \times \frac{13}{3} \right]^\circ = 130^\circ$$

$$\text{Angle traced by minute hand in 20 min.} = \left[ \frac{360}{60} \times 20 \right]^\circ = 120^\circ$$

$$\text{So, required angle} = (130 - 120)^\circ = 10^\circ$$

3. Option B

The hands of a clock point in opposite directions (in the same straight line) 11 times, in every 12 hours (Because between 5 and 7 they point in opposite directions at 6 o'clock only). So, in a day, the hands point in the opposite directions 22 times.

4. Option C

$$\text{Angle traced by hour hand in 12 hours} = 360^\circ$$

$$\text{Angle traced by it in } \frac{11}{3} \text{ hours} = \left[ \frac{360}{12} \times \frac{11}{3} \right]^\circ = 110^\circ$$

$$\text{Angle traced by minute hand in 60 min.} = 360^\circ$$

$$\text{Angle traced by it in 40 min.} = \left[ \frac{360}{60} \times 40 \right]^\circ = 240^\circ$$

$$\text{So, required angle} (240 - 110)^\circ = 130^\circ$$

5. Option D

At 3 o'clock, the minute hand is 15 min. spaces apart from the hour hand.

To be coincident, it must gain 15 min. spaces

55 min. are gained in 60 min.

$$15 \text{ min. are gained in } \left[ \frac{60}{55} \times 15 \right] \text{ min.} = 16\frac{4}{11} \text{ min.}$$

$$\text{So, the hands are coincident at } 16\frac{4}{11} \text{ min. past 3}$$

6. Option B

$$\text{Angle traced by hour hand in } \frac{17}{2} \text{ hours} = \left[ \frac{360}{12} \times \frac{17}{2} \right]^\circ = 255^\circ$$

$$\text{Angle traced by minute hand in 30 min.} = \left[ \frac{360}{60} \times 30 \right]^\circ = 180^\circ$$

$$\text{So, required angle} = (255 - 180)^\circ = 75^\circ$$

7. Option C

To be together between 9 and 10 o'clock, the minute hand has to gain 45 min. spaces 55 min. spaces gained in 60 min.

$$45 \text{ min. spaces are gained in } \left[ \frac{60}{55} \times 45 \right] \text{ min. or } 49\frac{1}{11} \text{ min.}$$

$$\text{So, the hands are together at } 49\frac{1}{11} \text{ min. past 9}$$

8. Option C

$$\text{Angle traced by hour hand in } \frac{21}{4} \text{ hours} = \left[ \frac{360}{12} \times \frac{21}{4} \right]^\circ = 157 \frac{1}{2}^\circ$$

$$\text{Angle traced by minute hand in 15 min.} = \left[ \frac{360}{12} \times 15 \right]^\circ = 90^\circ$$

$$\text{So, required angle} = \left[ 157 \frac{1}{2} \right]^\circ - 90^\circ = 67 \frac{1}{2}^\circ$$

9. Option D

At 4 o'clock, the hands of the watch are 20 min. spaces apart.

To be in opposite directions, they must be 30 min. spaces apart.

So, minute hand will have no gain 50 min. spaces

55 min. spaces are gained in 60 min.

$$50 \text{ min. spaces are gained in } \left[ \frac{60}{55} \times 50 \right] \text{ min. or } 54 \frac{6}{11} \text{ min.}$$

$$\text{So, required time} = 54 \frac{6}{11} \text{ min. past 4}$$

10. Option C

The hands of a clock coincide 11 times in every 12 hours (Since between 11 and 1, they coincide only once, i.e. at 12 o'clock).

So, the hands coincide 22 times in a day.

11. Option D

$$\text{Angle traced by hour hand in } \frac{125}{12} \text{ hours} = \left[ \frac{360}{12} \times \frac{125}{12} \right]^\circ = 312 \frac{1}{2}^\circ$$

$$\text{Angle traced by minute hand in 25 min.} = \left[ \frac{360}{60} \times 25 \right]^\circ = 150^\circ$$

$$\text{So, reflex angle} = 360^\circ - \left[ 312 \frac{1}{2} - 150 \right]^\circ = 360^\circ - 162 \frac{1}{2}^\circ = 197 \frac{1}{2}^\circ$$

12. Option C

Angle traced by hour hand in 12 hours =  $360^\circ$

$$\text{Angle traced by hour hand in 5 hours 10 min. i.e. } \frac{31}{6} \text{ hours} = \left[ \frac{360}{12} \times \frac{31}{6} \right]^\circ = 155^\circ$$

13. Option B

Time from 7 a.m. to 4.15 p.m. = 9 hours 15 min. =  $\frac{37}{4}$  hours

3 min. 5 sec. of this clock = 3 min. of the correct clock.

$\frac{37}{720}$  hours of this clock =  $\frac{1}{20}$  hours of the correct clock.

$\frac{37}{4}$  hours of this clock =  $\left[ \frac{1}{20} \times \frac{720}{37} \times \frac{37}{4} \right]$  hours of the correct clock.

= 9 hours of the correct clock.

So, the correct time is 9 hours after 7 a.m. i.e. 4 p.m.

14. Option A

55 min. spaces are covered in 60 min.

$$60 \text{ min. spaces are covered in } \left[ \frac{60}{55} \times 60 \right] \text{ min.} = 65 \frac{5}{11} \text{ min.}$$

$$\text{Loss in } 64 \text{ min.} = \left[ 66 \frac{5}{11} - 64 \right] = \frac{16}{11} \text{ min.}$$

$$\text{Loss in 24 hours} = \left[ \frac{16}{11} \times \frac{1}{64} \times 24 \times 60 \right] \text{ min.} = 32 \frac{8}{11} \text{ min.}$$

15. Option C

In 12 hours, they are at right angles 22 times.

So, in 24 hours, they are at right angles 44 times.

16. Option C

In 12 hours, the hands coincide or are in opposite direction 22 times.

So, in 24 hours, the hands coincide or are in opposite direction 44 times a day.

17. Option B

Time from 12 p.m. on Monday to 2 p.m. on the following Monday = 7 days 2 hours  
= 170 hours

So, the watch gains  $\left[ 2 + 4 \frac{4}{5} \right]$  min. or  $\frac{34}{5}$  min. in 170 hours

Now,  $\frac{34}{5}$  min. are gained in 170 hours.

So, 2 min. are gained in  $\left[ 170 \times \frac{5}{34} \times 2 \right]$  hours = 50 hours

So, watch is correct 2 days 2 hours after 12 p.m. on Monday i.e., it will be correct at 2 p.m. on Wednesday

## Chapter – 19

# Mixtures & Alligations

**Alligation:** Alligation is simplified method used to solve the problems related to mixture.

Alligation enables us to find desired ratio of ingredients that should mixed to get a desired mixture of ingredients at desired cost.

### Alligation Rule

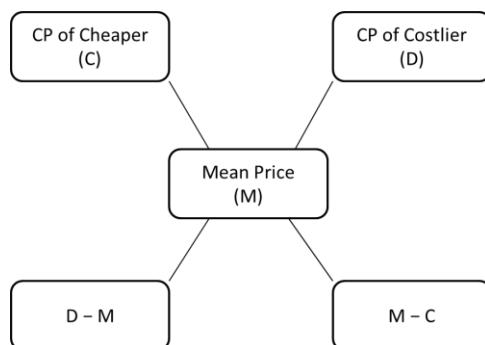
When two ingredients are mixed to make a mixture and their prices are different:-

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Costlier}} = \frac{\text{CP of Costlier} - \text{Mean Price}}{\text{Mean Price} - \text{CP of Cheaper}}$$

M = Mean price of mixture

C = Cost of cheaper ingredient

D = Cost of expensive ingredient



Then,

Cheaper Ingredient: Costlier Ingredient =  $(D - M) : (M - C)$

### Example 1:

A vessel is filled with liquid, 3 parts of which are water and 5 parts syrup. How much of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup?

### Solution:

Suppose the vessel initially contains 8 litres of liquid.

Let  $x$  litres of this liquid be replaced with water.

$$\text{Quantity of water in new mixture} = \left[ 3 - \frac{3x}{8} + x \right] \text{ litres}$$

$$\text{Quantity of syrup in new mixture} = \left[ 5 - \frac{5x}{8} \right] \text{ litres}$$

$$\text{So, } \left[ 3 - \frac{3x}{8} + x \right] = \left[ 5 - \frac{5x}{8} \right]$$

$$5x + 24 = 40 - 5x$$

$$10x = 16$$

$$x = \frac{8}{5}$$

$$\text{So, part of the mixture replaced} = \left[ \frac{8}{5} \times \frac{1}{8} \right] = \frac{1}{5}$$

**Example 2:**

Tea worth Rs. 126 per kg and Rs. 135 per kg are mixed with a third variety in the ratio 1 : 1 : 2. If the mixture is worth Rs. 153 per kg, the price of the third variety per kg will be:

**Solution:**

Since first and second varieties are mixed in equal proportions.

$$\text{So, their average price} = \text{Rs. } \left[ \frac{126 + 135}{2} \right] = \text{Rs. } 130.50$$

So, the mixture is formed by mixing two varieties, one at Rs. 130.50 per kg and the other at say, Rs. x per kg in the ratio 2 : 2, i.e., 1 : 1. We have to find x.

By the rule of allegation, we have :

Cost of 1 kg of 1<sup>st</sup> kind cost of 1 kg tea of 2<sup>nd</sup> kind

Rs. 130.50	Mean price Rs. 153	Rs. x 22.50
------------	--------------------	-------------

(x - 153)

$$\text{So, } \frac{x - 153}{22.50} = 1$$

$$x - 153 = 22.50$$

$$x = 175.50$$

**Example 3:**

A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture are drawn off and the can is filled with B, the ratio of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially?

**Solution:**

Suppose the can initially contains 7x and 5x of mixtures A and B respectively.]

$$\text{Quantity of A in mixture left} = \left[ 7x - \frac{7}{12} \times 9 \right] \text{ litres} = \left[ 7x - \frac{21}{4} \right] \text{ litres}$$

$$\text{Quantity of B in mixture left} = \left[ 5x - \frac{5}{12} \times 9 \right] \text{ litres} = \left[ 5x - \frac{15}{4} \right] \text{ litres}$$

$$\text{So, } \frac{7x - \frac{21}{4}}{5x - \frac{15}{4}} = \frac{7}{9}$$

$$\frac{28x - 21}{20x + 21} = \frac{7}{9}$$

$$252x - 189 = 140x + 147$$

$$112x = 336$$

$$x = 3$$

So, the Can contained 21 litres of A.

### Exercise - 19

- 1) A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk should he mix from each of the containers so as to get 12 litres of milk such that the ratio of water to milk is 3 : 5?  
 a) 4 litres, 8 litres      b) 6 litres, 6 litres      c) 5 litres, 7 litres  
 d) 7 litres, 5 litres      e) None of these
- 2) In what ratio must a grocer mix two varieties of pulses costing Rs. 15 and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.50 kg?  
 a) 3 : 7      b) 5 : 7      c) 7 : 3  
 d) 7 : 5      e) None of these
- 3) A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is:  
 a) 4%      b) 6  $\frac{1}{4}$ %      c) 20%  
 d) 25%      e) None of these
- 4) How many kilogram of sugar costing Rs. 9 per kg must be mixed with 27 kg of sugar costing Rs. 7 per kg so that there may be a gain of 10% by selling the mixture at Rs. 9.24 per kg??  
 a) 36 kg      b) 42 kg      c) 54 kg  
 d) 63 kg      e) None of these
- 5) A jar full of whisky contains 40% alcohol. A part of this whisky is replaced by another containing 19% alcohol and now the percentage of alcohol was found to be 26%. The quantity of whisky replaced is:  
 a) 1/3      b) 2/3      c) 2/5  
 d) 3/5      e) None of these
- 6) In what ratio must water be mixed with milk to gain  $16\frac{2}{3}\%$  on selling the mixture at cost price?  
 a) 1 : 6      b) 6 : 1      c) 2 : 3  
 d) 4 : 3      e) None of these
- 7) Find the ratio in which rice at Rs. 7.20 a kg be mixed with rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg.  
 a) 1 : 3      b) 2 : 3      c) 3 : 4  
 d) 4 : 5      e) None of these

- 8) In what ratio must a grocer mix two varieties of tea worth Rs. 60 a kg and Rs. 65 a kg so that by selling the mixture at Rs. 68.20 a kg he may gain 10%?  
a) 3 : 2                    b) 3 : 4                    c) 3 : 5  
d) 4 : 5                    e) None of these
- 9) The cost of Type 1 rice is Rs. 15 per kg and Type 2 rice is Rs. 20 per kg. If both Type 1 and Type 2 are mixed in the ratio of 2 : 3, then the price per kg of the mixed variety of rice is:?  
a) Rs. 18                    b) Rs. 18.50                    c) Rs. 19  
d) Rs. 19.50                e) None of these
- 10) A merchant has 1000 kg of sugar, part of which he sells at 8% profit and the rest at 18% profit. He gains 14% on the whole. The quantity sold at 18% profit is:  
a) 400 kg                    b) 560 kg                    c) 600 kg  
d) 640 kg                    e) None of these
- 11) Two vessels A and B contain milk and water mixed in the ratio 8 : 5 and 5 : 2 respectively. The ratio in which these two mixtures be mixed to get a new mixture containing  $69\frac{3}{4}\%$  milk is :  
a) 2 : 7                    b) 3 : 5                    c) 5 : 2  
d) 5 : 7                    e) None of these
- 12) In what ratio must tea at Rs.62 per kg be mixed with tea at Rs.72 per kg so that the mixture must be worth Rs.64.50 per kg?  
a) 3 : 1                    b) 3 : 2                    c) 4 : 3  
d) 5 : 3                    e) None of these
- 13) One quality of wheat at Rs.9.30 per kg is mixed with another quality at a certain rate in the ratio 8 : 7. If the mixture so formed be worth Rs.10 per kg, what is the rate per kg of the second quality of wheat?  
a) Rs.10.30                b) Rs.10.60                c) Rs.10.80  
d) Rs.11                    e) None of these
- 14) In what ratio must water be mixed with milk costing Rs.12 per litre to obtain a mixture worth of Rs.8 per litre?  
a) 1 : 2                    b) 2 : 1                    c) 2 : 3  
d) 3 : 2                    e) None of these
- 15) In what ratio must rice at Rs.9.30 per kg be mixed with rice at Rs.10.80 per kg so that the mixture be worth Rs.10 per kg?  
a) 8 : 7                    b) 7 : 8                    c) 8 : 9  
d) 9 : 8                    e) None of these
- 16) The milk and water in two vessels A and B are in the ratio 4 : 3 and 2 : 3 respectively. In what ratio the liquids in both the vessels be mixed to obtain a new mixture in vessel C consisting half milk and half water?  
a) 8 : 3                    b) 7 : 5                    c) 4 : 3



- 25) A mixture of certain quantity of milk with 20 litres of water of worth Rs.10 per litre. If pure milk is of worth Rs.15 per litre, how much milk is there in the mixture?
- 30 litres
  - 35 litres
  - 45 litres
  - 40 litres
  - None of these
- 26) In what proportion must water be mixed with milk to gain 20% by selling it at cost price?
- 4 : 1
  - 1 : 4
  - 5 : 4
  - 4 : 5
  - None of these
- 27) A goldsmith has two qualities of gold, one of 10 carats and another of 15 carates purity. In what proportion should he mix both to make an ornament of 12 carats purity?
- 3 : 2
  - 2 : 3
  - 3 : 4
  - 4 : 3
  - None of these
- 28) 400 gm spirit solution has 40% spirit in it, how many grams of spirit should be added to make it 60% in the solution?
- 600 gm
  - 500 gm
  - 200 gm
  - 250 gm
  - None of these

**Solutions:**

1. Option B

Let the cost of 1 litre milk be Rs. 1

Milk in 1 litre mix. in 1<sup>st</sup> can =  $\frac{3}{4}$  litre, C.P. of 1 litre mix. in 1<sup>st</sup> can Rs.  $\frac{3}{4}$

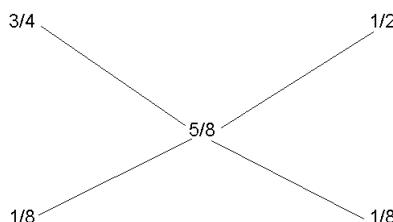
Milk in 1 litre mix. in 2<sup>nd</sup> can =  $\frac{1}{2}$  litre, C.P. of 1 litre mix. in 2<sup>nd</sup> can Rs.  $\frac{1}{2}$

Milk in 1 litre of final mix. =  $\frac{5}{8}$  litre, Mean price = Rs.  $\frac{5}{8}$

By the rule of allegation, we have:

C.P. of 1 litre mixture in 1<sup>st</sup> can

C.P. of 1 litre mixture in 2<sup>nd</sup> can



$$\text{So, ratio of two mixtures} = \frac{1}{8} : \frac{1}{8} = 1 : 1$$

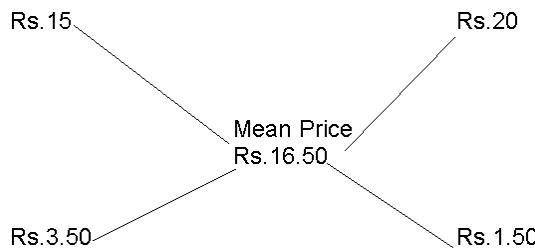
$$\text{So, quantity of mixture taken from each can} = \left[ \frac{1}{2} \times 12 \right] = 6 \text{ litres}$$

2. Option C

By the rule of allegation:

Cost of 1 kg pulses of 1<sup>st</sup> kind

Cost of 1 kg pulses of 2<sup>nd</sup> kind



$$\text{So, required rate} = 3.50 : 1.50 = 7 : 3$$

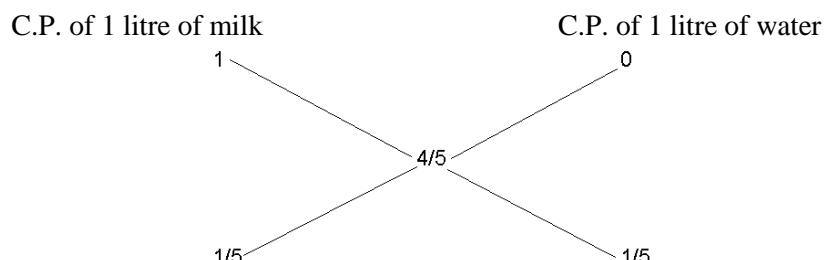
3. Option C

Let C.P. of 1 litre milk be Rs. 1

Then, S.P. of 1 litre of mixture = Rs. 1, Gain = 25%

$$\text{C.P. of 1 litre mixture} = \text{Rs. } \left[ \frac{100}{125 \times 1} \right] = \frac{4}{5}$$

By the rule of allegation, we have:



$$\text{So, ratio of milk to water} = \frac{4}{5} : \frac{1}{5} = 4 : 1$$

Hence, percentage of water in the mixture =

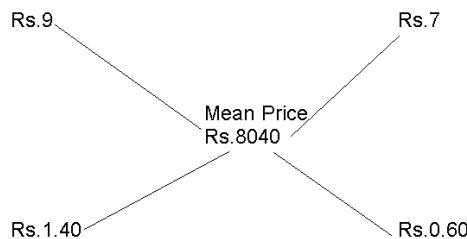
$$\left[ \frac{1}{5} \times 100 \right] \% = 20\%$$

## 4. Option D

S.P. off 1 kg of mixture = Rs.9.24, Gain 10%

$$\text{So, C.P. of 1 kg of mixture} = \text{Rs.} \left[ \frac{100}{110} \times 9.24 \right] = \text{Rs.} 8.40$$

By the rule of allegation, we have:



So, ratio of quantities of 1<sup>st</sup> and 2<sup>nd</sup> kind = 14 : 6 = 7 : 3

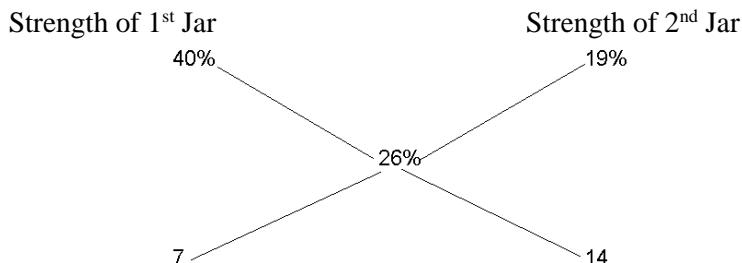
Let x kg of sugar of 1<sup>st</sup> be mixed with 27 kg of 2<sup>nd</sup> kind.

Then, 7 : 3 = x : 27

$$x = \left[ \frac{7 \times 27}{3} \right] = 63 \text{ kg}$$

## 5. Option B

By the rule of allegation, we have:



So, ratio of 1<sup>st</sup> and 2<sup>nd</sup> quantities = 7 : 14 = 1 : 2

$$\text{So, required quantity replaced} = \frac{2}{3}$$

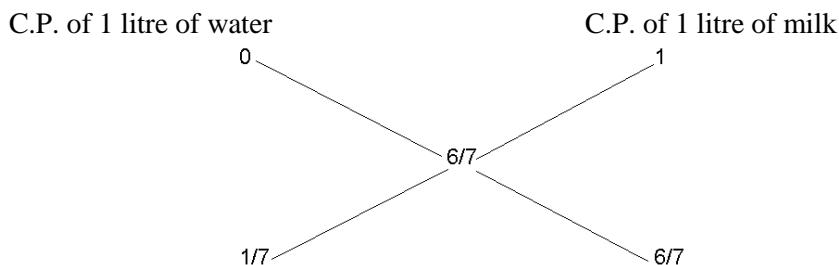
## 6. Option A

Let C.P. of 1 litre milk be Rs. 1.

S.P. of 1 litre of mixture = Rs. 1, Gain =  $\frac{50}{3}\%$

So, C.P. of 1 litre of mixture =  $\left[ 100 \times \frac{3}{350} \times 1 \right] = \frac{6}{7}$

By the rule of allegation, we have:

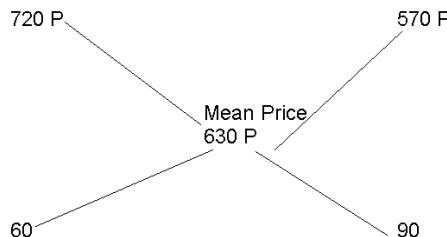


So, ratio of water and milk =  $\frac{1}{7} : \frac{6}{7} = 1 : 6$

## 7. By the rule of allegation:

Cost of 1 kg of 1<sup>st</sup> kind

Cost of 1 kg of 2<sup>nd</sup> kind



So, required ratio =  $60 : 90 = 2 : 3$

## 8. Option B

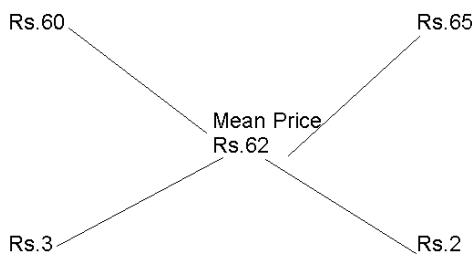
S.P. of 1 kg of the mixture = Rs. 68.20, Gain = 10%

C.P. of 1 kg of the mixture = Rs.  $\left[ \frac{100}{110} \times 68.20 \right] = \text{Rs. } 62$

By the rule of allegation, we have:

Cost of 1 kg tea of 1<sup>st</sup> kind

Cost of 1 kg tea of 2<sup>nd</sup> kind



So, required ratio = 3 : 2

9. Option A

Let the price of the mixed variety be Rs. x per kg.

By rule of allegation, we have:

Cost of 1 kg of type 1 rice

Cost of 1 kg of type 2 rice

$$\text{So, } \frac{20 - x}{x - 15} = \frac{2}{3}$$

$$60 - 3x = 2x - 30$$

$$5x = 90$$

$$x = 18$$

10. Option C

By the rule of allegation, we have:

Profit on 1<sup>st</sup> part

Profit on 2<sup>nd</sup> part

Ratio of 1<sup>st</sup> and 2<sup>nd</sup> parts = 4 : 6 = 2 : 3

$$\text{So, quantity of 2<sup>nd</sup> kind} = \left[ \frac{3}{5} \times 1000 \right] \text{kg} = 600 \text{ kg}$$

11. Option A

Let cost of 1 litre milk be Rs. 1

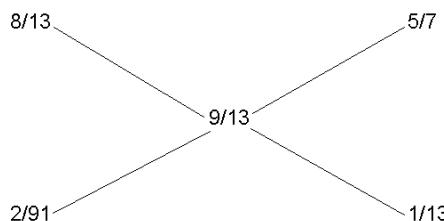
Milk in 1 litre mix. in A =  $\frac{8}{13}$  litre, C.P. of 1 litre mix. in A = Rs.  $\frac{8}{13}$

Milk in 1 litre mix. in B =  $\frac{5}{7}$  litre, C.P. of 1 litre mix. in B = Rs.  $\frac{5}{7}$

Milk in 1 litre of final mix. =  $\left[ \frac{900}{13} \times \frac{1}{100} \times 1 \right] = \frac{9}{13}$  litre; Mean price = Rs.  $\frac{9}{13}$

By the rule of allegation, we have :

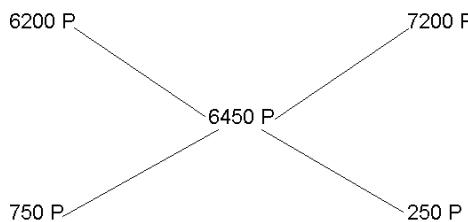
C.P. of 1 litre mixture in A



$$\text{So, required ratio} = \frac{2}{91} : \frac{1}{13} = 2 : 7$$

12. Option A

By the rule of allegation :

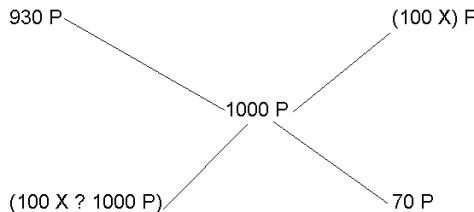
Cost of 1 kg tea of 1<sup>st</sup> kindCost of 1 kg tea of 2<sup>nd</sup> kind

$$\text{So, required ratio} = 750 : 250 = 3 : 1$$

13. Option C

Let the rate of the second quality be Rs. x per kg

By the rule of allegation, we have :

C.P. of 1 kg wheat of 1<sup>st</sup> kindC.P. of 1 kg wheat of 2<sup>nd</sup> kind

$$\text{So, } \frac{100x - 1000}{70} = \frac{8}{7}$$

$$700x - 7000 = 560$$

$$700x = 7560$$

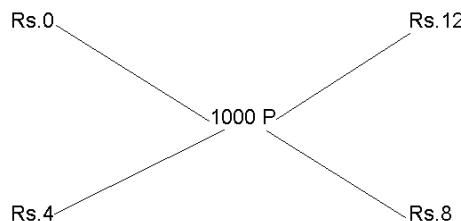
$$x = \text{Rs.} 10.80$$

14. Option A

By the rule of allegation :

C.P. of 1 litre of water

C.P. of 1 litre of milk



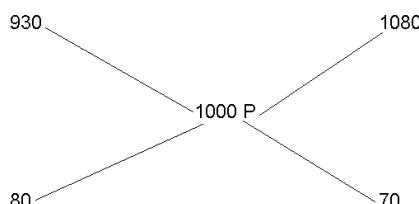
$$\text{Ratio of water to milk} = 4 : 8 = 1 : 2$$

15. Option A

By the rule of allegation:

C.P. of 1 kg rice of 1<sup>st</sup> kind

C.P. of 1 kg rice of 2<sup>nd</sup> kind



$$\text{So, required ratio} = 80 : 70 = 8 : 7$$

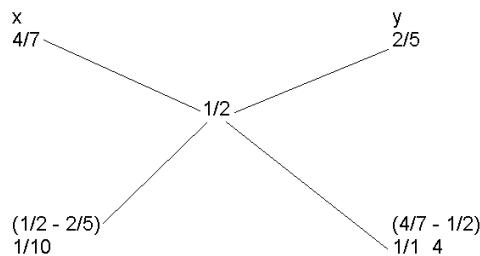
16. Option B

$$\text{Milk in 1 litre mixture of A} = \frac{4}{7} \text{ litre}$$

$$\text{Milk in 1 litre mixture of B} = \frac{2}{5} \text{ litre}$$

$$\text{Milk in 1 litre mixture of C} = \frac{1}{2} \text{ litre}$$

By rule of allegation we have required ratio X : Y



$$\text{So, required ratio } X : Y = \frac{1}{10} : \frac{1}{14} = 7 : 5$$

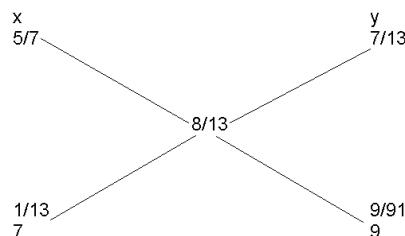
17. Option C

$$\text{Spirit in 1 litre mix of A} = \frac{5}{7} \text{ litre}$$

$$\text{Spirit in 1 litre mix of B} = \frac{7}{13} \text{ litre}$$

$$\text{Spirit in 1 litre mix of C} = \frac{8}{13} \text{ litre}$$

By rule of allegation we have required ratio X : Y



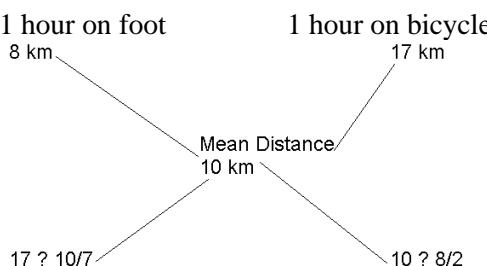
$$\text{Therefore required ratio} = \frac{1}{13} : \frac{9}{91} = 7 : 9$$

18. Option B

$$\text{Distance covered in 1 hour on foot} = 8 \text{ km}$$

$$\text{Distance covered in 1 hour on bicycle} = 17 \text{ km}$$

$$\text{Average distance covered in 1 hour} = \frac{90}{9} \text{ km} = 10 \text{ km (mean distance)}$$



Thus out of 9 hours, he took 7 hours on foot

$$\text{Distance covered on foot} = (8 \times 7) \text{ km} = 56 \text{ km}$$

19. Option B

The 20 litre mixture contains milk and water in the ratio of 3 : 2. Therefore, there will be 12 litres of milk in the mixture and 2 litres of water in the mixture.

**Step 1:** When 10 litres of the mixture is removed, 6 litres of milk is removed and 4 litres of water is removed. Therefore, there will be 6 litres of milk and 4 litres of water left in the container. It is then replaced with pure milk of 10 litres. Now the container will have 16 litres of milk and 4 litres of water.

**Step 2:** When 10 litres of the new mixture is removed, 8 litres of milk and 2 litres of water is removed. The container will have 8 litres of milk and 2 litres of water in it. Now 10 litres of pure milk is added. Therefore, the container will have 18 litres of milk and 2 litres of water in it at the end of the second step.

Therefore, the ratio of milk and water is 18 : 2 or 9 : 1.

20. Option A

Let the amount of Basmati rice being mixed be  $x$  kgs.

As the trader makes 25% profit by selling the mixture at Rs.40 per kg, his cost per kg of the mixture = Rs.32 per kg

$$\text{i.e. } (x \times 42) + (25 \times 24) = 32(x + 25)$$

$$42x + 600 = 32x + 800$$

$$10x = 200$$

$$x = 20 \text{ kgs.}$$

21. Option C

30 litres of the mixture has milk and water in the ratio 7 : 3 i.e. the solution has 21 litres of milk and 9 litres of water.

When you add more water, the amount of milk in the mixture remains constant at 21 litres. In the first case, before addition of further water 21 litres of milk account for 70% by volume. After water is added, the new mixture contains 60% milk and 40% water.

Therefore, the 21 litres of milk account for 60% by volume.

$$\text{Hence, } 100\% \text{ volume} = \frac{21}{0.6} = 35 \text{ litres}$$

We started with 30 litres and ended up with 35 litres. Therefore, 5 litres of water was added.

22. Option C

The best way to solve this problem is to go from the answer choices.

The mixture of 60 litres has in it 24 litres of milk and 36 litres of water (2 : 3 :: milk : water)

When you remove  $x$  litres from it, you will remove  $0.4x$  litres of milk and  $0.6x$  litres of water from it.

Take choice (b), according to this choice,  $x = 10$ .

So, when one removes, 10 litres of the mixture, one is removing 4 litres of milk and 6 litres of water.

Therefore, there will be 20 litres of milk and 30 litres of water in the container.

Now, when you add 10 litres of milk, you will have 30 litres of milk and 30 litres of water - i.e. milk and water are in equal proportion.

23. Option A

Here, CP of unit quantity of dearer = 460 per kg, CP of unit quantity of cheaper = 410 per kg

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{460 - 430}{430 - 410} = \frac{30}{20} = \frac{3}{2}$$

So, the required ratio be 3 : 2

24. Option A

First we have to find cost price of mixture, as seller is gaining 25% profit on mixture so its cost price will be

$$50 = \text{CP of mixture} \times \frac{125}{100}$$

$$\text{CP of mixture} = 40$$

Now use the formula of allegation to find out quantity of dearer rice,

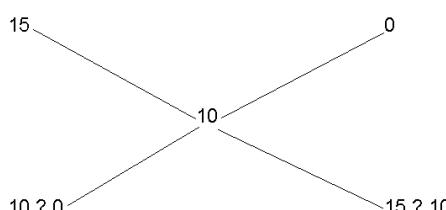
(**Note:** Here mean price will be CP of mixture, do not get confused by selling price Rs.50 per kg)

$$\frac{30}{\text{Quantity of dearer}} = \frac{60 - 40}{40 - 25} = \frac{20}{15} = \frac{4}{3}$$

$$\text{Quantity of dearer} = \frac{30 \times 3}{4} = 22.5 \text{ kgs.}$$

25. Option D

By the rule of allegation



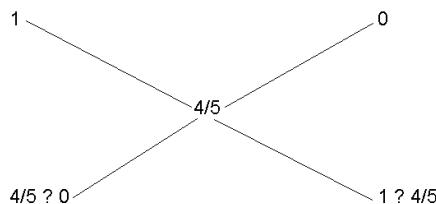
$$\frac{20}{\text{Quantity of milk}} = \frac{15 - 10}{10 - 0}$$

So, quantity of milk will be 40 litres

26. Option B

Let cost price of milk be Rs.1 per litre, then S.P. of mixture is also Rs.1 per litre

Now CP of mixture be =  $1 - (20\% \text{ of Rs.}1) = 1 - (20 \times \frac{1}{100}) = \frac{80}{100} = \frac{4}{5}$

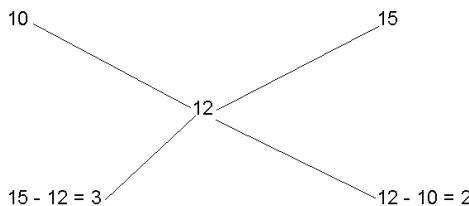


$$\frac{\text{Quantity of water}}{\text{Quantity of milk}} = \frac{\frac{1}{5} - \frac{4}{5}}{\frac{4}{5} - 0} = \frac{1}{4}$$

Required ratio = 1 : 4

27. Option A

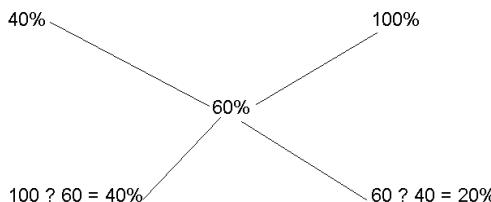
By applying rule of allegation



So, both qualities of gold should be mixed in the ratio of 3 : 2

28. Option C

By applying rule of allegation and mixture



So, two mixtures should be added in ratio 2 : 1

$$\text{Required amount of spirit} = \frac{1}{2} \times 400 = 200 \text{ gm}$$

## Chapter – 20

## Pipes & Cisterns

**Inlet Pipe:** A pipe used to fill the tank or cistern is known as Inlet Pipe.

**Outlet Pipe:** A pipe used to empty the tank or cistern is known as Outlet Pipe.

## Basic Rules

If an inlet pipe takes 2 hours to fill a tank then it will fill  $\frac{1}{2}$  of the tank per hour

If an outlet pipe can empty the tank in 4 hours then it will empty  $\frac{1}{4}$  of the tank per hour

If both of the above inlet and outlet pipes are opened at once then it will fill the tank  $\frac{1}{2} - \frac{1}{4} = \frac{1}{2}$  of the tank per hour

### Example 1:

A tank can be filled by a tap in 20 minutes and by another tap in 60 minutes. Both the taps are kept open for 10 minutes and then the first tap is shut off. After this, the tank will be completely filled in:

**Solution:**

$$\text{Part filled in 10 min.} = 10 \left[ \frac{1}{20} \right] + \left[ \frac{1}{60} \right] = 10 \times \frac{4}{60} = \frac{2}{3}$$

$$\text{Remaining part} = 1 - \frac{2}{3} = \frac{1}{3}$$

$$\text{Part filled by second tap in 1 min.} = \frac{1}{60}$$

$$\frac{1}{60} : \frac{1}{3} :: 1 : x$$

Hence, the remaining part will be filled in 20 min.

## Example 2:

A cistern can be filled in 9 hours but it takes 10 hours due to a leak at the bottom. If the cistern is full, then the time that the leak will take to empty it, is :

**Solution:**

$$\text{Work done by the leak in 1 hour} = \frac{1}{9} - \frac{1}{10} = \frac{1}{90}$$

Leak will empty the full cistern in 90 hours.

## **Exercise – 20**

- 1) Pipe A can fill a tank in 5 hours, pipe B in 10 hours and pipe C in 30 hours. If all the pipes are open, in how many hours will the tank be filled ?

  - a) 2
  - b) 2.5
  - c) 3
  - d) 3.5
  - e) None of these



- 10) Two pipes A and B can separately fill a cistern in 60 minutes and 75 minutes respectively. There is a third pipe in the bottom of the cistern to empty it. If all the three pipes are simultaneously opened, then the cistern is full in 50 minutes. In how much time, the third pipe alone can empty the cistern?
- a) 90 min                    b) 100 min                    c) 110 min  
d) 120 min                    e) None of these
- 11) A cistern can be filled by a tap in 4 hours while it can be emptied by another tap in 9 hours. If both the taps are opened simultaneously, then after how much time will the cistern get filled ?
- a) 4.5 Hours                    b) 5 Hours                    c) 6.5 Hours  
d) 7.2 Hours                    e) None of these
- 12) A large tanker can be filled by two pipes A and B in 60 minutes and 40 minutes respectively. How many minutes will it take to fill the tanker from empty state if B is used for half the time and A and B fill it together for the other half ?
- a) 15 min                    b) 20 min                    c) 27.5 min  
d) 30 min                    e) None of these
- 13) One pipe can fill a tank three times as fast as another pipe. If together the two pipes can fill the tank in 86 minutes, then the slower pipe alone will be able to fill the tank in
- a) 81 min                    b) 108 min                    c) 144 min  
d) 192 min                    e) None of these
- 14) A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely ?
- a) 3 hrs 15 min                    b) 3 hrs 45 min                    c) 4 hrs  
d) 4 hrs 15 mins                    e) None of these
- 15) Two pipes A and B can fill a tank in 6 hours and 4 hours respectively. If they are opened on alternate hours and if pipe A is opened first, in how many hours, the tank shall be full ?
- a) 4 Hrs                    b) 5 Hrs                    c) 7 Hrs  
d) 9 Hrs                    e) None of these
- 16) Two pipes A and B can fill a cistern in  $37\frac{1}{2}$  minutes and 45 minutes respectively. Both pipes are opened. The cistern will be filled in just half an hour, if the B is turned off after:
- a) 5                            b) 9                            c) 10  
d) 15                            e) None of these
- 17) A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank?
- a) 20 hours                    b) 25 hours                    c) 35 hours  
d) Data inadequate                    e) None of these

## Solutions:

- ### 1. Option C

$$\text{Part filled by } (A + B + C) \text{ in 1 hour} = \left[ \frac{1}{5} + \frac{1}{6} + \frac{1}{30} \right] \text{ 1/3.}$$

All the three pipes together will fill the tank in 3 hours.

