

## Table of Contents

Numbers .....	2
Simplification .....	7
Percentage .....	9
HCF & LCM .....	12
Power Cycles .....	16
Averages .....	21
Ratio & proportion .....	24
Simple Interest .....	28
Compound Interest.....	30
Stocks & Shares .....	32
Profit, Loss and Discount .....	35
Partnership .....	39
Mixtures and Alligations.....	41
Time Speed & Distance .....	43
Problems on Trains.....	47
Time & Work .....	50
Boats & Streams .....	53
Chain Rule .....	55
Clocks.....	56
Calendars .....	58
Probability .....	60
Permutation & combinations.....	63
Races & games .....	67
Problems Based On Ages .....	69
Volume & Surface Area.....	71
Area .....	73
Heights & Distance .....	76
Logical Reasoning .....	79
Family Relationship .....	89
Arrangements .....	91

## Numbers

### 1. Decimal Fractions:

Fractions in which denominators are powers of 10 are known as decimal fractions.

Thus,  $\frac{1}{10} = 1 \text{ tenth} = .1$ ;  $\frac{1}{100} = 1 \text{ hundredth} = .01$ ;

$\frac{99}{100} = 99 \text{ hundredths} = .99$ ;  $\frac{7}{1000} = 7 \text{ thousandths} = .007$ , etc;

### 2. Conversion of a Decimal into Vulgar Fraction:

Put 1 in the denominator under the decimal point and annex with it as many zeros as is the number of digits after the decimal point. Now, remove the decimal point and reduce the fraction to its lowest terms.

Thus,  $0.25 = \frac{25}{100} = \frac{1}{4}$  ;  $2.008 = \frac{2008}{1000} = \frac{251}{125}$ .

### 3. Annexing Zeros and Removing Decimal Signs:

Annexing zeros to the extreme right of a decimal fraction does not change its value. Thus,  $0.8 = 0.80 = 0.800$ , etc.

If numerator and denominator of a fraction contain the same number of decimal places, then we remove the decimal sign.

Thus,  $\frac{1.84}{2.99} = \frac{184}{299} = \frac{8}{13}$ .

### 4. Operations on Decimal Fractions:

i) Addition and Subtraction of Decimal Fractions: The given numbers are so placed under each other that the decimal points lie in one column. The numbers so arranged can now be added or subtracted in the usual way.

ii) Multiplication of a Decimal Fraction By a Power of 10: Shift the decimal point to the right by as many places as is the power of 10.

Thus,  $5.9632 \times 100 = 596.32$ ;  $0.073 \times 10000 = 730$ .

iii) Multiplication of Decimal Fractions: Multiply the given numbers considering them without decimal point. Now, in the product, the decimal point is marked off to obtain as many places of decimal as is the sum of the number of decimal places in the given numbers.

Suppose we have to find the product  $(.2 \times 0.02 \times .002)$ .

Now,  $2 \times 2 \times 2 = 8$ . Sum of decimal places =  $(1 + 2 + 3) = 6$ .

$.2 \times .02 \times .002 = .000008$

iv) Dividing a Decimal Fraction by a Counting Number: Divide the given number without considering the decimal point, by the given counting number. Now, in the quotient, put the decimal point to give as many places of decimal as there are in the dividend.

Suppose we have to find the quotient  $(0.0204 \div 17)$ . Now,  $204 \div 17 = 12$ .

Dividend contains 4 places of decimal. So,  $0.0204 \div 17 = 0.0012$

v) Dividing a Decimal Fraction By a Decimal Fraction: Multiply both the dividend and the divisor by a suitable power of 10 to make divisor a whole number.

Now, proceed as above.

Thus,  $\frac{0.00066}{0.11} = \frac{0.00066 \times 100}{0.11 \times 100}$

### 5. Comparison of Fractions:

Suppose some fractions are to be arranged in ascending or descending order of magnitude, then convert each one of the given fractions in the decimal form, and arrange them accordingly.

Let us to arrange the fractions  $\frac{3}{5}$ ,  $\frac{6}{7}$  and  $\frac{7}{9}$  in descending order.

$$\text{Now, } \frac{3}{5} = 0.6, \quad \frac{6}{7} = 0.857, \quad \frac{7}{9} = 0.777$$

$$\text{Since, } 0.857 > 0.777 \dots > 0.6. \text{ So, } \frac{6}{7} > \frac{7}{9} > \frac{3}{5}.$$

## 6. Recurring Decimal:

If in a decimal fraction, a figure or a set of figures is repeated continuously, then such a number is called a **recurring decimal**.

a recurring decimal, if a single figure is repeated, then it is expressed by putting a dot on it. If a set of figures is repeated, it is expressed by putting a bar on the set.

$$\text{Thus, } \frac{1}{3} = 0.333\dots = 0.3; \quad \frac{22}{7} = 3.142857142857\dots = 3.142857.$$

**7. Pure Recurring Decimal:** A decimal fraction, in which all the figures after the decimal point are repeated, is called a pure recurring decimal.

## 8. Converting a Pure Recurring Decimal into Vulgar Fraction:

Write the repeated figures only once in the numerator and take as many nines in the denominator as is the number of repeating figures.

$$\text{Thus, } 0.5 = \frac{5}{9}; \quad 0.53 = \frac{53}{99}; \quad 0.067 = \frac{67}{999}, \text{ etc.}$$

**9. Mixed Recurring Decimal:** A decimal fraction in which some figures do not repeat and some of them are repeated, is called a mixed recurring decimal.

$$\text{Eg. } 0.173333\dots = 0.173.$$

## 10. Converting a Mixed Recurring Decimal Into Vulgar Fraction:

In the numerator, take the difference between the number formed by all the digits after decimal point (taking repeated digits only once) and that formed by the digits which are not repeated. In the denominator, take the number formed by as many nines as there are repeating digits followed by as many zeros as is the number of non-repeating digits.

$$\text{Thus, } 0.16 = \frac{16-1}{90} = \frac{15}{90} = \frac{1}{6}; \quad 0.2273 = \frac{2273-22}{9900} = \frac{2251}{9900}.$$

## 11. Some Basic Formulae:

$$\text{i) } (a+b)(a-b) = (a^2 - b^2)$$

$$\text{ii) } (a+b)^2 = (a^2 + b^2 + 2ab)$$

$$\text{iii) } (a-b)^2 = (a^2 + b^2 - 2ab)$$

$$\text{iv) } (a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$

$$\text{v) } (a^3 + b^3) = (a+b)(a^2 - ab + b^2)$$

$$\text{vi) } (a^3 - b^3) = (a-b)(a^2 + ab + b^2)$$

$$\text{vii) } (a^3 + b^3 + c^3 - 3abc) = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ac)$$

$$\text{viii) When } a+b+c=0, \text{ then } a^3 + b^3 + c^3 = 3abc.$$

## PRACTICE QUESTIONS

1. How many of the following numbers are divisible by 132?

264, 396, 462, 792, 968, 2178, 5184, 6336

A. 4

B. 5

C. 6

D. 7

2.  $(112 \times 54) = ?$   
A. 67000      B. 70000      C. 76500      D. 77200
3. It is being given that  $(2^{32} + 1)$  is completely divisible by a whole number. Which of the following numbers is completely divisible by this number?  
A.  $(21^6 + 1)$       B.  $(21^6 - 1)$       C.  $(7 \times 2^{23})$       D.  $(2^{96} + 1)$
4. What least number must be added to 1056, so that the sum is completely divisible by 23?  
A. 2      B. 3      C. 18      D. 21
5. Which one of the following is not a prime number?  
A. 31      B. 61      C. 71      D. 91
6. The largest 4 digit number exactly divisible by 88 is:  
A. 9944      B. 9768      C. 9988      D. 8888      E. None of these
7. What is the unit digit in  $\{(6374)^{1793} \times (625)^{317} \times (341^{491})\}$ ?  
A. 0      B. 2      C. 3      D. 5
8. The difference of two numbers is 1365. On dividing the larger number by the smaller, we get 6 as quotient and the 15 as remainder. What is the smaller number?  
A. 240      B. 270      C. 295      D. 360
9. If the number  $517*324$  is completely divisible by 3, then the smallest whole number in the place of \* will be:  
A. 0      B. 1      C. 2      D. None of these
10.  $\frac{753 \times 753 + 247 \times 247 - 753 \times 247}{753 \times 753 \times 753 + 247 \times 247 \times 247} = ?$   
A.  $\frac{1}{1000}$       B.  $\frac{1}{506}$       C.  $\frac{253}{500}$       D. None of these
11. What will be remainder when  $(67^{67} + 67)$  is divided by 68?  
A. 1      B. 63      C. 66      D. 67
12. On dividing a number by 357, we get 39 as remainder. On dividing the same number 17, what will be the remainder?  
A. 0      B. 3      C. 5      D. 11
13. Which number has a property that his third is also a  $\frac{1}{2}$ ?  
A.  $\frac{2}{3}$  B.  $\frac{3}{2}$       C.  $\frac{5}{2}$       D.  $\frac{3}{4}$
14. 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.  $(4743 + 4343)$       D. None of these
15. In a division sum, the divisor is 10 times the quotient and 5 times the remainder. If the remainder is 46, what is the dividend?  
A. 4236      B. 4306      C. 4336      D. 5336      E. None of these
16. What is the number that is one half of one quarter of one tenth of 400?  
A. 2      B. 5      C. 8      D. 10      E. 40
17. If you count from 1 to 100, how many 7's will you pass on the way? -

A. 13

B. 11

C. 19

D. 2

E. 21

18. The sum of three consecutive odd number is always divisible by

A. 3

B. 2

C. 6

D. 3&amp;6

19. The sum of two even numbers and odd number is:

A. Odd

B. Even

C. either Odd or Even

D. A Prime Number

20. Add the following quantities:  $3742 + 4719 + 11 + 374$ 

A. 8736

B. 8746

C. 8836

D. 8846

21. Value of  $(x-a)(x-b)\dots(x-z)$ ?

A. x

B. z

C.  $(x-z)$ 

D. 0

22. What could be the maximum value of Q in the following equation:  $5P9 + 3R7 + 2Q8 = 1114$ 

A. 10

B. 12

C. 15

D. 9

23. The product of two numbers is 120 and the sum of their squares is 289 the sum of the number is,

A. 20

B. 23

C. 169

D. None of these

24. If  $(NM)^2 = RRM$  where N,M & R are distinct digits. Then possible values for R are,

A. 1

B. 2

C. 3

D. None of these

25. Evaluate:  $\frac{(2.39)^2 - (1.61)^2}{2.39 - 1.61}$ 

A. 2

B. 4

C. 6

D. 8

26. What decimal of an hour is a second?

A. .0025

B. 0.0256

C. 0.0027

D. 0.00126

27. The value of  $\frac{(0.96)^3 - (0.1)^3}{(0.96)^2 + 0.096 + (0.1)^2}$  is:

A. 0.86

B. 0.95

C. 0.97

D. 1.06

28. The value of  $\frac{0.1 \times 0.1 \times 0.1 + 0.02 \times 0.02 \times 0.02}{0.2 \times 0.2 \times 0.2 + 0.04 \times 0.04 \times 0.04}$  is:

A. 0.0125

B. 0.125

C. 0.25

D. 0.5

29. If  $2994 \div 14.5 = 172$ , then  $29.94 \div 1.45 = ?$ 

A. 0.172

B. 1.72

C. 17.2

D. 172

30. When 0.232323..... is converted into a fraction, then the result is:

A.  $\frac{1}{5}$ 

B.  $\frac{2}{9}$ 

C.  $\frac{23}{99}$ 

D.  $\frac{23}{100}$ 

31. The expression  $(11.98 \times 11.98 + 11.98 \times x + 0.02 \times 0.02)$  will be a perfect square for x equal to:

A. 0.02

B. 0.2

C. 0.04

D. 0.4

32.  $\frac{(0.1667)(0.8333)(0.3333)}{(0.2222)(0.6667)(0.1250)}$  is approximately equal to:

A. 2

B. 2.40

C. 2.43

D. 2.50

33. The price of commodity X increases by 40 paise every year, while the price of commodity Y increases by 15 paise every year. If in 2001, the price of commodity X was Rs.4.20 and that of Y was Rs. 6.30, in which year commodity X will cost 40 paise more than the commodity Y?
- A. 2010                      B. 2011                      C. 2012                      D. 2013

34. The rational number for recurring decimal 0.125125.... is:
- A.  $\frac{63}{487}$                       B.  $\frac{119}{993}$                       C.  $\frac{125}{999}$                       D. None of these

### Speed Calculations Practice

1.	26 kg + 4222 gm = _____ kg	
2.	12300 / 410 =	
3.	6528 / 6 — 704 / 8 =	
4.	6359 * 99999 =	
5.	1/5 * 1/5 * 17500 =	
6.	1232 + 232 + 32 =	
7.	(56) <sup>2</sup> — 49 =	
8.	750 / 6 * 165 / 15 =	
9.	2978 / 2 + 132 / 12 — 300 =	
10.	(Use < , = ) 3507 / 7 _____ 3644 / 2	
11.	500 — 799 =	
12.	(31 * 42) — (42 * 6) =	
13.	9 / 3 * 222 — 2/10 * 15/100 * 1100 =	
14.	(792 — 61) + 47 + (61 — 792 — 47) + 21 =	
15.	35 * 486 / 6 =	
16.	12 * 1890 / 4 =	
17.	-89.12+23.14	
18.	312-282=	
19.	89237 * ( 678 — 112 — 205 — 361) =	
20.	2016 * 40 * 0.25 =	
21.	((((89 + 14) + 89) + 14) - 89) =	
22.	Half of half of 12412 =	
23.	88 * 4 * 11 =	

## Simplification

### 'BODMAS' Rule:

This rule depicts the correct sequence in which the operations are to be executed, so as to find out the value of given expression. Here,

B - Bracket,

O - of,

D - Division,

M - Multiplication,

A - Addition and

S - Subtraction

Thus, in simplifying an expression, first of all the brackets must be removed, strictly in the order  $()$ ,  $\{\}$  and  $||$ .