- ## 2. Option D

$$\text{Work done by the leak in 1 hour} = \left[ \frac{1}{2} - \frac{3}{7} \right]$$

1/14

Leak will empty the tank in 14 hours.

3. Option C

Work done by the waste pipe in 1 minute =  $\frac{1}{15} - \left[ \frac{1}{20} + \frac{1}{24} \right] = \left[ \frac{1}{15} - \frac{11}{20} \right] = -\frac{1}{40}$  (- ve sign means emptying) volume of  $\frac{1}{40}$  part = 3 gallons. Volume of whole =  $(3 \times 40) = 120$  gallons.

4. Option A

Net apart filled in 1 hour =  $\left[ \frac{1}{10} + \frac{1}{12} - \frac{1}{20} \right] = \frac{8}{60} = \frac{2}{15}$ . Therefore the tank will be full in  $\frac{15}{2}$  hours = 7 hours 30 minute

5. Option D

Work done by the inlet in 1 hour =  $\left[ \frac{1}{8} - \frac{1}{12} \right] = \frac{1}{24}$

Work done by the inlet in 1 minute =  $\left[ \frac{1}{24} \times \frac{1}{60} \right] = \frac{1}{1440}$

Volume of  $\frac{1}{1440}$  part = 6 litres. Therefore, Volume of whole =  $[1440 \times 6]$   
= 8640 litres

6. Option D

Part filled by (A + B) in 1 hour =  $\left[ \frac{1}{5} + \frac{1}{20} \right]$   
 $= \frac{1}{4}$

So, A and B together can fill the tank in 4 hours.

Work done by the leak in 1 hour =  $\left[ \frac{1}{4} - \frac{2}{9} \right] = \frac{1}{36}$

Therefore, leak will empty the tank in 36 hours.

7. Option A

Part filled by A in 1 min. =  $\frac{1}{20}$

Part filled by B in 1 min. =  $\frac{1}{30}$

Part filled by (A + B) in 1 min. =  $\left[ \frac{1}{20} + \frac{1}{30} \right]$   
 $= \frac{1}{12}$

Both the pipes can fill the tank in 12 minutes.

8. Option C

Net part filled in 1 hour =  $\left[ \frac{1}{5} + \frac{1}{6} - \frac{1}{12} \right]$

$$= \frac{17}{60}$$

Therefore, the tank will be full in  $\frac{60}{17}$  hrs.  $= 3 \times \frac{9}{17}$  hrs.

9. Option D

$$\begin{aligned}\text{Capacity of the tank} &= (12 \times 13.5) \text{ litres} \\ &= 162 \text{ litres}\end{aligned}$$

Capacity of each bucket = 9 litres

$$\text{Number of buckets needed} = \left[ \frac{162}{9} \right] = 18$$

10. Option B

$$\text{Work done by the third pipe in 1 min.} = \frac{1}{50} - \left[ \frac{1}{60} + \frac{1}{75} \right]$$

$$= \left[ \frac{1}{50} - \frac{3}{100} \right]$$

$$= \frac{1}{100}$$

Therefore, the third pipe alone can empty the cistern in 100 min.

11. Option D

$$\begin{aligned}\text{Net part filled in 1 hour} &= \left[ \frac{1}{4} - \frac{1}{9} \right] \\ &= \frac{5}{36}\end{aligned}$$

Therefore, the cistern will be filled in  $\frac{36}{5}$  hours i.e. 7.2 hours

12. Option D

$$\begin{aligned}\text{Part filled by (A + B) in 1 minute} &= \left[ \frac{1}{60} + \frac{1}{40} \right] \\ &= \frac{1}{24}\end{aligned}$$

Suppose the tank is filled in x minutes  $= \frac{4}{8}$

Then,  $\frac{x}{2} \times \frac{1}{15} = 30$  min.

13. Option C

Let the slower pipe alone fill the tank in x minutes. Then, faster pipes will fill it in  $\frac{x}{3}$  minutes

$$\text{Therefore, } \frac{1}{x} + \frac{3}{x} = \frac{1}{36}$$

$$\frac{4}{x} = \frac{1}{36}$$

$$x = 144 \text{ min.}$$

## 14. Option B

Time taken by one tap to fill the half tank = 3 hours

$$\begin{aligned}\text{Part filled by the four taps in 1 hour} &= \left[ 4 \times \frac{1}{6} \right] \\ &= \frac{2}{3}\end{aligned}$$

$$\text{Remaining part} = \left[ 1 - \frac{1}{2} \right]$$

$$= \frac{1}{2}$$

$$\text{Therefore } \frac{\frac{2}{3}}{\frac{1}{2}} : : 1 : x$$

$$\left[ \frac{1}{2} \times 1 \times \frac{3}{2} \right]$$

$$= \frac{3}{4} \text{ hours i.e. 45 minutes.}$$

So, total time taken = 3 hours 45 minute

## 15. Option B

$$\text{A's work in 1 hour} = \frac{1}{6}$$

$$\text{B's work in 1 hour} = \frac{1}{4}$$

$$\text{(A + B)'s 2 hours work when opened alternately} = \left[ \frac{1}{6} + \frac{1}{4} \right]$$

$$= \frac{5}{12}$$

$$= \frac{10}{24}$$

$$= \frac{5}{12}$$

$$\text{(A + B)'s 4 hours work when opened alternately}$$

$$= \left[ \frac{1}{6} + \frac{1}{4} \right] \times 2$$

$$= \frac{5}{12} \times 2 = \frac{5}{6}$$

$$= \frac{5}{6}$$

$$\text{Remaining part} = \left[ 1 - \frac{5}{6} \right]$$

$$= \frac{1}{6}$$

Therefore, total time to fill the tank (4 + 1) hours = 5 hours

## 16. Option E

Let B be turned off after x minutes. Then,

Part filled by (A + B) in x min + Part filled by A in (30 - x) min. = 1

$$\text{So, } x \left[ \frac{2}{75} + \frac{1}{45} \right] + (30 - x) \times \frac{2}{75} = 1$$

## 17. Option E

Suppose pipe A alone takes x hours to fill the tank.

Then, pipes B and C will take  $\frac{x}{2}$  and  $\frac{x}{4}$  hours respectively to fill the tank.

$$\text{So, } \frac{1}{x} + \frac{2}{x} + \frac{4}{x} = \frac{1}{5}$$

$$\frac{7}{x} = \frac{1}{5}$$

$$x = 35 \text{ hours}$$

18. Option C

$$(A + B)'s 1 \text{ hour work} = \left[ \frac{1}{12} + \frac{1}{15} \right] = \frac{9}{60} = \frac{3}{20}$$

$$(A + C)'s 1 \text{ hour work} = \left[ \frac{1}{12} + \frac{1}{20} \right] = \frac{8}{60} = \frac{2}{15}$$

$$\text{Part filled in 2 hours} = \left[ \frac{3}{20} + \frac{2}{15} \right] = \frac{17}{60}$$

$$\text{Part filled in 6 hours} = \left[ 3 \times \frac{17}{60} \right] = \frac{17}{20}$$

$$\text{Remaining part} = \left[ 1 - \frac{17}{20} \right] = \frac{3}{20}$$

Now, it is the turn of A and B and  $\frac{3}{20}$  part is filled by A and B in 1 hour.

So, total time taken to fill the tank =  $(6 + 1) = 7$  hours

19. Option D

$$\text{Part filled in 4 minutes} = 4 \left[ \frac{1}{15} + \frac{1}{20} \right] = \frac{7}{15}$$

$$\text{Remaining part} = \left[ 1 - \frac{7}{15} \right] = \frac{8}{15}$$

$$\text{Part filled by B in 1 minute} = \frac{1}{20}$$

$$\text{So, } \frac{1}{20} : \frac{8}{15} :: 1 : x$$

$$x = \left[ \frac{8}{15} \times 1 \times 20 \right] = 10 \frac{2}{3} \text{ minute} = 10 \text{ minute } 40 \text{ seconds}$$

So, the tank will be full in  $(4 \text{ minute} + 10 \text{ minute} + 40 \text{ seconds}) = 14 \text{ minute } 40 \text{ seconds}$

20. Option C

$$\text{Part filled in 2 hours} = \frac{2}{6} = \frac{1}{3}$$

$$\text{Remaining part} = \left[ 1 - \frac{1}{3} \right] = \frac{2}{3}$$

$$\text{So, } (A + B)'s 7 \text{ hours work} = \frac{2}{3}$$

$$(A + B)'s 1 \text{ hour work} = \frac{2}{21}$$

$$\text{So, } C's 1 \text{ hour work} = \left[ (A + B + C)'s 1 \text{ hour work} \right] - (A + B)'s 1 \text{ hour's work} =$$

$$\left[ \frac{1}{6} - \frac{2}{21} \right] = \frac{1}{14}$$

So, C alone can fill the tank in 14 hours.

21. Option D

$$\begin{aligned}\text{Capacity of the tank} &= (12 \times 13.5) \text{ litre} = 162 \text{ litres} \\ \text{Capacity of each bucket} &= 9 \text{ litres} \\ \text{Number of buckets needed} &= \frac{162}{9} = 18\end{aligned}$$

22. Option D

$$\text{Part filled by } (A + B + C) \text{ in 1 hour} = \left[ \frac{1}{5} + \frac{1}{10} + \frac{1}{30} \right] = \frac{1}{3}$$

So, all the three pipes together will fill the tank in 3 hours.

23. Option D

Half tank will be filled in 3 hours

Lets calculate remaining half,

$$\text{Part filled by the four taps in 1 hour} = 1 \times \frac{1}{6} = \frac{2}{3}$$

$$\text{Remaining part after } \frac{1}{2} \text{ filled} = 1 - \frac{1}{2} = \frac{1}{2}$$

$$\frac{2}{3} : \frac{1}{2} :: 1 : x$$

$$x = \left[ \frac{1}{2} \times 1 \times 32 \right]$$

$$x = \frac{3}{4} \text{ hours} = 45 \text{ mins.}$$

Total time = 3 hours + 45 mins. = 3 hours 45 mins.

## Chapter – 21

# Simple interest & Compound Interest

When a person borrows some money from another person, the lender has to sacrifice his present needs. So lender should compensate for this sacrifice. This compensation is known as interest.

### **Simple interest**

The borrower has to pay interest according to some percent(interest rate) of principle for the fixed period of time. This percentage is known as Interest Rate. For example, the rate of interest is 10% per annum means the interest payable on Rs 100 for one year is Rs 10.

### **Some Basic Formulas**

If A = Amount

P = Principle

I = Interest

T = Time in years

R = Rate of interest per year, then

Amount = Principle + Interest

A = P + I

$$\text{Simple Interest} = \frac{\text{Principle} \times \text{Rate} \times \text{Time}}{100}$$

$$I = \frac{P \times R \times T}{100}$$

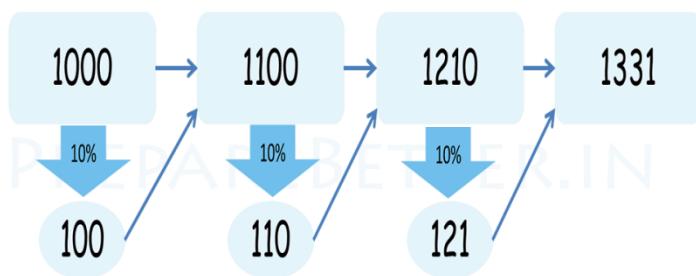
$$R = \frac{I \times 100}{P \times T} \quad OR \quad P = \frac{I \times 100}{R \times T} \quad OR \quad T = \frac{I \times 100}{P \times R}$$

### **Compound Interest**

In Compound Interest, every year interest value is added to principle and then interest is calculated on the amount.

To understand compound interest clearly, let's take an example.

Ram borrowed Rs 1000 from Sham for 3 years. What will be the interest value ?



Year	Principle	Interest (10%)	Amount
1st	1000	100	1100
2nd	1100	110	1210
3rd	1210	121	1331

### Difference between Simple Interest and compound interest

After three years, In simple interest, the total amount would be 1300

And in compound interest, the total amount would be 1331.

### Some Basic Formulas

If A = Amount

P = Principle

C.I. = Compound Interest

T = Time in years

R = Interest Rate Per Year

$$C.I. = P \left[ \left( 1 + \frac{R}{100} \right)^T - 1 \right]$$

$$A = P \left( 1 + \frac{R}{100} \right)^T$$

### Shortcut Formulas

**Rule 1:** If rate of interest is R<sub>1</sub>% for first year, R<sub>2</sub>% for second year and R<sub>3</sub>% for third year, then

$$A = P \left( 1 + \frac{R_1}{100} \right) \left( 1 + \frac{R_2}{100} \right) \left( 1 + \frac{R_3}{100} \right)$$

### Example

#### Rule

If principle = P, Rate = R% and Time = T years then

1. **If the interest is compounded annually:**

2:

$$A = P \left(1 + \frac{R}{100}\right)^T$$

2. If the interest is compounded half yearly (two times in year):

$$A = P \left(1 + \frac{\frac{R}{2}}{100}\right)^{2T}$$

3. If the interest is compounded quarterly (four times in year):

$$A = P \left(1 + \frac{\frac{R}{4}}{100}\right)^{4T}$$

**Example 1:**

Find the simple interest on Rs.7000 at  $\frac{50}{3}\%$  for 9 months

**Solution:**

$$\begin{aligned} S.I. &= \frac{P \times R \times T}{100} \\ &= \frac{7000 \times 50 \times 9}{3 \times 12 \times 100} = 875 \end{aligned}$$

**Example 2:**

If A lends Rs.3500 to B at 10% p.a. and B lends the same sum to C at 11.5% p.a., then the gain of B (in Rs.) in a period of 3 years is

**Solution:**

$$\text{Gain of B} = \frac{3500 \times 11.5 \times 3}{100} - \frac{3500 \times 10 \times 3}{100} = 157.50$$

### Exercise – 21

- 1) A sum of money at simple interest amounts to Rs. 815 in 3 years and to Rs. 854 in 4 years. The sum is:
 

a) Rs. 650	b) Rs. 690	c) Rs. 698
d) Rs. 700	e) None of these	
- 2) Mr. Thomas invested an amount of Rs. 13,900 divided in two different schemes A and B at the simple interest rate of 14% p.a. and 11% p.a. respectively. If the total amount of simple interest earned in 2 years be Rs. 3508, what was the amount invested in Scheme B?
 

a) Rs. 6400	b) Rs. 6500	c) Rs. 7200
d) Rs. 7500	e) None of these	
- 3) A sum fetched a total simple interest of Rs. 4016.25 at the rate of 9 p.c.p.a. in 5 years. What is the sum?
 

a) Rs. 4462.50	b) Rs. 8032.50	c) Rs. 8900
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- 12) A certain amount earns simple interest of Rs. 1750 after 7 years. Had the interest been 2% more, how much more interest would it have earned?  
a) Rs. 35                    b) Rs. 245                    c) Rs. 350  
d) Data inadequate        e) None of these
- 13) A person borrows Rs. 5000 for 2 years at 4% p.a. simple interest. He immediately lends it to another person at  $6\frac{1}{4}$  pa for 2 years. Find his gain in the transaction per year.  
a) Rs. 112.50              b) Rs. 125                    c) Rs. 150  
d) Rs. 150                  e) Rs. 167.50
- 14) What will be the simple interest earned on an amount of Rs.16,800 in 9 months at the rate of  $6\frac{1}{4}\%$  p.a.?  
a) Rs.787.50              b) Rs.812.50              c) Rs.860  
d) Rs.887.50              e) None of these
- 15) How much time will it take for an amount of Rs.450 to yield Rs.81 as interest at 4.5% per annum of simple interest?  
a) 3.5 years                b) 4 years                    c) 4.5 years  
d) 5 years                  e) None of these
- 16) A sum fetched a total simple interest of Rs.4016.25 at the rate of 9 p.c.p.a. in 5 years. What is the sum?  
a) Rs.4462.50              b) 8032.50                c) Rs.8900  
d) Rs.8925                  e) None of these
- 17) The simple interest on a sum of money will be Rs.600 after 10 years. If the principal is trebled after 5 years, what will be the total interest at the end of the tenth year?  
a) Rs.600                    b) Rs.900                    c) 1200  
d) Rs.1500                  e) Data inadequate
- 18) A sum of money trebles itself in 15 years 6 months. In how many years would it double itself?  
a) 6 years 3 months        b) 7 years 9 months        c) 8 years 3 months  
d) 9 years 6 months        e) None of these
- 19) If the simple interest on a certain sum for 15 months at  $7\frac{1}{2}\%$  per annum exceeds the simple interest on the same sum for 8 months at  $12\frac{1}{2}\%$  per annum by Rs.32.50, then the sum (in Rs.) is :  
a) Rs.3000                  b) Rs.3060                    c) Rs.3120  
d) Rs.3250                  e) None of these
- 20) If the annual rate of simple interest increases from 10% to  $12\frac{1}{2}\%$ , a man's yearly income increases by Rs.12520. His principal (in Rs.) is :  
a) 45,000                    b) 50,000                    c) 60,000  
d) 65,000                  e) None of these

- 21) An amount of Rs.1,00,000 is invested in two types of shares. The first yields an interest of 9% p.a. and the second, 11% p.a. If the total interest at the end of one year is  $9\frac{3}{4}\%$ , then the amount invested in each share was :  
a) Rs.52,500, Rs.47,500      b) Rs.62,500, Rs.37,500  
c) Rs.72,500, Rs.27,500      d) Rs.82,500, Rs.17,500  
e) None of these
- 22) If a sum of money at simple interest doubles in 6 years, it will become 4 times in :  
a) 12 years      b) 14 years      c) 16 years  
d) 18 years      e) None of these
- 23) A lends Rs.2500 to B and a certain sum to C at the same time at 7% p.a. simple interest. If after 4 years, A altogether receives Rs.1120 as interest from B and C, then the sum lent to C is :  
a) Rs.700      b) Rs.1500      c) Rs.4000  
d) Rs.6500      e) None of these
- 24) What should be the least number of years in which the simple interest on Rs.2600 at  $6\frac{2}{3}\%$  will be an exact number of rupees?  
a) 2      b) 3      c) 4  
d) 5      e) None of these
- 25) Mr.Thomas invested an amount of Rs.13,900 divided in two different schemes A and B at the simple interest rate of 14% p.a. and 11% p.a. respectively. If the total amount of simple interest earned in 2 years be Rs.3508, what was the amount invested in Scheme B?  
a) Rs.6400      b) Rs.6500      c) Rs.7200  
d) Rs.7500      e) None of these
- 26) The compound interest on a sum of money for 2 years is Rs.832 and the simple interest on the same sum for the same period is Rs.800. The difference between the compound Interest and the simple interest for 3 years will be;  
a) Rs.48      b) Rs.66.56      c) Rs.98.56  
d) Data inadequate      e) None of these
- 27) On a sum of money, the simple interest for 2 years is Rs.660, while the compound interest is Rs.696.30, the rate of interest being the same in both the cases. The rate of interest is :  
a) 10%      b) 10.5%      c) 12%  
d) Data inadequate      e) None of these

**Solutions:**

1.      Option C

S.I. for 1 year = Rs.  $(854 - 815) = \text{Rs.} 39$

S.I. for 3 years = Rs.  $(39 \times 3) = \text{Rs.} 117$

So, principal = Rs.  $(815 - 117) = \text{Rs.} 698$

2. Option A

Let the sum invested in scheme A be Rs. x and that in scheme B be Rs.  $(13900 - x)$

$$\text{Then, } \left[ \frac{x \times 14 \times 2}{100} \right] \div \left[ \frac{(13900 - x) \times 11 \times 2}{100} \right] = 3508$$

$$28x - 22x = 350800 - (13900 \times 22)$$

$$6x = 45000$$

$$x = 7500$$

So, sum invested in Scheme B = Rs.  $(13900 - 7500) = \text{Rs.} 6400$

3. Option D

$$\frac{x \times 9 \times 5}{100} = 4016.25$$

$$x = \frac{4016.25 \times 100}{9 \times 5} = 8925$$

4. Option B

$$\text{Time} = \left[ \frac{100 \times 81}{450 \times 4.5} \right] \text{ years} = 4 \text{ years}$$

5. Option B

Let rate = R% and time = R years

$$\text{Then, } \left[ \frac{1200 \times R \times R}{100} \right] = 432$$

$$12r^2 = 432$$

$$R^2 = 36$$

$$R = 6$$

6. Option D

S.I. = Rs.  $(15500 - 12500) = \text{Rs.} 3000$

$$\text{Rate} = \left[ \frac{100 \times 3000}{12500 \times 4} \right] \% = 6\%$$

7. Option B

Let the sum be Rs.100. Then,

$$\text{S.I. for first 6 months} = \text{Rs.} \left[ \frac{100 \times 10 \times 1}{100 \times 2} \right] = \text{Rs.} 5$$

$$\text{S.I. for last 6 months} = \text{Rs.} \left[ \frac{105 \times 10 \times 1}{100 \times 2} \right] = \text{Rs.} 5.25$$

So, amount at the end of 1 year = Rs.  $(100 + 5 + 5.25) = \text{Rs.} 110.25$   
 So, effective rate =  $(110.25 - 100) = 10.25\%$

8. Option D

Let the rate be R% p.a.

$$\text{Then, } \left[ \frac{5000 \times R \times 2}{100} \right] + \left[ \frac{3000 \times R \times 4}{100} \right] = 2200 \\ 100R + 120R = 2200$$

$$R = \left[ \frac{2200}{220} \right] = 10$$

So, rate = 10%

9. Option A

Let the original rate be R%. Then, new rate =  $(2R)\%$

Note: Here original rate is for 1 year (s); the new rate is for only 4 months i.e.  $\frac{1}{3}$  year(s).

$$\text{So, } \left[ \frac{725 \times R \times 1}{100} \right] + \left[ \frac{362.50 \times 2R \times 1}{100 \times 3} \right] = 33.50$$

$$(2175 + 725)R = 33.50 \times 100 \times 3$$

$$(2175 + 725)R = 10050$$

$$(2900)R = 10050$$

$$R = \frac{10050}{2900} = 3.46$$

So, original rate = 3.46%

10. Option C

$$\text{Principal} = \text{Rs.} \left[ \frac{100 \times 5400}{12 \times 3} \right] = \text{Rs.} 15000$$

11. Option C

Let the principal be P and rate of interest be R%.

$$\text{So, required ratio} = \frac{\frac{P \times R \times 6}{100}}{\frac{P \times R \times 9}{100}} = \frac{6PR}{9PR} = \frac{6}{9} = 2 : 3$$

12. Option D

We need to know the S.I., principal and time to find the rate.  
 Since the principal is not given, so data is inadequate.

13. Option A

$$\text{Gain in 2 years} = \text{Rs.} \left[ (5000 \times \frac{25}{4} \times \frac{2}{100}) - \left( \frac{5000 \times 4 \times 2}{100} \right) \right] \\ = \text{Rs.} (625 - 400) \\ = \text{Rs.} 225$$

$$\text{So, gain in 1 year} = \text{Rs. } \left[ \frac{225}{2} \right] = \text{Rs. } 112.50$$

14. Option A

$$\text{Time} = 9 \text{ months} = \frac{3}{4} \text{ years}$$

$$\text{So, S.I.} = \text{Rs. } \left[ 16800 \times \frac{25}{4} \times \frac{3}{4} \times \frac{1}{100} \right] = \text{Rs. } 787.50$$

15. Option B

$$\text{Time} = \left[ \frac{100 \times 81}{450 \times 4.5} \right] \text{ years} = 4 \text{ years}$$

16. Option D

$$\text{Principal} = \text{Rs. } \left[ \frac{100 \times 4016.25}{9 \times 5} \right] = \text{Rs. } \left[ \frac{401625}{45} \right] = \text{Rs. } 8925$$

17. Option C

Let the sum be Rs. x. Now, S.I. = Rs.600, T = 10 years

$$\text{Rate} = \left[ \frac{100 \times 600}{x \times 10} \right] \% = \left[ \frac{6000}{x} \right] \%$$

$$\text{S.I. for first 5 years} = \text{Rs. } \left[ \frac{x \times 5 \times 6000}{x \times 100} \right] = \text{Rs. } 300$$

$$\text{S.I. for last 5 years} = \text{Rs. } \left[ 3x \times 5 \times \frac{6000}{x \times 100} \right] = \text{Rs. } 900$$

So, total interest = Rs.1200

18. Option B

$$\text{Let sum} = x. \text{ Then, S.I.} = 2x, \text{ Time} = 15 \frac{1}{2} \text{ years} = \frac{31}{2} \text{ years}$$

$$\text{So, rate} = \left[ \frac{100 \times 2x}{x \times \frac{31}{2}} \right] \% = \frac{400}{31} \%$$

$$\text{Now, sum} = x, \text{ S.I.} = x, \text{ Rate} = \frac{400}{31} \%$$

$$\text{So, time} = \frac{100 \times x}{x \times \frac{400}{31}} = \frac{31}{4} \text{ years} = 7 \text{ years } 9 \text{ months}$$

19. Option C

$$\text{Let the sum be Rs. x. Then, } \left[ x \times \frac{15}{2} \times \frac{5}{4} \times \frac{1}{100} \right] - \left[ x \times \frac{25}{2} \times \frac{2}{3} \times \frac{1}{100} \right] = 32.50$$

$$\frac{75x}{8} - \frac{25x}{3} = 3250$$

$$25x = (3250 \times 24)$$

$$x = \left[ \frac{3250 \times 24}{25} \right] = 3120$$

20. Option B

Let the sum be Rs. x. Then,  $\left[ x \times \frac{25}{2} \times \frac{1}{100} \right] - \left[ \frac{x \times 10 \times 1}{100} \right] = 1250$

$$25x - 20x = 250000$$

$$5x = 250000$$

$$x = 50000$$

21. Option B

Let the sum invested at 9% be Rs. x and that invested at 11% be Rs. (100000 - x)

$$\text{Then, } \left[ \frac{x \times 9 \times 1}{100} \right] + \left[ \frac{(100000 - x) \times 11 \times 1}{100} \right] = \left[ 100000 \times \frac{39}{4} \times \frac{1}{100} \right]$$

$$\frac{9x + 1100000 - 11x}{100} = \frac{39000}{4} = 9750$$

$$2x = (1100000 - 975000) = 125000$$

$$x = 62500$$

Sum invested at 9% = Rs.62500

Sum invested at 11% = Rs. (100000 - 62500) = Rs.37500

22. Option D

Let sum = x. Then, S.I. = x.

$$\text{So, rate} = \left[ \frac{100 \times x}{x \times 6} \right] \% = \frac{50}{3} \%$$

Now, sum = x, S.I. = 3x, Rate =  $\frac{50}{3}\%$

$$\text{So, time} = \frac{100 \times 3x}{x \times \frac{50}{3}} = 18 \text{ years}$$

23. Option B

Let the sum lent to C be Rs. x. Then,  $\left[ \frac{2500 \times 7 \times 4}{100} \right] + \left[ \frac{x \times 7 \times 4}{100} \right] = 1120$

$$\frac{7}{25x} = (1120 - 700)$$

$$x = \left[ \frac{420 \times 25}{7} \right] = 1500$$

24. Option B

$$\text{S.I.} = \text{Rs.} \left[ 2600 \times \frac{20}{3} \times \frac{1}{100} \times T \right] = \text{Rs.} \left[ \frac{520}{3} \times T \right]$$

Which is an exact number of rupees when T = 3

25. Option A

Let the sum invested in Scheme A be Rs. x and that in Scheme B be Rs. (13900 - x)

$$\text{Then, } \left[ \frac{x \times 14 \times 2}{100} \right] + \left[ \frac{(13900 - x) \times 11 \times 2}{100} \right] = \text{Rs.} 3508$$

$$28x - 22x = 350800 - (13900 \times 22)$$

$$6x = 45000$$

$$x = 7500$$

So, sum invested in Scheme B = Rs. (13900 - 7500) = Rs.6400

26. Option C

Difference in C.I. and S.I. for 2 years = Rs.32

S.I. for one year = Rs.400

So, S.I. on Rs.400 for one year = Rs.32

$$\text{So, rate} = \left[ \frac{100 \times 32}{400 \times 1} \right] \% = 8\%$$

Hence, difference in C.I. and S.I. for 3<sup>rd</sup> year = S.I. on Rs.832 = Rs.  $\left[ \frac{832 \times 8 \times 1}{100} \right]$   
= Rs.66.56

Total difference = Rs. (32 + 66.56) = Rs.98.56

27. Option E

Difference in C.I. and S.I. for 2 years – Rs. (696.30 - 660) = Rs.36.30

S.I. for one year = Rs.330

So, S.I. on Rs.330 for 1 year = Rs.36.30

$$\text{So, rate} = \left[ \frac{100 \times 36.30}{330 \times 1} \right] \% = 11\%$$

## Chapter – 22

# Percentage

## Percentage

Word **Percent** is made by adding two words ‘Per’ and ‘Cent’. Per means every and Cent means hundred. Percent means ‘per every hundred’. 10% means ‘10 per 100’.

So we can say that  $10\% = 10/100$

### Conversion of Percentage into Fraction:

Step 1: The number is divided by 100.

Step 2: ‘%’ sign is removed.

Ex –  $30\% = 30/100$

### Conversion of Fraction Into Percentage:

Step 1: Multiply fraction by 100.

Step 2: Put a ‘%’ sign.

$6/10 = 6/10 \times 100 = 60\%$

### Conversion of Percentage into Decimal:

$40\% = 40/100 = 0.40$

### Convert Decimal Into Percentage:

$0.25 = (0.25 \times 100)\% = 25\%$

$1.50 = (1.50 \times 100)\% = 150\%$

### Example 1:

What will be the fraction of 20%

#### Solution:

$$20 \times \frac{1}{100} = \frac{1}{5}$$

### Example 2:

The ratio 5 : 20 expressed as percent equals to

#### Solution:

Actually it means 5 is what percent of 20, which can be calculated as,

$$\frac{5}{20} \times 100 = 5 \times 5 = 25$$

## Exercise – 22

- 1) 3.5 can be expressed in terms of percentage as :  
a) 0.35%      b) 3.5%      c) 35%  
d) 350%      e) None of these

2) 63% of  $3\frac{4}{7}$  is :  
a) 2.25      b) 2.40      c) 2.50  
d) 2.75      e) None of these

3) 45% of 750 - 25% of 480 = ?  
a) 216      b) 217.50      c) 236.50  
d) 245      e) None of these

4) 270 candidates appeared for an examination, of which 252 passed. The pass percentage is :  
a) 80%      b)  $83\frac{1}{2}\%$       c)  $90\frac{1}{3}\%$   
d)  $93\frac{1}{3}\%$       e) None of these

5) What percent of a day is 3 hours?  
a)  $12\frac{1}{2}\%$       b)  $16\frac{2}{3}\%$       c)  $18\frac{2}{3}\%$   
d)  $22\frac{1}{2}\%$       e) None of these

6) Which one of the following shows the best percentage?  
a)  $\frac{384}{540}$       b)  $\frac{425}{500}$       c)  $\frac{570}{700}$   
d)  $\frac{480}{660}$       e) None of these

7) 30% of 28% of 480 is the same as  
a) 15% of 56% of 240      b) 60% of 28% of 240      c) 60% of 56% of 240  
d) Data inadequate      e) None of these

8) An agent gets a commission of 2.5% on the sales of cloth. If on a certain day, he gets Rs.12.50 as commission, the cloth sold through him on that day is worth  
a) Rs.250      b) Rs.500      c) Rs.750  
d) Rs.1250      e) None of these

9) The number which exceeds 16% of it by 42 is  
a) 50      b) 52      c) 58  
d) 60      e) None of these

10) If 120 is 20% of a number, then 120% of that number will be :  
a) 20      b) 120      c) 360  
d) 720      e) None of these

- 11) When any number is divided by 12, then dividend becomes  $\frac{1}{4}$ th of the other number. By how much percent first number is greater than the second number?  
a) 150                    b) 200                    c) 300  
d) Data inadequate      e) None of these
- 12) A batsman scored 110 runs which included 3 boundaries and 8 sixes. What percent of his total score did he make by running between the wickets?  
a) 45%                    b)  $45\frac{5}{11}\%$                     c)  $54\frac{6}{11}\%$   
d) 55%                    e) None of these
- 13) 8% of the people eligible to vote are between 18 and 21 years of age. In an election, 85% of those eligible to vote, who were between 18 and 21, actually voted. In that election, the number of persons between 18 and 21, who actually voted, was what percent of those eligible to vote?  
a) 4.2                    b) 6.4                    c) 6.8  
d) 8                        e) None of these
- 14) The students appeared at an examination. One of them secured 9 marks more than the other and his marks was 56% of the sum of their marks. The marks obtained by them are :  
a) 39, 30                    b) 41, 32                    c) 42, 33  
d) 43, 34                    e) None of these
- 15) If 20% of a = b, then b% of 20 is the same as :  
a) 4% of a                    b) 5% of a                    c) 20% of a  
d) Data inadequate          e) None of these
- 16) The fruit seller had some apples. He sells 40% apples and still has 420 apples. Originally, he had :  
a) 588 apples                    b) 600 apples                    c) 672 apples  
d) 700 apples                    e) None of these
- 17) If  $x\%$  of a is the same as  $y\%$  of b, then  $z\%$  of b is :  
a)  $\frac{xy}{z}\%$  of a                    b)  $\frac{yz}{x}\%$  of a                    c)  $\frac{xz}{y}\%$  of a  
d) Data inadequate                e) None of these
- 18) What percentage of numbers from 1 to 70 have 1 or 9 in the unit's digit?  
a) 1                            b) 14                            c) 20  
d) 21                            e) None of these
- 19)  $65\% \text{ of } ? = 20\% \text{ of } 422.50$   
a) 84.5                            b) 130                            c) 139.425  
d) 200                            e) None of these
- 20) If  $A = x\% \text{ of } y$  and  $B = y\% \text{ of } x$ , then which of the following is true?







- a) Rs.32,500      b) Rs.48,750      c) Rs.76,375  
d) Rs.81,250      e) None of these
- 46) The price of a T.V. set is decreased by 25% as a result of which the sale increased by 20%. What will be the effect on the total revenue of the shop?  
a) No effect      b) 5% decrease      c) 5% increase  
d) 10% increase      e) None of these
- 47) Two numbers are respectively  $12\frac{1}{2}\%$  and 25% more than a third number. The first number as a percentage of the second number is :  
a) 50      b) 60      c) 75  
d) 90      e) None of these
- 48) In an examination, 5% of the applicants were found ineligible and 85% of the eligible candidates belonged to the general category. If 4275 eligible candidates belonged to other categories, then how many candidates applied for the examination?  
a) 30,000      b) 35,000      c) 37,000  
d) Data inadequate      e) None of these
- 49) Milk contains 5% water. What quantity of pure milk should be added to 10 litres of milk to reduce this to 2%?  
a) 5 litres      b) 7 litres      c) 15 litres  
d) Data inadequate      e) None of these
- 50) Raman's salary was decreased by 50% and subsequently increased by 50%. How much percent does he loss?  
a) Rs.25      b) Rs.50      c) Rs.75  
d) Rs.85      e) None of these
- 51) A reduction of 21% in the price of wheat enables a person to buy 10.5 kg more for Rs.100. What is the reduced price per kg?  
a) Rs.2      b) Rs.2.25      c) Rs.2.30  
d) Rs.2.50      e) None of these
- 52) How many litres of pure acid are there in 8 litres of a 20% solution?  
a) 1.4      b) 1.5      c) 1.6  
d) 2.4      e) None of these
- 53) Subtracting 6% of x from x is equivalent to multiplying x by how much?  
a) 0.094      b) 0.94      c) 9.4  
d) 94      e) None of these
- 54) Sameer spends 24% of his monthly income on food and 15% on the education of his children. Of the remaining salary, he spends 25% on entertainment and 20% on conveyance. He is now left with Rs.10,736. What is the monthly salary of Sameer?

- a) Rs.27,600  
d) Rs.32,000

- b) Rs.28,000  
e) None of these

- c) Rs.31,200

55) The price of a table is Rs.400 more than that of a chair. If 6 tables and 6 chairs together cost Rs.4800, by what percent is the price of the chair less than that of the table?

- a)  $33\frac{1}{3}\%$   
b) 50%  
c)  $66\frac{2}{3}\%$   
d) Data inadequate  
e) None of these

56) If the price of a book is first decreased by 25% and then increased by 20%, then the net change in the price will be :

- a) No change  
b) 5% increase  
c) 5% decrease  
d) 10% decrease  
e) None of these

57) The price of tea being increased by 20%, a man reduces his consumption by 20%. By how much percent will his expenses for tea be decreased?

- a) 2%  
b) 4%  
c) 6%  
d) 8%  
e) None of these

58) A's salary is 40% of B's salary which is 25% of C's salary. What percentage of C's salary is A's salary?

- a) 5%  
b) 10%  
c) 15%  
d) 20%  
e) None of these

59) The quantity of water (in ml) needed to reduce 9 ml shaving lotion containing 50% alcohol to a lotion containing 30% alcohol, is :

- a) 4  
b) 5  
c) 6  
d) 7  
e) None of these

60) Due to an increase of 30% in the price of eggs, 3 eggs less are available for Rs.7.80. The present rate of eggs per dozen is :

- a) Rs.8.64  
b) Rs.8.88  
c) Rs.9.36  
d) Rs.10.40  
e) None of these

### Solutions:

1. Option D

$$3.5 = \frac{35}{10} = \left[ \frac{35}{10} \times 100 \right] \% = 350\%$$

2. Option A

$$63\% \text{ of } 3\frac{4}{7} = \left[ \frac{63}{100} \times \frac{25}{7} \right] = \frac{4}{9} = 2.25$$

3. Option B

Given expression =  $\left[ \frac{45}{100} \times 750 \right] - \left[ \frac{25}{100} \times 480 \right] = (337.50 - 120) = 217.50$

4. Option D

$$\text{Pass percentage} = \left[ \frac{252}{270} \times 100 \right]\% = \frac{280}{3}\% = 93\frac{1}{3}\%$$

5. Option A

$$\text{Required percentage} = \left[ \frac{3}{24} \times 100 \right]\% = \frac{25}{2}\% = 12\frac{1}{2}\%$$

6. Option B

$$\frac{384}{540} = \left[ \frac{384}{540} \times 100 \right]\% = 71\frac{1}{9}\%; \quad \frac{425}{500} = \left[ \frac{425}{500} \times 100 \right]\% = 85\%$$

$$\frac{570}{700} = \left[ \frac{570}{700} \times 100 \right]\% = 81\frac{3}{7}\%; \quad \frac{480}{660} = \left[ \frac{480}{660} \times 100 \right]\% = 72\frac{8}{11}\%$$

So,  $\frac{425}{500}$  shows the best percentage.

7. Option E

$$\begin{aligned} \text{Clearly, } 60\% \text{ of } 28\% \text{ of } 240 &= \left[ \frac{60}{100} \times \frac{28}{100} \times 240 \right] = \left[ \frac{30}{100} \times \frac{28}{100} \times 2 \times 240 \right] \\ &= \left[ \frac{30}{100} \times \frac{28}{100} \times 480 \right] = 30\% \text{ of } 28\% \text{ of } 480 \end{aligned}$$

8. Option B

Let the total sale be Rs. x

Then, 2.5% of x = 12.50

$$\left[ \frac{25}{100} \times \frac{1}{100} \times x \right] = \frac{125}{10}$$

$$x = \left[ \frac{125}{10} \times \frac{100 \times 10}{25} \right] = 500$$

9. Option A

Let the number be x. Then, x - 16% of x = 42

$$x - \frac{16}{100} x = 42$$

$$x - \frac{4}{25} x = 42$$

$$\frac{21}{25} x = 42$$

$$x = \left[ \frac{42 \times 25}{21} \right] = 50$$

10. Option D

Let the number be x.

Then, 20% of  $x = 120$

$$\left[ \frac{20}{100} \times x \right] = 120$$

$$x = \left[ \frac{120 \times 100}{20} \right] = 600$$

$$\text{So, } 120\% \text{ of } x = \left[ \frac{120}{100} \times 600 \right] = 720$$

11. Option B

Let the number be  $x$  and  $y$ . Then,  $\frac{x}{12} = \frac{y}{4}$   
 $x = 3y$

$$\text{So, required percentage} = \left[ \frac{x - y}{y} \times 100 \right] \% = \left[ \frac{2y}{y} \times 100 \right] \% = 200\%$$

12. Option B

$$\begin{aligned} \text{Number of runs made by running} &= 110 - (3 \times 4 + 8 \times 6) \\ &= 110 - (60) \\ &= 50 \end{aligned}$$

$$\text{So, required percentage} = \left[ \frac{50}{110} \times 100 \right] \% = 45 \frac{5}{11}\%$$

13. Option C

Let the number of persons eligible to vote be  $x$ . Then,]

Number of eligible persons between 18 and 21 = 8% of  $x$

$$\begin{aligned} \text{Number of persons between 18 and 21, who voted} &= 85\% \text{ of } (8\% \text{ of } x) \\ &= \left[ \frac{85}{100} \times \frac{8}{100} \times x \right] = \frac{68}{1000} x \end{aligned}$$

$$\text{So, required percentage} = \left[ \frac{68x}{1000} \times \frac{1}{x} \times 100 \right] \% = 6.8\%$$

14. Option C

Let their marks be  $(x + 9)$  and  $x$ .

$$\text{Then, } x + 9 = \frac{56}{100} (x + 9 + x)$$

$$25(x + 9) = 14(2x + 9)$$

$$3x = 99$$

$$x = 33$$

So, their marks are 42 and 33.

15. Option A

20% of  $a = b$

$$\frac{20}{100} a = b$$

$$\text{So, } b\% \text{ of } 20 = \left[ \frac{b}{100} \times 20 \right] = \left[ \frac{20}{100} a \times \frac{1}{100} \times 20 \right] = \frac{4}{100} a = 4\% \text{ of } a$$

16. Option D

Suppose originally he had  $x$  apples.

Then,  $(100 - 40)\%$  of  $x = 420$

$$\frac{60}{100} \times x = 420$$

$$x = \left[ \frac{420 \times 100}{60} \right] = 700$$

17. Option C

$$x\% \text{ of } a = y\% \text{ of } b$$

$$\frac{x}{100} a = \frac{y}{100} b$$

$$b = \left[ \frac{x}{y} \right] a$$

$$\text{So, } z\% \text{ of } b = \left[ z\% \text{ of } \frac{x}{y} \right] a = \left[ \frac{xz}{y} \times 100 \right] a = \left[ \frac{xz}{y} \right]\% \text{ of } a.$$

18. Option C

Clearly, the numbers which have 1 or 9 in the unit's digit, have squares that end in the digit 1. Such numbers from 1 to 70 are 1, 9, 11, 19, 21, 29, 31, 39, 41, 49, 51, 59, 61, 69

Number of such number = 14

$$\text{So, required percentage} = \left[ \frac{14}{70} \times 100 \right]\% = 20\%$$

19. Option B

Let  $65\% \text{ of } x = 20\% \text{ of } 422.50$

$$\text{Then, } \frac{65}{100} \times x = \left[ \frac{20}{100} \times \frac{4225}{10} \right]$$

$$x = \left[ \frac{845}{10} \times \frac{100}{65} \right] = 130$$

20. Option E

$$x\% \text{ of } y = \left[ \frac{x}{100} \times y \right] = \left[ \frac{y}{100} \times x \right] = y\% \text{ of } x$$

So,  $A = B$

21. Option B

Let the number be  $x$ . Then,  $x - 40\% \text{ of } x = 30$

$$x - \frac{40}{100} x = 30$$

$$x - \frac{2}{5} x = 30$$

$$\frac{3x}{5} = 30$$

$$x = \left[ \frac{30 \times 5}{3} \right] = 50$$

22. Option A

Let the numbers be  $x$  and  $y$ . Then,

$$x + y = \frac{28}{25} x$$

$$y = \frac{28}{25} x - x$$

$$y = \frac{3}{25} x$$

$$\frac{y}{x} = \left[ \frac{3}{25} \times 100 \right] \% = 12\%$$

23. Option E

Let the number of students be  $x$ . Then,

Number of students above 8 years of age =  $(100 - 20)\% \text{ of } x = 80\% \text{ of } x$

So,  $80\% \text{ of } x = 48 + \frac{2}{3} \text{ of } 48$

$$\frac{80}{100} x = 80$$

$$x = 100$$

24. Option C

Let the total production be  $x$  lakh tons. Then,  $15\% \text{ of } x - 10\% \text{ of } x = (40 - 30)$  lakh tons

$5\% \text{ of } x = 10$  lakh tons

$$x = \left[ \frac{10 \times 100}{5} \right] = 200 \text{ lakh tons}$$

25. Option D

$$5\% \text{ of } A + 4\% \text{ of } B = \frac{2}{3} (6\% \text{ of } A + 8\% \text{ of } B)$$

$$\frac{5}{100} A + \frac{4}{100} B = \frac{2}{3} \left( \frac{6}{100} A + \frac{8}{100} B \right)$$

$$\frac{1}{20} A + \frac{1}{25} B = \frac{1}{25} A + \frac{4}{75} B$$

$$\left[ \frac{1}{20} - \frac{1}{25} \right] A = \left[ \frac{4}{75} - \frac{1}{25} \right] B$$

$$\frac{1}{100} A = \frac{1}{75} B$$

$$\frac{A}{B} = \frac{100}{75} = \frac{4}{3}$$

So, required ratio = 4 : 3

26. Option B

Let the maximum marks be x.

Then, 33% of x = 125 + 40

$$\frac{33}{100} x = 165$$

$$x = \left[ \frac{165 \times 100}{33} \right] = 500$$

27. Option D

Let the number be x.

$$\text{Then, error} = \frac{5}{3} x - \frac{3}{5} x = \frac{16}{15} x$$

$$\text{Error\%} = \left[ \frac{16x}{15} \times \frac{3}{5x} \times 100 \right]\% = 64\%$$

28. Option B

$$\text{Total number of students} = 1100 + 700 = 1800$$

$$\text{Number of students passed} = (42\% \text{ of } 1100 + 30\% \text{ of } 700) = (462 + 210) = 672$$

$$\text{Number of failures} = 1800 - 672 = 1128$$

$$\text{So, percentage failure} = \left[ \frac{1128}{1800} \times 100 \right]\% = 62 \frac{2}{3}\%$$

29. Option A

$$\text{Number of valid votes} = 80\% \text{ of } 7500 = 6000$$

$$\text{So, valid votes polled by other candidate} = 45\% \text{ of } 6000$$

$$= \left[ \frac{45}{100} \times 6000 \right] = 2700$$

30. Option B

$$\text{Required percentage} = \left[ \frac{5}{2250} \times 100 \right]\% = \frac{2}{9}\%$$

31. Option D

Let the number be x. Then, 50% of x - 35% of x = 12

$$\frac{50}{100} x - \frac{35}{100} x = 12$$

$$\frac{15}{100} x = 12$$

$$x = \left[ \frac{12 \times 100}{15} \right] = 80$$

32. Option B

Let the numbers be x and y.

$$\text{Then, } y - 25\% \text{ of } x = \frac{5}{6} y$$

$$y - \frac{5}{6}y = \frac{25}{100} x$$

$$\frac{y}{6} = \frac{x}{4}$$

$$\frac{x}{y} = \frac{4}{6} = \frac{2}{3}$$

33. Option A

$$\text{Total number of votes polled} = (1136 + 7636 + 11628) = 20400$$

$$\text{So, required percentage} = \left[ \frac{11628}{20400} \times 100 \right] \% = 57\%$$

34. Option B

Let the number of candidates appeared from each state be x.

$$\text{Then, } 7\% \text{ of } x - 6\% \text{ of } x = 80$$

$$1\% \text{ of } x = 80$$

$$x = 80 \times 100 = 8000$$

35. Option B

Let the sum paid to Y per week be Rs. z.

$$\text{Then, } z + 120\% \text{ of } z = 550$$

$$z + \frac{120}{100} z = 550$$

$$\frac{11}{5} z = 550$$

$$z = \left[ \frac{550 \times 5}{11} \right] = 250$$

36. Option B

Let the total number of votes polled be x.

$$\text{Then, votes polled by other candidate} = (100 - 84)\% \text{ of } x = 16\% \text{ of } x$$

$$\text{So, } 84\% \text{ of } x - 16\% \text{ of } x = 476$$

$$\frac{68}{100} x = 476$$

$$x = \left[ \frac{476 \times 100}{68} \right] = 700$$

37. Option C

Let the amount taxable purchases be Rs. x.

$$\text{Then, } 6\% \text{ of } x = \frac{30}{100}$$

$$x = \left[ \frac{30}{100} \times \frac{100}{6} \right] = 5$$

So, cost of tax free items = Rs.  $\left[ 25 - (5 + 0.30) \right]$  = Rs.19.70

38. Option B

$x = 80\% \text{ of } y$

$$x = \frac{80}{100} y$$

$$\frac{y}{x} = \frac{5}{4}$$

$$\frac{y}{2x} = \frac{5}{8}$$

$$\text{So, required percentage} = \left[ \frac{y}{2x} \times 100 \right]\% = \left[ \frac{5}{8} \times 100 \right]\% = 62 \frac{1}{2}\%$$

39. Option A

$$\text{Rebate} = 6\% \text{ of Rs.} 6650 = \text{Rs.} \left[ \frac{6}{100} \times 6650 \right] = \text{Rs.} 399$$

$$\text{Sales tax} = 10\% \text{ of Rs.} (6650 - 399) = \text{Rs.} \left[ \frac{10}{100} \times 6251 \right] = \text{Rs.} 625.10$$

$$\text{So, final amount} = \text{Rs.} (6251 + 625.10) = \text{Rs.} 6876.10$$

40. Option B

Let the amount with Aman be Rs.x

Then, amount received by Sahil =  $\frac{1}{4}$  of 40% of Rs. x = 10% of Rs. x

So, 10% of x = 600 + 220

$$\frac{10}{100} x = 800$$

$$x = 800 \times 10 = 8000$$

41. Option B

Increase in 10 years =  $(262500 - 175000)$  = 87500

$$\text{Increase \%} = \left[ \frac{87500}{175000} \times 100 \right]\% = 50\%$$

$$\text{So, required average} = \left[ \frac{50}{10} \right]\% = 5\%$$

42. Option A

Let total marks = x. Then,  $(30\% \text{ of } x) + 15 = (40\% \text{ of } x) - 35$

$$\frac{30}{100} x + 15 = \frac{40}{100} x - 35$$

$$\frac{1}{10} x = 50$$

$$x = 500$$

$$\text{So, passing marks} = (30\% \text{ of } 500) + 15 = \left[ \frac{30}{100} \times 500 + 15 \right] = 165$$

$$\text{So, pass percentage} = \left[ \frac{165}{500} \times 100 \right] \% = 33\%$$

43. Option B

$$\begin{aligned}\text{Actual price} &= \text{Rs. } (25 + 2.50) \\ &= \text{Rs. } 27.50 \\ \text{Therefore, saving} &= \left( \frac{2.50}{27.50} \times 100 \right) \% \\ &= \frac{100}{11} \% \\ &= 9 \times \frac{1}{11} \% \\ &= 9\%\end{aligned}$$

44. Option C

$$\text{Let total debt} = x. \text{ Asset} = \frac{87}{100} x$$

After paying 20% of the debt, he is left with 80% of the debt plus Rs.42.

$$\text{So, } 80\% \text{ of } x + 42 = \frac{87}{100} x$$

$$\begin{aligned}\frac{87}{100} x - \frac{80}{100} x &= 42 \\ x &= 600\end{aligned}$$

$$\text{So, debt} = \text{Rs. } 600 \text{ and assets} = \text{Rs. } \left[ \frac{87}{100} \times 600 \right] = \text{Rs. } 522$$

45. Option C

$$\begin{aligned}\text{Amount paid to car owner} &= 90\% \text{ of } 85\% \text{ of } \text{Rs. } 3,25,000 \\ &= \text{Rs. } \left( \frac{90}{100} \times \frac{85}{100} \times 325000 \right) \\ &= \text{Rs. } 2,48,625 \\ \text{Required difference} &= \text{Rs. } (325000 - 248625) \\ &= \text{Rs. } 76,375\end{aligned}$$

46. Option E

$$\begin{aligned}\text{Let original price per T.V.} &= \text{Rs. } 100 \text{ and original sale} = 100 \text{ T.Vs} \\ \text{Then, total revenue} &= \text{Rs. } (100 \times 100) = \text{Rs. } 10,000 \\ \text{New revenue} &= \text{Rs. } (75 \times 120) = \text{Rs. } 9000 \\ \text{So, decrease in revenue} &= \left[ \frac{1000}{10000} \times 100 \right] \% = 10\%\end{aligned}$$

47. Option D

Let third number be x.

Then, first number =  $112 \frac{1}{2}\% \text{ of } x = \frac{9x}{8}$

Second number =  $125\% \text{ of } x = \frac{5}{4} x$

So, required percentage =  $\left[ \frac{9x}{8} \times \frac{4}{5x} \times 100 \right]\% = 90\%$

48. Option A

Let the number of applicants be  $x$ .

Number of eligible candidates =  $95\% \text{ of } x$

Eligible candidates of each other categories =  $15\% \text{ of } (95\% \text{ of } x)$

$$\begin{aligned} &= \left[ \frac{15}{100} \times \frac{95}{100} \times x \right] \\ &= \frac{57}{400} \times x \end{aligned}$$

Therefore,  $\frac{57}{400} \times x = 4275$

$$x = \frac{(4275 \times 400)}{57}$$

30000

49. Option C

Quantity of water in 10 litres =  $5\% \text{ of } 10 \text{ litres} = 0.5 \text{ litres}$

Let  $x$  litres of pure milk be added. Then,  $\frac{0.5}{10 + x} = \frac{2}{100}$

$$2x = 30$$

$$x = 15$$

50. Option C

Let the original salary = Rs.100

New final salary =  $150\% \text{ of } (50\% \text{ of } \text{Rs.100})$

$$\begin{aligned} &= \text{Rs.} \left[ \frac{150}{100} \times \frac{50}{100} \times 100 \right] \\ &= \text{Rs.} 75 \end{aligned}$$

Decrease =  $25\%$

51. Option A

Let original price = Rs.  $x$  per kg.

Reduced price = Rs.  $\left[ \frac{79x}{100} \right]$  per kg

$$\text{So, } \frac{\frac{100}{79x}}{100} - \frac{100}{x} = 10.5$$

$$\frac{10000}{79x} - \frac{100}{x} = 10.5$$

$$10000 - 7900 = 10.5 \times 79x$$

$$x = \frac{2100}{10.5 \times 79}$$

So, reduced price  $= \text{Rs. } \left[ \frac{79}{100} \times \frac{2100}{10.5 \times 79} \right] \text{ per kg} = \text{Rs. } 2 \text{ per kg}$

52. Option C

Quantity of pure acid  $= 20\% \text{ of } 8 \text{ litres}$   
 $= \left[ \frac{20}{100} \times 8 \right] \text{ litres}$   
 $= 1.6 \text{ litres}$

53. Option B

Let  $x - 6\% \text{ of } x = xz$

Then,  $94\% \text{ of } x = xz$

$$\frac{94}{100} x \times \frac{1}{x} = z$$

$$z = 0.94$$

54. Option D

Let the monthly salary of Sameer be Rs. x.

Then,  $\left[ 100 - (25 + 20) \right]\% \text{ of } \left[ 100 - (24 + 15) \right]\% \text{ of } x = 10736$

$55\% \text{ of } 61\% \text{ of } x = 10736$

$$\frac{55}{100} \times \frac{61}{100} \times x = 10736$$

$$x = \left[ \frac{10736 \times 100 \times 100}{55 \times 61} \right] = 32000$$

55. Option C

Let the price of a chair be Rs. x. Then, price of a table = Rs.  $(x + 400)$

So,  $6(x + 400) + 6x = 4800$

$$12x = 2400$$

$$x = 200$$

So, price of a table = Rs. 600; Price of a chair = Rs. 200

$$\text{Required percentage} = \left[ \frac{400}{600} \times 100 \right]\% = 66 \frac{2}{3}\%$$

56. Option D

Let the original price be Rs. 100

New final price =  $120\% \text{ of } (75\% \text{ of } \text{Rs. } 100) = \text{Rs. } \left[ \frac{120}{100} \times \frac{75}{100} \times 100 \right] = \text{Rs. } 90$

So, decrease = 10%

57. Option B

Let original consumption = 100 units and original price = Rs. 100 per unit

Original expenditure = Rs.  $(100 \times 100)$  = Rs. 10000

New expenditure = Rs.  $(120 \times 80)$  = Rs. 9600

$$\text{So, decrease in expenditure} = \left[ \frac{400}{10000} \times 100 \right] \% = 4\%$$

58. Option B

$$A = 40\% \text{ of } B = 40\% \text{ of } (25\% \text{ of } C) = \left[ \frac{40}{100} \times \frac{25}{100} \times 100 \right] \% \text{ of } C = 10\% \text{ of } C$$

59. Option C

$$\text{Quantity of alcohol in 9 ml lotion} = \left[ \frac{50}{100} \times 9 \right] \text{ ml} = 4.5 \text{ ml}$$

Let the water to be added be  $x$  ml.

$$\text{Then, } \frac{4.5}{9+x} = \frac{30}{100}$$

$$270 + 30x = 450$$

$$x = 6 \text{ ml}$$

60. Option C

Let the original price per egg be Rs.  $x$ . Then, increased price = Rs.  $\left[ \frac{130}{100} x \right]$

$$\text{So, } \frac{7.80}{x} - \frac{7.80}{\frac{130}{100}x} = 3$$

$$\frac{7.80}{x} - \frac{780}{130x} = 3$$

$$1014 - 780 = 3 \times 130x$$

$$390x = 234$$

$$x = 0.6$$

$$\text{So, present price per dozen} = \text{Rs. } \left[ 12 \times \frac{130}{100} \times 0.6 \right] = \text{Rs. } 9.36$$

## Chapter – 23

# Mensuration

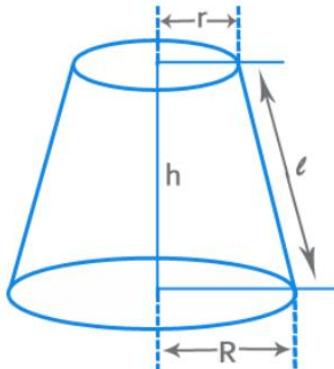
### Solid Figures

	Volume	Total surface area	Lateral/curved surface area
Cube	$side^3$	$6 \times side^2$	$4 \times side^2$
Cuboid	$L \times B \times H$	$2(LB + LH + BH)$	$2(LH + BH)$
Cylinder	$\pi r^2 h$	$2\pi r(r + h)$	$2\pi rh$
Cone	$\left(\frac{1}{3}\right) \pi r^2 h$	$\pi r(r + L)$	$\pi r l$ [where $L = \sqrt{r^2 + h^2}$ ]
Sphere	$\left(\frac{4}{3}\right) \pi r^3$	$4\pi r^2$	$4\pi r^2$
Hemisphere	$\left(\frac{2}{3}\right) \pi r^3$	$3\pi r^2$	$2\pi r^2$

There are 4 body diagonals in a cube/cuboid of length  $(\sqrt{3} \times \text{side})$  and  $\sqrt{l^2 + b^2 + h^2}$  respectively.

### Frustum / Truncated Cone

It can be obtained by cutting a cone with a plane parallel to the circular base.



$$\text{Volume} = \frac{1}{3} \pi h (R^2 + r^2 + Rr)$$

$$\text{Lateral Surface Area} = \pi(R+r) L$$

$$\text{Total Surface Area} = \pi(R+r) L + \pi (R^2 + r^2)$$

### Prism



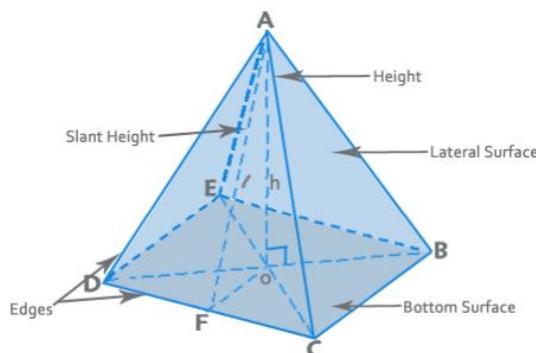
It is a solid with rectangular vertical faces and bases as congruent polygons (of n sides). It will have '2n' Vertices; 'n+2' Faces and '3n' Sides / Edges.

$$\text{Lateral Surface Area} = \text{Perimeter} \times \text{Height}$$

$$\text{Total Surface Area} = \text{Perimeter} \times \text{Height} + 2 \text{Area}_{\text{Base}}$$

$$\text{Volume} = \text{Area}_{\text{Base}} \times \text{Height}$$

### Pyramid



It is a figure in which the outer surfaces are triangular and converge at a point known as the apex, which is aligned directly above the centre of the base.

$$\text{Lateral Surface Area} = \frac{1}{2} \times \text{Perimeter} \times \text{Slant Height}$$

$$\text{Total Surface Area} = \frac{1}{2} \times \text{Perimeter} \times \text{Slant Height} + {}^{\text{Area}}\text{Base}$$

$$\text{Volume} = \frac{1}{3} \times {}^{\text{Area}}\text{Base} \times \text{Height}$$

**Facts:**

- If a sphere is inscribed in a cube of side  $a$ , the radius of the sphere will be  $\frac{a}{2}$ . If a sphere is circumscribed about a cube of side  $a$ , the radius of the sphere will be  $\sqrt{\frac{a^2}{3}}$ .
- If a largest possible sphere is inscribed in a cylinder of radius ' $a$ ' and height  $h$ , its radius  $r$  will be  $r = \frac{h}{2}$  {If  $2a > h$ },  $r = a$  {If  $2a < h$ }
- If a largest possible sphere is inscribed in a cone of radius  $r$  and slant height equal to  $2r$ , then the radius of sphere  $= \frac{r}{\sqrt{3}}$
- If a cube is inscribed in a hemisphere of radius  $r$ , then the edge of the cube  $= r \sqrt{\frac{2}{3}}$

**Example 1:**

The area of a rectangle is 460 square metres. If the length is 15% more than the breadth, what is the breadth of the rectangular field?

**Solution:**

Let breadth =  $x$  metres

$$\text{Then length} = \frac{115x}{100} \text{ metres}$$

$$= x \times \frac{115}{100} = 460$$

$$x^2 = \frac{460x \times 100}{115}$$

$$x^2 = 400$$

$$x = 20$$

**Example 2:**

A rectangular field is to be fenced on three sides leaving a side of 20 feet uncovered. If the area of the field is 680 sq. ft., how many feet of fencing will be required?

**Solution:**

We are given with length and area, so we can find the breadth.

As length  $\times$  breadth = Area

$$= > 20 \times \text{breadth} = 680$$

$$= > \text{breadth} = 34 \text{ feet}$$

$$\text{Area to be fenced} = 2B + L = 2 \times 34 + 20 = 88 \text{ feet}$$

**Exercise - 23**

- 1) One side of a rectangular field is 15 m and one of its diagonals is 17 m. Find the area of the field.  
a)  $160\ m^2$       b)  $120\ m^2$       c)  $110\ m^2$   
d)  $130\ m^2$       e) None of these
- 2) The diagonals of two squares are in the ratio of 2 : 5. Find the ratio of their areas.  
a) 25 : 4      b) 4 : 25      c) 10 : 1  
d) 1 : 10      e) None of these
- 3) Find the area of a rhombus one side of which measures 20 cm and one diagonal 24 cm.  
a)  $375\ cm^2$       b)  $378\ cm^2$       c)  $390\ cm^2$   
d)  $384\ cm^2$       e) None of these
- 4) Find the area of right angled triangle whose base is 12 cm and hypotenuse 13 cm.  
a)  $30\ cm^2$       b)  $60\ cm^2$       c)  $70\ cm^2$   
d)  $80\ cm^2$       e) None of these
- 5) The length of a rectangle is 18 cm and its breadth is 10 cm. When the length is increased to 25 cm, what will be the breadth of the rectangle if the area remains the same?  
a) 7 cm      b) 7.1 cm      c) 7.2 cm  
d) 7.3 cm      e) None of these
- 6) A rectangular parking space is marked out by painting three of its sides. If the length of the unpainted side is 9 feet, and the sum of the lengths of the painted sides is 37 feet, then what is the area of the parking space in square feet?  
a) 46      b) 81      c) 126  
d) 252      e) None of these
- 7) The length of a rectangular hall is 5 m more than its breadth. The area of the hall is  $750\ m^2$ . The length of the hall is :  
a) 15 m      b) 22.5 m      c) 25 m  
d) 30 m      e) None of these
- 8) The cost of carpeting a room 18 m long with a carpet 75 cm wide at Rs.4.50 per metre is Rs.810. The breadth of the room is :  
a) 7 m      b) 7.5 m      c) 8 m  
d) 8.5 m      e) None of these
- 9) The percentage increase in the area of a rectangle, if each of its sides is increased by 20%, is :  
a) 40%      b) 42%      c) 44%  
d) 46%      e) None of these

- 10) 2 metres broad pathway is to be constructed around a rectangular plot on the inside. The area of the plot is 96 sq. m. The rate of construction is Rs.50 per square metre. Find the total cost of the construction.

a) Rs.2400                    b) Rs.4000                    c) Rs.4800  
d) Data inadequate            e) None of these

11) A sphere of 30 cm radius is dropped into a cylindrical vessel of 80 cm diameter, which is partly filled with water, then its level rises by  $x$  cm. Find  $x$ :

a) 27.5 cm                    b) 22.5 cm                    c) 18.5 cm  
d) Data inadequate            e) None of these

12) Altitude and base of a right angle triangle are  $(x + 2)$  and  $(2x + 3)$  (in cm). If the area of the triangle be  $60 \text{ cm}^2$ , the length of the hypotenuse is :

a) 21 cm                    b) 13 cm                    c) 17 cm  
d) 15 cm                    e) None of these

13) A rectangular lawn  $60 \text{ m} \times 40 \text{ m}$  has two roads each 5 m wide running in the middle of it, one parallel to length and the other parallel to breadth. The cost of graveling the roads at 80 paise per sq. m is :

a) Rs.380                    b) Rs.385                    c) Rs.400  
d) Data Inadequate            e) None of these

14) What is the ratio of the area of larger square shaped plot to the area of the smaller square shaped plot?

a) 17 : 1                    b) 25 : 9                    c) 16 : 1  
d) Data inadequate            e) None of these

## Solutions:

- ### 1. Option B

$$\begin{aligned}\text{Other side} &= \sqrt{17^2 - 15^2} \\&= \sqrt{289 - 225} \\&= \sqrt{64} = 8 \text{ m} \\ \text{So, area} &= (15 \times 8) \text{ } m^2 = 120 \text{ } m^2\end{aligned}$$

- ## 2. Option B

Let the diagonals of the squares be  $2x$  and  $5x$  respectively.

$$\text{So, ratio of their areas} = \frac{1}{2} \times (2x^2) : \frac{1}{2} \times 5x^2 = 4x^2 : 25x^2 = 4 : 25$$

- ### 3. Option D

Let other diagonal =  $2x$  cm.

Since diagonals of a rhombus bisect each other at right angles, we have :

$$(20)^2 = (12)^2 + x^2$$

$$x = \sqrt{20^2 - 12^2} = \sqrt{256} = 16 \text{ cm.}$$

So, other diagonal = 32 cm.

$$\text{So, area of rhombus} = \frac{1}{2} \times (\text{Product of diagonals}) = \left[ \frac{1}{2} \times 24 \times 32 \right] \text{ cm}^2 = 384 \text{ cm}^2$$

4. Option A

$$\text{Height of the triangle} = \sqrt{13^2 - 12^2} \text{ cm} = \sqrt{25} \text{ cm} = 5 \text{ cm.}$$

$$\text{So, its area} = \frac{1}{2} \times \text{Base} \times \text{Height} = \left[ \frac{1}{2} \times 12 \times 5 \right] \text{ cm}^2 = 30 \text{ cm}^2$$

5. Option C

Let the breadth be b. Then,  $25 \times b = 18 \times 10$

$$b = \left[ \frac{18 \times 10}{25} \right] \text{ cm} = 7.2 \text{ cm}$$

6. Option C

Clearly we have L = 9 and  $L + 2b = 37$  or  $b = 14$

So, area =  $(L \times b) = (9 \times 14)$  sq. ft. = 126 sq. ft.

7. Option D

Let breadth = x metres. Then, length =  $[x + 5]$  metres

Then,  $x(x + 5) = 750$

$$x^2 + 5x - 750 = 0$$

$$(x + 30)(x - 25) = 0$$

$$x = 25$$

$$\text{So, length} = (x + 5) = 30 \text{ m}$$

8. Option B

$$\text{Length of the carpet} = \left[ \frac{\text{total cost}}{\text{Rate}/m} \right] = \left[ \frac{8100}{45} \right] \text{ m} = 180 \text{ m.}$$

$$\text{Area of the room} = \text{Area of the carpet} = \left[ 180 \times \frac{75}{100} \right] \text{ m}^2 = 135 \text{ m}^2$$

$$\text{So, breadth of the room} = \left[ \frac{\text{Area}}{\text{length}} \right] = \left[ \frac{135}{18} \right] \text{ m} = 7.5 \text{ m}$$

9. Option C

Let original length = x metres and original breadth = y metres.

$$\text{Original area} = (xy) \text{ m}^2$$

$$\text{New length} = \left[ \frac{120}{100} x \right] \text{ m} = \left[ \frac{6}{5} x \right] \text{ m}, \text{ New breadth} = \left[ \frac{120}{100} y \right] \text{ m} = \left[ \frac{6}{5} y \right] \text{ m}$$

$$\text{New area} = \left[ \frac{6}{5} x \times \frac{6}{5} y \right] m^2 = \left[ \frac{36}{25} xy \right] m^2$$

$$\text{So, increase \%} = \left[ \frac{11}{25} xy \times \frac{1}{xy} \times 100 \right] \% = 44\%$$

10. Option D

$$Lb = 96 \text{ (Given)}$$

Area of pathway =  $[(L - 4)(b - 4) - Lb] = 16 - 4(L + b)$ , which can be determined. So, data is inadequate.

11. Option B

Volume of water displaced = volume of sphere

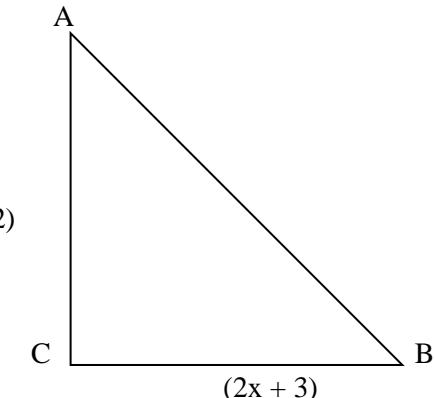
$$\pi \times (40)^2 \times h = \frac{4}{3} \pi \times (30)^3$$

$$h = \frac{90}{4} = 22.5 \text{ cm}$$

Thus, the level of water rises by 22.5 cm.

**Note** The volume of water will be calculated by considering it in the cylindrical shape since the water takes the shape of vessel in which it is filled.

12. Option C



$$\text{Area of right angle triangle} = \frac{(x+2)(2x+3)}{2} = 60$$

$$2x^2 + 7x + 6 = 120$$

$$2x^2 + 7x - 114 = 0$$

Solving the above quadratic equation, we get  $x = 6$

$$x + 2 = 8 \text{ cm}$$

$$\text{and } 2x + 3 = 15 \text{ cm}$$

$$\text{So, Hypotenuse AB} = \sqrt{(8)^2 + (15)^2} = 17 \text{ cm}$$

13. Option A

$$\text{Area of path} = (L + b - w) w$$

$$\begin{aligned} &= (60 + 40 - 5) \times 5 = 475 \text{ } m^2 \\ \text{Cost} &= \text{Area} \times \text{rate} \\ &= 475 \times 0.8 = \text{Rs.}380 \end{aligned}$$

14. Option C

$$\frac{4x \times 4x}{x \times x} = \frac{16}{1} = 16 : 1$$

## Chapter – 25

# Data sufficiency

### Exercise - 25

In each of the question below consists of a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statements are sufficient to answer the question. Read both the statements and

Give answer

- (A) if the data in statement I alone are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question
- (B) if the data in statement II alone are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question
- (C) if the data either in statement I alone or in statement II alone are sufficient to answer the question
- (D) if the data given in both statements I and II together are not sufficient to answer the question and
- (E) if the data in both statements I and II together are necessary to answer the question

1) In which year was Rahul born?

**Statements:**

- I. Rahul at present is 25 years younger to his mother.
- II. Rahul's brother, who was born in 1964, is 35 years younger to his mother.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

2) What will be the total weight of 10 poles, each of the same weight?

**Statements:**

- I. One-fourth of the weight of each pole is 5 kg.
- II. The total weight of three poles is 20 kilograms more than the total weight of two poles.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient

E. Both I and II are sufficient

3) How many children does M have?

**Statements:**

- I. H is the only daughter of X who is wife of M.
- II. K and J are brothers of M.

A. I alone is sufficient while II alone is not sufficient

B. II alone is sufficient while I alone is not sufficient

C. Either I or II is sufficient

D. Neither I nor II is sufficient

E. Both I and II are sufficient

4) How much was the total sale of the company?

**Statements:**

- I. The company sold 8000 units of product A each costing Rs.25
- II. This company has no other product line.

A. I alone is sufficient while II alone is not sufficient

B. II alone is sufficient while I alone is not sufficient

C. Either I or II is sufficient

D. Neither I nor II is sufficient

E. Both I and II are sufficient

5) The last Sunday of March, 2006 fell on which date?

**Statements:**

- I. The first Sunday of that month fell on 5<sup>th</sup>.
- II. The last day of that month was Friday.

A. I alone is sufficient while II alone is not sufficient

B. II alone is sufficient while I alone is not sufficient

C. Either I or II is sufficient

D. Neither I nor II is sufficient

E. Both I and II are sufficient

Each of the questions given below consists of a statement and / or a question and two statements numbered I and II given below it. You have to decide whether the data provided in the statement(s) is/are sufficient to answer the given question. Read the both statements and

Give answer

6) What is the number?

**Statements:**

- I. The sum of the two digits is 8. The ratio of the two digits is 1 : 3.
- II. The product of the two digit of a number is 12. The quotient of two digits is 3.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

7) What is the two-digit number?

**Statements:**

- I. The difference between the two digits is 9.
- II. The sum of the digits is equal to the difference between the two digits.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

8) What is the two-digit number whose first digit is  $a$  and the second digit is  $b$ ? The number is greater than 9.

**Statements:**

- I. The number is multiple of 51.
- II. The sum of the digits  $a$  and  $b$  is 6.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

9) What is the code for 'sky' in the code language?

**Statements:**

- I. In the code language, 'sky is clear' is written as 'de ra fa' /
- II. In the same code language, 'make it clear' is written as 'de ga jo'

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

10) How many children are there between P and Q in a row of children?

**Statements:**

- I. P is 15<sup>th</sup> from the left in the row.
- II. Q is exactly in the middle and there are ten children towards his right.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient

- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

11) How is T related to K?

**Statements:**

- I. R's sister J has married T's brother L, who is the only son of his parents.
- II. K is the only daughter of L and J.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

12) How is J related to P?

**Statements:**

- I. M is brother of P and T is sister of P.
- II. P's mother is married to J's husband who has one son and two daughters.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

13) How is X related to Y?

**Statements:**

- I. Y and Z are children of D who is wife of X.
- II. R's sister X is married to Y's father.

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

Each question given has a problem and two statements numbered I and II giving certain information. You have to decide if the information given in the statement is sufficient for answering the problem.

14) What is Reen's rank in the class?

**Statements:**

- I. There are 26 students in the class
- II. There are 9 students who have scored less than Reena

- A. I alone is sufficient while II alone is not sufficient
- B. II alone is sufficient while I alone is not sufficient
- C. Either I or II is sufficient
- D. Neither I nor II is sufficient
- E. Both I and II are sufficient

15) Who is father of M?

**Statements:**

- I. A and B are brothers.
- II. B's wife is sister of M's wife.

16) Who is Manohar's birthday this year?

**Statements:**

- I. It is between January 13 and 15, January 13 being Wednesday.
- II. It is not on Friday.

17) What is the monthly salary of Praveen?

**Statements:**

- I. Praveen gets 15% more than Sumit while Sumit gets 10% less than Lokesh.
- II. Lokesh's monthly salary is Rs.2500.

18) The Chairman of a big company visits one department on Monday of every week except for the Monday of third week of every month. When did he visit the purchase department?

**Statements:**

- I. He visited Account department in the second week of September after having visited purchase department on the earlier occasion.
- II. He has visited purchase department immediately after visiting stores department but before visiting Accounts department.

19) Which day of the last week did Satish meet Kapil at Kapil's residence?

**Statements:**

- I. Kapil was out of town from Monday to Wednesday. He returned on Thursday morning.
- II. On Friday night Satish telephoned his friend to inform that only yesterday he had got approval of Kapil after personally explaining to him all the details?

20) How much was the total sale of the company?

**Statements:**

- I. The company sold 8000 units of product A each costing Rs.25.
- II. The company has no other product line.

21) Who is to the immediate right of P among five persons P, Q, R, S and T facing North?

**Statements:**

- I. R is third to the left of Q and P is second to the right of R.

II. Q is to the immediate left of T who is second to the right of P.

22) On which date of month was Anjali born in February 2004?

**Statements:**

- I. Anjali was born on an even date of the month.
- II. Anjali's birth date was a prime number.

23) How is X related to Y?

**Statements:**

- I. Y says, "I have only one brother".
- II. X says, "I have only one sister"/

24) How is F related to P?

**Statements:**

- I. P has two sisters M and N.
- II. F's mother is sister of M's father.

25) B is the brother of A. How is A related to B?

**Statements:**

- I. A is the sister of C.
- II. E is the husband of A.

26) A, B, C, D and E are sitting in a row. B is between A and E. Who among them is in the middle?

**Statements:**

- I. A is left of B and right of D.
- II. C is at the right end.

27) Is Arun taller than Sachin?

**Statements:**

- I. Dinesh is of the same height as Arun and Sachin.
- II. Sachin is not shorter than Dinesh.

28) In a certain language 'pit nac mit' means 'red pant shirt' which word mean 'pant' in that language?

**Statements:**

- I. 'mit tim nac sir' means 'he wore red pant'
- II. 'nee jic pit' means 'shirt is dirty'

29) How many children are there in the row of children facing north?

**Statements:**

- I. Vishakha who is fifth from the left end is eighth to the left of Ashish who is twelfth from the right end.
- II. Rohit is fifth to the left of Nisha who is seventh from the right end and eighteenth from the left end.

30) How many doctors are practicing in this town?

**Statements:**

- I. There is one doctor per seven hundred residents.
- II. There are 16 wards with each ward having as many doctors as the number of wards.

31) On which day of the week was birthday of Sahil?

**Statements:**

- I. Sahil celebrated his birthday the very next day on which Arun celebrated his birthday.
- II. The sister of Sahil was born on the third day of the week and two days after Sahil was born.

32) How many pages of book X did Robert read on Sunday?

**Statements:**

- I. The book has 300 pages out of which two-thirds were read by him before Sunday.
- II. Robert read the last 40 pages of the book on the morning of Monday.

33) How is Tanya related to man in the photograph?

**Statements:**

- I. Man in the photograph is the only son of Tanya's grandfather.
- II. The man in the photograph has no brothers or sisters and his father is Tanya's grandfather.

34) Among T, V, B, E and C, who is the third from the top when arranged in the descending order of their weights?

**Statements:**

- I. B is heavier than T and C and is less heavier than V who is not the heaviest.
- II. C is heavier than only T.

35) Which word in the code language means 'flower'?