After removing the brackets, we must use the following operations strictly in the order:

(i) of (ii) Division (iii) Multiplication (iv) Addition (v) Subtraction.

### PRACTICE QUESTIONS

1. A man has Rs.480 in the denominations of one-rupee notes, five-rupee notes and ten-rupee notes. The number of notes of each denomination is equal. What is the total number of notes that he has ?

- A. 45                                      B. 60                                      C. 75                                      D. 90

2. There are two examinations rooms A and B. If 10 students are sent from A to B, then the number of students in each room is the same. If 20 candidates are sent from B to A, then the number of students in A is double the number of students in B. The number of students in room A is:

- A. 20                                      B. 80                                      C. 100                                      D. 200

3. The price of 10 chairs is equal to that of 4 tables. The price of 15 chairs and 2 tables together is Rs. 4000. The total price of 12 chairs and 3 tables is:

- A. Rs.3500                                      B. Rs.3750                                      C. Rs.3840                                      D. Rs.3900

4. If  $a - b = 3$  and  $a^2 + b^2 = 29$ , find the value of  $ab$ .

- A. 10                                      B. 12                                      C. 15                                      D. 18

5. The price of 2 sarees and 4 shirts is Rs.1600. With the same money one can buy 1 saree and 6 shirts. If one wants to buy 12 shirts, how much shall he have to pay?

- A. Rs.1200                                      B. Rs.400                                      C. Rs.4800                                      D. Cannot be determined                                      E. None of these

6. A, B, C and D are all positive number. A is twice as big as B, B is greater than C, and D is greater than C but smaller than B which of the following expressions is the largest?

- a)  $A/C$                                       b)  $C/A$                                       c)  $B/D$                                       d)  $B/C$

7. One-third of Rahul's savings in National Savings Certificate is equal to one-half of his savings in Public Provident Fund. If he has Rs.1,50,000 as total savings, how much has he saved in Public Provident Fund ?

- A. Rs.30,000                                      B. Rs.50,000                                      C. Rs.60,000                                      D. Rs.90,000

8. A fires 5 shots to B's 3 but A kills only once in 3 shots while B kills once in 2 shots. When B has missed 27 times, A has killed:

- A. 30 birds                                      B. 60 birds                                      C. 72 birds                                      D. 90 birds

9. Eight people are planning to share equally the cost of a rental car. If one person withdraws from the arrangement and the others share equally the entire cost of the car, then the share of each of the remaining persons increased by:

- A.  $\frac{1}{7}$                       B.  $\frac{1}{8}$                       C.  $\frac{1}{9}$                       D.  $\frac{7}{8}$

10. To fill a tank, 25 buckets of water is required. How many buckets of water will be required to fill the same tank if the capacity of the bucket is reduced to two-fifth of its present?

- A. 10                      B. 35                      C. 62.5                      D. Cannot be determined                      E. None of these

11. In a regular week, there are 5 working days and for each day, the working hours are 8. A man gets Rs.2.40 per hour for regular work and Rs.3.20 per hours for overtime. If he earns Rs.432 in 4 weeks, then how many hours does he work for?

- A. 160    B. 175                      C. 180                      D. 195

12. Free notebooks were distributed equally among children of a class. The number of notebooks each child got was one-eighth of the number of children. Had the number of children been half, each child would have got 16 notebooks. Total how many notebooks were distributed?

- A. 256    B. 432                      C. 512                      D. 640                      E. None of these

13. A man has some hens and cows. If the number of heads be 48 and the number of feet equals 140, then the number of hens will be:

- A. 22    B. 23                      C. 24                      D. 26

14.  $\frac{(469 + 174)2 - (469 - 174)2}{(469 \times 174)} = ?$

- A. 2                      B. 4                      C. 295                      D. 643

15. There is a number which is very peculiar. This number is three times the sum of its digits. Can you find the number?

16. If  $6A8=53$  and  $5A7=40$ ,  $6A9=?$

- a) 63                      b) 61                      c) 62                      d) 59

17. What could be the maximum value of Q in the following equation?

$$5P9 + 3R7 + 2Q8 = 1114$$

- a) 10                      b) 12                      c) 15                      d) 9

18. In the middle of a round pool lays a beautiful water-lily. The water –lily doubles in size every day. After exactly 20 days the complete pool will be covered by the lily after how many days will half of the pool be covered by the water-lily?

19. A necklace is made by stringing N individual pearls together in the repeating pattern red pearl, white pearl, blue pearl, and yellow pearl. If the necklace design begins with a red pearl and ends with a white pearl, then N equal

- a) 32                      b) 41                      c) 54                      d) 68

20. Hari Sadu has 10 pairs of matched socks. If he loses 7 individual socks what is the greatest number of pair of match socks he can have left?

- a) 4                      b) 5                      c) 7                      d) 6



## Percentage

Percentage = (Sum of quantities)/(Number of quantities)

Percentage increase by  $x\%$  =  $((x+100)/100) \times \text{Initial}$

Percentage decrease by  $x\%$  =  $((100-x)/100) \times \text{Initial}$

### Some common percentage conversions

1/2=50%	2/6=33.33%	2/8=25%	6/9=66.66%	9/10=90%	1/12=8.33%
1/3=33.33%	3/6=50%	3/8=37.5%	7/9=77.77%	1/11=9.09%	2/12=16.67%
2/3=66.67%	4/6=66.67%	4/8=50%	8/9=88.88%	2/11=18.18%	3/12=25%
1/4=25%	5/6=83.33%	5/8=62.5%	1/10=10%	3/11=27.27%	4/12=33.33%
2/4=50%	1/7=14.28%	6/8=75%	2/10=20%	4/11=36.36%	5/12=41.67%
3/4=75%	2/7=28.57%	7/8=87.5%	3/10=30%	5/11=45.45%	6/12=50%
1/5=20%	3/7=42.85%	1/9=11.11%	4/10=40%	6/11=54.54%	7/12=58.33%
2/5=40%	4/7=57.14%	2/9=22.22%	5/10=50%	7/11=63.63%	8/12=66.67%
3/5=60%	5/7=71.72%	3/9=33.33%	6/10=60%	8/11=72.72%	9/12=75%
4/5=80%	6/7=85.71%	4/9=44.44%	7/10=70%	9/11=81.81%	10/12=83.33%
1/8=12.5%	1/8=12.5%	5/9=55.55%	8/10=80%	10/11=90.9%	11/12=91.67%