**Statements:**

- I. 'de fu la pane' means 'rose flower is beautiful' and 'la quiz' means 'beautiful tree'.
- II. 'de la chin' means 'red rose flower' and 'pa chin' means 'red tea'.

36) How many students in a class play football?

**Statements:**

- I. Only boys play football.
- II. There are forty boys and thirty girls in the class.

37) Who is C's partner in a game of cards involving four players A, B, C and D?

**Statements:**

- I. D is sitting opposite to A.
- II. B is sitting right of A and left of D.

38) On a T.V. channel, four serials A, B, C and D were screened, one on each day, on four consecutive days but not necessarily in that order. On which day was the serial C screened?

**Statements:**

- I. The first serial was screened on 23<sup>rd</sup>, Tuesday and was followed by serial D.
- II. Serial A was not screened on 25<sup>th</sup> and one serial was screened between serials A and B.

39) What is the speed of running train?

**Statements:**

- I. If train covers a bridge in 40 seconds.
- II. If train crosses another train in 10 seconds.

40) C is the brother of D. How is D related to C?

**Statements:**

- I. D is the sister of E.
- II. F is the husband of D.

41) How many persons saw the Mela today?

**Statements:**

- I. Each pass holder can bring two persons with him/her.
- II. In all 200 passes are sold till today.

42) How is Sulekha related to Nandini?

**Statements:**

- I. Sulekha's husband is the only son of Nandini's mother.
- II. Sulekha's brother and Nandini's husband are cousins.

43) Can Ritesh retire from office X in January 2006, with full pension benefits?

**Statements:**

- I. Ritesh will complete 30 years of service in office X in April 2000 and desires to retire.
- II. As per office X rules, an employee has to complete minimum 30 years of service and attain age of 60. Ritesh has 3 years to complete age of 60.

44) What is the code for 'or' in the code language?

**Statements:**

- I. 'nil sa te' means 'right or wrong', 'ro da nik' means 'he is right' and 'fe te ro' means 'that is wrong'.
- II. 'pa nnik la' means 'that right man', 'sa ne pa' means 'this or that' and 'ne ka re' means 'tell this there'.

45) Madan is elder than Kamal and Sharad is younger than Arvind. Who among them is the youngest?

**Statements:**

- I. Sharad is younger than Madan.
- II. Arvind is younger than Kamal.

46) On which date in August was Kapil born?

**Statements:**

- I. Kapil's mother remembers that Kapil was born before nineteenth but after fifteenth.
- II. Kapil's brother remembers that Kapil was born before seventeenth but after twelfth.

47) What is Gagan's age?

**Statements:**

- I. Gagan, Vimal and Kunal are all of the same age.
- II. Total age of Vimal, Kunal and Anil is 32 years and Anil is as old as Vimal and Kunal together.

**Solutions:**

1. Option E

From both I and II, we find that Rahul is  $(35 - 25) = 10$  years older than his brother, who was born in 1964. So, Rahul was born in 1954

2. Option C

From I, we conclude that weight of each pole =  $(4 \times 5)$  kg = 20 kg

So, total weight of 10 poles =  $(20 \times 10)$  kg = 200 kg

From II, we conclude that:

Weight of each pole = (weight of 3 poles) - (weight of 2 poles) = 20 kg

So, total weight of 10 poles =  $(20 \times 10)$  kg = 200 kg

3. Option D

From I, we conclude that H is the only daughter of M. But this does not indicate that M has no son. The information given in II is immaterial.

4. Option E

From I, total sale of product A = Rs.  $(8000 \times 25)$  = Rs.200000

From II, we know that the company deals only in product A.

This implies that sale of product A is the total sale of the company, which is Rs.200000

5. Option C

From I, we conclude that 5<sup>th</sup>, 12<sup>th</sup>, 19<sup>th</sup>, and 26<sup>th</sup> of March, 2006 were Sundays. So, the last Sunday fell on 26<sup>th</sup>.

From II, we conclude that 31<sup>st</sup> March 2006 was Friday. Thus, 26<sup>th</sup> March 2006 was last Sunday of the month.

## 6. Option C

Let the tens and units digit be  $x$  and  $y$  respectively. Then,

I.  $x + y = 8$  and  $\frac{x}{y} = \frac{1}{3}$

I gives,  $4y = 24$

$$y = 6$$

$$\text{So, } x + 6 = 8$$

$$x = 2$$

II.  $xy = 12$  and  $\frac{x}{y} = \frac{3}{1}$

II gives,  $x^2 = 36$

$$x = 6$$

$$\text{So, } 3y = 6$$

$$y = 2$$

Therefore, Either I or II alone sufficient

## 7. Option E

Let the tens and unit digits be  $x$  and  $y$  respectively. Then,

I.  $x - y = 9$

II.  $x + y = x - y$

From I and II, we get  $x - y = 9$  and  $x + y = 9$

On solving, we get  $x = 9$  and  $y = 0$

So, required number is 90.

Thus, both I and II are needed to get the answer.

## 8. Option A

I. A two digit number, greater than 9 and multiple of 51 should be 51 itself.

Because,  $2 \times 51 = 102$  (3 digit number). Therefore, I alone sufficient to answer.

II. A two digit number, greater than 9 and sum of the digit is 6.

It can be 15, 24, 33, 42, 51. So we cannot determine the required answer from the statement II alone.

Thus, I alone give the answer while II alone not sufficient

## 9. Option D

The only word common to I and II is ‘clear’ and as such, only the code for ‘clear’ can be ascertained from the given information.

## 10. Option E

From II, Q being in the middle, there are 10 children to his right as well as to his left. So, Q is 11<sup>th</sup> from the left. From I, P is 15<sup>th</sup> from the left.

Thus, from both I and II, we conclude that there are 3 children between P and Q.

11. Option E

From I, we know that L is T's brother and J's husband. Since L is the only son of his parents, T is L's sister.

From II, we know that K is L's daughter.

Thus, from I and II, we conclude that T is the sister of K's father i.e. T is K's aunt.

12. Option B

From II, we know that P's mother is married to J's husband, which means that J is P's mother.

13. Option C

From I, we conclude that Y is the child of D who is wife of X i.e. X is Y's father.

From II, X is married to Y's father. This implies that X is Y's mother.

14. Option E

From I and II we conclude that there are 16 students above Reena in rank. Thus, Reena's rank is 17<sup>th</sup> in the class. So, both the statements are necessary.

15. Option D

From II we conclude that B is the brother-in-law of M, So, even from both the statements, we can't find out who is the father of M.

16. Option A

From statement I, we conclude that Manohar's birthday is on January 14 which is Thursday this year. So only I is needed.

17. Option E

From both the given statements, we find that Praveen's salary = 1115% of (90% of Rs.2500) = Rs.2587.50

So, both I and II are required.

18. Option A

From statement I we can conclude that the Chairman visited purchase department on Monday of the first week of September. So, I alone is sufficient.

19. Option B

Statement II reveals that Satish met his friend Kapil on the day prior to Friday i.e. Thursday.

20. Option E

From statement I and II together we find that company sells only product A and total sales of product A = Rs.  $(8000 \times 25)$  = Rs.200000 which is also the total sale of the company.

21. Option C

From I, we have the order : R, -, P, Q.

From II, we have the order : P, Q, T

Clearly, each one of the above two orders indicates that Q is to the immediate right of P.

22. Option E

From I and II, we conclude that Anjali was born in February 2004 on a date which is an even prime number, since the only even prime number is 2, so Anjali was born on 2<sup>nd</sup> February 2004.

23. Option D

The statements in I and II do not provide any clue regarding relation between X and Y.

24. Option E

From I and II, we conclude that P is M's brother and so M's father is P's father. So, F is the child of the sister of P's father i.e. F's mother is P's aunt or F is P's cousin.

25. Option C

B is A's brother means A is either brother or sister of B. Now each one of I and II individually indicates that A is a female, which means that A is B's sister.

26. Option E

Clearly we have the order : A, B, E

From I we have the order : D, A, B, E

From II we get the complete sequence as D, A, B, E, C. Clearly B is in middle. So, both I and II are required.

27. Option A

From statement I we can conclude that Arun, Sachin and Dinesh are of same height.

28. Option D

Clearly from each of the statements, we find that the code for ‘pant’ is either ‘mit’ or ‘nac’. So, none of them sufficient to answer the question.

29. Option C

Since 8<sup>th</sup> to the left of 12<sup>th</sup> from the right is 20<sup>th</sup> from the right. So, from I, we know that Vishakha is 5<sup>th</sup> from left and 20<sup>th</sup> from right i.e. there are 4 children to the left and 19 to the right of Vishakha. So, there are  $(4 + 1 + 19)$  i.e. 24 children in the row.

From II, Nisha is 7<sup>th</sup> from right and 18<sup>th</sup> from left end of the row.

So, there are  $(6 + 1 + 17) = 24$  children in the row.

30. Option B

From I, total number of doctors in town =  $\left[ \frac{1}{700} \times N \right]$ , where N = total number of residents in town. But, the value of N is not known.

From II, total number of doctors in town.

= (Number of wards in town)  $\times$  (Number of doctors in each ward)

=  $16 \times 16 = 256$

31. Option B

I does not mention the day of the week on the birthday of either Arun or Sahil.

According to II, Sahil’s sister was born on Wednesday and Sahil was born two days before Wednesday i.e. on Monday.

32. Option E

From I and II, we find that Robert read  $\left[ 300 \times \frac{2}{3} \right]$  i.e. 200 pages before Sunday and the last 40 pages on Monday.

This means that he read  $\left[ 300 - (200 + 40) \right]$  i.e. 60 pages on Sunday.

33. Option B

From I, we conclude that the man is the only son of Tanya’s grandfather i.e. he is Tanya’s father or Tanya is the man’s daughter.

From II, we conclude that the man’s father is Tanya’s grandfather. Since the man has no brothers or sisters, so he is Tanya’s father or Tanya is the man’s daughter.

34. Option A

From I, we have : B > T, B > C, V > B. Thus, V is heavier than each one of B, T and C. But V is not the heaviest. So, E is the heaviest.

Thus, we have the order. E > V > B > T > C or E > V > B > C > T. Clearly, B is third from the top.

35. Option D

From the two statements given in I, the code for the only common word ‘beautiful’ can be determined.

From the two statements given in II, the code for the only common word ‘red’ can be determined.

In I and II, the common words are ‘rose and flower’ and the common code words are ‘de’ and ‘la’. So, the code for ‘flower’ is either ‘de’ or ‘la’.

36. Option D

It is not mentioned whether all the boys or a proportion of them play football.

37. Option C

Clearly, each of the given statements shows that B is sitting opposite to C or B is the partner of C.

38. Option E

From I, we know that the serials were screened on 23<sup>rd</sup>, 24<sup>th</sup>, 25<sup>th</sup> and 26<sup>th</sup>.

Clearly, D was screened second i.e. on 24<sup>th</sup>, Wednesday.

From II, we know that one serial was screened between A and B.

So, A and B were screened first and third, i.e. on 23<sup>rd</sup> and 25<sup>th</sup>. But A was not screened on 25<sup>th</sup>.

So, A was screened on 23<sup>rd</sup> and B on 25<sup>th</sup>. Thus, C was screened on 26<sup>th</sup>, Friday.

39. Option D

As we know that to calculate the speed, we need distance covered in particular time. So, we need these two data in the statements. But in the above example, it is obvious that both data are insufficient.

40. Option C

Data provided by both statements I and II shows that D is female.

41. Option D

Beacuse even by using both statements exact number of Mela viewers cannot be calculated.

42. Option C

From I, we conclude that Sulekha is the wife of Nandini's mother's only son i.e. Nandini's brother. Thus, Sulekha is Nandini's sister-in-law.

From II, we conclude that Sulekha is the cousin of Nandini's husband, which implies that Sulekha is Nandini's sister-in-law.

43. Option E

Clearly, the facts given in I and II contain two conditions to be fulfilled to get retirement and also indicate that Ritesh fulfills only one condition out of them.

44. Option C

I. In 'right or wrong' and 'he is right', the common word is 'right' and the common code word is 'nik'. So 'nik' means 'right'. In 'right or wrong' and 'that is wrong', the common word is 'wrong' and the common code word is 'te'. So, 'te' means 'wrong'.

Thus, in 'right or wrong', 'sa' is the code for 'or'. II. In 'that right man' and 'this or that', the common word is 'that' and the common code word is 'pa'. So, 'pa' means 'that'. In 'this or that' and 'tell this there', the common word is 'this' and the common code word is 'ne'. So, 'ne' means 'this'. Thus, in 'this or that', 'sa' is the code for 'or'.

45. Option B

As given, we have :  $M > K, A > S$ .

From II,  $K > A$ . Thus, we have :  $M > K > A > S$ .

So, Sharad is the youngest. From I,  $M > S$ . Thus, we have :  $M > K > A > S$  or  $M > A > K > S$  or  $M > A > S > K$ .

46. Option E

From I, we conclude that Kapil was born on any one of the dates among 16<sup>th</sup>, 17<sup>th</sup> and 18<sup>th</sup>.

From II, we conclude that Kapil was born on any one of the dates among 13<sup>th</sup>, 14<sup>th</sup>, 15<sup>th</sup> and 16<sup>th</sup>.

Thus, from both I and II, we conclude that Kapil was born on 16<sup>th</sup> August.

47. Option E

As given in I and II, we have :  $G = V = K, V + K + A = 32$  and  $A = V + K$

Putting  $V + K = A$  in  $V + K + A = 32$ , we have :  $2A = 32$  or  $A = 16$

Thus,  $V + K = 16$  and  $V = K$ . So,  $V = K = 8$ . Thus,  $G = 8$



Model Paper – 1

Study the following table and answer the questions based on it.

**Expenditures of a Company (in Lakh Rupees) per Annum Over the given Years.**

Year	Item of Expenditure				
	Salary	Fuel and Transport	Bonus	Interest on Loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	101	3.84	41.6	74
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

15. What is the average amount of interest per year which the company had to pay during this period?
- a) Rs.32.43 lakhs      b) Rs.33.72 lakhs      c) Rs.34.18 lakhs  
d) Rs.36.66 lakhs      e) None of these
16. The total amount of bonus paid by the company during the given period is approximately what percent of the total amount of salary paid during this period?
- a) 0.1%      b) 0.5%      c) 1%  
d) 1.25%      e) None of these
17. Total expenditure on all these items in 1998 was approximately what percent of the total expenditure in 2002?
- a) 62%      b) 66%      c) 69%  
d) 71%      e) None of these
18. The total expenditure of the company over these items during the year 2000 is?
- a) Rs.544.44 lakhs      b) Rs.501.11 lakhs      c) Rs.446.46 lakhs  
d) Rs.478.87 lakhs      e) None of these
19. The ratio between the total expenditure on taxes for all the years and the total expenditure on fuel and transport for all the years respectively is approximately?
- a) 4 : 7      b) 10 : 13      c) 15 : 18  
d) 5 : 8      e) None of these
20. On 6<sup>th</sup> March 2005 Monday falls. What was the day of the week on 6<sup>th</sup> March 2004?
- a) Sunday      b) Saturday      c) Tuesday  
d) Wednesday      e) None of these
21. At what angle the hands of a clock are inclined at 15 minutes past 5?
- a)  $58\frac{1}{2}^\circ$       b)  $64^\circ$       c)  $67\frac{1}{2}^\circ$   
d)  $72\frac{1}{2}^\circ$       e) None of these
22. Two pipes A and B can fill a tank in 20 and 30 minutes respectively. If both the pipes are used together, then how long will it take to fill the tank?
- a) 12 min      b) 15 min      c) 25 min  
d) 50 min      e) None of these
23. A lent Rs. 5000 to B for 2 years and Rs. 3000 to C for 4 years on simple interest at the same rate of interest and received Rs. 2200 in all from both of them as interest. The rate of interest per annum is:
- a) 5%      b) 7%      c) 7 1/8%  
d) 10%      e) None of these
24. An agent gets a commission of 2.5% on the sales of cloth. If on a certain day, he gets Rs.12.50 as commission, the cloth sold through him on that day is worth
- a) Rs.250      b) Rs.500      c) Rs.750

- d) Rs.1250      e) None of these

25. The cost of carpeting a room 18 m long with a carpet 75 cm wide at Rs.4.50 per metre is Rs.810. The breadth of the room is :  
 a) 7 m      b) 7.5 m      c) 8 m  
 d) 8.5 m      e) None of these

26. Which one of the following is the common factor of  $(47^{43} + 43^{43})$  and  $(47^{47} + 43^{47})$ ?  
 a)  $(47 - 43)$       b)  $(47 + 43)$       c)  $(47^{43} + 43^{43})$   
 d) Data inadequate      e) None of these

27. A Students was asked to find the arithmetic mean of the numbers 3, 11, 7, 9, 15, 13, 8, 19, 17, 21, 14 and x. He found the mean to be 12. What should be the number in place of x?  
 a) 3      b) 7      c) 17  
 d) 31      e) None of these

28. Which of the following is a pair of co-primes?  
 a) (16, 62)      b) (18, 25)      c) (21, 35)  
 d) (23, 92)      e) None of these

29. A camel pursue an elephant and takes 5 leaps for every 7 leaps of the elephant, but 5 leaps of elephant are equal to 3 leaps of camel. What is the ratio of speeds of camel and elephant?  
 a) 21 : 25      b) 24 : 23      c) 25 : 21  
 d) 23 : 24      e) None of these

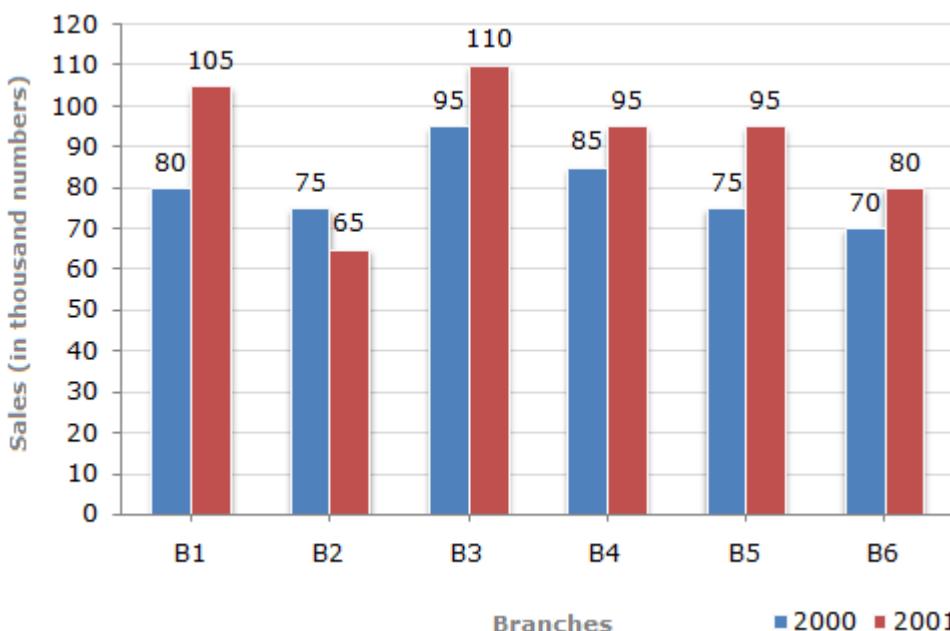
30. A, B and C jointly thought of engaging themselves in a business venture. It was agreed that A would invest Rs. 6500 for 6 months, B, Rs. 8400 for 5 months and C, Rs. 10,000 for 3 months. A wants to be the working member for which, he was to receive 5% of the profits. The profit earned was Rs. 7400. Calculate the share of B in the profit.  
 a) Rs. 1900      b) Rs. 2660      c) Rs. 2800  
 d) Rs. 2840      e) None of these

31. In how many different ways can 6 different balls be distributed to 4 different boxes, when each box can hold any number of ball?  
 a) 2048      b) 1296      c)  $(24)^2$   
 d) 4096      e) None of these

32. In a single throw of a dice, What is the probability of getting a number greater than 4?  
 a)  $\frac{1}{2}$       b)  $\frac{1}{3}$       c)  $\frac{2}{3}$   
 d)  $\frac{1}{4}$       e) None of these

The bar graph given below shows the sales of books (in thousand number) from six branches of a publishing company during two consecutive years 2000 and 2001.

**Sales of Books (in thousand numbers) from Six Branches - B1, B2, B3, B4, B5 and B6 of a publishing Company in 2000 and 2001.**

**Branches****■ 2000 ■ 2001**

41. What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?
- 2 : 3
  - 3 : 5
  - 4 : 5
  - 7 : 9
  - None of these
42. Total sales of branch B6 for both the years is what percent of the total sales of branches B3 for both the years?
- 68.54%
  - 71.11%
  - 73.17%
  - 75.55%
  - None of these
43. What percent of the average sales of branches B1, B2 and B3 in 2001 is the average sales of branches B1, B3 and B6 in 2000?
- 75%
  - 77.5%
  - 82.5%
  - 87.5%
  - None of these
44. What is the average sales of all the branches (in thousand numbers) for the year 2000?
- 73
  - 80
  - 83
  - 88
  - None of these
45. Total sales of branches B1, B3 and B5 together for both the years (in thousand numbers) is?
- 250
  - 310
  - 435
  - 560
  - None of these
46. In what ratio must water be mixed with milk costing Rs.12 per litre to obtain a mixture worth of Rs.8 per litre?
- 1 : 2
  - 2 : 1
  - 2 : 3

## Solutions:

- Sum of the present ages of husband, wife and child =  $(27 \times 3 + 3 \times 3)$  years = 90 years.  
 Sum of the present ages of wife and child =  $(20 \times 2 + 5 \times 2)$  years = 50 years.  
 Husband's present age =  $(90 - 50)$  years = 40 years.
  - Largest size of the tile.  
 HCF of 378 cm and 525 cm = 21 cms.
  - Murugan : Prasanna : Arun  

$$\begin{aligned} &= (8000 \times 6) : (4000 \times 8) : (8000 \times 8) \\ &= 48 : 32 : 64 \\ &= 3 : 2 : 4 \\ \text{Kamal's share} &= \text{Rs.}4005 \times \frac{2}{9} \\ &= \text{Rs.}890 \end{aligned}$$
  - Required number of ways  

$$\begin{aligned} &= {}^8C_5 \times {}^{10}C_6 \\ &= {}^8C_3 \times {}^{10}C_4 \\ &= \left[ \frac{8 \times 7 \times 6}{3 \times 2 \times 1} \times \frac{10 \times 9 \times 8 \times 7}{4 \times 3 \times 2 \times 1} \right] \\ &= 11760 \end{aligned}$$
  - $P(\text{getting a prize}) = \frac{10}{(10+25)} = \frac{10}{35} = \frac{2}{7}$
  - Let the son's present age be  $x$  years.  
 Then, man's present age  

$$\begin{aligned} &= (x + 24) \text{ years} \\ &= (x + 24) + 2 = x(x + 2) \end{aligned}$$

$$= x + 26 = 2x + 4 \\ = 22 \text{ years}$$

$$\begin{aligned} 7. \text{ C.P.} &= \text{Rs.} \left[ \frac{100}{122.50} \times 392 \right] \\ &= \text{Rs.} \left[ \frac{1000}{1225} \times 392 \right] \\ &= \text{Rs.} 320 \end{aligned}$$

$$\begin{aligned} \text{Therefore, profit} &= \text{Rs.}(392 - 320) \\ &= \text{Rs.} 72 \end{aligned}$$

$$\begin{aligned} 8. \quad 1 + 4 + 9 + 16 + \dots + n^2 \\ = 1^2 + 2^2 + 3^2 + 4^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6} \end{aligned}$$

9. Sum of decimal places in the numerator and denominator under the radical sign being the same, we remove the decimal.

$$\begin{aligned} \text{Given exp.} &= \sqrt{81 \times 484 / 64 \times 625} \\ &= 9 \times \frac{22}{8} \times 25 \\ &= 0.99 \end{aligned}$$

$$\begin{aligned} 10. \text{ Average speed} &= \left[ 2 \times 3 \times \frac{2}{3} + 2 \right] \text{ km./hr.} \\ &= \frac{12}{5} \text{ km./hr.} \end{aligned}$$

$$\begin{aligned} \text{Distance travelled} &= \left[ \frac{12}{5} \times 5 \right] \text{ km.} \\ &= 12 \text{ km.} \end{aligned}$$

$$\text{Distance between house and school} = \left[ \frac{12}{2} \right] \text{ km} \\ = 6 \text{ km.}$$

$$\begin{aligned} 11. (A+B)'s \text{ 1 day's work} &= \frac{1}{10} \\ C's \text{ 1 day's work} &= \frac{1}{50} \\ (A+B+C)'s \text{ 1 day's work} &= \left[ \frac{1}{10} + \frac{1}{50} \right] = \frac{6}{50} = \frac{3}{25} \dots\dots\dots (i) \\ A's \text{ 1 day's work} &= (B+C)'s \text{ 1 day's work} \dots\dots\dots (ii) \\ \text{From (i) and (ii), we get } 2 \times (A's \text{ 1 day's work}) &= \frac{3}{25} \\ A's \text{ day's work} &= \frac{3}{50} \\ B's \text{ 1 day's work} &= \left[ \frac{1}{10} - \frac{3}{50} \right] = \frac{2}{50} = \frac{1}{25} \\ \text{So, B alone could do the work in } 25 \text{ days.} & \end{aligned}$$

$$\begin{aligned} 12. \sin B &= \frac{b}{2R} \\ &= \frac{AC}{2} \end{aligned}$$

$$\begin{aligned}
 &= \frac{R}{\frac{2}{2} R} \quad [\text{Given } AB = AC = R] \\
 &= \frac{1}{2} \\
 &B = \frac{\pi}{6} \text{ or } \frac{5\pi}{6}
 \end{aligned}$$

But, when  $B = \frac{5\pi}{6}$ ,  $C = \frac{5\pi}{6}$   $[AB = AC \Rightarrow B = C]$   
 $\Rightarrow B + C > \pi$

So,  $B = \frac{5\pi}{6}$  not possible  
 $\therefore B = \frac{\pi}{6}$

$$C = \frac{\pi}{6} \quad [AB = AC \Rightarrow B = C]$$

$$\begin{aligned}
 A &= \pi - \left[ \frac{\pi}{6} + \frac{\pi}{6} \right] \\
 A &= \frac{2\pi}{3}
 \end{aligned}$$

13. For any triangle sum of any two sides must be greater than the third side.

The sides are 10, 12 and 'x'.

From Rule 2, x can take the following values : 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21 – A total of 19 values.

When  $x = 3$  or  $x = 4$  or  $x = 5$  or  $x = 6$ , the triangle is an OBTUSE angled triangle.

The smallest value of x that satisfies both conditions is 7. ( $10^2 + 7^2 > 12^2$ )

The highest value of x that satisfies both conditions is 15. ( $10^2 + 12^2 + 15^2$ )

When  $x = 16$  or  $x = 17$  or  $x = 18$  or  $x = 19$  or  $x = 20$  or  $x = 21$ , the triangle is an OBTUSE angled triangle.

Hence, the values of x that satisfy both the rules are  $x = 7, 8, 9, 10, 11, 12, 13, 14, 15$ . A total of 9 values.

$$\begin{aligned}
 14. \text{ Rate in still water} &= \frac{1}{2} (10 + 7) \text{ km./hr.} \\
 &= 8.5 \text{ km./hr.} \\
 \text{Rate of current} &= \frac{1}{2} (10 - 7) \text{ km./hr.} \\
 &= 1.5 \text{ km./hr.}
 \end{aligned}$$

15. Average amount of interest paid by the company during the given period

$$\begin{aligned}
 &= \text{Rs.} \left[ \frac{23.4 + 32.5 + 41.6 + 36.4 + 49.4}{5} \right] \text{lakhs} \\
 &= \text{Rs.} \left[ \frac{183.3}{5} \right] \text{lakhs} \\
 &= \text{Rs.} 36.66 \text{ lakhs}
 \end{aligned}$$

$$\begin{aligned}
 16. \text{ Required percentage} &= \left[ \frac{3.00 + 2.52 + 3.84 + 3.68 + 3.96}{288 + 342 + 324 + 336 + 420} \times 100 \right] \% \\
 &= \left[ \frac{17}{1710} \times 100 \right] \% \\
 &= 1\%
 \end{aligned}$$

$$\begin{aligned}
 17. \text{ Required percentage} &= \left[ \frac{288 + 98 + 3.00 + 23.4 + 83}{420 + 142 + 3.96 + 49.4 + 98} \times 100 \right] \% \\
 &= \left[ \frac{495.4}{713.36} \times 100 \right] \% \\
 &= 69.45
 \end{aligned}$$

$$\begin{aligned}
 18. \text{ Total expenditure of company during 2000} &= \text{Rs.}324 + 101 + 3.84 + 41.6 + 74) \\
 &\text{lakhs} \\
 &= \text{Rs.}544.44 \text{ lakhs}
 \end{aligned}$$

$$\begin{aligned}
 19. \text{ Required ratio} &= \frac{83 + 108 + 74 + 88 + 98}{98 + 112 + 101 + 133 + 142} \\
 &= \frac{451}{586} \\
 &= \frac{1}{1.3} \\
 &= \frac{10}{13}
 \end{aligned}$$

20. The year 2004 is a leap year. So, it has 2 odd days.  
 So, the day on 6<sup>th</sup> March 2005 will be 2 days beyond the day on 6<sup>th</sup> March 2004.  
 But 6<sup>th</sup> March 2005 is Monday  
 So, 6<sup>th</sup> March 2004 is Saturday.

$$\begin{aligned}
 21. \text{ Angle traced by hour hand in } \frac{21}{4} \text{ hours} &= \left[ \frac{360}{12} \times \frac{21}{4} \right]^\circ = 157\frac{1}{2}^\circ \\
 \text{Angle traced by minute hand in 15 min.} &= \left[ \frac{360}{12} \times 15 \right]^\circ = 90^\circ \\
 \text{So, required angle} &= \left[ 157\frac{1}{2} \right]^\circ - 90^\circ = 67\frac{1}{2}^\circ
 \end{aligned}$$

$$\begin{aligned}
 22. \text{ Part filled by A in 1 min.} &= \frac{1}{20} \\
 \text{Part filled by B in 1 min.} &= \frac{1}{30} \\
 \text{Part filled by (A + B) in 1 min.} &= \left[ \frac{1}{20} + \frac{1}{30} \right] \\
 &= \frac{1}{12}
 \end{aligned}$$

Both the pipes can fill the tank in 12 minutes.

23. Let the rate be R% p.a.

$$\text{Then, } \left[ \frac{5000 \times R \times 2}{100} \right] + \left[ \frac{3000 \times R \times 4}{100} \right] = 2200$$

$$100R + 120R = 2200$$

$$\begin{aligned}
 R &= \left[ \frac{2200}{220} \right] = 10 \\
 \text{So, rate} &= 10\%
 \end{aligned}$$

24. Let the total sale be Rs. x

Then, 2.5% of x = 12.50

$$\left[ \frac{25}{100} \times \frac{1}{100} \times x \right] = \frac{125}{10}$$

$$x = \left[ \frac{125}{10} \times \frac{100 \times 10}{25} \right] = 500$$

25. Length of the carpet =  $\left[ \frac{\text{total cost}}{\text{Rate}/m} \right] = \left[ \frac{8100}{45} \right] \text{ m} = 180 \text{ m.}$

Area of the room = Area of the carpet =  $\left[ 180 \times \frac{75}{100} \right] \text{ m}^2 = 135 \text{ m}^2$

So, breadth of the room =  $\left[ \frac{\text{Area}}{\text{length}} \right] = \left[ \frac{135}{18} \right] \text{ m} = 7.5 \text{ m}$

26. When n is odd,  $(x^n + a^n)$  is always divisible by  $(x + a)$

So, each one of  $47^{43} + 43^{43}$  and  $47^{47} + 43^{43}$  is divisible by  $47 + 43$

27. Clearly, we have  $(3+11+7+9+15+13+8+19+17+21+14+x/12)$

Number in place x is

$$137 + x = 144$$

$$x = 144 - 137$$

$$x = 7$$

28. HCF of 18 and 25 is 1. So, they are co-primes.

29. Ratio of speed of camel and elephant =  $\frac{5}{3} : \frac{7}{5} = \frac{5}{3} \times 15 : \frac{7}{5} \times 15$   
 $= 25 : 21$

30. For managing, A received = 5% of Rs. 7400 = Rs. 370.

Balance = Rs.  $(7400 - 370) = \text{Rs. } 7030$ .

Ratio of their investments =  $(6500 \times 6) : (8400 \times 5) : (10000 \times 3)$

$$= 39000 : 42000 : 30000$$

$$= 13 : 14 : 10$$

B's share = Rs.  $\left[ 7030 \times \frac{14}{37} \right] = \text{Rs. } 2660$

31. Every ball can be distributed in 4 ways.

Hence the required number of ways  $= 4 \times 4 \times 4 \times 4 \times 4 \times 4$   
 $= 4^6 = 4096$

32. When a dice is thrown, we have  $S = [1, 2, 3, 4, 5, 6]$

Let E = event of getting a number greater than 4 =  $[5, 6]$

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$$

33. Suppose, the ratio was  $3 : 5$ ,  $x$  years ago.

Then,

$$\begin{aligned} &= 40 - \frac{x}{60} \cdot x \\ &= \frac{3}{5} \\ &= 5(40 - x) = 3(60 - x) \\ &2x = 20 \\ &x = 10 \end{aligned}$$

34. SP = Rs.220, Loss = 12%

Let CP = Rs.x

Then SP = 88% of CP

$$\begin{aligned} 220 &= \frac{88}{100} \times x \\ x &= 250 \end{aligned}$$

Therefore cost price = Rs.250

$$3\sqrt{5} + \sqrt{125} = 17.88$$

$$3\sqrt{5} + \sqrt{25 \times 5} = 17.88$$

$$3\sqrt{5} + 5\sqrt{5} = 17.88$$

$$8\sqrt{5} = 17.88$$

$$\sqrt{5} = 2.235$$

$$\therefore \sqrt{80} + 6\sqrt{5} = \sqrt{16 \times 5} + 6\sqrt{5}$$

$$= 4\sqrt{5} + 6\sqrt{5}$$

$$= 10\sqrt{5} = (10 \times 2.235) = 22.35$$

$$36. \text{ Speed} = \left[ \frac{750}{150} \right] \text{ m/sec} = 5 \text{ m/sec} = \left[ 5 \times \frac{18}{5} \right] \text{ km/hr} = 18 \text{ km/hr}$$

37. Number of pages typed by Ravi in 1 hour

$$= \frac{32}{6} = \frac{16}{3}$$

Number of pages typed by Kumar in 1 hour

$$= \frac{40}{5} = 8$$

Number of pages typed by both in 1 hour

$$= \left[ \frac{16}{3} + 8 \right] = \frac{40}{3}$$

Time taken by both to type 110 pages

$$= \left[ 110 \times \frac{3}{40} \right] \text{ hours}$$

$$= 8\frac{1}{4} \text{ hours or } 8 \text{ hours } 15 \text{ minutes}$$

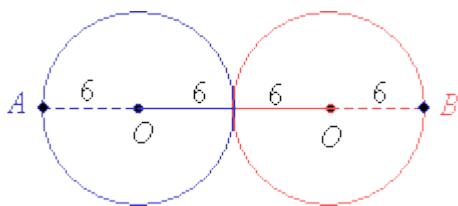
38. The diagram below shows the rectangle with the diagonals and half one of the angles with size  $x$ .

$$\tan(x) = \frac{5}{2.5} = 2, x = \arctan(2)$$

larger angle made by diagonals  $2x = 2 \arctan(2) = 127^\circ$

smaller angle made by diagonals  $180 - 2x = 53^\circ$

39.



Sketch the two circles touching at one point.

The furthest that A and B can be would be at the two ends as shown in the above diagram.

If the radius is 6 then the diameter is  $2 \times 6 = 12$  and the distance from A to B would be  $2 \times 12 = 24$

40. Let the rate along the current be x kmph. Then,  $\frac{1}{2}(x + 3.5) = 5$  or  $x = 6.5$  kmph

$$41. \text{ Required ratio} = \frac{75 + 65}{85 + 95} = \frac{140}{180} = \frac{7}{9}$$

$$42. \text{ Required percentage} = \left[ \frac{70 + 80}{95 + 110} \times 100 \right] \% \\ = \left[ \frac{150}{205} \times 100 \right] \% \\ = 73.17\%$$

43. Average sales (in thousand number) of branches B1, B3 and B6 in 2000

$$= \frac{1}{3} \times 80 + 95 + 70 = \frac{245}{3}$$

Average sales (in thousand number) of branches B1, B2 and B3 in 2001

$$= \frac{1}{3} \times 105 + 65 + 110 = \frac{280}{3}$$

$$\therefore \text{required percentage} = \left[ \frac{245/3}{280/3} \times 100 \right] \% = \left[ \frac{245}{280} \times 100 \right] \% = 87.5\%$$

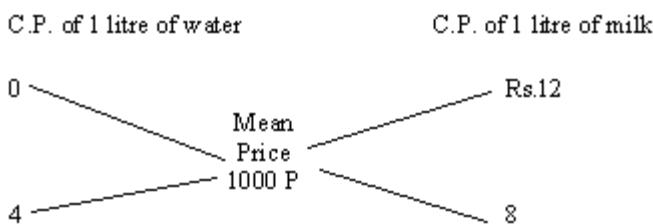
44. Average sales of all the six branches (in thousand numbers) for the year 2000

$$= \frac{1}{6} \times 80 + 75 + 95 + 85 + 75 + 70 \\ = 80$$

45. Total sales of branches B1, B3 and B5 for both the years (in thousand numbers)

$$= 80 + 105 + 95 + 110 + 75 + 95 = 56$$

46. By the rule of allegation :



Ratio of water to milk = 4 : 8 = 1 : 2

47. Let sum = x. Then, S.I. = 2x, Time =  $15\frac{1}{2}$  years =  $\frac{31}{2}$  years

$$\text{So, rate} = \left[ \frac{100 \times 2x}{x \times \frac{31}{2}} \right] \% = \frac{400}{31}\%$$

Now, sum = x, S.I. = x, Rate =  $\frac{400}{31}\%$

$$\text{So, time} = \frac{100 \times x}{x \times \frac{400}{31}} = \frac{31}{4} \text{ years} = 7 \text{ years } 9 \text{ months}$$

48.  $3.5 = \frac{35}{10} = \left[ \frac{35}{10} \times 100 \right] \% = 350\%$

49. Other side =  $\sqrt{17^2 - 15^2}$

$$= \sqrt{289 - 225}$$

$$= \sqrt{64} = 8 \text{ m}$$

$$\text{So, area} = (15 \times 8) \text{ } m^2 = 120 \text{ } m^2$$

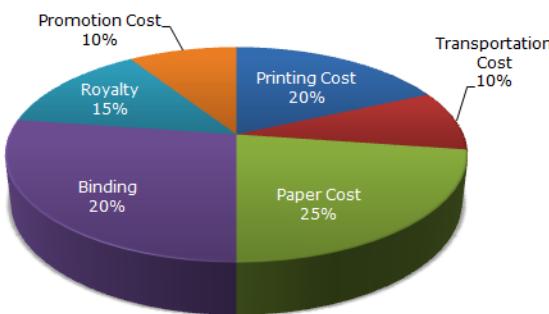
50. 91 is divisible by 7. So, it is not a prime number.