### PRACTICE QUESTIONS

- If A is 125% of B, then B is what percent of A?
- The price of an article falls by 25%. By what percent should the price increase in order to reach its original value?
- The sides of the square increases by 10%. By what % will the area increase?
- Charlie bought a \$60 radio on sale at 5% off. How much did he pay including 5% sale tax?
- In 1970 there were 8,902 women stockbrokers in the United States. By 1978 the number had increased to 19,947. Approximately what was the percent increase?  
A. 45%      B. 125%      C. 145      D. 150%      E. 225%
- Positive integer y is 50 percent of positive integer x, and y percent of x equals 100. What is the value of x?  
A. 50      B.  $100\sqrt{2}$       C. 100      D. 200
- The price of a house was 962400. If it increases by 8.33%, what will be the new price?
- The number of students in a college is 36996. There was a decrease of 7.69% over the previous year, how many students were there last year?
- 9 is  $\frac{1}{3}\%$  of what number?  
A. 0.03      B. 27      C. 3      D. 300      E. 2700

10. The price of a T.V. is increased 30% before budget and in budget 20% is also increased. Then the price of TV is
11. Of a group of people surveyed in a political poll, 60 percent said that they would vote for candidate *R*. Of those who said they would vote for *R*. 90 percent actually voted for *R*. and of those who did not say that they would vote for *R*. 5 percent actually voted for *R*. What percent of the group voted for *R*?  
 A. 56%                      B. 59%                      C. 62%                      D. 65%                      E. 74%
12. One-fifth of the light switches produced by a certain factory are defective. Four-fifths of the defective switches are rejected and  $\frac{1}{20}$  of the non-defective switches are rejected by mistake. If all the switches not rejected are sold, what percent of the switches sold by the factory are defective?
13. An employee is paid a salary of \$300 per month and earns a 6 percent commission on all her sales. What must her annual sales be in order for her to have a gross annual salary of exactly \$21,600?  
 A. \$22,896    B. \$26,712    C. \$300,000    D. \$330,000    E. \$360,000
14. Price of petrol is increased by 14.28%. By how much should I reduce my consumption to keep my expenses constant?
15. Out of a total of 1,000 employees at a certain corporation, 52 percent are female and 40 percent of these females work in research. If 60 percent of the total number of employees works in research, how many male employees do NOT work in research?  
 A. 520              B. 480              C. 392              D. 208              E. 88
16. No. of seats in an auditorium has gone down by 25%. By how much should the price per ticket be increased to keep the profit same.
17. The government has increased the price of petrol by 16.67%. However, due to widespread opposition, it had to revert back to the original price. By what percentage should they reduce the price now?
18. Adding 20% of *x* to *x* is equivalent to multiplying *x* by which of the following?  
 A. 12.5              B. 1.05              C. 1.15              D. 1.20
19. A number *p* is increased by 30% and another number *q* is decreased by 30% to make them equal. By what percentage is *q* greater than *p*?  
 A. 65%              B. 80%              C. 74%              D. 100%              E. 86%

### Speed Calculations Practice

1.	93% of 29 is 29% of _____	
2.	$11.1\% \times 56,000$	
3.	5% of 10% of 200	
4.	3.6 million = ? % of 18 million.	
5.	10% of 20% of 30	
6.	400% of a is what % of 400a	
7.	$1356 \times 0.1\% \times 2 \times 5$	
8.	If 1 micron = 10,000 angstroms, then 100 angstroms is what % of 10 micron	
9.	22 % of 26000	
10.	8 % discount on 26,000 is a 10 % per cent discount on	

## HCF & LCM

1. **Factors and Multiples:** If number a divided another number b exactly, we say that a is a factor of b. In this case, b is called a multiple of a.

2. **Highest Common Factor (H.C.F.)** or Greatest Common Measure (G.C.M.) or Greatest Common Divisor (G.C.D.): The H.C.F. of two or more than two numbers is the greatest number that divides each of them exactly.

There are two methods of finding the H.C.F. of a given set of numbers:

I. Factorization Method: Express the each one of the given numbers as the product of prime factors. The product of least powers of common prime factors gives H.C.F.

II. Division Method: Suppose we have to find the H.C.F. of two given numbers, divide the larger by the smaller one. Now, divide the divisor by the remainder. Repeat the process of dividing the preceding number by the remainder last obtained till zero is obtained as remainder. The last divisor is required H.C.F.

### 3. Least Common Multiple (L.C.M.):

The least number which is exactly divisible by each one of the given numbers is called their L.C.M.

There are two methods of finding the L.C.M. of a given set of numbers:

I. Factorization Method: Resolve each one of the given numbers into a product of prime factors. Then, L.C.M. is the product of highest powers of all the factors.

II. Division Method (short-cut): Arrange the given numbers in a row in any order. Divide by a number which divided exactly at least two of the given numbers and carry forward the numbers which are not divisible. Repeat the above process till no two of the numbers are divisible by the same number except 1. The product of the divisors and the undivided numbers is the required L.C.M. of the given numbers.

4. **Product of two numbers** = Product of their H.C.F. and L.C.M.

5. **Co-primes:** Two numbers are said to be co-primes if their H.C.F. is 1.

### 6. H.C.F. and L.C.M. of Fractions:

1.  $H.C.F. = \frac{H.C.F. \text{ of Numerators}}{L.C.M. \text{ of Denominators}}$

2.  $L.C.M. = \frac{L.C.M. \text{ of Numerators}}{H.C.F. \text{ of Denominators}}$

8. **H.C.F. and L.C.M. of Decimal Fractions:** In a given numbers, make the same number of decimal places by annexing zeros in some numbers, if necessary. Considering these numbers without decimal point, find H.C.F. or L.C.M. as the case may be. Now, in the result, mark off as many decimal places as are there in each of the given numbers.

9. **Comparison of Fractions:** Find the L.C.M. of the denominators of the given fractions. Convert each of the fractions into an equivalent fraction with L.C.M as the denominator, by multiplying both the numerator and denominator by the same number. The resultant fraction with the greatest numerator is the greatest.

## PRACTICE QUESTIONS

**Find the HCF of:-**

1)	45, 63		6)	84, 98 and 154	
2)	72, 56		7)	72, 144 and 312	
3)	114, 171		8)	525, 875 and 1575	
4)	225, 825		9)	36, 48, 84, 132 and 204	
5)	89, 111		10)	117, 132 and 169	

**Find the LCM of:-**

1)	36, 48		6)	8, 12 and 36	
2)	54, 27		7)	36, 48 and 60	
3)	88, 33		8)	78, 104 and 130	
4)	64, 112		9)	12, 20, 24, 36 and 40	
5)	161, 46		10)	2, 3, 5, 7 and 11	

- Find the greatest number such that when 23 and 78 are divided by that number, we get remainders of 2 and 1 respectively.
- Find the highest number which divides both 57 and 209.
- Find the HCF of 67, 68 and 69.
- Find the HCF of 483 and 535.
- Find the smallest number which when divided by 16 and 24 will leave a remainder of 3 in each case.
- The least number which when divided by 39 and 91 leaving a remainder of 2 in each case is \_\_\_\_.
- Find the HCF of  $\frac{4}{7}$  and  $\frac{12}{35}$ .
- Find the LCM of  $\frac{9}{5}$  and  $\frac{12}{25}$ .
- Two lights, red and green glow after every 8 and 14 seconds respectively. After how many seconds will they glow together?
- Find all the common divisors of 56 and 84.
- Find the least number which when divided by 8, 18 and 24 leaves remainders of 2, 12 and 18 respectively.  
A. 78                      B. 70                      C. 66                      D. 138
- Find the highest number such that when 64, 118 and 190 are divided by that number, we get the same remainder in each case.  
A. 3                      B. 6                      C. 9                      D. None of these
- Find the least number which when divided by 4, 5 and 6 will leave remainders of 2, 1 and 4 respectively.

A. 22 B. 47

C. 46

D. 106.

14. Find the least number which when divided by 2, 4, 6 and 8 will leave remainders of 1, 3, 5 and 6 respectively.

A. 23 B. 22

C. 47

D. Cannot be determined

15. Two lights yellow and blue glow at the rates of 3 times a minute and 4 times every two minutes respectively. Find the number of times that they will glow together in half an hour.

A. 15 B. 30

C. 45

D. 60

16. Find the HCF of 1111...(15 times) and 1111...(25 times).

A. 1111...(15 times)

B. 1111...(10 times)

C. 11111

D. 11

17. Find the number of factors of 72.

A. 6

B. 8

C. 10

D. 12

18. Find the number of even factors of 144.

A. 8

B. 9

C. 10

D. 12

19. Find the HCF of  $75 - 1$  and  $75 + 1$ .

A. 1

B. 2

C. 4

D. 8

20. A screen displays the alphabets A, B and C after every 4, 5 and 7 seconds respectively for one complete second. After how many seconds will the entire display glow together?

A. 140 sec

B. 210 sec

C. 240 sec

D. 120 sec

21. If  $n = 1 + x$ , where  $x$  is the product of four consecutive positive integers, then which of the following is/are true?

i.  $n$  is odd

ii.  $n$  is prime

iii.  $n$  is a perfect square

A. i and iii only

B. i and ii only

C. i only

D. None of these

22. For two positive integers  $a$  and  $b$  define the function  $h(a,b)$  as the greatest common factor (gcf) of  $a, b$ . Let  $A$  be a set of  $n$  positive integers.  $G(A)$ , the gcf of the elements of set  $A$  is computed by repeatedly using the function  $h$ . The minimum number of times  $h$  is required to be used to compute  $G$  is:

A.  $n/2$ 

B.  $(n - 1)$ 

C.  $n$ 

D. None of these

23. How many numbers between 1 and 200 are there such that when they are divided by 2, 3, 4, 5 and 6, they leave remainders 1, 2, 3, 4 and 5 respectively?

A. 1

B. 2

C. 3

D. 4

24. A screen displays words 'I', 'AM', 'SMART' after every  $2\frac{1}{4}$ ,  $3\frac{1}{2}$  and  $4\frac{3}{4}$  seconds respectively. After how many seconds will all the words flash together?

A. 94.5 sec

B. 189 sec

C. 190 sec

D. 403 sec

25. Find the sum of all the factors of 180.

A. 546

B. 576

C. 625

D. 640

26. Find the highest number

A.  $21/2$ 

B.  $41/4$ 

C.  $61/6$ 

D.  $31/3$ 

27.  $a, a+2, a+4$  are prime numbers, then find the number of possible solution of  $a$ .

- A. 1                      B. 2                      C. 3                      D. 4

28. In how many ways can 48 be written as a product of two co-prime numbers?

- A. 8                      B. 16                      C. 32                      D. 4

29. Let X be the set of numbers from 1 to 100 such that the HCF of any two numbers in X is 3. Find the number of elements in X.

- A. 11                      B. 12                      C. 17                      D. 33

30. A number which when divided by 3, 4 and 5 leaves remainders of 1, 3 and 4 respectively. Find the remainder when the same number is divided by 60.

- A. 29                      B. 59                      C. 19                      D. 9

31. Find the greatest number 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

32. Six bells commence tolling together and toll at intervals of 2, 4, 6, 8, 10 and 12 seconds respectively. In 30 minutes, how many times do they toll together?

- A. 4                      B. 10                      C. 15                      D. 16

33. Three numbers are in the ratio of 3: 4: 5 and their L.C.M. is 2400. Their H.C.F. is:

- A. 40                      B. 80                      C. 120                      D. 200

34. The product of two numbers is 2028 and their H.C.F. is 13. The number of such pairs is:

- A. 1                      B. 2                      C. 3                      D. 4

35. The least multiple of 7, which leaves a remainder of 4, when divided by 6, 9, 15 and 18 is:

- A. 74                      B. 94                      C. 184                      D. 364

36. A, B, C and D are all positive numbers. A is twice as big as B, B is greater than C, and D is greater than C but smaller than B. Which of the following expressions is the largest?

- a)  $A/C$                       b)  $C/A$                       c)  $B/D$                       d)  $B/C$

## Power Cycles

$1^2 - 1$	$11^2 - 121$	$21^2 - 441$	$31^2 - 961$	$41^2 - 1681$
$2^2 - 4$	$12^2 - 144$	$22^2 - 484$	$32^2 - 1024$	$42^2 - 1764$
$3^2 - 9$	$13^2 - 169$	$23^2 - 529$	$33^2 - 1089$	$43^2 - 1849$
$4^2 - 16$	$14^2 - 196$	$24^2 - 576$	$34^2 - 1156$	$44^2 - 1936$
$5^2 - 25$	$15^2 - 225$	$25^2 - 625$	$35^2 - 1225$	$45^2 - 2025$
$6^2 - 36$	$16^2 - 256$	$26^2 - 676$	$36^2 - 1296$	$46^2 - 2116$
$7^2 - 49$	$17^2 - 289$	$27^2 - 729$	$37^2 - 1369$	$47^2 - 2209$
$8^2 - 64$	$18^2 - 324$	$28^2 - 784$	$38^2 - 1444$	$48^2 - 2304$
$9^2 - 81$	$19^2 - 361$	$29^2 - 841$	$39^2 - 1521$	$49^2 - 2401$
$10^2 - 100$	$20^2 - 400$	$30^2 - 900$	$40^2 - 1600$	$50^2 - 2500$

### 1. Laws of Indices:

i)  $a^m \times a^n = a^{m+n}$

ii)  $\frac{a^m}{a^n} = a^{m-n}$

iii)  $(am)^n = a^{mn}$

iv)  $(ab)^n = a^n b^n$

v)  $\left[\frac{a}{b}\right]^n = \frac{a^n}{b^n}$

vi)  $a^0 = 1$

### 2. Surds:

Let a be rational number and n be a positive integer such that  $a^{(1/n)} = a$ . Then, a is called a surd of order n.