## **Model Paper – 2**

- What percentage of numbers from 1 to 70 have 1 or 9 in the unit's digit?
    - 1
    - 14
    - 20
    - 21
    - None of these
  - $(935421 \times 625) = ?$ 
    - 575648125
    - 584638125
    - 584649125
    - 585628125
    - None of these
  - Reena took a loan of Rs.1200 with simple interest for as many years as the rate of interest. If she paid Rs.432 as interest at the end of the loan period, what was the rate of interest?
    - 3.6
    - 6
    - 18
    - Data inadequate
    - None of these
  - A leak in the bottom of a tank can empty the full tank in 8 hours. An inlet pipe fills water at the rate of 6 litres a minute. When the tank is full, the inlet is opened and due to the leak, the tank is empty in 12 hours. How many litres does the cistern hold?
    - 7580
    - 7960
    - 8290
    - 8640
    - None of these
  - In what ratio must a grocer mix two varieties of pulses costing Rs.15 and Rs.20 per kg respectively so as to get a mixture worth Rs.16.50 kg?
    - 3 : 7
    - 5 : 7
    - 7 : 3
    - 7 : 5
    - None of these
  - At what time, in minutes, between 3 o'clock and 4 o'clock, both the needles will coincide each other?
    - $5\frac{1}{11}$
    - $12\frac{4}{11}$
    - $13\frac{4}{11}$
    - $16\frac{4}{11}$
    - None of these
  - What was the day of the week on 28<sup>th</sup> May 2006?
    - Thursday
    - Friday
    - Saturday
    - Sunday
    - None of these

The following pie-chart shows the percentage distribution of the expenditure incurred in publishing a book. Study the pie-chart and the answer the questions based on it.

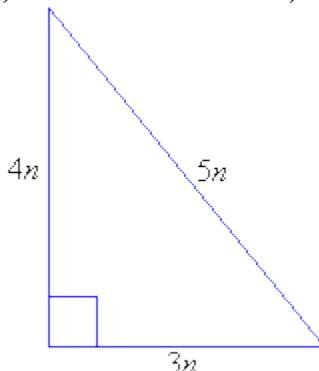
### **Various Expenditures (in percentage) Incurred in Publishing a Book**



8. If for a certain quantity of books, the publisher has to pay Rs.30,600 as printing cost, then what will be amount of royalty to be paid for these books?
- Rs.19,450
  - Rs.21,200
  - Rs.22,950
  - Rs.26,150
  - None of these
9. What is the central angle of the sector corresponding to the expenditure incurred on royalty?
- $15^\circ$
  - $24^\circ$
  - $54^\circ$
  - $48^\circ$
  - None of these
10. The price of the book is marked 20% above the C.P. If the marked price of the book is Rs.180, then what is the cost of the paper used in a single copy of the book?
- Rs.36
  - Rs.37.50
  - Rs.42
  - Rs.44.25
  - None of these
11. If 5500 copies are published and the transportation cost on them amounts to Rs.82500, then what should be the selling price of the book so that the publisher can earn a profit of 25%?
- Rs.187.50
  - Rs.191.50
  - Rs.175
  - Rs.180
  - None of these
12. Royalty on the book is less than the printing cost by:
- 5%
  - $33\frac{1}{5}\%$
  - 20%
  - 25%
  - None of these
13. A man can row upstream at 8 kmph and downstream at 13 kmph. The speed of the stream is
- 2.5 km/hr
  - 4.2 km/hr
  - 5 km/hr
  - 10.5 km/hr
  - None of these
14. If the sum of the interior angles of a regular polygon measures upto 1440 degrees, how many sides does the polygon have?
- 10 sides
  - 8 sides
  - 12 sides
  - 9 sides
  - None of these

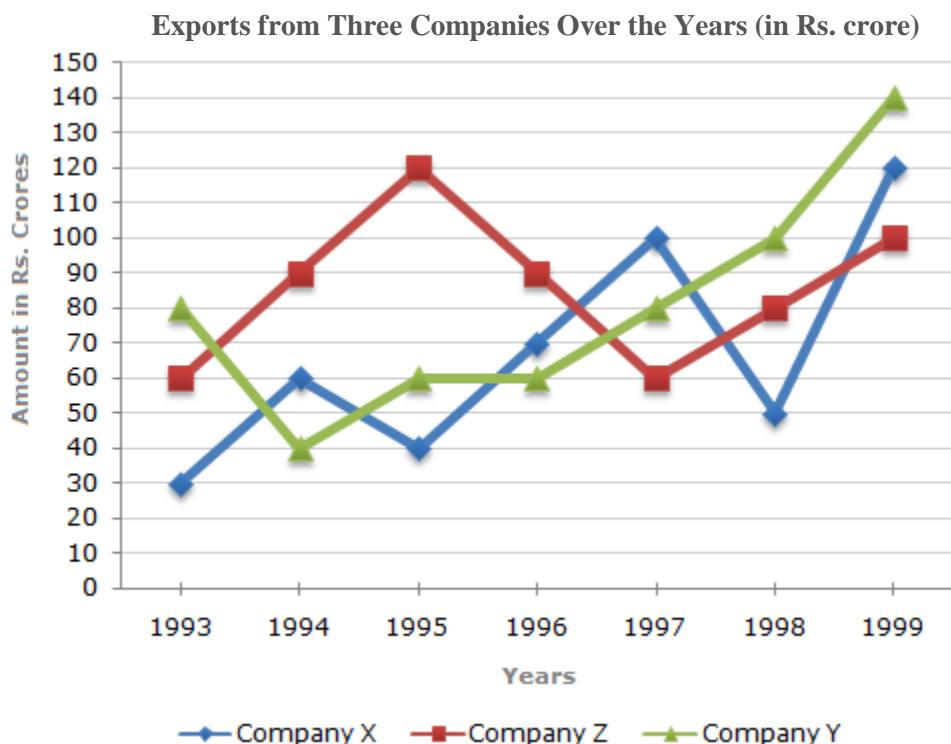






39. There is a road beside a river. Two friends started from a place A, moved to a temple situated at another place B and then returned to A again. One of them moves on a cycle at a speed of 12 km/hr, while the other sails on a boat at a speed of 10 km/hr. If the river flows at the speed of 4 km/hr, which of the two friends will return to place A first ?
- a) 5.4 km /hr, boat      b) 12 km /hr, cycle      c) 8.4 km/hr, boat  
 d) 9.6 km /hr, cycle      e) None of these

Study the following line graph and answer the question.



40. For which of the following pairs of years the total exports from the three companies together are equal?
- a) 1995 and 1998      b) 1996 and 1998      c) 1997 and 1998  
 d) 1995 and 1996      e) None of these
41. Average annual exports during the given period for Company Y is approximately what percent of the average annual exports for Company Z?
- a) 87.12%      b) 89.64%      c) 91.21%  
 d) 93.33%      e) None of these
42. In which year was the difference between the exports from Companies X and Y the minimum?
- a) 1994      b) 1995      c) 1996

## Solutions:

1. Clearly, the numbers which have 1 or 9 in the unit's digit, have squares that end in the digit 1. Such numbers from 1 to 70 are 1, 9, 11, 19, 21, 29, 31, 39, 41, 49, 51, 59, 61, 69

Number of such number = 14

$$\text{So, required percentage} = \left[ \frac{14}{70} \times 100 \right] \% = 20\%$$

$$\begin{aligned} 2. \quad & 935421 \times 625 = 935421 \times 5^4 = 935421 \times \left[ \frac{10}{2} \right]^4 \\ & = \frac{935421 \times 10^4}{2^4} = \frac{9354210000}{16} \\ & = 584638125 \end{aligned}$$

3. Let rate = R% and time = R years

$$\text{Then, } \left[ \frac{1200 \times R \times R}{100} \right] = 432$$

$$12R^2 = 432$$

$$R^2 = 36$$

$$R = 6$$

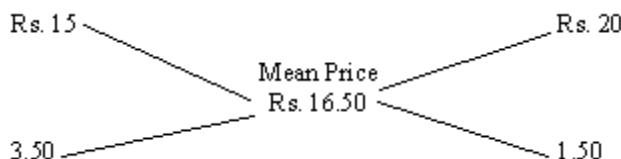
$$4. \quad \text{Work done by the inlet in 1 hour} = \left[ \frac{1}{8} - \frac{1}{12} \right] = \frac{1}{24}$$

$$\text{Work done by the inlet in 1 minute} = \left[ \frac{1}{24} \times \frac{1}{60} \right] = \frac{1}{1440}$$

$$\text{Volume of } \frac{1}{1440} \text{ part} = 6 \text{ litres. Therefore, Volume of whole} = \left[ 1440 \times 6 \right] \\ = 8640 \text{ litres}$$

5. By the rule of allegation:

Cost of 1 kg pulses of 1 <sup>st</sup> kind	Cost of 1 kg pulses of 2 <sup>nd</sup> kind
---	---



So, required rate = 3.50 : 1.50 = 7 : 3

6. At 3 o'clock, the minute hand is 15 min. spaces apart from the hour hand.  
To be coincident, it must gain 15 min. spaces  
55 min. are gained in 60 min.

$$15 \text{ min. are gained in } \left[ \frac{60}{55} \times 15 \right] \text{ min.} = 16 \frac{4}{11} \text{ min.}$$

So, the hands are coincident at  $16\frac{4}{11}$  min. past 3

7.  $28 \text{ May } 2006 = (2005 \text{ years} + \text{period from } 1.1.2006 \text{ to } 28.5.2006)$   
 Odd days in 1600 years = 0  
 Odd days in 400 years = 0  
 $5 \text{ years} = (4 \text{ ordinary years} + 1 \text{ leap year}) = (4 \times 1 + 1 \times 2) = 6 \text{ odd days}$

Jan.	Feb.	March	April	May
(31 +	28	+ 31	+ 30	+ 28) = 148 days

So, 148 days = (21 weeks + 1 day) = 1 odd day  
 Total number of odd days =  $(0 + 0 + 6 + 1) = 7 = 0$  odd day.  
 Given day is Sunday

8. Let the amount of royalty to be paid for these books be Rs.r.

$$\text{Then, } 20 : 15 = 30600 : r = \text{Rs. } \frac{30600 \times 15}{20} = \text{Rs. } 22,950$$

9. Central angle corresponding to royalty = 15% of  $360^\circ$   
 $= \left( \frac{15}{100} \times 360 \right)^\circ$   
 $= 54^\circ$

10. Clearly, marked price of the book = 120% of C.P.

Also, cost of paper = 25% of C.P.

Let the cost of paper for a single book be Rs.n.

$$\text{Then, } 120 : 25 = 180 : n \quad n = \text{Rs. } \frac{25 \times 180}{120} = \text{Rs. } 37.50$$

11. For the publisher to earn a profit of 25%, S.P. = 125% of C.P.

Also transportation cost = 10% of C.P.

Let the S.P. of 5500 books be Rs.x.

$$\text{Then, } 10 : 125 = 82500 : x \quad x = \text{Rs. } \frac{125 \times 82500}{10} = \text{Rs. } 1031250$$

$$\therefore \text{S.P. of one book} = \text{Rs. } \frac{1031250}{5500} = \text{Rs. } 187.50$$

12. Printing cost of book = 20% of C.P.

Royalty on book = 15% of C.P.

Difference = 20% of C.P. - 15% of C.P. = 5% of C.P.

$$\therefore \text{percentage difference} = \left[ \frac{\text{difference}}{\text{printing cost}} \times 100 \right] \%$$

$$= \left[ \frac{5\% \text{ of C.P.}}{\text{printing cost}} \times 100 \right] \% = 25\%$$

13. Speed of stream =  $\frac{1}{2} (13 - 8) \text{ kmph}$   
 $= \frac{1}{2} \times 5$   
 $= \frac{5}{2}$   
 $= 2.5$

14. We know that the sum of an exterior angle and an interior angle of a polygon =  $180^\circ$

We also know that sum of all the exterior angles of a polygon =  $360^\circ$

The question states that the sum of all interior angles of the given polygon =  $1440^\circ$

Therefore, sum of all the interior and exterior angles of the polygon =  $1440 + 360 = 1800$

If there are 'n' sides to this polygon, then the sum of all the exterior and interior angles =  $180 \times n = 10$

15.  $\tan x + \sec x = 2 \cos x$

$$\sin x + 1 = 2 \cos^2 x, \cos x \neq 0$$

$$\sin x + 1 = 2(1 - \sin^2 x)$$

$$2 \sin^2 x + \sin x - 1 = 0$$

This is quadratic equation in  $\sin x$ . Solve for  $\sin x$

$$\sin x = -1 \text{ or } \sin x = \frac{1}{2}$$

$$\sin x = -1$$

$\cos x = 0$ , which is not possible  $[\cos x \neq 0 \text{ from above}]$

$$\therefore \sin x = \frac{1}{2}$$

$$x = \pi \text{ or } x = \pi - (\pi / 6), \text{ in the interval } [0, 2\pi]$$

$$x = \pi \text{ or } x = \frac{5\pi}{6}$$

16. C's 1 day's work

$$= \frac{1}{3} - \left[ \frac{1}{6} + \frac{1}{8} \right] = \frac{1}{3} - \frac{7}{24} = \frac{1}{24}$$

$$\text{A's wages : B's wages : C's wages} = \frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1$$

$$\text{C's share (for 3 days)} = \text{Rs.} \left[ 3 \times \frac{1}{24} \times 3200 \right] = \text{Rs.} 400$$

17. Total distance travelled

$$= \left[ (50 \times 2 \times \frac{1}{2}) \right] + \left[ 70 \times 1 \times \frac{1}{2} \right]$$

$$= (125 + 105) \text{ miles}$$

$$= 230 \text{ miles}$$

18. Let the required number be x.

$$\text{Then, } \frac{x}{\sqrt{0.25}}$$

$$= 25$$

$$= \frac{x}{0.5} = 25$$

$$= x = 25 \times 0.5$$

$$= 12.5$$

19. Let d be the common difference of the A.P.

$$\text{Then } a_3 \cdot a_7 \cdot a_{11} = (22 - 4d) \cdot 22 \cdot (22 + 4d) \\ = 88 (121 - 4d^2)$$

Obviously, R.H.S. is greatest for  $d = 0$

20. Let the labeled price be Rs.x

$$88\% \text{ of } 80\% \text{ of } x = 704$$

$$\begin{aligned} x &= \left[ 704 \times 100 \times \frac{100}{88} \times 80 \right] \\ &= 1000 \end{aligned}$$

21. Let the present ages of the person be  $x$  years.

$$\begin{aligned} \text{Then } &= 3(x - 3) - 3(x - 3) \\ x &= (3x + 9) - (3x - 9) \\ x &= 18 \end{aligned}$$

22. Here  $S = \{\text{TTT, TTH, THT, HTT, THH, HTH, HHT, HHH}\}$

Let  $E$  = event of getting at most two heads.

Then  $E = \{\text{TTT, TTH, THT, HTT, THH, HTH, HHT}\}$

$$P(E) = \frac{n(E)}{n(S)} = \frac{7}{8}$$

23. The word 'LEADER' contains 6 letters, namely 1L, 2E, 1A, 1D and 1R.

$$\text{Required number of ways} = \frac{6!}{(1!)(2!)(1!)(1!)(1!)} = 360$$

24. Required number

$$\begin{aligned} &= \text{HCF of } (91 - 43), (183 - 91) \text{ and } (183 - 43) \\ &= \text{HCF of } 48, 92 \text{ and } 140 \\ &= 4 \end{aligned}$$

25. Total weight increased =  $(8 \times 2.5)$  kg = 20 kg.

$$\text{Weight of new person} = (65 + 20) \text{ kg} = 85 \text{ kg.}$$

26. Let Arun's weight by  $X$  kg.

According to Arun,  $65 < X < 72$

According to Arun's brother,  $60 < X < 70$ .

According to Arun's mother,  $X \leq 68$

The values satisfying all the above conditions are 66, 67 and 68.

$$\text{Required Average} = \left[ \frac{66 + 67 + 68}{3} \right] = \left[ \frac{201}{3} \right] = 67 \text{ kg.}$$

27. HCF of co-prime numbers is 1.

$$\begin{aligned} \text{So, LCM} &= \frac{117}{1} \\ &= 117 \end{aligned}$$

28. Let B's capital be Rs. $x$ . Then,  $3500 \times \frac{12}{7x} = \frac{2}{3}$

$$14x = 126000$$

$$x = 9000$$

29. There are 6 letters in the given word, out of which there are 3 vowels and 3 consonants.

Let us mark these positions as under:

$$(2) (2) (3) (4) (5) (6)$$

Now, 3 vowels can be placed at any of the three places out of 4, marked 1, 3, 5

Number of ways of arranging the vowels =  ${}^3P_3 = 3! = 6$

Also, the 3 consonants can be arranged at the remaining 3 positions.

Number of ways of these arrangements =  ${}^3P_3 = 3! = 6$

Total number of ways =  $(6 \times 6) = 36$

30. Clearly,  $n(S) = (6 \times 6) = 36$

Let E = Event that the sum is a prime number.

Then = {(1, 1), (1, 2), (1, 4), (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, 4), (4, 1), (4, 3),

(5,

2), (5, 6), (6, 1), (6, 5)}

$n(E) = 15$

$$P(E) = \frac{n(E)}{n(S)} = \frac{15}{36} = \frac{5}{12}$$

31. Let the ages of the children be  $x, (x + 3), (x + 6), (x + 9)$  and  $(x + 12)$  years.

Then,  $x + (x + 3) + (x + 6) + (x + 9) + (x + 12) = 50$

$$5x = 20$$

$$x = 4$$

Age of the youngest child = 4 years

32. Therefore, profit  $= \left[ \frac{200}{800} \times 100 \right] \%$   
 $= 25\%$

33. The two sequences are 17, 21, 25, 29, 33, 37, 41 .... 417  
 16, 21, 26, 31, 36, 41 .... 466

The common terms are 21, 41, 61, 81 .... 381, 401

So, number of terms (which are common) = 20

34.  $\sqrt{50} \times \sqrt{98}$   $= \sqrt{50} \times \sqrt{98}$   
 $= \sqrt{4900}$   
 $= 70$

35. Speed  $= \frac{200}{24}$  m/sec  
 $= \frac{25}{3}$  m/sec  
 $= \left[ \frac{25}{3} \times \frac{18}{5} \right]$  km./hr.  
 $= 30$  km./hr.

36.  $(P + Q + R)$ 's 1 hour's work  $= \left[ \frac{1}{8} + \frac{1}{10} + \frac{1}{12} \right] = \frac{37}{120}$

Work done by P, Q and R in 2 hours  $= \left[ \frac{37}{120} \times 2 \right] = \frac{37}{60}$

Remaining work  $= \left[ 1 - \frac{37}{60} \right] = \frac{23}{60}$

$$(Q + R) \text{'s 1 hour's work} = \left[ \frac{1}{10} + \frac{1}{12} \right] = \frac{11}{60}$$

Now,  $\frac{11}{60}$  work is done by Q and R in 1 hour.

So,  $\frac{23}{60}$  work will be done by Q and R in  $\left[ \frac{60}{11} \times \frac{23}{60} \right] = \frac{23}{11}$  hours  $\approx 2$  hours

So, the work will be finished approximately 2 hours after 11 A.M., i.e., around 1 P.M.

$$\begin{aligned} 37. \tan(\cos^{-1} x) &= \frac{\sin(\cos^{-1} x)}{\cos(\cos^{-1} x)} \\ &= \frac{\sqrt{1 - x^2}}{x} \end{aligned}$$

38. Test the ratio of the lengths to see if it fits the  $3n : 4n : 5n$  ratio.

$$6 : 8 : ? = 3(2) : 4(2) : ?$$

Yes, it is a 3-4-5 triangle for  $n =$

$$\text{Calculate the third side } 5n = 5 \times 2 = 10$$

The length of the hypotenuse is 10 inches.

39. Clearly, the cyclist moves both ways at a speed of 12 km./hr.

So, average speed of the cyclist = 12 km./hr.

$$\begin{aligned} \text{Average speed} &= (2 \times 14 \times \frac{6}{14} + 6) \text{ km./hr.} \\ &= \frac{42}{5} \text{ kmph} \\ &= 8.4 \text{ kmph} \end{aligned}$$

Since the average speed of the cyclist is greater, he will return to A first.

40. Total exports of the three Companies X, Y and Z together, during various years are :

In 1993 = Rs.30 + 80 + 60 Crores = Rs.170 Crores

In 1994 = Rs.60 + 40 + 90 Crores = Rs.190 Crores

In 1995 = Rs.40 + 60 + 120 Crores = Rs.220 Crores

In 1996 = Rs.70 + 60 + 90 Crores = Rs.220 Crores

In 1997 = Rs.100 + 80 + 60 Crores = Rs.240 Crores

In 1998 = Rs.50 + 100 + 80 Crores = Rs.230 Crores

In 1999 = Rs.120 + 140 + 100 Crores = Rs.360 Crores

Clearly, the total exports of the three Companies X, Y and Z together are same during the years 1995 and 1996.

#### **41. Analysis of the graph: From the graph it is clear that**

1. The amount of exports of Company X (in Crore Rs.) in the years 1993, 1994, 1995, 1996, 1997, 1998 and 1999 are 30, 60, 40, 70, 100, 50 and 120 respectively.
2. The amount of exports of Company Y (in Crore Rs.) in the years 1993, 1994, 1995, 1996, 1997, 1998 and 1999 are 80, 40, 60, 60, 80, 100 and 140 respectively.
3. The amount of exports of Company Z (in Crore Rs.) in the years 1993, 1994, 1995, 1996, 1997, 1998 and 1999 are 60, 90, 120, 90, 60, 80 and 100 respectively.

Average annual exports (in Rs. Crore) of Company Y during the given period  
 $= \frac{1}{7} \times 80 + 40 + 60 + 60 + 80 + 100 + 140 = \frac{560}{7} = 80$

Average annual exports (in Rs. Crore) of Company Z during the given period  
 $= \frac{1}{7} \times 60 + 90 + 120 + 90 + 60 + 80 + 100 = \frac{600}{7} =$

$$\text{Required percentage} = \left[ \frac{\frac{80}{7}}{\frac{600}{7}} \times 100 \right] \% = 93.33\%$$

42. The difference between the exports from the Companies X and Y during the various years are

In 1993 = Rs.80 - 30 Crores = Rs.50 Crores

In 1994 = Rs.60 - 40 Crores = Rs.20 Crores

In 1995 = Rs.60 - 40 Crores = Rs.20 Crores

In 1996 = Rs.70 - 60 Crores = Rs.10 Crores

In 1997 = Rs.100 - 80 Crores = Rs.20 Crores

In 1998 = Rs.100 - 50 Crores = Rs.50 Crores

In 1999 = Rs.140 - 120 Crores = Rs.20 Crores

Clearly, the difference is minimum in the year 1996.

43. Average exports of the three Companies X, Y and Z in 1993

$$= \text{Rs. } \frac{1}{3} \times 30 + 80 + 60 \text{ Crores} = \text{Rs. } \frac{170}{3} \text{ Crores}$$

Average exports of the three Companies X, Y and Z in 1998

$$= \text{Rs. } \frac{1}{3} \times 50 + 100 + 80 \text{ Crores} = \text{Rs. } \frac{230}{3} \text{ Crores}$$

$$\text{Difference} = \text{Rs. } \frac{230}{3} - \frac{170}{3} \text{ Crores}$$

$$= \text{Rs. } \frac{60}{3} \text{ Crores}$$

$$= \text{Rs. } 20 \text{ Crores}$$

44. Average annual exports of Company Z during the given period

$$= \frac{1}{7} \times 60 + 90 + 120 + 90 + 60 + 80 + 100$$

$$= \text{Rs. } \frac{600}{7} \text{ Crores}$$

$$= \text{Rs. } 85.71 \text{ Crores}$$

From the analysis of graph the exports of Company Z are more than the average annual exports of Company Z (i.e. Rs.85.71 Crores) during the years 1994, 1995, 1996 and 1999, i.e. during 4 of the given years.

45. Each day of the week is repeated after 7 days.

So, after 63 days, it will be Monday.

So, after 61 days, it will be Saturday

46. The hands of a clock coincide 11 times in every 12 hours (Since between 11 and 1, they coincide only once, i.e. at 12 o'clock).

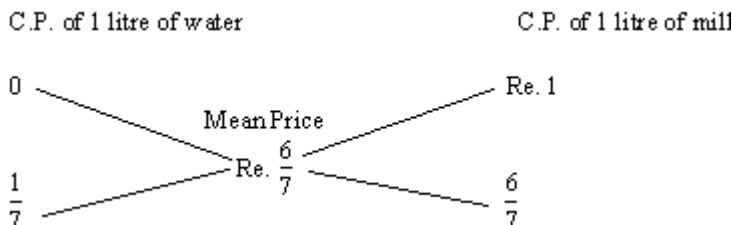
So, the hands coincide 22 times in a day.

47. Let C.P. of 1 litre milk be Rs. 1.

S.P. of 1 litre of mixture = Rs. 1, Gain =  $\frac{50}{3}\%$

So, C.P. of 1 litre of mixture =  $\left[ 100 \times \frac{3}{350} \times 1 \right] = \frac{6}{7}$

By the rule of allegation, we have:



So, ratio of water and milk =  $\frac{1}{7} : \frac{6}{7} = 1 : 6$

48. Capacity of the tank =  $(12 \times 13.5)$  litres  
= 162 litres

Capacity of each bucket = 9 litres

$$\text{Number of buckets needed} = \left[ \frac{162}{9} \right] = 18$$

49. Principal = Rs.  $\left[ \frac{100 \times 5400}{12 \times 3} \right]$  = Rs. 15000

50. Let the number be x.

Then, 20% of x = 120

$$\left[ \frac{20}{100} \times x \right] = 120$$

$$x = \left[ \frac{120 \times 100}{20} \right] = 600$$

$$\text{So, } 120\% \text{ of } x = \left[ \frac{120}{100} \times 600 \right] = 720$$

Model Paper – 3

- A sphere of 30 cm radius is dropped into a cylindrical vessel of 80 cm diameter, which is partly filled with water, then its level rises by x cm. Find x:  
a) 27.5 cm      b) 22.5 cm      c) 18.5 cm  
d) Data inadequate      e) None of these
  - On dividing a number by 357, we get 39 as remainder. On dividing the same number by 17, what will be the remainder?  
a) 0      b) 3      c) 5  
d) 11      e) None of these
  - After replacing an old member by a new member, it was found that the average age of five members of a club is the same as it was 3 years ago. What is the difference between the ages of the replaced and the new member?  
a) 2 years      b) 4 years      c) 8 years  
d) 15 years      e) None of these
  - The LCM of two numbers is 495 and their HCF is 5. If the sum of the numbers is 10, then their difference is  
a) 10      b) 46      c) 70  
d) 90      e) None of these
  - A child has three different kinds of chocolates costing Rs.2, Rs.5 and Rs.10. He spends total Rs.120 on the chocolates. What is the minimum possible number of chocolates, he can buy, if there must be atleast one chocolate of each kind?  
a) 22      b) 19      c) 17  
d) 15      e) None of these
  - A, B, C rent a pasture. A puts 10 oxen for 7 months, B puts 12 oxen for 5 months and C puts 15 oxen for 3 months for grazing. If the rent of the pasture is Rs. 175, how much must C pay as his share of rent?  
a) Rs.45      b) Rs.50      c) Rs.55  
d) Rs.60      e) None of these
  - A letter lock consists of 4 rings, each ring contains 9 non-zero digits. This lock can be opened by setting a 4 digit code with the proper combination of each of the 4 rings Maximum how many codes can be formed to open the lock?  
a)  $4^9$       b)  $9p4$       c)  $9^4$   
d) Data inadequate      e) None of these
  - A bag contains 6 black and 8 white balls. One ball is drawn at random. What is the probability that the ball drawn is white?  
a)  $3/4$       b)  $4/7$       c)  $1/8$   
d)  $3/7$       e) None of these
  - The ration between the present ages of P and Q is  $6 : 7$ . If Q is 4 years old than P, what will be the ratio of the ages of P and Q after 4 years?

Study the following table and answer the questions.

### **Number of Candidates Appeared and Qualified in a Competitive Examination from Different States Over the Years.**

State	Year									
	1997		1998		1999		2000		2001	
	App.	Qual.								
M	5200	720	8500	980	7400	850	6800	775	9500	1125
N	7500	840	9200	1050	8450	920	9200	980	8800	1020
P	6400	780	8800	1020	7800	890	8750	1010	9750	1250
Q	8100	950	9500	1240	8700	980	9700	1200	8950	995
R	7800	870	7600	940	9800	1350	7600	945	7990	885

18. Total number of candidates qualified from all the states together in 1997 is approximately what percentage of the total number of candidates qualified from all the states together in 1998?  
a) 72%                          b) 77%                          c) 80%  
d) 83%                          e) None of these

19. What is the average candidates who appeared from State Q during the given years?  
a) 8700                          b) 8760                          c) 8990  
d) 8920                          e) None of these

20. In which of the given years the number of candidates appeared from State p has maximum percentage of qualified candidates?  
a) 1997                          b) 1998                          c) 1999  
d) 2001                          e) None of these

21. What is the percentage of candidates qualified from State N for all the years together, over the candidates appeared from State N during all the years together?  
a) 12.36%                          b) 12.16%                          c) 11.47%  
d) 11.15%                          e) None of these

22. The percentage of total number of qualified candidates to the total number of appeared candidates among all the five states in 1999 is?  
a) 11.49%                          b) 11.84%                          c) 12.21%  
d) 12.57%                          e) None of these

23. How many times are the hands of a clock at right angle in a day?  
a) 22                                  b) 24                                  c) 44  
d) 48                                  e) None of these

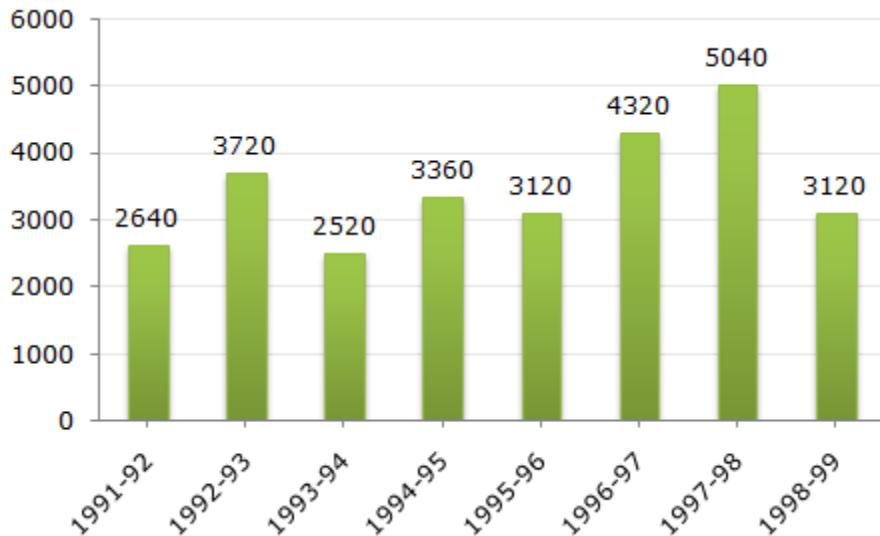
24. Two vessels A and B contain milk and water mixed in the ratio 8 : 5 and 5 : 2 respectively. The ratio in which these two mixtures be mixed to get a new mixture containing  $69\frac{3}{4}\%$  milk is :

- a) 2 : 7                    b) 3 : 5                    c) 5 : 2  
d) 5 : 7                    e) None of these
25. A tap can fill a tank in 6 hours. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely ?  
a) 3 hrs 15 min            b) 3 hrs 45 min            c) 4 hrs  
d) 4 hrs 15 mins            e) None of these
26. How much time will it take for an amount of Rs.450 to yield Rs.81 as interest at 4.5% per annum of simple interest?  
a) 3.5 years                b) 4 years                c) 4.5 years  
d) 5 years                e) None of these
27. If  $20\% \text{ of } a = b$ , then  $b\% \text{ of } 20$  is the same as :  
a) 4% of a                b) 5% of a                c) 20% of a  
d) Data inadequate            e) None of these
28. Which one of the following numbers will completely divide  $(4^{61} + 4^{62} + 4^{63} + 4^{64})$ ?  
a) 3                        b) 10                        c) 11  
d) 13                        e) None of these
29. The average of 20 numbers is zero. Of them, at the most, how many may be greater than zero?  
a) 0                        b) 1                        c) 10  
d) 19                        e) None of these
30. The greatest possible length which can be used to measure exactly the length 7m, 3m, 85cm, 12m, 95 cm is  
a) 15 cm                    b) 25 cm                    c) 35 cm  
d) 42 cm                    e) None of these
31. If  $(a + b) : (a - b) = 15 : 1$ , then the value of  $a^2 - b^2$  is :  
a) 56                        b) 15                        c) 112  
d) 8                        e) None of these
32. Simran started a software business by investing Rs.50,000. After six months, Nanda joined her with a capital of Rs.80,000. After 3 years, they earned a profit of Rs.24,500. What was Simran's share in the profit?  
a) Rs.9423                    b) Rs.10,250                    c) Rs.10,500  
d) Rs.14,000                    e) None of these
33. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?  
a) 210                        b) 1050                        c) 25200  
d) 21400                        e) None of these
34. What is the probability of getting a sum 9 from two throws of a dice?

- a) 1/6                    b) 1/8                    c) 1/9  
d) 1/12                  e) None of these
35. My brother is 3 years elder to me. My father was 28 years of age when my sister was born while my mother was 26 years of age when I was born. If my sister was 4 years of age when my brother was born, then, what was the age of my father and mother respectively when my brother was born?  
a) 32 yrs., 23 yrs.      b) 32 yrs., 29 yrs.      c) 35 yrs., 29 yrs.  
d) 35 yrs., 33 yrs.      e) None of these
36. A fruit seller sells mangoes at the rate of Rs.9 per kg and thereby loses 20%. At what price per kg, he should have sold them to make a profit of 5%?  
a) Rs.11.81              b) Rs.12                    c) Rs.12.25  
d) Rs.12.31              e) None of these
37. How many terms are common in two arithmetic progression 1, 4, 7, 10 .... Upto 63 terms and 3, 7, 11, 15 .... Upto 47 terms :  
a) 12                      b) 16                      c) 15  
d) Data inadequate      e) None of these
38. What is the square of 0.16?  
a) 0.004                  b) 0.04                    c) 0.4  
d) 4                        e) None of these
39. A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?  
a) 3.6                    b) 7.2                      c) 8.4  
d) 10                      e) None of these
40. A is thrice as good as workman as B and therefore is able to finish a job in 60 days less than B. Working together, they can do it in:  
a) 20 days                b)  $22\frac{1}{2}$                 c) 25 days  
d) 30 days                e) None of these
41. Verticles of a quadrilateral ABCD are A (0, 0), B (4, 5), C (9, 9) and D (5, 4). What is the shape of the quadrilateral?  
a) Square                b) Rectangle but not a square  
c) Rhombus              d) Parallelogram but not a rhombus    e) None of these
42. A boat running downstream covers a distance of 16 km in 2 hours while for covering the same distance upstream, it takes 4 hours. What is the speed of the boat in still water?  
a) 4 km/hr                b) 6 km/hr                c) 8 km/hr  
d) Data inadequate      e) None of these

The bar graph given below shows the foreign exchange reserves of a country (in million US \$) from 1991-1992 to 1998-1999

Foreign Exchange Reserves Of a Country. (in million US \$)



43. The ratio of the number of years, in which the foreign exchange reserves are above the average reserves, to those in which the reserves are below the average reserves is?
- a) 2 : 6                          b) 3 : 4                          c) 3 : 5  
 d) 4 : 4                           e) None of these
44. The foreign exchange reserves in 1997-98 was how many times that in 1994-95?
- a) 0.7                              b) 1.2                              c) 1.4  
 d) 1.5                              e) None of these
45. For which year, the percent increase of foreign exchange reserves over the previous year, is the highest?
- a) 1992-93                        b) 1993-94                        c) 1994-95  
 d) 1996-97                        e) None of these
46. The foreign exchange reserves in 1996-97 were approximately what percent of the average foreign exchange reserves over the period under review?
- a) 95%                             b) 110%                            c) 115%  
 d) 125%                           e) None of these
47. What was the percentage increase in the foreign exchange reserves in 1997-98 over 1993-94?
- a) 100                             b) 150                             c) 200  
 d) 620                             e) None of these
48. What was the day of the week on 4<sup>th</sup> June, 2002?
- a) Tuesday                        b) Wednesday                    c) Thursday

## Solutions:

1. Volume of water displaced = volume of sphere

$$\pi \times (40)^2 \times h = \frac{4}{3} \pi \times (30)^3$$

Thus, the level of water rises by 22.5 cm.

**Note** The volume of water will be calculated by considering it in the cylindrical shape since the water takes the shape of vessel in which it is filled.

2. Let  $x$  be the number and  $y$  be the quotient. Then,

$$\begin{aligned}x &= 357 \times y + 39 \\&= (17 \times 21 \times y) + (17 \times 2) + 5 \\&= 17 \times (21y + 2) + 5 \\&\text{So, required number} = 5\end{aligned}$$

- $$3. \text{ Age decreased} = 5 \times 3 \text{ years} = 15 \text{ years}$$

So, required difference = 15 years

4. Let the numbers be  $x$  and  $(100 - x)$

$$\text{Then, } x(100 - x) = 5 \times 495$$

$$x^2 - 100x + 2475 = 0$$

$$(x - 55)(x - 45) = 0$$

$$x = 55 \text{ or } x = 45$$

Therefore, the numbers are 45 and 55.

Required difference = (55 - 45) = 10

5. Minimum number of chocolates are possible when he purchases maximum number of costliest chocolates.

Thus  $2 \times 5 + 5 \times 2 = \text{Rs } 20$

Now, Rs.100 must be spent on 10 chocolates as  $100 = 10 \times 10$   
 Thus, minimum number of chocolates =  $5 + 2 + 10 = 17$

$$\begin{aligned} 6. \quad A : B : C &= 10 \times 7 : 12 \times 5 : 9 \times 5 \\ &= 70 : 60 : 45 \\ &= 14 : 12 : 9 \\ &= \text{Rs.}175 \times \frac{9}{35} = \text{Rs.}45 \end{aligned}$$

$$7. \quad 9 \times 9 \times 9 \times 9 = 9^4$$

$$8. \quad \text{Let number of balls} = (6 + 8) = 14$$

Number of white balls = 8

$$P(\text{drawing a white ball}) = \frac{8}{14} = \frac{4}{7}$$

$$9. \quad \text{Let P's age and Q's age be } 6x \text{ years and } 7x \text{ years respectively.}$$

$$\begin{aligned} \text{Then} \quad 7x - 6x \\ x = 4 \end{aligned}$$

$$\begin{aligned} \text{Required ratio} \quad &= (6x + 4) : (7x + 4) \\ &= 28 : 32 \\ &= 7 : 8 \end{aligned}$$

$$10. \quad \text{Gain \%} \quad = \left[ \frac{0.70}{70} \times 100 \right] \% \\ = 1\%$$

$$11. \quad T_{11} + T_{12} + T_{13} = 114$$

$$T_{12} = \frac{114}{3} = 38$$

$$a + 11d = 38 \quad \dots \text{(i)}$$

$$\text{and } T_{21} + T_{22} + T_{23} = 204$$

$$T_{22} = 68$$

$$a + 21d = 68 \quad \dots \text{(ii)}$$

from equations (i) and (ii)

$$10d = 30$$

$$d = 3$$

So,  $a = 5$

$$T_1 + T_2 + T_3 = 5 + 8 + 11 = 24$$

$$12. \quad \sqrt{0.09} = \sqrt{9/100}$$

$$= \frac{3}{10}$$

0.3, which is rational.

13. Suppose they meet  $x$  hrs. after 8 a.m. then  
 (Distance moved by first in  $x$  hrs.) +  $= 300$

$$\left[ \text{Distance moved by second in } (x - 1) \text{ hrs.} \right]$$

$$\text{Therefore } 60x + 75(x - 1) \Leftrightarrow 330 \\ x = 3$$

So, they meet at  $(8 + 3)$  i.e. 11 a.m.

$$\begin{array}{ll} 14. 1 \text{ woman's 1 day's work} & = \frac{1}{70} \\ 1 \text{ child's 1 day's work} & = \frac{1}{140} \end{array}$$

$$(5 \text{ women} + 10 \text{ children})'s \text{ day's work} = \left[ \frac{5}{70} + \frac{10}{140} \right] = \left[ \frac{1}{14} + \frac{1}{14} \right] = \frac{1}{7}$$

5 women and 10 children will complete the work in 7 days.

15. BH perpendicular to AC means that triangles ABH and HBC are right triangles.  
 Hence

$$\tan(39^\circ) = 11/AH \text{ or } AH = 11/\tan(39^\circ)$$

$$HC = 19 - AH = 19 - 11/\tan(39^\circ)$$

$$\text{Pythagora's theorem applied to right triangle HBC : } 11^2 + HC^2 = x^2$$

$$\text{Solve for } x \text{ and substitute HC : } x = \sqrt{11^2 + (19 - 11/\tan(39^\circ))^2}$$

$$= 12.3$$

16. This is a right triangle with a  $30^\circ$  angle so it must be a  $30^\circ - 60^\circ - 90^\circ$  triangle.

You are given that the hypotenuse is 8. Substituting 8 into the third value of the ratio  $n$ :  $n\sqrt{3}$  :  $2n$ ,

we get that  $2n = 8$

$$n = 4$$

Substituting  $n = 4$  into the first and second value of the ratio we get that the other two sides are 4 and  $4\sqrt{3}$

The lengths of the two sides are 4 inches and  $4\sqrt{3}$  inches.

$$17. \text{ Rate downstream} = \left[ \frac{\frac{15}{3}}{\frac{3}{4}} \right] \text{ km/hr} = \left[ 15 \times \frac{4}{15} \right] \text{ km/hr} = 4 \text{ km/hr}$$

$$\text{Rate upstream} = \left[ \frac{5}{2 \frac{1}{2}} \right] \text{ km/hr} = \left[ 5 \times \frac{2}{5} \right] \text{ km/hr} = 2 \text{ km/hr}$$

$$\text{So, speed of current} = \frac{1}{2} (4 - 2) \text{ km/hr} = 1 \text{ km/hr}$$

$$18. \text{ Required percentage} = \left[ \frac{720 + 840 + 780 + 950 + 870}{1980 + 1050 + 1020 + 1240 + 940} \times 100 \right] \%$$

$$= \left[ \frac{4160}{5230} \times 100 \right] \%$$

$$= 79.54\% \sim 80\%$$

19. Required average

$$= \frac{8100 + 9500 + 8700 + 9700 + 8950}{5}$$

$$= \frac{44950}{5} = 8990$$

20. The percentages of candidates qualified to candidates appeared from State P during different years are :

$$\text{For 1997} = \left[ \frac{780}{6400} \times 100 \right] \% = 12.19\%$$

$$\text{For 1998} = \left[ \frac{1020}{8800} \times 100 \right] \% = 11.59\%$$

$$\text{For 1999} = \left[ \frac{890}{7800} \times 100 \right] \% = 11.41\%$$

$$\text{For 2000} = \left[ \frac{1010}{8750} \times 100 \right] \% = 11.54\%$$

$$\text{For 2001} = \left[ \frac{1250}{9750} \times 100 \right] \% = 12.82\%$$

Maximum percentage is for the year 2001.

21. Required percentage

$$= \left[ \frac{840 + 1050 + 920 + 980 + 1020}{7500 + 9200 + 8450 + 9200 + 8800} \times 100 \right] \%$$

$$= \left[ \frac{4810}{43150} \times 100 \right] \%$$

$$= 11.15\%$$

22. Required percentage

$$= \left[ \frac{850 + 920 + 890 + 980 + 1350}{7400 + 8450 + 7800 + 8700 + 9800} \times 100 \right] \%$$

$$= \left[ \frac{4990}{42150} \times 100 \right] \%$$

$$= 11.84\%$$

23. In 12 hours, they are at right angles 22 times.

So, in 24 hours, they are at right angles 44 times.

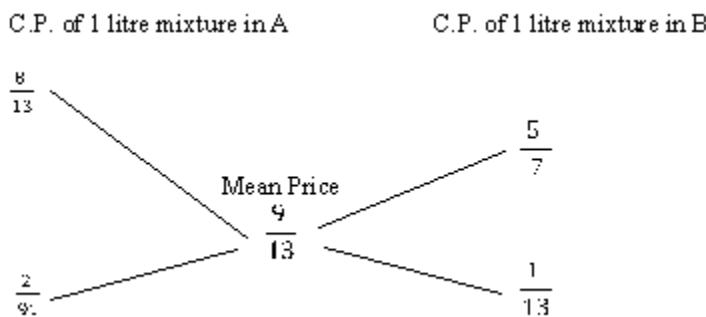
24. Let cost of 1 litre milk be Rs. 1

Milk in 1 litre mix. in A =  $\frac{8}{13}$  litre, C.P. of 1 litre mix. in A = Rs.  $\frac{8}{13}$

Milk in 1 litre mix. in B =  $\frac{5}{7}$  litre, C.P. of 1 litre mix. in B = Rs.  $\frac{5}{7}$

Milk in 1 litre of final mix. =  $\left[ \frac{900}{13} \times \frac{1}{100} \times 1 \right] = \frac{9}{13}$  litre; Mean price = Rs.  $\frac{9}{13}$

By the rule of allegation, we have :



$$\text{So, required ratio} = \frac{2}{91} : \frac{1}{13} = 2 : 7$$

25. Time taken by one tap to fill the half tank = 3 hours

$$\begin{aligned}\text{Part filled by the four taps in 1 hour} &= \left[ 4 \times \frac{1}{6} \right] \\ &= \frac{2}{3}\end{aligned}$$

$$\text{Remaining part} = \left[ 1 - \frac{1}{2} \right]$$

$$= \frac{1}{2}$$

$$\text{Therefore } \frac{2}{3} : \frac{1}{2} :: 1 : x$$

$$\left[ \frac{1}{2} \times 1 \times \frac{3}{2} \right]$$

$$= \frac{3}{4} \text{ hours i.e. 45 minutes.}$$

So, total time taken = 3 hours 45 minute

$$26. \text{Time} = \left[ \frac{100 \times 81}{450 \times 4.5} \right] \text{ years} = 4 \text{ years}$$

27. 20% of a = b

$$\frac{20}{100} a = b$$

$$\text{So, } b\% \text{ of } 20 = \left[ \frac{b}{100} \times 20 \right] = \left[ \frac{20}{100} a \times \frac{1}{100} \times 20 \right] = \frac{4}{100} a = 4\% \text{ of } a$$

$$\begin{aligned}28. (4^{61} + 4^{62} + 4^{63} + 4^{64}) &= 4^{61} \times (1 + 4 + 4^2 + 4^3) = 4^{61} \times 85 \\ &= 4^{60} \times (4 \times 85) = (4^{60} \times 340), \text{ which is divisible by 10.}\end{aligned}$$

29. Average of 20 numbers = 0.

$\therefore$  Sum of 20 numbers ( $0 \times 20$ ) = 0.

It is quite possible that 19 of these numbers may be positive and if their sum is  $a$  then 20th number is  $(-a)$ .

$$\begin{aligned}30. \text{Required length} &= \text{HCF of } 700 \text{ cm, } 385 \text{ cm and } 1295 \text{ cm} \\ &= 35 \text{ cm}\end{aligned}$$

31.  $\frac{(a+b)}{(a-b)} = \frac{15}{1}$   
 $\frac{a}{b} = \frac{8}{7}$  (by componendo and dividend)  
 Therefore  $a^2 - b^2 = 64 - 49 = 15$

32. Simran : Nanda  $= [5000 \times 36] : [80000 \times 3]$   
 $= 3 : 4$

Simran's share  $= \text{Rs. } [24500 \times \frac{3}{7}]$

33. Number of ways of selecting (3 consonants out of 7) and (2 vowels out of 4) =  ${}^7C_3 \times {}^4C_2$   
 $= \frac{7 \times 6 \times 5}{3 \times 2 \times 1} \times \frac{4 \times 3}{2 \times 1} = 210$   
 Number of groups, each having 3 consonants and 2 vowels = 210  
 Each group contains 5 letters.  
 Number of ways of arranging  
 5 letters among themselves =  $5 \times 4 \times 3 \times 2 \times 1 = 120$   
 Required number of ways =  $210 \times 120 = 25200$

34. In two throws of a die,  $n(S) = (6 \times 6) = 36$

Let E = event of getting a sum =  $\{(3, 6), (4, 5), (5, 4), (6, 3)\}$   
 $P(E) = \frac{n(E)}{n(S)} = \frac{4}{36} = \frac{1}{9}$

35. Clearly, my mother was born 3 years before I was born and 4 years after my sister was born.  
 So, father's age when  $= (28 + 4)$   
 Brother was born  $= 32$  years  
 Mother's age when brother was born  $= (26 - 3)$   
 $= 23$  years

36.  $85 : 9 = 105 : x$   
 $x = [9 \times \frac{105}{80}]$   
 $= \text{Rs. } 11.81$   
 Hence, S.P. per kg = Rs.11.81

37. 1, 4, 7, 10, 13, 16, 19, 22, 25, 28, 31, 34, 37, .... 187  
 3, 7, 11, 15, 19, 23, 27, 31, 35, 39, .... 187  
 The common terms are 7, 19, 31, 43, .... 187

Therefore number of such terms =  $\left[ \frac{187 - 7}{12} \right] + 1 = 16$

38.  $\sqrt{0.16} = \sqrt{16/100}$   
 $= \sqrt{16} / \sqrt{100}$   
 $= 4/10$   
 $= 0.4$

39. Speed

$$\begin{aligned}
 &= \left[ \frac{600}{5} \times 60 \right] \text{ m/sec} \\
 &= 2 \text{ m/sec} \\
 &= \left[ 2 \times \frac{18}{5} \right] \text{ km/hr.} \\
 &= 7.2 \text{ km/hr.}
 \end{aligned}$$

40. Ratio of times taken by A and B = 1 : 3

The time difference is (3 - 1) 2 days while B takes 3 days and A takes 1 day.  
If difference of time is 2 days, B takes 3 days.

If difference of time is 60 days, B takes  $\left[ \frac{3}{2} \times 60 \right] = 90$  days

So, A takes 30 days to do the work.

A's 1 day's work

$$= \frac{1}{30}$$

B's 1 day's work

$$= \frac{1}{90}$$

(A + B)'s 1 day's work

$$= \left[ \frac{1}{30} + \frac{1}{90} \right] = \frac{4}{90} = \frac{2}{45}$$

A and B together can do the work in  $\frac{45}{2} = 22 \frac{1}{2}$  days

41. The lengths of the four sides AB, BC, CD and DA are all equal to  $\sqrt{41}$

Hence, the given quadrilateral is either a Rhombus or a Square.

Now let us compute the lengths of the two diagonals AC and BD.

The length of AC is  $\sqrt{162}$  and the length of BD is  $\sqrt{2}$

As the diagonals are not equal and the sides are equal, the given quadrilateral is a **Rhombus**.

42. Rate Downstream

$$\begin{aligned}
 &= \left[ \frac{16}{2} \right] \text{ kmph} \\
 &= 8 \text{ kmph}
 \end{aligned}$$

Rate upstream

$$\begin{aligned}
 &= \left[ \frac{16}{4} \right] \text{ kmph} \\
 &= 4 \text{ kmph}
 \end{aligned}$$

Speed in still water

$$\begin{aligned}
 &= \frac{1}{2} (8 + 4) \text{ kmph} \\
 &= \frac{1}{2} \times 12 \\
 &= 6 \text{ kmph}
 \end{aligned}$$

43. Average foreign exchange reserves over the given period = 3480 million US \$

The country had reserves above 3480 million US \$ during the years 1992-93, 1996-97 and 1997-98, i.e. for 3 years and below 3480 million US \$ during the years 1991-92, 1993-94, 1994-95, 1995-96 and 1998-99, i.e. for 5 years.

Hence, required ratio = 3 : 5

44. Required ratio =  $\frac{5040}{3360} = 1.5$

45. There is an increase in foreign exchange reserves during the years 1992-1993, 1994-95, 1996-97, 1997-98 as compared to previous year (as shown by bar graph)

The percentage increase in reserves during these years compared to previous year are :

$$\text{For 1992-93} = \left[ \frac{3720 - 2640}{2640} \times 100 \right] \% = 40.91\%$$

$$\text{For 1994-95} = \left[ \frac{3360 - 2520}{2520} \times 100 \right] \% = 33.33\%$$

$$\text{For 1996-97} = \left[ \frac{4320 - 3120}{3120} \times 100 \right] \% = 38.46\%$$

$$\text{For 1997-98} = \left[ \frac{5040 - 4320}{4320} \times 100 \right] \% = 16.67\%$$

Clearly, the percentage increase over previous year is highest for 1992-93

46. Average foreign exchange reserves over the given period

$$\begin{aligned} &= \left[ \frac{1}{8} \times 2640 + 3720 + 2520 + 3360 + 3120 + 4320 + 5040 + 3120 \right] \text{ million US } \\ &\$ \\ &= 3480 \text{ million US \$} \end{aligned}$$

Foreign exchange reserves in 1996-97 = 4320 million US \$

$$\text{Required percentage} = \left[ \frac{4320}{3480} \times 100 \right] \% = 124.14\% \sim 125\%$$

47. Foreign exchange reserves in 1997-98 = 5040 million US \$

Foreign exchange reserves in 1993-94 = 2520 million US \$

Increase = 5040 - 2520 = 2520 US \$

$$\text{Percentage increase} = \left[ \frac{2520}{2520} \times 100 \right] \% = 100\%$$

48. 4<sup>th</sup> June 2002 = (2001 years + period from 1.1.2002 to 4.6.2002)

Odd days in 1600 years = 0

Odd days in 400 years = 0

Odd days in 1 ordinary year = 1

Odd days in 2001 years = (0 + 0 + 1) = 1

Jan.	Feb.	March	April	May	June
(31 +	28	+ 31	+ 30	+ 31	+ 4)
					= 155 days

= 22 weeks + 1 day = 1 odd day

Total number of odd days = (1 + 1) = 2

So, required day is Tuesday

49. Angle traced by hour hand in 12 hours = 360°

$$\text{Angle traced by it in } \frac{11}{3} \text{ hours} = \left[ \frac{360}{12} \times \frac{11}{3} \right]^\circ = 110^\circ$$

Angle traced by minute hand in 60 min. = 360°

$$\text{Angle traced by it in 40 min.} = \left[ \frac{360}{60} \times 40 \right]^\circ = 240^\circ$$

So, required angle (240 - 110)° = 130°

50. Let the cost of 1 litre milk be Rs. 1

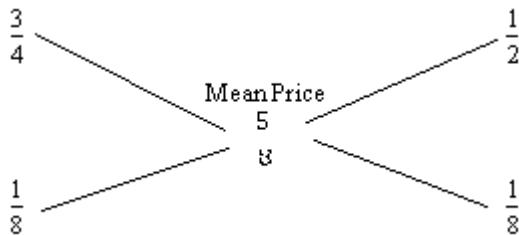
Milk in 1 litre mix. in 1<sup>st</sup> can =  $\frac{3}{4}$  litre, C.P. of 1 litre mix. in 1<sup>st</sup> can Rs.  $\frac{3}{4}$

Milk in 1 litre mix. in 2<sup>nd</sup> can =  $\frac{1}{2}$  litre, C.P. of 1 litre mix. in 2<sup>nd</sup> can Rs.  $\frac{1}{2}$

Milk in 1 litre of final mix. =  $\frac{5}{8}$  litre, Mean price = Rs.  $\frac{5}{8}$

By the rule of allegation, we have:

C.P. of 1 litre mixture in 1<sup>st</sup> can    C.P. of 1 litre mixture in 2<sup>nd</sup> can



So, ratio of two mixtures =  $\frac{1}{8} : \frac{1}{8} = 1 : 1$

So, quantity of mixture taken from each can =  $\left[ \frac{1}{2} \times 12 \right] = 6$  litres

**Model Paper – 4**

1. Two pipes A and B can separately fill a cistern in 60 minutes and 75 minutes respectively. There is a third pipe in the bottom of the cistern to empty it. If all the three pipes are simultaneously opened, then the cistern is full in 50 minutes. In how much time, the third pipe alone can empty the cistern?  
a) 90 min                    b) 100 min                    c) 110 min  
d) 120 min                    e) None of these
2. What will be the ratio of simple interest earned by certain amount at the same rate of interest for 6 years and that for 9 years?  
a) 1 : 3                    b) 1 : 4                    c) 2 : 3  
d) Data inadequate    e) None of these
3. When any number is divided by 12, then dividend becomes  $\frac{1}{4}$ th of the other number. By how much percent first number is greater than the second number?  
a) 150                    b) 200                    c) 300  
d) Data inadequate    e) None of these
4. A sphere of 30 cm radius is dropped into a cylindrical vessel of 80 cm diameter, which is partly filled with water, then its level rises by x cm. Find x:  
a) 27.5 cm                    b) 22.5 cm                    c) 18.5 cm  
d) Data inadequate    e) None of these
5. Which of the following numbers is divisible by 24?  
a) 35718                    b) 63810                    c) 537804  
d) 3125736                    e) None of these
6. The average weight of A, B and C is 45 kg. If the average weight of A and B be 40 kg and that of B and C be 43 kg, then the weight of B is:  
a) 17 kg                    b) 20Kg                    c) 26Kg  
d) 31Kg                    e) None of these
7. The maximum numbers of students among them 1001 pens and 910 pencils can be distributed in such a way that each student gets the same number of pens and same number of pencils is  
a) 91                    b) 910                    c) 1001  
d) 1911                    e) None of these
8. In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?  
a) 63                    b) 90                    c) 126  
d) 145                    e) None of these
9. A card is drawn from a pack of 52 cards. The probability of getting a queen of club or a king of heart is:

- a)  $1/13$   
d)  $1/52$

- b)  $2/13$   
e) None of these

- c)  $1/26$

10. Ayesha's father was 38 years of age when she was born while her mother was 36 years old when her brother four years younger to her was born. What is the difference between the ages of her parents?

- a) 2 years  
d) 12 years

- b) 4 years  
e) None of these

- c) 6 years

11. Samant bought a microwave oven and paid 10% less than the original price. He sold it with 30% profit on the price he had paid. What percentage of profit did Samant earn on the original price?

- a) 17%  
d) 32%

- b) 20%  
e) None of these

- c) 27%

12. The sum of  $n$  terms of the series, where  $n$  is an even number :

$$1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + \dots : \\ \text{a) } n(n+1) \quad \text{b) } \frac{n(n+1)}{2} \\ \text{d) Data inadequate} \quad \text{e) None of these}$$

$$\text{c) } -\frac{n(n+1)}{2}$$

13. If  $x \times y = x + y + \sqrt{xy}$  then the value of  $6 \times 24$  is

- a) 41  
d) 44

- b) 42  
e) None of these

- c) 43

14. A person has to cover a distance of 6 km in 45 minutes. If he covers one-half of the distance in two-thirds of the total time; to cover the remaining distance in the remaining time, his speed (in Km/hr) must be

- a) 6  
d) 15

- b) 8  
e) None of these

- c) 12

15. A can finish a work in 18 days and B can do the same work in 15 days. B worked for 10 days and left the job. In how many days, A alone can finish the remaining work?

- a) 5  
d) 8

- b)  $5\frac{1}{2}$   
e) None of these

- c) 6

16. In  $\Delta ABC$ ,  $B = \frac{\pi}{3}$  and  $C = \frac{\pi}{4}$ . Let D divide BC internally in the ratio 1 : 3, then

$$\frac{\sin(\angle BAD)}{\sin(\angle CAD)} =$$

- a)  $\frac{1}{3}$   
d)  $\sqrt{\frac{2}{3}}$

- b)  $\frac{1}{\sqrt{6}}$   
e) None of these

- c)  $\frac{1}{\sqrt{3}}$

17. Find the length of one side of a right triangle if the length of the hypotenuse is 15 inches and the length of the other side is 12 inches.

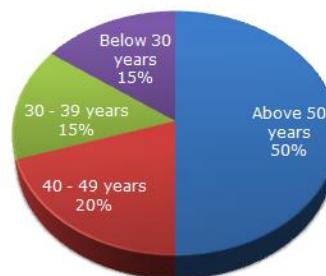
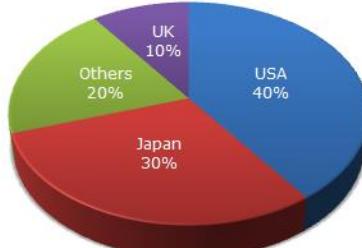
- a) 8 inches
  - b) 7 inches
  - c) 9 inches
  - d) 13 inches
  - e) None of these

18. In one hour, a boat goes 11 km along the stream and 5 km against the stream. The speed of the boat in still water is ( km/hr )



The following pie charts exhibit the distribution of the overseas tourist traffic from India. The two charts show the tourist distribution by country and the age profiles of the tourists respectively.

## Distribution of Overseas Tourist Traffic from India.



19. What percentage of Indian tourist went to either USA or UK?



20. The ratio of the number of Indian tourists that went to USA to the number of Indian tourists who were below 30 years of age is?



21. If amongst other countries, Switzerland accounted for 25% of the Indian tourist traffic, and it is known from official Swiss records that a total of 25 lakh Indian tourists had gone to Switzerland during the year, then find the number of 30 – 39 year old Indian tourists who went abroad in that year?

22. On 8<sup>th</sup> Feb. 2005 it was Tuesday. What was the day of the week on 08<sup>th</sup> Feb. 2004?
- a) Tuesday
  - b) Monday
  - c) Sunday
  - d) Wednesday
  - e) None of these
23. The reflex angle between the hands of a clock at 10.25 is :
- a)  $180^\circ$
  - b)  $192\frac{1}{2}^\circ$
  - c)  $195^\circ$
  - d)  $197\frac{1}{2}^\circ$
  - e) None of these
24. Find the ratio in which rice at Rs. 7.20 a kg be mixed with rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg.
- a) 1 : 3
  - b) 2 : 3
  - c) 3 : 4
  - d) 4 : 5
  - e) None of these
25. One pipe can fill a tank three times as fast as another pipe. If together the two pipes can fill the tank in 86 minutes, then the slower pipe alone will be able to fill the tank in
- a) 81 min
  - b) 108 min
  - c) 144 min
  - d) 192 min
  - e) None of these
26. What will be the simple interest earned on an amount of Rs.16,800 in 9 months at the rate of  $6\frac{1}{4}\%$  p.a.?
- a) Rs.787.50
  - b) Rs.812.50
  - c) Rs.860
  - d) Rs.887.50
  - e) None of these
27. The students appeared at an examination. One of them secured 9 marks more than the other and his marks was 56% of the sum of their marks. The marks obtained by them are :
- a) 39, 30
  - b) 41, 32
  - c) 42, 33
  - d) 43, 34
  - e) None of these
28. What is the ratio of the area of larger square shaped plot to the area of the smaller square shaped plot?
- a) 17 : 1
  - b) 25 : 9
  - c) 16 : 1
  - d) Data inadequate
  - e) None of these
29. The difference of the squares of two consecutive even integers is divisible by which of the following integers?
- a) 3
  - b) 4
  - c) 6
  - d) 7
  - e) None of these
30. If the average marks of three batches of 55, 60 and 45 students respectively is 50, 55, 60, then the average marks of all the students is:
- a) 53.33
  - b) 54.68
  - c) 55
  - d) Data inadequate
  - e) None of these



The following line graph gives the ratio of the amounts of imports by a company to the amount of exports from that company over the period from 1995 to 2001.

## Ratio of Value of Imports to Exports by a Company Over the Years.



45. If the imports in 1998 was Rs.250 Crores and the total exports in the years 1998 and 1999 together was Rs.500 Crores, then the imports in 1999 was?

- a) Rs.250 Crores      b) Rs.300 Crores      c) Rs.357 Crores  
 d) Rs.420 Crores      e) None of these
46. The imports were minimum proportionate to the exports of the company in the year?  
 a) 1995      b) 1996      c) 1997  
 d) 2000      e) None of these
47. What was the percentage increase in imports from 1997 to 1998?  
 a) 72      b) 56      c) 28  
 d) Data inadequate      e) None of these
48. If the imports of the company in 1996 was Rs.272 Crores, the exports from the company in 1996 was?  
 a) Rs.370 Crores      b) Rs.320 Crores      c) Rs.280 Crores  
 d) Rs.275 Crores      e) None of these
49. In how many of the given years were the exports more than the imports?  
 a) 1      b) 2      c) 3  
 d) 4      e) None of these
50. January 1, 2007 was Monday. What day of the week lies on Jan. 1, 2008?  
 a) Monday      b) Tuesday      c) Wednesday  
 d) Sunday      e) None of these

**Solutions:**

$$\begin{aligned}
 1. \text{ Work done by the third pipe in 1 min.} &= \frac{1}{50} - \left[ \frac{1}{60} + \frac{1}{75} \right] \\
 &= \left[ \frac{1}{50} - \frac{3}{100} \right] \\
 &= \frac{1}{100}
 \end{aligned}$$

Therefore, the third pipe alone can empty the cistern in 100 min.

2. Let the principal be P and rate of interest be R%.

$$\text{So, required ratio} = \frac{\frac{P \times R \times 6}{100}}{\frac{P \times R \times 9}{100}} = \frac{6PR}{9PR} = \frac{6}{9} = 2 : 3$$

3. Let the number be x and y. Then,  $\frac{x}{12} = \frac{y}{4}$   
 $x = 3y$

$$\text{So, required percentage} = \left[ \frac{x-y}{y} \times 100 \right] \% = \left[ \frac{2y}{y} \times 100 \right] \% = 200\%$$

4. Volume of water displaced = volume of sphere

$$\pi \times (40)^2 \times h = \frac{4}{3} \pi \times (30)^3$$

$$h = \frac{90}{4} = 22.5 \text{ cm}$$

Thus, the level of water rises by 22.5 cm.

**Note** The volume of water will be calculated by considering it in the cylindrical shape since the water takes the shape of vessel in which it is filled.

5.  $24 = 3 \times 8$ , where 3 and 8 are co-primes.

Clearly, 35718 is not divisible by 8, as 718 is not divisible by 8

Similarly, 63810 is not divisible by 8 and 537804 is not divisible by 8.

Consider part (d)

Sum of digits  $= (3 + 1 + 2 + 5 + 7 + 3 + 6) = 27$ , which is divisible by 3.

Also, 736 is divisible by 8.

So, 3125736 is divisible by  $(3 \times 8)$ , i.e. 24.

6. Let A, B, C represent their respective weights. Then, we have:

$$A + B + C = (45 \times 3) = 135 \dots \text{(i)}$$

$$A + B = (40 \times 2) = 80 \dots \text{(ii)}$$

$$B + C = (43 \times 2) = 86 \dots \text{(iii)}$$

Adding (ii) and (iii), we get:  $A + 2B + C = 166 \dots \text{(iv)}$

Subtracting (i) from (iv), we get :  $B = 31$ .

B's weight = 31 kg.

7. Required number of students = HCF of 1001 and 910  
 $= 91$

8. Required number of ways  $= {}^7C_5 \times {}^3C_2 = {}^7C_2 \times {}^3C_1 = \left[ \frac{7 \times 6}{2 \times 1} \times 3 \right] = 63$

9. Here,  $n(S) = 52$

Let E = event of getting a queen of club or a king of heart.

Then,  $n(E) = 2$

$$P(E) = \frac{n(E)}{n(S)} = \frac{2}{52} = \frac{1}{26}$$

10. Mother's age when Ayesha's brother was born = 36 years  
 Father's age when Ayesha's brother was born =  $(38 + 4)$  years  
 $= 42$  years  
 Required difference =  $(42 - 36)$   
 $= 6$  years

11. Let the original price = Rs.100  
 Then, C.P. = Rs.90

$$S.P. = 130\% \text{ of Rs.90} = \text{Rs.} \left[ \frac{130}{100} \times 90 \right]$$

$$\begin{aligned}
 &= \text{Rs.} 117 \\
 \text{Required percentage} &= (117 - 100)\% \\
 &= 17\%
 \end{aligned}$$

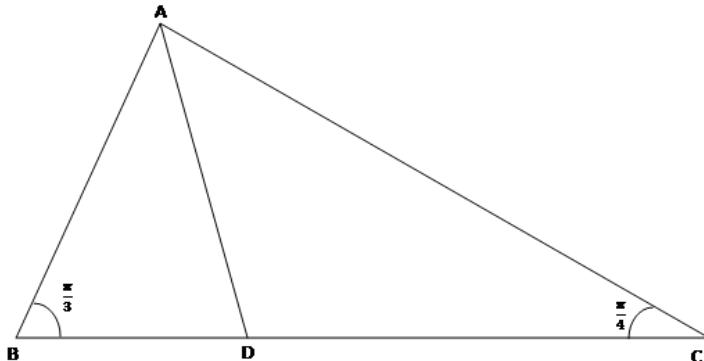
$$\begin{aligned}
 12. \quad &1^2 - 2^2 + 3^2 - 4^2 + 5^2 - 6^2 + 7^2 - 8^2 + \dots \\
 &= (1 - 2)(1 + 2) + (3 - 4)(3 + 4) + (5 - 6)(5 + 6) + (7 - 8)(7 + 8) + \dots \\
 &= -(1 + 2) - (3 + 4) - (5 + 6) \dots \\
 &= -[(1 + 2) + (3 + 4) + (5 + 6) + \dots] \\
 &= -[1 + 2 + 3 + 4 + 5 + 6 + \dots] = -\frac{n(n+1)}{2}
 \end{aligned}$$

$$\begin{aligned}
 13. \quad &6 \times 24 \\
 &= 6 + 24 + \sqrt{6 \times 24} \\
 &= 30 + \sqrt{144} \\
 &= 30 + 12 \\
 &= 42
 \end{aligned}$$

$$\begin{aligned}
 14. \quad \text{Remaining distance} &= 3 \text{ km./hr.} \\
 \text{Remaining time} &= \left[ \frac{1}{3} \times 45 \right] \text{ min} \\
 &= 15 \text{ min} \\
 &= \frac{1}{4} \\
 \text{Required speed} &= (3 \times 4) \text{ km./hr.} \\
 &= 12 \text{ km./hr.}
 \end{aligned}$$

$$\begin{aligned}
 15. \quad \text{B's 10 day's work} &= \left[ \frac{1}{15} \times 10 \right] = \frac{2}{3} \\
 \text{Remaining work} &= \left[ 1 - \frac{2}{3} \right] = \frac{1}{3} \\
 \text{Now, } \frac{1}{18} \text{ work is done by A in 1 day.} \\
 \frac{1}{3} \text{ work is done by A in } &\left[ 18 \times \frac{1}{3} \right] = 6 \text{ days.}
 \end{aligned}$$

$$16. \quad \frac{BD}{DC} = \frac{1}{3} \quad [\text{Given}]$$



From  $\Delta ABD$ ,

$$BD/\sin(\angle BAD) = AD/\sin(\pi/3) \dots (1)$$

From  $\Delta ACD$ ,

$$DC/\sin(\angle CAD) = AD/\sin(\pi/4) \dots (2)$$

Now, divide (1) by (2) and use  $BD/DC = 1/3$

$$\Rightarrow \sin(\angle BAD)/\sin(\angle CAD) = \frac{1}{\sqrt{6}}$$

17. Test the ratio of the lengths to see if it fits the  $3n : 4n : 5n$  ratio.

$$? : 12 : 15 = ? : 4 (3) : 5 (3)$$

Yes, it is a  $3 - 4 - 5$  triangle for  $n = 3$

$$\text{Calculate the third side } 3n = 3 \times 3 = 9$$

The length of the side is 9 inches.

18. Speed in still water  $= \frac{1}{2} (11 + 5) \text{ km./hr.}$   
 $= 8 \text{ km./hr.}$

19.  $(40 + 10) = 50\%$  (from first chart)

20.  $40 : 15 = 8 : 3$

21. Tourist traffic from other countries to Swiz is 20%

Amongst this 20%, 25% of traffic from India.

So, 25% of 20% = 5% corresponds to the Indian traffic in Switzerland.

5% corresponds to Switzerland's 25 lakh. Hence 15% will be 75 lakh.

22. The year 2004 is a leap year. It has 2 odd days.

So, the day on 8<sup>th</sup> Feb. 2004 is 2 days before the day on 8<sup>th</sup> Feb. 2005

Hence, this day is Sunday.

23. Angle traced by hour hand in  $\frac{125}{12}$  hours  $= \left[ \frac{360}{12} \times \frac{125}{12} \right]^\circ = 312 \frac{1}{2}^\circ$

$$\text{Angle traced by minute hand in 25 min.} = \left[ \frac{360}{60} \times 25 \right]^\circ = 150^\circ$$

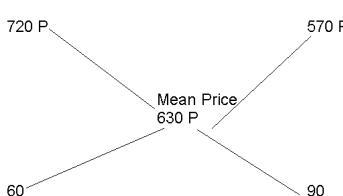
$$\text{So, reflex angle} = 360^\circ - \left[ 312 \frac{1}{2}^\circ - 150^\circ \right]^\circ = 360^\circ - 162 \frac{1}{2}^\circ = 197 \frac{1}{2}^\circ$$

24. By the rule of allegation:

Cost of 1 kg of 1<sup>st</sup> kind

Cost of 1 kg of 2<sup>nd</sup> kind

kind



So, required ratio =  $60 : 90 = 2 : 3$

25. Let the slower pipe alone fill the tank in  $x$  minutes. Then, faster pipes will fill it in  $\frac{x}{3}$  minutes

$$\text{Therefore, } \frac{1}{x} + \frac{3}{x} = \frac{1}{36}$$

$$\frac{4}{x} = \frac{1}{36}$$

$$x = 144 \text{ min.}$$

26. Time = 9 months =  $\frac{3}{4}$  years

$$\text{So, S.I.} = \text{Rs.} \left[ 16800 \times \frac{25}{4} \times \frac{3}{4} \times \frac{1}{100} \right] = \text{Rs.} 787.50$$

27. Let their marks be  $(x + 9)$  and  $x$ .

$$\text{Then, } x + 9 = \frac{56}{100} (x + 9 + x)$$

$$25(x + 9) = 14(2x + 9)$$

$$3x = 99$$

$$x = 33$$

So, their marks are 42 and 33.

28.  $\frac{4x \times 4x}{x \times x} = \frac{16}{1} = 16 : 1$

29. Let the two consecutive even integers be  $2n$  and  $(2n + 2)$ . Then

$$(2n + 2)^2 - (2n)^2 = (2n + 2 + 2n)(2n + 2 - 2n)$$

$$= 2(4n + 2) = 4(2n + 1), \text{ which is divisible by 4.}$$

$$\begin{aligned} 30. \text{ Required Average} &= \left[ \frac{55 \times 50 + 60 \times 55 + 45 \times 60}{55 + 60 + 45} \right] \\ &= \left[ \frac{2750 + 3300 + 2700}{160} \right] \\ &= \frac{8750}{160} \\ &= 54.68 \end{aligned}$$

31. HCF of two numbers divides their LCM exactly. Clearly, 8 is not a factor 60.

32.  $5x^2 - 13xy + 6y^2 = 0$

$5x^2 - 10xy - 3xy + 6y^2 = 0$

$5x(x - 2y) - 3y(x - 2y) = 0$

$(x - 2y)(5x - 3y) = 0$

$x = 2y \text{ pr } 5x = 3y \quad \frac{x}{y} = \frac{2}{1} \text{ or } \frac{x}{y} = \frac{3}{5}$

So,  $(x : y) = (2b : 1)$  or  $(3 : 5)$

33.  $A : B : C$

$= 7 : 8 : 11$

$$\begin{aligned} \text{Hire charges paid by B} &= \text{Rs. } \left[ 520 \times \frac{8}{26} \right] \\ &= \text{Rs. } 160 \end{aligned}$$

34. The word 'OPTICAL' contains 7 different letters.

When the vowels OIA are always together, they can be supposed to form one letter.  
Then, we have to arrange the letters PTCL (OIA).

Now, 5 letters can be arranged in  $5! = 120$  ways

The vowels (OIA) can be arranged among themselves in  $3! = 6$  ways

$$\text{Required number of ways} = (120 \times 6) = 720$$

35. Clearly, there are 52 cards, out of which there are 12 face cards.

$$P(\text{getting a face card}) = \frac{12}{52} = \frac{3}{13}$$

$$\begin{aligned} 36. [(A + B) - (B + C)] &= 12 \\ &= A - C \\ &= 12 \end{aligned}$$

37. Let the labeled price be Rs.x. Then, 120% of x = 2880

$$\begin{aligned} \text{Therefore} \quad x &= \left[ 2880 \times \frac{100}{120} \right] \\ &= 2400 \\ \text{C.P.} &= 85\% \text{ of Rs. } 2400 \\ &= \text{Rs. } \left[ \frac{85}{100} \times 2400 \right] \\ &= \text{Rs. } 2040 \end{aligned}$$

38. Let  $n = 2$ , then

$$\begin{aligned} S_n &= 3 + 6 = 9 \\ S_n &= 2(3) + 2^2 - 1 = 9 \\ \text{at } n = 3, \quad S_n &= 19 \\ \text{So, } S_n &= 3 \times 4 + 2^3 - 1 = 19 \end{aligned}$$

Hence choice (b) is correct

**Alternatively :**

$$\begin{aligned} &\quad 3 + 6 + 10 + 16 + \dots \\ &= (2 + 4 + 6 + 8 + \dots) + (1 + 2 + 4 + 8 + \dots) \\ &= n(n + 1) + (2^n - 1) \end{aligned}$$

39. Given exp.

$$\begin{aligned} &= \left[ \frac{25}{11} \times \frac{14}{5} \times \frac{11}{14} \right] \\ &= 5 \end{aligned}$$

40. Relative speed

$$\begin{aligned} &= (2 + 3) \\ &= 5 \text{ rounds per hour} \end{aligned}$$

So, they cross each other 5 times in an hour and 2 times in half an hour.

Hence, they cross each other 7 times before 9.30 a.m.

41. P can complete the work in  $(12 \times 8)$  hrs. = 96 hrs.

Q can complete the work in  $(8 \times 10)$  hrs. = 80 hrs.

P's 1 hour's work =  $\frac{1}{96}$  and Q's 1 hour's work =  $\frac{1}{80}$

$$[P + Q]'s \text{ 1 hour's work} = \left[ \frac{1}{96} + \frac{1}{80} \right] = \frac{11}{480}$$

So, both P and Q will finish the work in  $\left[ \frac{480}{11} \right]$  hrs.

$$\text{Number of days of 8 hours each} = \left[ \frac{480}{11} \times \frac{1}{8} \right] = \frac{60}{11} \text{ days} = 5 \frac{5}{11} \text{ days}$$

42.  $\sin x + \sin^2 x = 1$  [Given]

$$\Rightarrow \sin x = 1 - \sin^2 x = \cos^2 x$$

$$\therefore \cos^2 x + \cos^4 x = \sin x + \sin^2 x = 1$$

43. Test the ratio of the lengths to see if it fits the  $n : n\sqrt{3} : 2n$  ratio.

$$4 : 4\sqrt{3} : ? n : n\sqrt{3} : 2n$$

Yes, it is a  $30^\circ - 60^\circ - 90^\circ$  triangle for  $n = 4$

Calculate the third side

$$2n = 2 \times 4 = 8$$

The length of the hypotenuse is 8 inches.

44. Speed downstreams =  $(10 + x)$  mph.

$$\text{Speed upstreams} = (10 - x) \text{ mph.}$$

$$= 18 \text{ kmph.}$$

$$\frac{36}{10 - x} - \frac{36}{10 + x}$$

$$= \frac{90}{60}$$

$$= 72x \times 60$$

$$= 90(100 - x^2)$$

$$= x^2 + 48x + 100 = 0$$

$$x = 2 \text{ mph.}$$

45. **Option D**

The ratio of imports to exports for the years 1998 and 1999 are 1.25 and 1.40 respectively.

Let the exports in the year 1998 = Rs.x Crores

Then, the exports in the year 1999 = Rs.(500 - x) Crores

$$1.25 = \frac{250}{x} \quad x = \frac{250}{1.25} = 200 \text{ (Using ratio for 1998)}$$

Thus, the exports in the year 1999 = Rs. (500 - 200) Crores = Rs.300 Crores

Let the imports in the year 1999 = Rs.y Crores

$$\text{Then, } 1.40 = \frac{y}{300} \quad y = 300 \times 1.40 = 420$$

Imports in the year 1999 = Rs.420 Crores

46. **Option C**

The imports are minimum proportionate to the exports implies that the ratio of the value of imports to exports has the minimum value.