### 3. Laws of Surds:

i)  $a = a^{(1/n)}$

ii)  $ab = a \times b$

iv)  $\sqrt[n]{\frac{a}{b}} = \frac{a}{b}$

v)  $\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$

vi)  $(a)^m = a^m$



## PRACTICE QUESTIONS

### Speed Calculations Practice

1. $93^2 =$	11. $73984 * 9999 =$	21. $108 * 92 =$	31. $43^2 =$	41. $59^2 =$
2. $1012^2 =$	12. $68 * 43 =$	22. $9998^2 =$	32. $37^2 =$	42. $194^2 =$
3. $57^2 =$	13. $125 * 68 =$	23. $78 * 84 =$	33. $99^2 =$	43. $507^2 =$
4. $63 * 47 =$	14. $\sqrt{12544} =$	24. $62 * 18 =$	34. $68^2 =$	44. $37 * 22 =$
5. $59 * 48 =$	15. $100012^2 =$	25. $28 * 22 =$	35. $151^2 =$	45. $107 * 68 =$
6. $987^2 =$	16. $124 * 126 =$	26. $725^2 =$	36. $89^2 =$	46. $104^3 =$
7. $71^2 =$	17. $11111^2 =$	27. $625^2 =$	37. $131^2 =$	47. $97^3 =$
8. $48^2 =$	18. $6348 * 9999 =$	28. $301^2 =$	38. $97^2 =$	48. $\sqrt{7744} =$
9. $207^2 =$	19. $107 * 112 =$	29. $325^2 =$	39. $92^2 =$	49. $\sqrt[3]{3375} =$
10. $293^2 =$	20. $93 * 87 =$	30. $87 * 83 =$	40. $37^2 =$	50. $\sqrt[3]{79507} =$

Find the last digit of:-

1) $2^{31}$		6) $13^{23}$	
2) $3^{41}$		7) $16^{48}$	
3) $5^{49}$		8) $19^{21}$	
4) $7^{19}$		9) $215^{41}$	
5) $8^{12}$		10) $108^{34}$	

Find the number of zeroes at the end of:-

25!		200!	
35!		225!	
60!		250!	
125!		102!	
140!		500!	

1. The cube root of .000216 is:

A. (.6)

B. (.06)

C. (6)

D. (7)

2. What should come in place of both x in the equation  $\frac{x}{SQ\ ROOT\ 128} = \frac{SQ\ ROOT\ 162}{x}$

- A. 12                      B. 14                      C. 144                      D. 196
3. The least perfect square, which is divisible by each of 21, 36 and 66 is:  
A. 213444                      B. 214344                      C. 214434                      D. 231444
4. The value of  $5^{1/4} * (125)^{0.25}$
5. The value of  $(32/243)^{-4/5}$  is:
6. If  $x = \text{ROOT} \frac{3+1}{3-1}$  and  $y = \text{ROOT} \frac{3-1}{3+1}$ , then the value of  $(x^2 + y^2)$  is:  
A. 10                      B. 13                      C. 14                      D. 15
7. A group of students decided to collect as many paise from each member of group as is the number of members. If the total collection amounts to Rs.59.29, the number of the member is the group is:  
A. 57                      B. 67                      C. 77                      D. 87
8. Square Root of  $7 * 124 / 7 - 43 =$
9.  $(2^{n+4} - 2 \cdot 2^n) / (2 \cdot 2^{n+3}) = 2^{-3}$  is equal to:
10. If  $\sqrt{2n} = 64$ , then the value of n is:
11.  $(17)^{3.5} \times (17)^? = 17^8$   
A. 2.29                      B. 2.75                      C. 4.25                      D. 4.5
12. If  $\left(\frac{a}{b}\right)^{x-1} = \left(\frac{b}{a}\right)^{x-3}$   
A.  $\frac{1}{2}$                       B. 1                      C. 2                      D.  $\frac{7}{2}$
13. Given that  $100.48 = x$ ,  $100.70 = y$  and  $xz = y^2$ , then the value of z is close to:  
A. 1.45                      B. 1.88                      C. 2.9                      D. 3.7
14. If  $3(x - y) = 27$  and  $3(x + y) = 243$ , then x is equal to:  
A. 0                      B. 2                      C. 4                      D. 6
15.  $\frac{1}{1+x^{(b-a)}+x^{(c-a)}} + \frac{1}{1+x^{(a-b)}+x^{(c-b)}} + \frac{1}{1+x^{(b-c)}+x^{(a-c)}}$   
A. 0                      B. 1                      C.  $x^{a-b-c}$                       D. None of these
16.  $(0.04)^{-1.5} = ?$   
A. 25                      B. 125                      C. 250                      D. 625
17.  $\frac{(243)^{n/5} \times 3^{2n+1}}{9^n \times 3^{n-1}} = ?$   
A. 1                      B. 2                      C. 9                      D.  $3^n$
18.  $\frac{1}{1+a^{(n-m)}} + \frac{1}{1+a^{(m-n)}}$   
A. 0                      B.  $\frac{1}{2}$                       C. 1                      D.  $a^{m+n}$

19. If  $m$  and  $n$  are whole numbers such that  $mn = 121$ , the value of  $(m - 1)^{n+1}$  is:

- A. 1                      B. 10                      C. 121                      D. 1000

20.  $\left(\frac{x^b}{x^c}\right)^{(a+b-c)} \cdot \left(\frac{x^c}{x^a}\right)^{(c+a-b)} \cdot \left(\frac{x^a}{x^b}\right)^{(a+b-c)}$

- A.  $x^{abc}$                       B. 1                      C.  $x^{ab+bc+ca}$                       D.  $x^{a+b+c}$

21. If  $x = 3 + 22$ , then the value of  $\left(\text{ROOT}x - \frac{1}{\text{ROOT}x}\right)$  is:

- A. 1                      B. 2                      C. 22                      D. 33

22. If  $r=0.345$ ,  $s=(0.345)^2$ , and  $t=(0.345)^{0.5}$ , which of the following is the correct ordering of  $r$ ,  $s$ , and  $t$ ?

- a)  $r < t < s$                       b)  $s < t < r$                       c)  $t < r < s$                       d)  $s < r < t$

23. If  $\frac{x}{y} = \frac{4}{9}$ , find  $\frac{x^2 + y^2}{y^2 - x^2}$

- A.  $\frac{16}{81}$                       B.  $\frac{97}{65}$                       C.  $\frac{21}{74}$                       D.  $\frac{26}{41}$                       E.  $\frac{23}{78}$

24. Find the remainder when  $23^{24}$  is divided by 10.

25. Find the remainder when  $102^{100}$  is divided by 10.

26. Find the maximum power of 3 that will divide  $24!$  completely.

27. Find the maximum power of 2 that will divide  $14!$  completely.

28. Find the maximum power of 7 that will divide  $45!$  completely.

29. Two numbers  $A$  and  $B$  when divided by a certain divisor leave remainders of 12 and 14. When the sum of these two numbers is divided by the same divisor, the remainder is 9. Find the divisor.