Now, this ratio has a minimum value 0.35 in 1997, i.e., the imports are minimum proportionate to the exports in 1997.

**47. Option D**

The graph gives only the ratio of imports to exports for different years. To find the percentage increase in imports from 1997 to 1998, we require more details such as the value of imports or exports during these years.

Hence, the data is inadequate to answer this question.

**48. Option B**

Ratio of imports to exports in the year 1996 = 0.85

Let the exports in 1996 = Rs. x Crores

$$\text{Then, } \frac{272}{x} = 0.85 \quad x = \frac{272}{0.85} = 320$$

Exports in 1996 = Rs. 320 Crores

**49. Option D**

The exports are more than the imports imply that the ratio of value of imports to exports is less than 1.

Now, this ratio is less than 1 in years 1995, 1996, 1997 and 2000.

Thus, there are four such years.

**50. The year 2007 is an ordinary year. So, it has 1 odd day.**

1<sup>st</sup> day of the year 2007 was Monday.

1<sup>st</sup> day of the year 2008 will be 1 day beyond Monday.

Hence, it will be Tuesday.

**Model Paper - 5**

**Directions (Q. 1 to 5): What will come in place of question mark (?) in the following question?**

- 1)  $3\frac{1}{3} \div 6\frac{3}{7} \times 1\frac{1}{2} \times \frac{22}{7} = ?$ 
  - a) 4.4
  - b)  $\frac{22}{7}$
  - c)  $\frac{5}{22}$
  - d) 40.5
  - e) None of these
  
- 2)  $(10^{3.7} \times 10^{1.3})^2 = 10^?$ 
  - a) 6
  - b) 7
  - c) 5
  - d) 3
  - e) 10
  
- 3)  $(4)^{3.7} \times (8)^{-1.2} \div (32)^{-1} \div \frac{1}{(8)^{-3}} = (2)^?$ 
  - a) 2.8
  - b) 1.6
  - c) - 0.2
  - d) 3.2
  - e) 4.6
  
- 4)  $\frac{2}{7}$  of  $\frac{3}{11}$  of  $\frac{5}{9}$  of 51975 = ?
  - a) 8019
  - b) 2110
  - c) 2610
  - d) 2250
  - e) 2358
  
- 5)  $\sqrt[3]{?} = (756 \times 67) \div 804$ 
  - a) 195112
  - b) 250047
  - c) 226981
  - d) 274625
  - e) None of these

**Directions : (Q. 6 to 10): In each of the following number series, a wrong number is given, find out that number.**

- 6) 3      9      23      99      479      2881      20159
  - a) 9
  - b) 23
  - c) 99
  - d) 479
  - e) 2881
  
- 7) 1      3      6      11      20      39      70
  - a) 3
  - b) 39
  - c) 11
  - d) 20
  - e) 6
  
- 8) 50      51      47      56      42      65      29
  - a) 51
  - b) 47
  - c) 56
  - d) 42
  - e) 65
  
- 9) 2      13      27      113      561      3369      23581
  - a) 27
  - b) 13
  - c) 113
  - d) 561
  - e) 3369
  
- 10) 7      4      6      9      20      52.5      160.5

**Directions (11 to 15):** Find out the approximate value that should come in the place of question mark (?) in the following question. (You are not expected to find out the exact value.)

- 11)  $27 \times 164 + 3379 = ? - 32.630$   
a) 105400      b) 4000      c) 8200  
d) 690      e) 6300

12) 134% of 3894 + 38.94% of 134 = ?  
a) 5300      b) 5500      c) 5000  
d) 4900      e) 5280

13) 1.65% of 8471 - 0.61% of 9326 = ?  
a) 76      b) 78      c) 75  
d) 80      e) 95

14)  $(4874 + 5995 + 3329) \div (712 + 510 + 325) = ?$   
a) 9      b) 11      c) 7  
d) 12      e) None of these

15) 63.5% of 8924.19 + 22% of 5324.42 = ?  
a) 6278      b) 6128      c) 6228  
d) 5624      e) 6817

**Directions (16 to 17): Study the information carefully to answer the questions that follow:**

A basket contains 3 blue, 2 green and 5 red balls.

- 16) If three balls are picked at random, what is the probability that at least one of them is red?

a)  $\frac{1}{5}$       b)  $\frac{7}{12}$       c)  $\frac{1}{2}$   
d)  $\frac{11}{12}$       e) None of these

17) If four balls are picked at random, what is the probability that two of them are green and two are blue?

a)  $\frac{3}{5}$       b)  $\frac{1}{2}$       c)  $\frac{1}{18}$   
d)  $\frac{1}{70}$       e)  $\frac{11}{12}$

18) In how many different ways can the letters of the word INDIGO be arranged?

a) 1680      b) 360      c) 2520  
d) 840      e) 1260

- 19) 8 men can complete a piece of work in 12 days. 4 women can complete the same piece of work in 48 days and 10 children can complete that piece of work in 24 days. In how many days can 10 men, 4 women and 10 children together complete the work?
- a) 12 days                    b) 15 days                    c) 6 days  
d) 8 days                    e) None of these
- 20) If the digits of a two-digit number are interchanged, the number so obtained is greater than the original number by 27. If the sum of the two digits of the number is 11, what is the original number?
- a) 47                        b) 38                        c) 74  
d) 83                        e) None of these
- 21) A boat takes 8 hours to cover a distance while travelling upstream. Whereas while travelling downstream, it takes 6 hours. If the speed of the stream is 4 kmph, what is the speed of the boat in still water?
- a) 16 kmph                    b) 18 kmph                    c) 28 kmph  
d) Cannot be determined            e) None of these
- 22) If the numerator of a fraction is increased by 250% and the denominator by 400% the resultant fraction is  $\frac{7}{19}$ . What is the original fraction?
- a)  $\frac{9}{5}$                         b)  $\frac{5}{9}$                         c)  $\frac{10}{19}$   
d)  $\frac{7}{19}$                         e) None of these
- 23) A, B, C and D are four consecutive even numbers and their average is 65. What is the product of A and D?
- a) 4092                        b) 4352                        c) 4216  
d) 3968                        e) None of these
- 24) A sum of Rs.1634 is divided among A, B and C such that A receives 25% more than B and B receives 25% less than C. What is A's share in the amount?
- a) Rs.456                        b) Rs.494                        c) Rs.570  
d) Rs.628                        e) None of these
- 25) The average of four positive integers is 72.5. The highest integer is 117 and the lowest integer is 15. The difference between the remaining two integers is 12. Which is the higher of the two remaining integers?
- a) 76                            b) 84                            c) 74  
d) Cannot be determined            e) None of these
- 26) The difference between the simple interest and the compound interest obtained on a principal amount at 5 pcpa after 2 years is Rs.35. What is the principal amount?
- a) Rs.12000                    b) Rs.14000                    c) Rs.16000  
d) Rs.13000                    e) None of these

- 27) A circle and a rectangle have the same perimeter. The sides of the rectangle are 14 cm and 30 cm. What is the area of the circle?
- a)  $312 \text{ cm}^2$       b)  $1218 \text{ cm}^2$       c)  $456 \text{ cm}^2$   
d) Cannot be determined      e) None of these
- 28) In how many ways can a committee consisting of 5 men and 6 women be formed from 8 men and 12 women?
- a) 744      b) 612      c) 778  
d) 628      e) None of these
- 29) In a test consisting of 80 question carrying one mark each, Shilpi answered 65% of the first 40 question correctly. What percent of the other 40 questions does she need to answer correctly to score 75% on the entire test?
- a) 40%      b) 75%      c) 60%  
d) 85%      e) None of these
- 30) After giving a discount of 30% on marked price a shopkeeper gets a profit of 40% on cost price. What percent of the cost price is the marked price?
- a) 25%      b) 44%      c) 50%  
d) 56%      e) None of these
- 31) A dishonest dealer sells the goods at 10% loss on the cost price but uses 25% less weight. What is the percentage profit or loss?
- a) 25% profit      b) 20% loss      c) 22% loss  
d) 20% profit      e) 24% profit
- 32) On Rs.3000 invested at a simple rate of interest 4% per annum, Rs.600 is obtained as dinterest in a certain number of years. In order to earn Rs.2000 as interest on Rs.5000 in the same number of years, what should be the rate of simple interest?
- a) 7%      b) 8%      c) 6%  
d) 5%      e) None of these
- 33) Divide Rs.5500 between A and B so that A's share at the end of 3 years may equal B's share at the end of 5 years, compound interest being at 20%.
- a) A-3000, B-2500      b) A-2600, B-2900      c) A-2000, B-3500  
d) A-2400, B-3100      e) A-2500, B-3000
- 34) A can do a piece of work in 8 days and B can do it in 5 days. They work together for 2 days and then A leaves the work. How long will now B take to finish it?
- a)  $1\frac{3}{4}$  days      b)  $1\frac{2}{5}$  days      c)  $1\frac{3}{7}$  days  
d)  $1\frac{4}{9}$  days      e)  $1\frac{5}{7}$  days
- 35) A man travels 420 km in 5 hours partly by train and partly be car. Had he travelled all the way by train he would have saved  $\frac{3}{4}$  of the time he was in car and would have arrived at his destination 2 hours early. Find the distance he travelled by car.

- a) 89.72 km                    b) 90.69 km                    c) 93.34 km  
 d) 96.71 km                    e) 98.54 km

**Directions (Q. 36 to 40): Study the table carefully to answer the questions that follow:**

Number of candidates appeared and qualified for an examination in six management institutes over the years

Year	Management institutes											
	A		B		C		D		E		F	
	App	Qual	App	Qual	App	Qual	App	Qual	App	Qual	App	Qual
2007	1576	241	1845	165	1584	140	1500	175	1654	182	1868	132
2008	1687	120	1798	187	1650	182	1490	182	1675	198	1774	187
2009	1875	165	1647	152	1745	208	1384	120	1520	215	1748	196
2010	1720	243	1898	145	1816	190	1748	248	1684	200	1654	183
2011	1815	265	2115	194	1676	200	1580	190	1690	180	1682	177
2012	1923	243	2085	255	1894	264	1762	197	1532	210	1574	223
2013	1920	208	2105	223	1738	205	1787	205	1846	212	1447	219

- 36) Approximately what percentage of candidates qualified with respect to those appeared from all the six institutes together in 2012?
- a) 12%                    b) 13%                    c) 15%  
 d) 18%                    e) None of these
- 37) What is the approximately average number of candidates qualified from Institute D over the given years?
- a) 177                    b) 193                    c) 207  
 d) 188                    e) 169
- 38) The percentage of candidates qualified with respect to those appeared is the highest for which of the following Institutes in 2010?
- a) D                    b) A                    c) F  
 d) E                    e) None of these
- 39) The percentage of candidates qualified with respect to those appeared from Institute B is the lowest during which of the following years?
- a) 2007                    b) 2008                    c) 2010  
 d) 2009                    e) None of these
- 40) The number of candidates qualified from Institute C in 2008 and 2009 together is what percent of the number of candidates appeared from Institute F in 2009 and 2010 together? (Rounded off to two digits after decimal)
- a) 10.06%                    b) 14.46%                    c) 13.56%  
 d) 15.56%                    e) 11.46%

### Solution – 1

$$\begin{aligned}
 ? &= 3\frac{1}{3} \div 6\frac{3}{7} \times 1\frac{1}{2} \times \frac{22}{7} \\
 &= \frac{10}{3} \div \frac{45}{7} \times \frac{3}{2} \times \frac{22}{7} = \frac{10}{3} \times \frac{7}{45} \times \frac{3}{2} \times \frac{22}{7} \\
 &= \frac{22}{9} = 2.44
 \end{aligned}$$

**Solution – 2**

$$10^? = (10^{3.7} \times 10^{1.3})^2$$

$$= (10^{3.7+1.3})^2$$

$$\text{Or, } 10^? = (10^5)^2$$

$$\text{Or, } 10^? = 10^{10}$$

$$\therefore ? = 10$$

**Solution – 3**

$$(4)^{3.7} \times (8)^{-1.2} \div (32)^{-1} \div \frac{1}{(8)^{-3}} = (2)^?$$

$$\text{Or, } 2^2)^{3.7} \times (2^3)^{-1.2} \div (2^3)^3 = 2^?$$

$$\text{Or, } 2^{7.4} \times 2^{-3.6} \div 2^{-5} \div 2^9 = 2^?$$

$$\text{Or, } 2^{7.4 - 3.6 + 5 - 9} = 2^?$$

$$\therefore ? = -0.2$$

**Solution – 4**

$$? = \frac{2}{7} \times \frac{3}{11} \times \frac{5}{9} \times 51975 = \frac{30 \times 51975}{99 \times 7} = 2250$$

**Solution – 5**

$$\sqrt[3]{?} = \left[ \frac{756 \times 67}{804} \right] = 63$$

$$\therefore ? = (63)^3 = 250047$$

**Solution – 6**

The series is  $3 \times 2 + 3 = 9$ ,  $9 \times 3 - 4 = 23$ ,  $23 \times 4 + 5 = 97$ ,  $97 \times 5 - 6 = 479$ ,  $479 \times 6 + 7 = 2881$ ,  $2881 \times 7 - 8 = 20159$

Hence, there should be 97 in place of 99.

**Solution – 7**

The series is  $1 \times 2 + 1 = 3$ ,  $3 \times 2 + 0 = 6$ ,  $6 \times 2 - 1 = 11$ ,  $11 \times 2 - 2 = 20$ ,  $20 \times 2 - 3 = 37$ ,  $37 \times 2 - 4 = 70$

Hence, there should be 37 in place of 39

**Solution – 8**

The series is  $50 + 1^2 = 51$ ,  $51 - 2^2 = 47$ ,  $47 + 3^2 = 56$ ,  $56 - 4^2 = 40$ ,  $40 + 5^2 = 65$ ,  $65 - 6^2 = 29$ .

Hence, there should be 40 in place of 42.

**Solution – 9**

The series is  $2 \times 2 + 7 = 11$ ,  $11 \times 3 - 6 = 27$ ,  $27 \times 4 + 5 = 113$ ,  $113 \times 5 - 4 = 561$ ,  $561 \times 6 + 3 = 3369$ ,  $3369 \times 7 - 2 = 23581$

Hence, there should be 11 in place of 13.

### Solution – 10

The series is  $\times \frac{1}{2} + \frac{1}{2}$ ,  $1 + 1$ ,  $\times 1 \frac{1}{2} + 1 \frac{1}{2}$  ...

Hence, there should be 5 in place of 6.

### Solution – 11

$$? - 32.630 = 27 \times 164 + 3379 = 4428 + 3379$$

$$\text{Or, } ? \approx 8167 + 33 = 8200$$

### Solution – 12

$$\begin{aligned} ? &= \frac{134 \times 3894}{100} + \frac{38.94 \times 134}{100} \approx \frac{134 \times 3900}{100} + \frac{39 \times 134}{100} \\ &= 5226 + 52 = 5278 \approx 5280 \end{aligned}$$

### Solution – 13

$$\begin{aligned} (8471 \times 1.65\%) - (9326 \times 0.61) \\ = 85 \times 1.6 - 93 \times 0.6 = 136 - 55.8 \\ \approx 80.2 \approx 80 \end{aligned}$$

### Solution – 14

$$? = \frac{14198}{1547} \approx 9.17 \approx 9$$

### Solution – 15

$$\begin{aligned} ? &= \frac{63.5 \times 8924.19}{100} + \frac{22 \times 5324.42}{100} \\ &= 63.5 \times 89 + 22 \times 53 \\ &\approx 5651 + 1166 = 6817 \end{aligned}$$

### Solution – 16

Total number of balls =  $3 + 2 + 5 = 10$

So,  $n(S) = {}^{10}C_3$

Now,  $P(\text{at least one red}) = 1 - P(\text{no red})$

$$= 1 - {}^5C_3 / {}^{10}C_3$$

$$= 1 - \frac{10}{120} = \frac{11}{12}$$

### Solution – 17

Picked P (2 green + 2 blue)

$\therefore$  required probability

$$= {}^2C_2 \times {}^3C_2 / {}^{10}C_4$$

$$= \frac{1 \times 3}{210} = \frac{1}{70}$$

### Solution – 18

Total number of letters in the word INDIGO is 6. However 'I' occurs twice.

$$\therefore \text{required number of ways} = \frac{6!}{2!} = 360$$

**Solution – 19**

Work done by  $(8 \times 12)$  men

$= (4 \times 48)$  women  $= (10 \times 24)$  children

i.e. 1 man  $= 2$  women  $= 2.5$  children

$$\therefore \text{required number of days} = \frac{10 \times 24}{10 \times 2.5 + 4 \times 2.5 - 2 + 10} = \frac{10 \times 24}{40} = 6 \text{ days}$$

**Solution – 20**

We have,

$$\text{Difference of two digits} = \frac{27}{9} = 3$$

$$\text{Sum of two digits} = 11$$

$$\text{The two digits are } \frac{11+3}{2} \text{ and } \frac{11-3}{2}$$

i.e. 7 and 4. Thus, the number will be either 74 or 47. But the number will be 47 because  $47 < 74$ .

**Solution – 21**

Let the speed of the boat in still water be  $x$  kmph.

$$\text{Then, } (x + 4) \times 6 = (x - 4) \times 8$$

$$\text{Or, } 6x + 24 = 8x - 32$$

$$\text{Or, } x = 28 \text{ kmph}$$

**Solution – 22**

Let the fraction be  $\frac{x}{y}$

$$\text{Then, } \frac{\frac{350x}{100}}{\frac{500y}{100}} = \frac{7}{19}$$

$$\text{Or, } \frac{7x}{10y} = \frac{7}{19}$$

$$\text{Or, } \frac{x}{y} = \frac{10}{19}$$

**Solution – 23**

$$\text{Average} = \frac{x + (x + 2) + (x + 4) + (x + 6)}{4} = 65$$

$$\text{Or, } x = 62 \text{ and } x + 6 = 68$$

$$\therefore \text{product of A and D} = 62 \times 68 = 4216$$

**Solution – 24**

$$\text{Here, } A : B = 125 : 100 = 5 : 4$$

$$B : C = 75 : 100 = 3 : 4$$

$$\text{Now, } A : B : C = 15 : 12 : 16$$

$$\text{Hence, A's share} = \frac{15}{(15 + 12 + 16)} \times 1634 = \text{Rs.} 570$$

**Solution – 25**

Let the remaining integers be  $x$  and  $x + 12$

$$\text{Then, } 117 + x + (x + 12) + 15 = 72.5 \times 4$$

$$\begin{aligned} \text{Or, } 2x &= 146 \\ \therefore x &= 73 \\ \therefore \text{required number} &= x + 12 = 73 + 12 = 85 \end{aligned}$$

**Solution – 26**

$$\begin{aligned} \text{Difference} &= \text{sum} \left[ \frac{r}{100} \right]^2 \\ \text{Or, } 35 &= \text{sum} \left[ \frac{5}{100} \right]^2 \\ \therefore \text{sum} &= 35 \times 400 = \text{Rs.}14000 \end{aligned}$$

**Solution – 27**

$$\begin{aligned} \text{Perimeter of rectangle} &= 2(\text{length} + \text{breadth}) = 2(14 + 30) = 88 \text{ cm}^2 \\ \text{Now, perimeter of the circle} &= 2\pi r \\ \text{Or, } 2\pi r &= 88 \\ \therefore r &= \frac{44}{\pi} \\ \text{Area of the circle} &= \pi r^2 \\ &= \pi \times \frac{44}{\pi} \times \frac{44}{\pi} = \frac{44 \times 44}{22} \times 7 = 616 \text{ cm}^2 \end{aligned}$$

**Solution – 28**

$$\text{Required number of ways} = {}^8C_5 \times {}^{12}C_6 = 51744$$

**Solution – 29**

$$\text{Required \%} = \frac{60 - 40 \times \frac{65}{100}}{40} \times 100 = \frac{34}{40} \times 100 = 85\%$$

**Solution – 30**

$$\begin{aligned} \text{Let the CP be Rs.}100. \\ \text{Then, SP} &= \text{Rs.}140 \\ \therefore \text{Marked price} &= 140 \times \frac{100}{70} = \text{Rs.}200 \\ \text{So, required percentage} &= \frac{200}{100} \times 100 = 200\% \end{aligned}$$

**Solution – 31**

$$\begin{aligned} \text{Percentage loss or gain} &= \frac{\text{percentage error in weight} - \text{percentage loss}}{100 - \text{percentage error in weight}} \times 100 \\ &= \frac{25 - 10}{100 - 25} \times 100\% = \frac{15}{75} \times 100\% = 20\% \end{aligned}$$

The positive sign indicates that there is a profit of 20%

**Solution – 32**

$$\begin{aligned} \text{Time} &= \frac{600 \times 100}{3000 \times 4} = 5 \text{ years} \\ \therefore \text{Rate} &= \frac{2000 \times 100}{5 \times 5000} = 8\% \end{aligned}$$

**Solution – 33**

$$\text{Suppose that share of A} = \text{Rs.}x$$

Share of B = Rs. (5500 - x)

According to the question,

$$x \left(1 + \frac{20}{100}\right)^3 = (5500 - x) \left(1 + \frac{20}{100}\right)^2$$

$$\text{Or, } x \times \frac{6}{5} \times \frac{6}{5} \times \frac{6}{5} = (5500 - x) \times \frac{6 \times 6}{5 \times 5}$$

$$\text{Or, } \frac{6x}{5} = 5500 - x$$

$$\text{Or, } 11x = 5 \times 5500$$

$$\therefore x = 500 \times 5 = \text{Rs.}2500$$

$$\text{Share of A} = \text{Rs.}2500$$

$$\text{Share of B} = 5500 - 2500 = \text{Rs.}3000$$

### Solution – 34

$$\text{Work done by A in 1 day} = \frac{1}{8}$$

$$\text{Work done by B in 1 day} = \frac{1}{5}$$

$$\text{Work done in 2 days when A and B work together} = \left[ \frac{1}{8} + \frac{1}{5} \right] \times 2 = \frac{13}{20}$$

$$\therefore \text{remaining work} = 1 - \frac{13}{20} = \frac{7}{20}$$

$$\therefore \text{remaining work will be done by B in } \frac{\frac{7}{20}}{\frac{1}{5}} = \frac{7}{20} \times 5 = \frac{7}{4} \text{ days} = 1\frac{3}{4} \text{ days}$$

### Solution – 35

$$\frac{3}{4} \text{ of total time in car} = 2 \text{ hours}$$

$$\therefore \text{total time in car} = \frac{2 \times 4}{3} = \frac{8}{3} \text{ hours}$$

$$\text{Total time spent in train} = \left[ 5 - \frac{8}{3} \right] = \frac{7}{3} \text{ hours}$$

$$\text{If 420 km is covered by train, the distance covered} = \frac{420}{3} \times \frac{7}{3} = 326.66 \text{ km}$$

$$\therefore \text{Distance covered by car} = (420 - 326.66) = 93.34 \text{ km}$$

### Solution – 36

$$\text{Total candidates appeared from all six institutes in 2012} = 1923 + 2085 + 1894 + 1762 + 1532 + 1574 = 10770$$

$$\text{Total candidates qualified from all six institutes in 2012} = 243 + 255 + 264 + 197 + 210 + 223 = 1392$$

$$\therefore \text{required \%} = \frac{1392}{10770} \times 100 = 13\%$$

### Solution – 37

The number of candidates qualified from D over the given years

$$= \frac{175 + 182 + 120 + 248 + 190 + 197 + 205}{7}$$

$$= \frac{1313}{7} = 188.14 \approx 188$$

### Solution – 38

Percentage of candidates qualified over appeared is the highest in Institute D in  
 $2010 = \frac{248}{1748} \times 100 = 14.19\%$

**Solution – 39**

Percentage of candidates qualified w.r.t. appeared from Institute B is the lowest in  
 $2010 = \frac{145}{1898} \times 100 = 7.63\%$

**Solution – 40**

Number of candidates qualified from Institute C in 2008 and 2009 =  $182 + 208 = 390$

Number of candidates appeared from Institute F in 2009 and 2010 =  $1748 + 1654 = 3402$

$$\therefore \text{required \%} = \frac{390}{3402} \times 100 \approx 11.46\%$$

**Model Paper – 6**

**Directions (Q. 1-15) : What should come in place of question mark (?) in the following questions?**

1.  $58.89 + 77.77 + 55.52 + 44.41 + 22.29 = ?$   
a) 243.87      b) 258.88      c) 169.44  
d) 285.88      e) 275.12
  
2.  $196 \times 157.5 \div 35 - 25 = ?$   
a) 635      b) 857      c) 647  
d) 675      e) 887
  
3.  $42 \frac{10}{11} + 142 \frac{13}{22} + 162 \frac{17}{22} - 35 \frac{3}{11} = ?$   
a) 313      b)  $320 \frac{6}{11}$       c) 312  
d) 335      e)  $323 \frac{4}{11}$
  
4.  $\frac{127}{35} \times \frac{140}{36} \times \frac{27}{39} \times ? = 381$   
a) 28      b) 30      c) 32  
d) 24      e) 39
  
5. 18.2% of 10953 = ?  
a) 1951.756      b) 1861.546      c) 1971.546  
d) 1993.446      e) 1741.556
  
6.  $\sqrt{41616} + 472 = (?)^2$   
a) 28      b) 24      c) 26  
d) 22      e) 32
  
7.  $182 \times 93 + 5 \times 127 - 42 \times 37 = ?$   
a) 17009      b) 16007      c) 16551  
d) 17551      e) 16220
  
8.  $? \div 10 = (16)^2 - 16$   
a) 34      b) 44      c) 40  
d) 24      e) 16
  
9.  $\sqrt{1444} - \sqrt{784} + \sqrt{2304} = ?$   
a) 58      b) 54      c) 52  
d) 48      e) 46
  
10.  $(176)^2 - (123)^2 + (14)^2 = ?$   
a) 16031      b) 16531      c) 16642  
d) 16719      e) 16043

11.  $43\frac{17}{27} + 102\frac{22}{27} - 89\frac{11}{54} + 22\frac{17}{54} = ?$
- a)  $76\frac{4}{9}$       b)  $79\frac{5}{9}$       c)  $75\frac{3}{8}$   
d)  $74\frac{7}{11}$       e)  $73\frac{7}{9}$
12.  $28 \times 39 \times 15 \div ? = 819$
- a) 22      b) 30      c) 40  
d) 42      e) 20
13.  $1974 \div 47 \times 103 - 204 = ?$
- a) 3130      b) 4520      c) 4122  
d) 3460      e) 3220
14. 123% of 6350 + 23% of 193 + 47% of 2405 = ?
- a) 9925.41      b) 8714.31      c) 8465.51  
d) 8985.24      e) 8968.21
15.  $33 \times 90 + 20\% \text{ of } 987 - (35 \times 21) \div 4 = ?$
- a) 2983.65      b) 2740.23      c) 2833.14  
d) 2515.65      e) 2629.27
16. In how many different ways can the letters of the word INTERACTION be arranged?
- a) 4989600      b) 4951500      c) 4748100  
d) 4936400      e) 4627300
17. What will be the average of 147, 273, 538, 641, 312 and 465?
- a) 362      b) 352      c) 342  
d) 371      e) 396
18. The circumference of a circle is 132 cm. What is the area of the square whose side is equal to the radius of this circle?
- a)  $49 \text{ cm}^2$       b)  $529 \text{ cm}^2$       c)  $441 \text{ cm}^2$   
d)  $589 \text{ cm}^2$       e)  $35.2 \text{ cm}^2$
19. Find the smallest 4 digit number such that it is exactly divisible by 7, 4 and 6?
- a) 2000      b) 9180      c) 7800  
d) 1576      e) 1008
20. Ajay can do a piece of work in 25 days. Ajay and Vijay together can do the same piece of work in 20 days. If they are paid Rs.1875 for the work, how much money would Vijay get?
- a) Rs.475      b) Rs.375      c) Rs.350  
d) Rs.450      e) Rs.485

**Directions (Q. 21-25): Study the information given below and answer the questions that follow.**

Priyanshu borrows Rs.20000 at compound rate of interest 5% yearly for 3 years. He gave 50% of this money to Rajveer Singh at a compound rate of interest 6% per annum for 3 years and the remaining amount was used to purchase four mobile phones. He earned a profit of 15% by selling the mobile phones.

21. What is the compound interest paid by Rajveer Singh after 3 years?

a) Rs.1950.50      b) Rs.1910.16      c) Rs.1157.625  
d) Rs.1280.75      e) Rs.1310.75

22. What is the profit earned by Priyanshu by selling the mobile phones?

a) Rs.1500      b) Rs.1600      c) Rs.1725  
d) Rs.1625      e) Rs.1650

23. What is the net profit of Priyanshu after paying his debt in 3 years?

a) Rs.276.25      b) Rs.307.625      c) Rs.257.66  
d) Rs.207.625      e) Rs.217.875

24. If 3 men or 5 boys can do a work in 86 days, how long would 12 men and 11 boys take to complete the work?

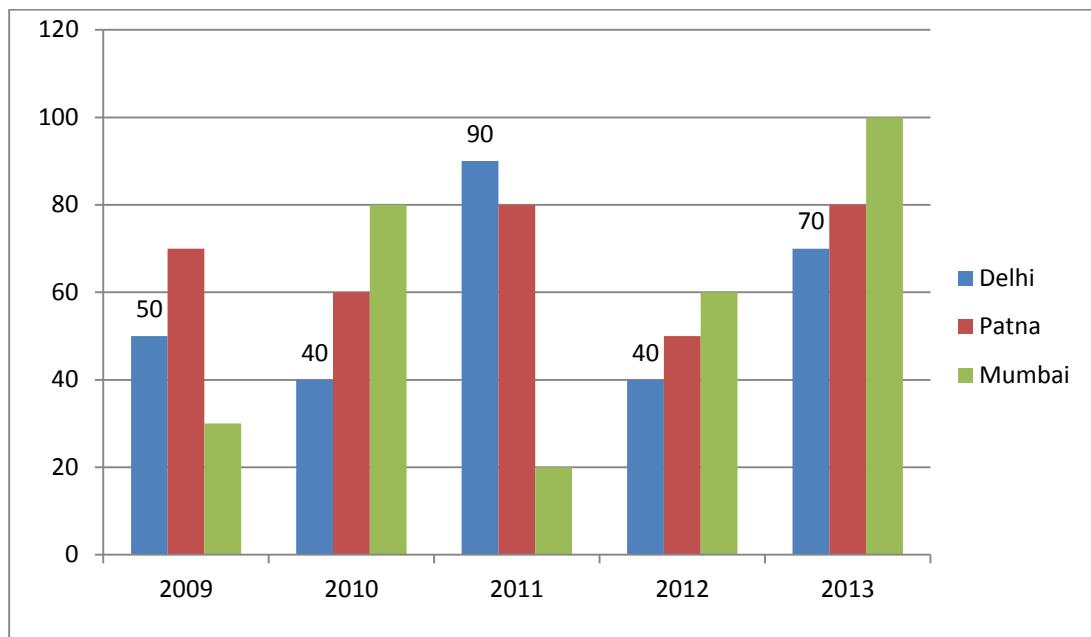
a) 15 days      b) 14 days      c) 16 days  
d) 14 days      e) 10 days

25. Shyam can row 36 km upstream inn 4 hours. If the speed of the stream is 3 kmph then find how far he can go downstream in 6 hours.

a) 68 km      b) 72 km      c) 70 km  
d) 65 km      e) 75 km

**Directions (Q. 26-30): Study the following bar graph carefully and answer the questions that follow.**

The number of students taking admission from three different cities in Delhi University between 2009 and 2013



26. What is the difference between the number of students from Patna in 2011 and that from Mumbai in 2012?
- a) 22000      b) 20000      c) 32000  
d) 30000      e) 25000
27. The number of students taking admission in Delhi University in 2013 is what percent more than that in 2009?
- a) 70.2%      b) 60%      c) 76.66%  
d) 66.66%      e) 55%
28. What is the ratio of the number of students taking admission in 2010 to that in 2012?
- a) 6 : 5      b) 4 : 3      c) 2 : 5  
d) 1 : 7      e) 7 : 2
29. What is the average number of students taking admission during the given five years?
- a) 134000      b) 194000      c) 164000  
d) 154000      e) 184000
30. From which city is the number of students maximum during the given five years?
- a) Patna      b) Mumbai      c) Delhi  
d) Both Patna and Mumbai      e) Both Delhi and Patna
31. A train passes two persons walking in the same direction at the rate of 2 kmph and 3 kmph completely in 10 and 12 seconds respectively. Find the length of the train?
- a) 210 m      b) 216 m      c) 208 m

**Directions (Q. 36-40): What should come in place of question mark (?) in the following number series?**

**Solutions****Solution – 1**

$$58.89 + 77.77 + 52.52 + 44.41 + 22.29 = 258.88$$

**Solution – 2**

$$196 \times 157.5 \div 35 - 25 = 196 \times \frac{157.5}{35} - 25 = 882 - 25 = 857$$

**Solution – 3**

$$\begin{aligned} 42 \frac{10}{11} + 142 \frac{13}{22} + 162 \frac{17}{22} - 35 \frac{3}{11} &= (42 + 142 + 162 - 35) + \left[ \frac{10}{11} + \frac{13}{22} + \frac{17}{22} - \frac{3}{11} \right] \\ &= 311 + \left[ \frac{20 + 13 + 17 - 6}{22} \right] \\ &= 311 + \frac{44}{22} = 311 + 2 = 311 + 2 = 313 \end{aligned}$$

**Solution – 4**

$$\frac{127}{35} \times \frac{140}{36} \times \frac{27}{39} \times ? = 381$$

$$\text{Or, } \frac{127}{13} \times ? = 381$$

$$\therefore ? = \frac{381 \times 13}{127} = 39$$

**Solution – 5**

$$18.2\% \text{ of } 10953 = ?$$

$$\text{Or, } ? = 10953 \times \frac{18.2}{100} = 1993.446$$

**Solution – 6**

$$\sqrt{41616} + 472 = (?)^2$$

$$\text{Or, } 204 + 472 = (?)^2$$

$$\text{Or, } 676 = (?)^2$$

$$\therefore ? = 26$$

**Solution – 7**

$$182 \times 93 + 5 \times 127 - 42 \times 37 = 16926 \quad 635 - 1554 = 16007$$

**Solution – 8**

$$? \div 10 = (16)^2 - 16$$

$$\text{Or, } ? \div 10 = 256 - 16$$

$$\text{Or, } ? = \frac{240}{10} = 24$$

**Solution – 9**

$$\sqrt{1444} - \sqrt{784} + \sqrt{2304} = ?$$

$$\text{Or, } ? = 38 - 28 + 48 = 58$$

**Solution – 10**

$$(176)^2 - (123)^2 + (14)^2 = ? \\ = 30976 - 15129 + 196 = 16043$$

**Solution – 11**

$$\begin{aligned} & 43 \frac{17}{27} + 102 \frac{22}{27} - 89 \frac{11}{54} + 22 \frac{17}{54} = \\ & = (43 + 102 - 89 + 22) + \left[ \frac{17}{27} + \frac{22}{27} - \frac{11}{54} + \frac{17}{54} \right] \\ & = 78 + \left[ \frac{34 + 44 - 11 + 17}{54} \right] \\ & = 78 + \frac{84}{54} = 78 + \frac{14}{9} = 78 + 1 \frac{5}{9} = 79 \frac{5}{9} \end{aligned}$$

**Solution – 12**

$$28 \times 39 \times 15 \div ? = 819$$

$$\text{Or, } 16380 \div ? = 819$$

$$\text{Or, } ? = \frac{16380}{819} = 20$$

**Solution – 13**

$$? = 1974 \div 47 \times 103 - 204$$

$$= \frac{1974}{47} \times 103 - 204 = 42 \times 103 - 204 = 4326 - 204 = 4122$$

**Solution – 14**

$$123\% \text{ of } 6350 + 23\% \text{ of } 193 + 47\% \text{ of } 2405$$

$$\begin{aligned} & = 6350 \times \frac{123}{100} + 193 \times \frac{23}{100} + 2405 \times \frac{47}{100} \\ & = 7810.5 + 44.39 + 1130.35 = 8985.24 \end{aligned}$$

**Solution – 15**

$$\begin{aligned} ? & = 33 \times 90 + 987 \times \frac{20}{100} - (35 \times 21) \times \frac{1}{4} \\ & = 2970 + 197.4 - 183.75 = 2983.65 \end{aligned}$$

**Solution – 16**

The word INTERACTION contains 11 letters where there are 2 ‘Is’, 2 ‘Ns’ and 2 ‘Ts’

$$\therefore \text{Number of arrangements} = \frac{11!}{2! \times 2! \times 2!} = 4989600$$

**Solution – 17**

$$\text{Average} = \frac{147 + 273 + 538 + 641 + 312 + 465}{6} = 396$$

**Solution – 18**

The circumference of the circle = 132 cm

$$\text{Or, } 2\pi r = 132 \quad \therefore r = \frac{132}{2\pi} = 21 \text{ cm}$$

$$\therefore \text{Area of the square} = (\text{side})^2 = 21 \times 21 = 441 \text{ cm}^2$$

**Solution – 19**

LCM of 7, 4 and 6 = 84

Smallest 4 digit number = 1000

When we divide 1000 by 84 the remainder is 76.

$$\therefore \text{required smalles number} = 1000 + (84 - 76) = 1008$$

### Solution – 20

Work done by Ajay in one day =  $\frac{1}{25}$

$$\therefore \text{work done by Vijay in one day} = \frac{1}{20} - \frac{1}{25} \\ = \frac{5 - 4}{100} = \frac{1}{100}$$

$\therefore$  Ajay worked four times more than Vijay.

Let Vijay get Rs. x. Then, Ajay will get Rs.4x.

Then,  $x + 4x = 1875$

$$\therefore x = \frac{1875}{5} = \text{Rs.}375$$

Hence, Vijay gets Rs.375

### Solution – 21

$$\text{Compound interest paid by Rajveer Singh} = 10000 \left(1 + \frac{6}{100}\right)^3 - 10000 \\ = 11910.16 - 10000 = \text{Rs.}1910.16$$

### Solution – 22

Cost price =  $(20000 - 10000) = \text{Rs.}10000$

Profit = 15%

$$\text{Profit} = \left[ 10000 \left(1 + \frac{15}{100}\right) - 10000 \right] \\ = (11500 - 10000) = \text{Rs.}1500$$

### Solution – 23

$$\text{Net profit} = 11910.16 + 11500 - 23152.5 = \text{Rs.}257.66$$

### Solution – 24

3 men = 5 boys

$$\therefore 12 \text{ men} = \frac{5}{13} \times 12 = 20 \text{ boys}$$

5 boys can do a work in 62 days.

$$\therefore (20 + 11) \text{ boys can do the work in } \left[ \frac{62 \times 5}{31} \right] = 10 \text{ days}$$

### Solution – 25

Speed of the stream = 3 kmph

Let the speed of Shyam be x kmph.

$$\text{According to the question, } \frac{36}{x - 3} = 4$$

$$\therefore x = \left[ \frac{36}{4} \right] + 3 = 9 \text{ kmph}$$

$$\text{Distance traveled downstream in 6 hours} = 6 \times (9 + 3) = 72 \text{ km}$$

**Solution – 26**

Number of students from Patna in 2011 = 80000

Number of students from Mumbai in 2012 = 60000

∴ required difference = (80000 - 60000) = 20000

**Solution – 27**

Total number of students in 2013 =  $(70 + 80 + 100) \times 1000 = 250000$

Total number of students in 2009 =  $(30 + 50 + 70) \times 1000 = 150000$

∴ required % =  $\frac{250000 - 150000}{150000} \times 100 = 66.66\%$

**Solution – 28**

Required ratio of students in 2010 to that in 2012 =  $(40 + 60 + 80) \times 1000 : (40 + 50 + 60) \times 1000 = 180000 : 150000 = 6 : 5$

**Solution – 29**

Total number of students during 5 years =  $(50 + 30 + 70 + 40 + 60 + 80 + 90 + 80 + 20 + 40 + 50 + 60 + 70 + 80 + 100) \times 1000 = 920000$

∴ Average number of students per year =  $\frac{920000}{5} = 184000$

**Solution – 30**

Number of students in Delhi during 5 years =  $(50 + 40 + 90 + 40 + 70) \times 1000 = 290000$

Number of students from Patna during the given 5 years =  $(70 + 60 + 80 + 50 + 80) \times 1000 = 340000$

Number of students from Mumbai during the given 5 years =  $(30 + 80 + 20 + 60 + 100) \times 1000 = 290000$

The number of students from Patna is maximum during the given 5 years.