- A. 15                      B. 34                      C. 17                      D. Cannot be determined

30. Find the last digit of  $23^{65} + 32^{45}$ .

- A. 0                      B. 5                      C. 6                      D. 8

31. Find the last digit of  $78^{65} \times 47^{50}$ .

- A. 0                      B. 1                      C. 2                      D. 3

32. Three labeled boxes containing red and white cricket balls are all mislabeled. It is known that one of the boxes contains only white balls and one only red balls. The third contains a mixture of red and white balls. You are required to correctly label the boxes with the labels red, white and red and white by picking a sample of one ball from only one box. What is the label on the box you should sample?

- A. White                      B. Red                      C. Red and White  
D. Not possible to determine from a sample of one ball

33. All the numbers from 1 to 100 that have exactly 2 divisors are multiplied. Find the number of zeroes at the end of the product.

- A. 12                      B. 8                      C. 1                      D. 0

34. Let  $x$ ,  $y$  and  $z$  be distinct integers,  $x$  and  $y$  are odd and positive, and  $z$  is even and positive. Which one of the following statements can not be true?

1.  $(x - z)^2 y$  is even    2.  $(x - y)y^2$  is odd    3.  $(x - z)y$  is odd    4.  $(x - y)^2 z$  is even

35. If  $a$ ,  $b$ ,  $c$  and  $d$  are four positive real numbers such that  $abcd = 1$ , what is the minimum value of  $(1 + a)(1 + b)(1 + c)(1 + d)$ .

1. 4    2. 1    3. 16    4. 18

36.  $7^{6n} - 6^{6n}$ , where  $n$  is an integer  $> 0$ , is divisible by

1. 13    2. 127    3. 559    4. None of these

37. When  $2^{256}$  is divided by 17 the remainder would be

1. 1    2. 16    3. 14    4. None of these

38. A rich merchant had collected many gold coins. He did not want anybody to know about them. One day, his wife asked, "How many gold coins do we have?" After pausing a moment, he replied, "Well! If I divide the coins into two unequal numbers, then 48 times the difference between the two numbers equals the difference between the squares of the two numbers." The wife looked puzzled. Can you help the merchant's wife by finding out how many coins the merchant has?

- A. 96    B. 53    C. 43    D. none of these

## Averages

Find the AM of:-

- A. 21, 22 and 26
- B. 45, 34, 11, 26 and 84
- C. 1, 3, 5, 7,..., 19
- D. 1, 2, 3, ..., 40
- E. 22, 24, 26,..., 50
- F. 6451, 6659, 6663

Find the GM of :-

- 1. 4 and 9
- 2. 12, 9, 16
- 3. 1, 2, 4, 8
- 4. 16 and 25
- 5. 1, 2, 3, 4, 5

Find the median for 1) 31, 54, 11, 12, 89, 901, 100.

2) 12, 78, 54, 1, 3, 9.

Find the mode for 1) 2, 6, 8, 9, 1, 3, 10, 1, 3, 4, 8, 3, 4, 10, 3.

2) 1, 2, 3, 4, 5

3) 3,4,23,4,2,3,54,3,6,4

1. Find the average of the first 10 whole numbers.

2. Find the average of the first 50 whole numbers.

3. Michael's average (arithmetic mean) on 4 tests is 80. What does he need on his fifth test to raise his average to 84?

- A. 82
- B. 84
- C. 92
- D. 96
- E. 100

4. Marline's average (arithmetic mean) on 4 tests is 80. Assuming she can earn no more than 100 on any test, what is the least she can earn on her fifth test and still have a chance for an 85 average after seven tests?

- A. 60
- B. 70
- C. 75
- D. 80
- E. 85

5. In a triangle the first angle is half the size of the second angle, and the third angle is the average of the first and the second. The second angle in degree is

- A. 30 degrees
- B. 60 degrees
- C. 80 degrees
- D. 40 degrees

6. If all the 6 are replaced by 9, then the algebraic sum of all the numbers from 1 to 100(both inclusive) varies by: \_\_\_\_\_

7. A gym class can be divided into 8 teams with an equal number of players on each team or into 12 teams with an equal number of players on each team. What is the lowest possible number of student in class?

- A. 24
- B. 20
- C. 36
- D. 48

8. A man has some hens and cows. If the number of heads be 48 and the number of feet equals 140, then the number of hens will be

A. 22

B. 24

C. 26

D. 20

9. The average age of 10 students and their teacher is 15 years. The average age of the first seven students is 15 year and that of the last three is 11 yr. What is the teacher's age?

A. 33 years

B. 30 years

C. 27 years

D. 24 years

10. Average age of 7 family members is 75 years. But average age of 6 of them is 74 years 6 months. What is the age of the 7th family member?

A. 75.5

B. 78

C. 68

D. 80

11. If in objective test a correct and score is 4 marks and on a wrong and 2 marks are negated a student scores 480 marks from 150 questions. How many and were correct? Select the correct option(s):

A. 120

B. 130

C. 110

D. 150

12. The average age of a class of 39 students is 15 years. If the age of the teacher be included, then the average increases by 3 months. Find the age of the teacher.

A. 25 years

B. 27 years

C. 35 years

D. 28 years

13. The average of six numbers is 30. If the average of first four is 25 and that of last three is 35, the fourth number is?

A. 25

B. 30

C. 35

D. 40

14. A pupil's marks were wrongly entered as 83 instead of 63. Due to that the average for the class got increase by half. The number of pupils in the class is:

1. 10

B. 20

C. 40

D. 73

15. I participated in a race  $\frac{1}{5}$ <sup>th</sup> of those before me are equal to  $\frac{5}{6}$  th of those behind me. What are the minimum number of contestants in the race?

A. 31

B. 62

C. 24

D. 32

16. The average of ten numbers is 7. If each number is multiplied by 12; then the average of new set of numbers is?

A. 7

B. 19

C. 82

D. 84

17. Out of four numbers, the average of first three is 16 and that of the last three is 15. If the last number is 18, the first number is?

A. 20

B. 21

C. 23

D. 25

18. A bacterium doubles in a day. A bacterium is kept in a container. After 10 days the container is completely filled with bacteria. How much time will take to half fill the container?

19. Three math classes: X, Y, and Z, take an algebra test.

The average score in class X is 83.

The average score in class Y is 76.

The average score in class Z is 85.

The average score of all students in classes X and Y together is 79.

The average score of all students in classes Y and Z together is 81.

What is the average for all the three classes?

A. 81

B. 81.5

C. 82

D. 84.5

20. Amol was asked to calculate the arithmetic mean of ten positive integers each of which had two digits. By mistake, he interchanged the two digits, say  $a$  and  $b$ , in one of these ten integers. As a result, his answer for the arithmetic mean was 1.8 more than what it should have been. Then  $b - a$  equals
- A. 1                      B. 2                      C. 3                      D. none of these
21. If the ratio of harmonic means of two numbers to their geometric means is 12 : 13, find the ratio of the numbers.
- A. 4 : 9                      B. 8 : 9                      C. 4 : 5                      D. 9 : 4                      E. Options 1 or 4.
22. The average weight of students in a class is 50 kg. What is the number of students in the class? The heaviest and the lightest members of the class weigh 60 kg and 40 kg respectively. Exclusion of the heaviest and the lightest members from the class does not change the average weight of the students.
23. The girl's age is twice that of boy, if the boy is four years old. After four years the age of the girl is?
24. The average of 20 numbers is zero. Of them, at the most, how many may be greater than zero?