**Solution – 31**

Let the length of the train be  $x$  metres and the speed of the train be  $y$  m/sec.

Speed of the two persons = 2 kmph

$$= \frac{2 \times 3600}{1000} = 7.2 \text{ m/sec.}$$

$$\text{And } 3 \text{ kmph} = \frac{3 \times 3600}{1000} \text{ m/s} = 10.8 \text{ m/s}$$

According to the question,

$$\frac{x}{y - 7.2} = 10$$

$$\text{Or, } x = (y - 7.2) \times 10 \quad \dots \text{(i)}$$

$$\text{And } \frac{x}{y - 10.8} = 12$$

$$\text{Or, } x = 12(y - 10.8) \quad \dots \text{(ii)}$$

From (i) and (ii)

$$(y - 7.2) \times 10 = 12 \times (y - 10.8)$$

$$\therefore y = \frac{129.6 - 72}{2} = 28.8$$

Putting the value of  $y$  in eqn. (i), we get

$$\therefore x = 10(28.8 - 7.2) = 216 \text{ m}$$

**Solution – 32**

The cistern gets filled in 5 hours. Due to a leak it gets filled in 7 hours.

Suppose the leak empties the full cistern in  $x$  hours.

$$\text{Thus, } \frac{1}{5} - \frac{1}{x} = \frac{1}{7} \quad \text{or, } x = 17.5 \text{ hours}$$

$\therefore$  the leak will empty the full cistern in 17 hours and 30 minutes.

**Solution – 33**

Hkjhjh

**Solution – 34**

Profit = selling price of 35 metres of cloth - cost price of 35 metres of cloth

Now, selling price of 5 metres = selling price of 35 metres of cloth - cost price of 35 metres of cloth

Or, cost price of 35 metres of cloth = Selling price of 30 metres of cloth

Supposes the cost price of 1 metre of cloth is Rs.1

$\therefore$  cost price of 35 metres of cloth = Rs.35

Selling price of 30 metres of cloth = Rs.35

$$\therefore \text{selling price of 35 metres of cloth} = \frac{35}{30} \times 35$$

$$\therefore \% \text{ gain} = \frac{\text{selling price} - \text{cost price}}{\text{cost price}} \times 100$$

$$\frac{\frac{35}{30} \times 35 - 35}{35} \times 100 = 16\frac{2}{3}\%$$

**Solution – 35**

Suppose the capital of Sohan, Ram and Karan is  $x$ ,  $2x$  and  $3x$  respectively. They invested their capitals for  $y$ ,  $2y$  and  $3y$  months.

$\therefore$  ratio of their profits

$$= x \times y : 2x \times 2y : 3x \times 3y = 1 : 4 : 9$$

**Solution – 36**

The series is  $5, 5 \times 2 = 10, 10 \times 3 = 30, 30 \times 4 = 120, 120 \times 5 = 600, 600 \times 6 = 3600$

**Solution – 37**

The series is  $4, 4 - 2 = 2, 2 + 4 = 6, 6 - 6 = 0, 0 + 8 = 8, 8 - 10 = -2$

**Solution – 38**

The series is  $0^2 \times 2 = 0, 1^2 \times 2 = 2, 2^2 \times 2 = 8, 3^2 \times 2 = 18, 4^2 \times 2 = 32, 5^2 \times 2 = 50$

**Solution – 39**

The series is  $13 + 11 - 7 = 17, 23 + 19 - 17 = 25, 37 + 31 - 29 = 39, 47 + 43 - 41 = 49, 61 + 59 - 53 = 67, 73 + 71 - 67 = 77$  (only prime numbers in sequence)

**Solution – 40**

The series is  $2160 \div 6 = 360, 360 \div 5 = 72, 72 \div 4 = 18, 18 \div 3 = 6, 6 \div 2 = 3$

Model Paper – 7

**Directions (1 to 5):** What approximate value should come in place of the question mark (?) in the following questions?

(Note: You are not expected to calculate the exact value)

- 1)  $1504 \times 5.865 - 24.091 = ?$   
a) 7200                      b) 9500                      c) 6950  
d) 5480                      e) 8800

2)  $16.928 + 24.7582 \div 5.015 = ?$   
a) 35                          b) 40                          c) 22  
d) 12                          e) 45

3)  $\sqrt[3]{7.938} \times (6.120)^2 - 4.9256 = ?$   
a) 70                          b) 55                          c) 30  
d) 25                          e) 90

4)  $16.046 \div 2.8 \times 0.599 = ?$   
a) 3.5                          b) 7.9                          c) 1.9  
d) 5.6                          e) 6.2

5)  $\sqrt{963} + (4.895)^2 - 9.24 = ?$   
a) 60                          b) 35                          c) 85  
d) 45                          e) 25

**Directions (6 to 20): What should come in place of the question mark (?) in the following questions?**

- 6)  $(12 \times 19) + (13 \times 8) = (15 \times 14) + ?$

a) 124                      b) 122                      c) 126  
d) 128                      e) None of these

7)  $\sqrt{65} \times 12 - 50 + 54 = ?$

a)  $\sqrt{28}$                       b)  $28^2$                       c) 28  
d) 784                            e) None of these

- 8)  $15\% \text{ of } 524 - 2\% \text{ of } 985 + ? = 20\% \text{ of } 423$   
a) 25.9      b) 27.7      c) 25.7  
d) 24.9      e) None of these
- 9)  $151 \times 8 + (228 \div 19)^2 = ?$   
a) 1360      b) 1354      c) 1368  
d) 1381      e) None of these
- 10)  $\sqrt{1521} + \sqrt{225} = ?$   
a) 56      b) 58      c) 54  
d) 62      e) None of these
- 11)  $38.734 + 8.638 - 5.19 = ?$   
a) 41.971      b) 42.179      c) 43.072  
d) 42.182      e) None of these
- 12)  $7^{8.9} \div (343)^{1.7} \times (49)^{4.8} = ?$   
a) 13.4      b) 12.8      c) 11.4  
d) 9.6      e) None of these
- 13)  $\sqrt[3]{512} \div \sqrt[4]{16} \div \sqrt{576} = ?$   
a) 24      b) 31      c) 22  
d) 18      e) None of these
- 14)  $(42 \times 3.2) \div (16 \times 1.5) = ?$   
a) 5.9      b) 5.6      c) 6.1  
d) 4.8      e) None of these
- 15)  $199 + 5^3 \div 4 \times 4^2 = ?$   
a) 969      b) 655      c) 966  
d) 799      e) None of these
- 16)  $342 \div 6 \times 28 = 1099 + ?$   
a) 478      b) 502      c) 486  
d) 504      e) None of these
- 17)  $\frac{9.8 \times 2.5 \times 7.6}{0.5} = ?$   
a) 384.2      b) 379.5      c) 364.3  
d) 372.4      e) None of these
- 18)  $\frac{3}{5} \text{ of } \frac{2}{7} \text{ of } ? = 426$   
a) 2490      b) 2565      c) 2475  
d) 2485      e) None of these
- 19)  $3 \frac{2}{5} + 1 \frac{2}{9} = 4 \frac{4}{5} - ?$

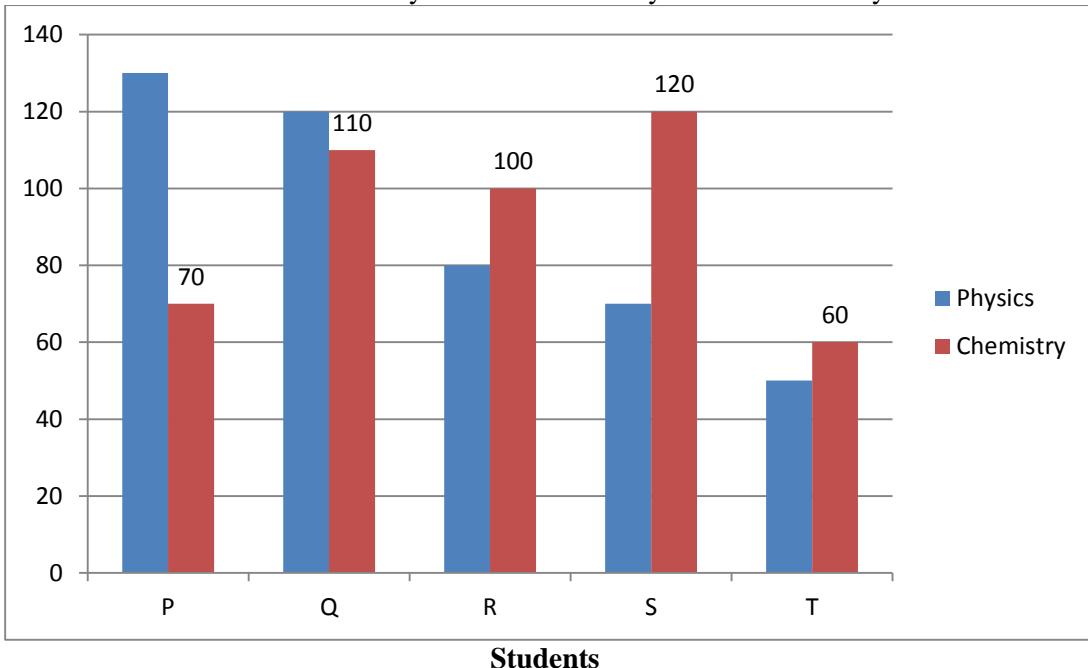
- a)  $\frac{8}{45}$       b)  $\frac{7}{47}$       c)  $\frac{7}{45}$   
 d)  $\frac{8}{51}$       e) None of these

$$20) \frac{13}{63} \div \frac{104}{14} \times \frac{52}{19} = ?$$

- a)  $\frac{12}{173}$       b)  $\frac{13}{171}$       c)  $\frac{17}{171}$   
d)  $\frac{18}{171}$       e) None of these

**Directions (21 to 25): Study the following bar graph carefully to answer the questions.**

### Marks obtained by five students in Physics and Chemistry



- a) Q in Chemistry      b) R in Physics      c) S in Chemistry  
d) P in Physics      e) R in both the subjects together
- 24) What is the respective ratio between the total marks obtained by P in Physics and Chemistry together to the total marks obtained by T in Physics and Chemistry together?  
a) 3 : 2      b) 4 : 3      c) 5 : 3  
d) 2 : 1      e) None of these
- 25) What is the respective ratio between the total marks obtained by Q and S together in Chemistry to the total marks obtained by P and R together in Physics?  
a) 23 : 25      b) 23 : 21      c) 17 : 19  
d) 17 : 23      e) None of these
- 26) Meera purchased 23 bracelets at the rate of Rs.160 per bracelet. At what rate per bracelet should she sell the bracelets so that profit earned is 15%  
a) Rs.184      b) Rs.186      c) Rs.192  
d) Rs.198      e) None of these
- 27) Kajal spends 55% of her monthly income on grocery, clothes and education in the ratio of 4 : 2 : 5 respectively. If the amount spent on clothes is Rs.5540, what is Kajal's monthly income?  
a) Rs.55400      b) Rs.54500      c) Rs.55450  
d) Rs.55650      e) None of these
- 28) 35 percent of a number is two times 75 percent of another number. What is the ratio between the first and the second number respectively?  
a) 35 : 6      b) 31 : 7      c) 23 : 7  
d) 32 : 9      e) None of these
- 29) Area of a rectangular field is  $3584 m^2$  and the length and the breadth are in the ratio 7 : 2 respectively. What is the perimeter of the rectangle?  
a) 246 m      b) 292 m      c) 286 m  
d) 288 m      e) None of these
- 30) Last year there were 610 boys in a school. The number decreased by 20 percent this year. How many girls are there in the school if the number of girls is 175 percent of the total number of boys in the school this year?  
a) 854      b) 848      c) 798  
d) 782      e) None of these
- 31) Aryan got 350 marks and Vidya scored 76 percent marks in the same test. If Vidya scored 296 marks more than Aryan, what were the maximum marks of the test?  
a) 650      b) 900      c) 850  
d) 950      e) None of these



- 40) A truck covers a distance of 368 km at a certain speed in 8 hours. How much time would a car take at an average speed which is 18 km/hr more than that of the speed of the truck to cover a distance which is 16 km more than that travelled by the truck?
- a) 7 hours                  b) 5 hours                  c) 6 hours  
 d) 8 hours                  e) None of these

**Solutions:****Solution – 1**

$$\begin{aligned} ? &= 1504 \times 5.865 - 24.091 \\ ? &= 8820.96 - 24.091 \approx 8800 \end{aligned}$$

**Solution – 2**

$$\begin{aligned} ? &= 16.928 + 24.7582 \div 5.015 \\ ? &= 16.928 + 4.936 = 21.864 = 22 \end{aligned}$$

**Solution – 3**

$$\begin{aligned} ? &= \sqrt[3]{7.938} \times (6.120)^2 - 4.9256 \\ ? &= 1.9948 \times 37.4544 - 4.9256 \\ ? &= 74.7140 - 4.9256 \approx 70 \end{aligned}$$

**Solution – 4**

$$\begin{aligned} ? &= 16.046 \div 2.8 \times 0.599 \\ ? &= 5.7307 \times 0.599 \approx 3.5 \end{aligned}$$

**Solution – 5**

$$\begin{aligned} ? &= \sqrt{963} + (4.895)^2 - 9.24 \\ ? &= 31.03 + 23.9610 - 9.24 \approx 45 \end{aligned}$$

**Solution – 6**

$$\begin{aligned} ? + (15 \times 14) &= (12 \times 19) + (13 \times 8) \\ ? + 210 &= 228 + 104 \\ ? &= 332 - 210 = 122 \end{aligned}$$

**Solution – 7**

$$\begin{aligned} ? &= \sqrt{65 \times 12 - 50 + 54} \\ ? &= \sqrt{780 - 50 + 54} \\ ? &= \sqrt{784} = 28 \end{aligned}$$

**Solution – 8**

$$\begin{aligned} \frac{15}{100} \times 524 - \frac{2}{100} \times 985 + ? &= \frac{20}{100} \times 423 \\ 78.6 - 19.7 + ? &= 84.6 \\ ? &= 84.6 - 58.9 = 25.7 \end{aligned}$$

**Solution – 9**

$$\begin{aligned} ? &= 152 \times 8 + (228 + 19)^2 \\ ? &= 152 \times 8 + 144 \\ ? &= 1216 + 144 = 1360 \end{aligned}$$

**Solution – 10**

$$\begin{aligned} ? &= \sqrt{1521} + \sqrt{225} \\ ? &= 39 + 15 = 54 \end{aligned}$$

**Solution – 11**

$$\begin{aligned} ? &= 38.734 + 8.638 - 5.19 \\ ? &= 47.372 - 5.19 = 42.182 \end{aligned}$$

**Solution – 12**

$$\begin{aligned} 7^{8.9} \div (343)^{1.7} \times (49)^{4.8} &= 7^? \\ 7^{8.9} \div 7^{5.1} \times 9^{9.6} &= 7^7 \\ 7^{8.9 - 5.1 + 9.6} &= 7^? \end{aligned}$$

By exponent comparison

$$? = 13.4$$

**Solution – 13**

$$\begin{aligned} ? &= \sqrt[3]{512} \div \sqrt[4]{16} \div \sqrt{576} \\ ? &= 8 \div 2 + 24 \\ ? &= 4 + 24 = 28 \end{aligned}$$

**Solution – 14**

$$\begin{aligned} ? &= (42 \times 3.2) \div (16 \times 1.5) \\ ? &= \frac{134.4}{24} = 5.6 \end{aligned}$$

**Solution – 15**

$$\begin{aligned} ? &= 199 + 5^3 \div 4 \times 4^2 \\ ? &= 199 + 31.25 \times 16 \\ ? &= 199 + 500 = 699 \end{aligned}$$

**Solution – 16**

$$\begin{aligned} ? + 1099 &= 342 \div 6 \times 28 \\ ? + 1099 &= 57 \times 28 \\ ? &= 1596 - 1099 = 497 \end{aligned}$$

**Solution – 17**

$$\begin{aligned} ? &= \frac{9.8 \times 2.5 \times 7.6}{0.5} \\ ? &= \frac{186.2}{0.5} = 372.4 \end{aligned}$$

**Solution – 18**

$$\frac{3}{5} \text{ of } \frac{2}{7} \times ? = 426$$

$$? = 426 \times \frac{5}{3} \times \frac{7}{2} = 2485$$

**Solution – 19**

$$? = \frac{\frac{24}{5}}{\frac{5}{216}} - \frac{\frac{17}{5}}{\frac{153}{45}} - \frac{\frac{11}{9}}{\frac{55}{45}}$$

$$? = \frac{24}{5} \times \frac{216}{45} - \frac{17}{5} \times \frac{45}{153} - \frac{11}{9} \times \frac{45}{55}$$

$$? = \frac{8}{45}$$

**Solution – 20**

$$? = \frac{13}{63} \times \frac{104}{14} \times \frac{52}{19}$$

$$? = \frac{13}{171}$$

**Solution – 21**

$$\text{Required percentage mark} = \frac{120}{90+110+100+120+60} \times 100$$

$$\frac{120}{480} \times 100 = 25\%$$

**Solution – 22**

$$\text{New marks of T in physics} = \frac{114}{100} \times 50 = 57$$

$$\therefore \text{T's new percentage} = \frac{57}{140} \times 100 \approx 41$$

**Solution – 23**

Marks obtained by T in both subjects together is more than the marks obtained by R in Physics.

**Solution – 24**

$$\begin{aligned}\text{Required ratio} &= 130 + 90 : 50 + 60 \\ &= 220 : 110 \\ &= 2 : 1\end{aligned}$$

**Solution – 25**

$$\begin{aligned}\text{Required ratio} &= 110 + 120 : 130 + 80 \\ &= 230 : 210 \\ &= 23 : 21\end{aligned}$$

**Solution – 26**

$$\begin{aligned}\text{Required rate of a bracelet} &= \text{Rs.} \left[ 160 \times \frac{115}{100} \right] \\ &= \text{Rs.} 184\end{aligned}$$

**Solution – 27**

Let the Kajal's monthly income be Rs.x and the common ratio be y

$\therefore$  Amount spent on grocery, clothes and education =  $4y + 2y + 5y$

According to the question,

$$11y = \frac{55x}{100} \quad \dots \text{(i)}$$

And  $2y = 5540$

$y = 2770$

By putting the value of  $y$  in equation (i), we get,

$$\begin{aligned} 11 \times 2770 &= \frac{55x}{100} \\ x &= \frac{11 \times 2770 \times 100}{55} \\ x &= \text{Rs.}55400 \end{aligned}$$

### Solution – 28

Let the two numbers be  $x$  and  $y$  respectively.

According to the question,

$$\begin{aligned} \frac{35x}{100} &= 2 \times \frac{75y}{100} \\ \frac{x}{y} &= \frac{2 \times 75}{35} = \frac{30}{7} \\ \therefore \text{required ratio} &= 30 : 7 \end{aligned}$$

### Solution – 29

Let the common ratio be  $x$

$\therefore$  length of the rectangular field  $= 7x$  m

Breadth of the rectangular field  $= 2x$  m

According to the question,

$$7x \times 2x = 3584$$

$$x = 16$$

$$\therefore \text{required perimeter} = 2(7 \times 16 + 2 \times 16)$$

$$= 2(112 + 32)$$

$$= 2 \times 144 = 288 \text{ m}$$

### Solution – 30

$$\text{Required number of girls} = 610 \times \frac{80}{100} \times \frac{175}{100} = 854$$

### Solution – 31

Let the maximum marks of the test be  $x$ .

According to the question,

$$\begin{aligned} \frac{76x}{100} - 350 &= 296 \\ \frac{76x}{100} &= 296 + 350 \\ x &= \frac{646 \times 100}{76} = 850 \end{aligned}$$

### Solution – 32

Let the original marks awarded to the student be  $x$ .

According to the question,

$$x - \frac{40x}{100} = 96$$

$$\frac{60x}{100} = 96$$

$$x = 160$$

$$\therefore \text{required difference} = 160 - 96 = 64$$

**Solution – 33**

$$\text{Number of selected candidates} = 855 \times \frac{20}{100} = 171655$$

**Solution – 34**

$$\text{Sum of five numbers} = 61 \times 5 = 305$$

$$\text{Sum of first and third number} = 69 \times 2 = 138$$

$$\text{And sum of second and fourth number} = 69 \times 2 = 138$$

$$\therefore \text{fifth number} = 305 - 138 - 138 = 29$$

**Solution – 35**

Let the common ratio be  $x$

$\therefore$  the percentages of father's, mother's and daughter's are  $7x$ ,  $6x$ ,  $2x$  respectively.

According to the question

$$6x - 2x = 24$$

$$4x = 24$$

$$x = 6$$

$$\therefore \text{father's present age} = 7 \times 6 = 42 \text{ years}$$

**Solution – 36**

$$\begin{aligned}\text{Required combined average} &= \frac{19 \times 74 + 38 \times 63}{19 + 38} \\ &= \frac{1406 + 2394}{57} = \frac{3800}{57} = 67 \text{ kgs.}\end{aligned}$$

**Solution – 37**

$$32\% \text{ of } 750 < 98\% \text{ of } 250$$

$$\frac{32}{100} \times 750 < \frac{98}{100} \times 250$$

$$240 < 245$$

**Solution – 38**

$$\begin{aligned}\text{Mother's overall percentage} &= \frac{42 + 51 + 58 + 35 + 48}{5 \times 60} \times 100 \\ &= \frac{234}{300} \times 100 = 78\%\end{aligned}$$

**Solution – 39**

$$\text{Fare of one chile} = \frac{114}{6} = \text{Rs.}19$$

$$\begin{aligned}\therefore \text{fare for 4 adults and 5 children} &= \text{Rs.} (114 \times 4 + 19 \times 5) \\ &= \text{Rs.}551\end{aligned}$$

**Solution – 40**

$$\text{Speed of truck} = \frac{368}{8} = 46 \text{ kmph}$$

$$\therefore \text{required time} = \frac{368 + 16}{46 + 18} = \frac{384}{64} = 6 \text{ hours}$$



Model Paper – 8

**Directions (1 to 5): What value should come in the place of question mark (?) in the following questions?**

1.  $3.6 + 36.6 + 3.66 + 0.36 + 3.0 = ?$   
a) 44.22      b) 77.22      c) 74.22  
d) 47.22      e) None of these

2.  $23 \times 45 \div 15 = ?$   
a) 69      b) 65      c) 63  
d) 71      e) None of these

3.  $4\frac{5}{6} + 7\frac{1}{2} - 5\frac{8}{11} = ?$   
a)  $2\frac{10}{23}$       b)  $6\frac{20}{33}$       c)  $2\frac{20}{33}$   
d)  $6\frac{10}{33}$       e) None of these

4.  $\frac{210}{14} \times \frac{17}{15} \times ? = 4046$   
a) 202      b) 218      c) 233  
d) 227      e) None of these

5. 83% of 2350 = ?  
a) 1509.5      b) 1950.5      c) 1905.5  
d) 1590.5      e) None of these

6.  $\sqrt{1089} + 3 = (?)^2$   
a) 5      b) 6      c) 3  
d) 8      e) 4

7.  $96 + 32 \times 5 - 31 = ?$   
a) 223      b) 225      c) 229  
d) 221      e) None of these

8.  $? \div 36 = (7)^2 - 8$   
a) 1426      b) 1449      c) 1463  
d) 1476      e) None of these

9.  $\sqrt{8281} = ?$   
a) 89      b) 97      c) 93  
d) 91      e) 83

10.  $(63)^2 - (12)^2 = ?$   
a) 3528      b) 3852      c) 3582  
d) 3825      e) None of these

11.  $1\frac{4}{5} + 3\frac{3}{5} = ? - 4\frac{3}{10}$   
a)  $9\frac{7}{10}$       b)  $7\frac{7}{10}$       c)  $9\frac{3}{10}$
12.  $17 \times 19 \times 4 \div ? = 161.5$   
a) 8      b) 6      c) 7  
d) 9      e) None of these
13.  $1798 \div 31 \times ? = 348$   
a) 3      b) 6      c) 4  
d) 5      e) None of these
14.  $(9.8 \times 2.3 + 4.46) \div 3 = (3)^?$   
a) 3      b) 9      c) 5  
d) 2      e) None of these
15. 43% of 600 + ?% of 300 = 399  
a) 45      b) 41      c) 42  
d) 47      e) None of these
16. What will be the compound interest on a sum of Rs.7500 at 4 p.c.a. in 2 years?  
a) Rs.618      b) Rs.612      c) Rs.624  
d) Rs.606      e) Rs.621
17. In how many different ways can the letters of the word ‘CREAM’ be arranged?  
a) 720      b) 240      c) 360  
d) 504      e) None of these
18. The circumference of a circle is 792 meters. What will be its radius?  
a) 120 meters      b) 133 meters      c) 145 meters  
d) 136 meters      e) None of these
19. Cost of 36 pens and 42 pencils is Rs.460 what is the cost of 18 pens and 21 pencils?  
a) Rs.230      b) Rs.203      c) Rs.302  
d) Rs.320      e) None of these
20. The ratio of the ages of A and B seven years ago was 3 : 4 respectively. The ratio of their ages nine years from now will be 7 : 8 respectively. What is B’s age at present?  
a) 16 years      b) 19 years      c) 28 years  
d) 23 years      e) None of these
21. In how many years will Rs.4600 amount to Rs.5428 at 3 p.c.a. a simple interest?  
a) 3      b) 5      c) 6  
d) 4      e) None of these
22. What will be the average of the followings set of scores?

59, 84, 44, 98, 30, 40, 58

- |       |       |       |
|-------|-------|-------|
| a) 62 | b) 66 | c) 75 |
| d) 52 | e) 59 |       |

23. The sum of three consecutive odd numbers is 1383. What is the largest number?
- |        |                  |        |
|--------|------------------|--------|
| a) 463 | b) 459           | c) 457 |
| d) 461 | e) None of these |        |

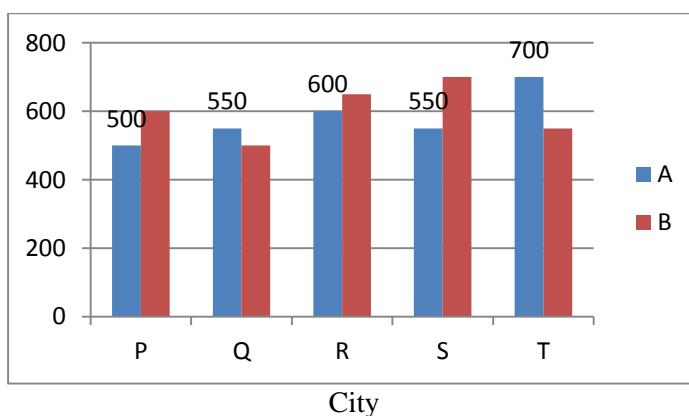
**Directions (24 to 26): Study the information given below and answer the questions that follow:**

An article was bought for Rs.5600. Its price was marked up by 12% thereafter it was sold at a discount of 5% on the marked price.

24. What was the marked price of the articles?
- |            |            |            |
|------------|------------|------------|
| a) Rs.6207 | b) Rs.6242 | c) Rs.6292 |
| d) Rs.6192 | e) Rs.6272 |            |
25. What was the percent profit on the transaction?
- |         |         |         |
|---------|---------|---------|
| a) 6.8% | b) 6.3% | c) 6.4% |
| d) 6.6% | e) 6.2% |         |
26. What was the amount of discount given?
- |             |             |             |
|-------------|-------------|-------------|
| a) Rs.319.6 | b) Rs.303.6 | c) Rs.306.3 |
| d) Rs.313.6 | e) Rs.316.9 |             |
27. The area of a rectangle is 1209 square meters. Its length measures 39 meters. How much is its perimeter?
- |               |                  |               |
|---------------|------------------|---------------|
| a) 122 meters | b) 134 meters    | c) 148 meters |
| d) 144 meters | e) None of these |               |

**Directions (28 to 32): Study the following graph carefully and answer the questions that follow:**

The graph given below represents the number of users of two broadband services A and B across 5 cities P, Q, R, S and T.



28. What is the total number of users of brand B across all give cities together?  
a) 2700                    b) 3000                    c) 3100  
d) 2900                    e) 3200
29. The number of users of brand A in city T is what percent of the number of users of brand B in city Q?  
a) 150                    b) 110                    c) 140  
d) 160                    e) 120
30. What is the average number of users of brand A across all five cities together?  
a) 560                    b) 570                    c) 580  
d) 590                    e) 550
31. What is the difference between the total number of users of brand A and B together in city R and the ottal number of users of brand A and B together in city P?  
a) 170                    b) 140                    c) 130  
d) 150                    e) 160
32. What is the respective ratio of the number users of brand A in city P to the number of users of brand B in city S?  
a) 5 : 7                    b) 4 : 7                    c) 2 : 5  
d) 3 : 4                    e) 5 : 6
33. 21 articles were bought for Rs.6531 and sold for Rs.9954. How much was the approximate profit percentage per article?  
a) 56%                    b) 43%                    c) 52%  
d) 49%                    e) 61%
34. A and B together can complete a particular task in 8 days. If B alone can complete the same task in 10 days, how many days will A take to complete the task if he works alone?  
a) 28                    b) 36                    c) 40  
d) 32                    e) None of these
35. The cost price of an article is Rs.1700. If it was sold at a price of Rs.2006 what was the percentage profit on the transaction?  
a) 18                    b) 12                    c) 10  
d) 15                    e) 20

**Directions (36 to 40): What should come in place of the question mark (?) in the following number series?**

36. 1                    1                    2                    6                    ?                    120  
a) 24                    b) 60                    c) 100  
d) 30                    e) None of these

40. 41472      5184      576      72      8      ?  
a) 0      b) 9      c) 1  
d) 8      e) None of these

**Solutions:****Solution – 1**

$$3.6 + 36.6 + 3.66 + 0.36 + 3.0 = ?$$

$$? = 47.22$$

**Solution – 2**

$$23 \times 45 \div 15 = 23 \times \frac{45}{15} = 23 \times 3 = 69$$

**Solution – 3**

$$4\frac{5}{6} + 7\frac{1}{2} - 5\frac{8}{11} = \frac{29}{6} + \frac{15}{2} - \frac{63}{11}$$

$$= \frac{\frac{319}{6} + \frac{495}{12} - \frac{378}{11}}{66} = \frac{436}{66} = 6\frac{20}{33}$$

**Solution – 4**

$$\frac{210}{14} \times \frac{17}{15} \times ? = 4046$$

$$? = \frac{4046 \times 14 \times 15}{210 \times 17} = 238$$

**Solution – 5**

$$\frac{83}{100} \times 2350 = 1950.5$$

**Solution – 6**

$$\sqrt{1089} + 3 = (?)^2$$

$$33 + 3 = (?)^2$$

$$(?)^2 = 36$$

$$? = \sqrt{36} = 6$$

**Solution – 7**

$$96 + 32 \times 5 - 31 = ?$$

$$96 + 160 - 31 = 225$$

**Solution – 8**

$$? \div 36 = (7)^2 - 8$$

$$\frac{?}{36} = 49 - 8$$

$$? = 36 \times 41 = 1476$$

**Solution – 9**

$$\sqrt{8281} = ?$$

$$? = 91$$

**Solution – 10**

$$(63)^2 - (12)^2 = ?$$

$$3969 - 144 = ?$$

$$? = 3825$$

**Solution – 11**

$$\begin{aligned} 1\frac{4}{5} + 3\frac{3}{5} &= ? - 4\frac{3}{10} \\ ? &= \frac{9}{5} + \frac{18}{5} + \frac{43}{10} \\ ? &= \frac{18 + 36 + 43}{10} = \frac{97}{10} = 9\frac{7}{10} \end{aligned}$$

**Solution – 12**

$$\begin{aligned} 17 \times 9 \times 4 \div ? &= 161.5 \\ ? &= \frac{17 \times 19 \times 4}{161.5} = 8 \end{aligned}$$

**Solution – 13**

$$\begin{aligned} 1798 \div 31 \times ? &= 348 \\ ? &= \frac{348 \times 31}{1798} = 6 \end{aligned}$$

**Solution – 14**

$$\begin{aligned} (9.8 \times 2.3 + 4.46) \div 3 &= (3)^? \\ (22.54 + 4.46 \div 3) &= (3)^? \\ \frac{27}{3} &= (3)^? \\ 9 &= (3)^? \\ (3)^? &= (3)^? \\ ? &= 2 \end{aligned}$$

**Solution – 15**

$$\begin{aligned} \frac{43}{100} \times 600 + \frac{?}{100} \times 300 &= 399 \\ 258 + \times ? &= 399 \\ 3? &= 141 \\ ? &= 47 \end{aligned}$$

**Solution – 16**

Principal = Rs.7500, Rate = 4%, Time = 2 years

$$\begin{aligned} \text{C.I.} &= P \left( 1 + \frac{R}{100} \right)^n - P \\ &= 7500 \left[ 1 + \frac{4}{100} \right] - 7500 \\ &= 7500 \left[ \frac{104}{100} \times \frac{104}{100} - 1 \right] \\ &= 7500 \left[ \frac{10816}{10000} - 1 \right] \\ &= 7500 \left[ 1.0816 - 1 \right] \\ &= 7500 \times 0.0816 = \text{Rs.}612 \end{aligned}$$

**Solution – 17**

$$\text{CREAM} = 5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$$

**Solution – 18**

Circumference of circle =  $2\pi r$

$$792 = 2 \times \frac{22}{7} \times r$$

$$\therefore \text{radius} = \frac{792 \times 7}{22 \times 2} = 126 \text{ meters}$$

**Solution – 19**

Cost of 36 pens and 42 pencils = Rs.460

Cost of 18 pens and 21 pencils will be half the cost of 36 pens and 42 pencils i.e.

$$\text{cost of 18 pens and 21 pencils} = \frac{460}{2} = \text{Rs.230}$$

**Solution – 20**

Let the common ratio be = x

Therefore, the present age of A be =  $3x + 7$

Similarly, the present age of B be =  $4x + 7$

According to the question,

$$\frac{3x + 7 + 9}{4x + 7 + 9} = \frac{7}{8}$$

$$\frac{3x + 16}{4x + 16} = \frac{7}{8}$$

$$24x + 128 = 28x + 112$$

$$4x = 16$$

$$x = 4$$

$$\text{Present age of B} = 4x + 7 = 4 \times 4 + 7 = 16 + 7 = 23 \text{ years}$$

**Solution – 21**

Principal = Rs.4600; Amount = Rs.5428

Amount = Principal + Simple interest

Simple interest = 5428 - 4600 = Rs.828

Rate = 3%; Time = ?

$$\text{Simple interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$$

$$828 = \frac{4600 \times 3 \times \text{time}}{100}$$

$$\text{Time} = \frac{828 \times 100}{4600 \times 3}$$

$$\text{Time} = 6 \text{ years}$$

**Solution – 22**

$$\text{Average} = \frac{\text{sum of all the scores}}{\text{Total sets of scores}}$$

$$= \frac{59 + 84 + 44 + 98 + 30 + 40 + 58}{7} = \frac{413}{7} = 59$$

**Solution – 23**

Sum of three consecutive odd numbers =  $459 + 461 + 463 = 1383$

Largest number = 463

**Solution – 24**

Cost price = Rs.5600

Marked price = 12% up by cost price

$$= \frac{112}{100} \times 5600 = \text{Rs.6272}$$

$$\text{Selling price} = 5\% \text{ discount on Marked price} = \frac{95}{100} \times 6272 = \text{Rs.5958.40}$$

Rs.6272

### Solution – 25

Cost price = Rs.5600

Marked price = 12% up by cost price

$$= \frac{112}{100} \times 5600 = \text{Rs.6272}$$

$$\text{Selling price} = 5\% \text{ discount on Marked price} = \frac{95}{100} \times 6272 = \text{Rs.5958.40}$$

$$\text{Profit \%} = \frac{5958.40 - 5600}{5600} \times 100 = \frac{358.4}{5600} \times 100 = 6.4\%$$

### Solution – 26

Cost price = Rs.5600

Marked price = 12% up by cost price

$$= \frac{112}{100} \times 5600 = \text{Rs.6272}$$

$$\text{Selling price} = 5\% \text{ discount on Marked price} = \frac{95}{100} \times 6272 = \text{Rs.5958.40}$$

$$\text{Amount of discount given} = \frac{5}{100} \times 6272 = \text{Rs.313.60}$$

### Solution – 27

Area of rectangle = length × breadth

$$\text{Breadth} = \frac{1209}{30} = 31 \text{ meters}$$

$$\begin{aligned} \text{Perimeter of Rectangle} &= 2(l + b) \\ &= 2(39 + 31) = 2 \times 70 = 140 \text{ meters} \end{aligned}$$

### Solution – 28

Total users of brand B across five cities =  $600 + 500 + 650 + 700 + 550 = 3000$

### Solution – 29

Brand A users in city T = 700

Brand B users in city Q = 500

$$\text{Required \%} = \frac{700}{500} \times 100 = 140\%$$

### Solution – 30

Total users of Brand A across five cities =  $500 + 550 + 600 + 550 + 700 = 2900$

$$\text{Average} = \frac{2900}{5} = 580$$

**Solution – 31**

Brand A and B users in city R =  $600 + 650 = 1250$

Brand A and B users in city P =  $500 + 600 = 1100$

Required difference =  $1250 - 1100 = 150$

**Solution – 32**

Brand A users in city P = 500

Brand B users in city S = 700

$$\text{Ratio} = \frac{500}{700} = \frac{5}{7} = 5 : 7$$

**Solution – 33**

Cost price of one article =  $\frac{6531}{21} = \text{Rs.}311$

Selling price of one article =  $\frac{9954}{21} = \text{Rs.}474$

Profit on one article =  $474 - 311 = \text{Rs.}163$

% profit per article (approx.) =  $\frac{163 \times 100}{311} = 52.41\% = 52\%$

**Solution – 34**

A and B together complete a work in = 8 days

(A and B)'s 1 day work =  $\frac{1}{8}$

B alone complete a work in = 10 days

B's 1 day work =  $\frac{1}{10}$

A's 1 day work will be =  $\frac{1}{8} - \frac{1}{10}$

$$= \frac{5 - 4}{40} = \frac{1}{40}$$

A alone will do a work in = 40 days

**Solution – 35**

Cost price = Rs.1700

Selling price = Rs.2006

Profit = S.P. - C.P.

$$= 2006 - 1700 = \text{Rs.}306$$

$$\text{Profit\%} = \frac{\text{profit}}{\text{C.P.}} \times 100 = \frac{306}{1700} \times 100 = 18\%$$

**Solution – 36**

$$\begin{array}{ccccccccc}
 & & & & 24 & & & & \\
 1 & & 1 & & 2 & & 6 & ? & 120 \\
 \times 1 & & \times 2 & & \times 3 & & \times 4 & \times 5 &
 \end{array}$$

**Solution – 37**

$$\begin{array}{ccccccccc}
 & & & & 107 & & & & \\
 7 & & 8 & & 16 & & 43 & ? & 232
 \end{array}$$

$$+(1)^3 \quad +(2)^3 \quad +(3)^3 \quad +(4)^3 \quad +(5)^3$$

**Solution – 38**

			<b>26</b>		
4	13	17	?	30	39
+9	+4	+9	+4	+9	

**Solution – 39**

982	977	952	827	822	?
-(5) <sup>1</sup>	-(5) <sup>2</sup>	-(5) <sup>3</sup>	-(5) <sup>1</sup>	-(5) <sup>2</sup>	<b>797</b>

**Solution – 40**

41472	5184	576	72	8	?
÷ 8	÷ 9	÷ 8	÷ 9	÷ 8	<b>1</b>