### Ratio & proportion

**1. Ratio:** The ratio of two quantities  $a$  and  $b$  in the same units, is the fraction  $\frac{a}{b}$  and we write it as  $a : b$ . In the ratio  $a : b$ , we call  $a$  as the first term or **antecedent** and  $b$ , the second term or **consequent**.  
Eg. The ratio 5 : 9 represents  $\frac{5}{9}$  with antecedent = 5, consequent = 9.

**Rule:** The multiplication or division of each term of a ratio by the same non-zero number does not affect the ratio.

Eg. 4 : 5 = 8 : 10 = 12 : 15. Also, 4 : 6 = 2 : 3.

**2. Proportion:** The equality of two ratios is called proportion.

If  $a : b = c : d$ , we write  $a : b :: c : d$  and we say that  $a, b, c, d$  are in proportion.

Here  $a$  and  $d$  are called **extremes**, while  $b$  and  $c$  are called **mean terms**.

Product of means = Product of extremes.

Thus,  $a : b :: c : d \Leftrightarrow (b \times c) = (a \times d)$ .

**3. Fourth Proportional:** If  $a : b = c : d$ , then  $d$  is called the fourth proportional to  $a, b, c$ .

**4. Third Proportional:**  $a : b = c : d$ , then  $c$  is called the third proportion to  $a$  and  $b$ .

**5. Mean Proportional:** Mean proportional between  $a$  and  $b$  is  $ab$ .

**6. Comparison of Ratios:** We say that  $(a : b) > (c : d) \Leftrightarrow \frac{a}{b} > \frac{c}{d}$ .

**7. Compounded Ratio:** The compounded ratio of the ratios:  $(a : b), (c : d), (e : f)$  is  $(ace : bdf)$ .

**8. Duplicate Ratios:**

Duplicate ratio of  $(a : b)$  is  $(a^2 : b^2)$ .

Sub-duplicate ratio of  $(a : b)$  is  $(a : b)$ .

Triplicate ratio of  $(a : b)$  is  $(a^3 : b^3)$ .

Sub-triplicate ratio of  $(a : b)$  is  $(a^{1/3} : b^{1/3})$ .

If  $\frac{a}{b} = \frac{c}{d}$ , then  $\frac{a+b}{a-b} = \frac{c+d}{c-d}$  [componendo and dividendo]

**9. Variations:**

We say that  $x$  is directly proportional to  $y$ , if  $x = ky$  for some constant  $k$  and we write,  $x \propto y$ .

We say that  $x$  is inversely proportional to  $y$ , if  $xy = k$  for some constant  $k$  and

we write,  $x \propto \frac{1}{y}$ .

### PRACTICE QUESTIONS

- A and B together have Rs.1210. If of A's amount is equal to of B's amount, how much amount does B have?  
A. Rs.460                      B. Rs.484                      C. Rs.550                      D. Rs.664
- Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is:  
A. 2 : 5                      B. 3 : 5                      C. 4 : 5                      D. 6 : 7
- A sum of money is to be distributed among A, B, C, D in the proportion of 5 : 2 : 4 : 3. If C gets Rs.1000 more than D, what is B's share?



- A. Rs.500                      B. Rs.1500                      C. Rs.2000                      D. None of these

4. Seats for Mathematics, Physics and Biology in a school are in the ratio 5 : 7 : 8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats?

- A. 2 : 3 : 4                      B. 6 : 7 : 8                      C. 6 : 8 : 9                      D. None of these

5. In a mixture 60 litres, the ratio of milk and water 2 : 1. If this ratio is to be 1 : 2, then the quantity of water to be further added is:

- A. 20 litres                      B. 30 litres                      C. 40 litres                      D. 60 litres

6. Salaries of Ravi and Sumit are in the ratio 2 : 3. If the salary of each is increased by Rs.4000, the new ratio becomes 40 : 57. What is Sumit's salary?

- A. Rs.17,000                      B. Rs.20,000                      C. Rs.25,500                      D. Rs.8,000

7. If  $0.75 : x :: 5 : 8$ , then x is equal to:

- A. 1.12                      B. 1.2                      C. 1.25                      D. 1.30

8. The sum of three numbers is 98. If the ratio of the first to second is 2 : 3 and that of the second to the third is 5 : 8, then the second number is:

- A. 20                      B. 30                      C. 48                      D. 58

9. If Rs.782 be divided into three parts, proportional to : : , then the first part is:

- A. Rs.182                      B. Rs.190                      C. Rs.196                      D. Rs.204

10. If 40% of a number is equal to two-third of another number, what is the ratio of first number to the second number?

- A. 2 : 5                      B. 3 : 7                      C. 5 : 3                      D. 7 : 3

11. Two number 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

12. In a bag, there are coins of 25 p, 10 p and 5 p in the ratio of 1 : 2 : 3. If there is Rs.30 in all, how many 5 p coins are there?

- A. 50                      B. 100                      C. 150                      D. 200

13. At Central state College the ratio of the number of students taking Spanish to the number taking French is 7:2 If 140 students are taking French, how many are taking Spanish?

- A. 40                      B. 140                      C. 360                      D. 490                      E. 630

14. A club had 3 boys and 5 girls. During a membership drive the same number of boys and girls joined the club. How many members does the club have now if the ratio of boys to girls is 3:4?

- A. 12                      B. 14                      C. 16                      D. 21                      E. 28

15. In a class of 60 students, the number of boys and girls participating in the Annual sports is in the ratio 3 : 2 respectively. The number of girls not participating in the sports is 5 more than the number of boys not participating in the sports? If the number of boys participating in the sports is 15, then how many girls are there in the class?

- A. 20                      B. 25                      C. 30                      D. Data inadequate

16. If watermelon weighed 100 pounds, it has 99% water. If it is kept under the sun, water content becomes 98%. Find the loss of water in pounds.
17. Ram, Sham and Suresh start business investing in the ratio  $\frac{1}{2} : \frac{1}{3} : \frac{1}{6}$ . The time for which each of them invested their money was in the ratio 8:6:12 respectively. If they get profit of Rs.18000 from the business, then how much share of profit will Ram get?  
 A. Rs.4000                      B. Rs.6000                      C. Rs.8000                      D. Rs.10000
18. The ratio of the number of boys and girls in a college is 7 : 8. If the percentage increase in the number of boys and girls be 20% and 10% respectively, what will be the new ratio?  
 A. 8 : 9                      B. 17 : 18                      C. 21 : 22                      D. Cannot be determined
19. Two numbers are 20% and 50% more than a third number. The ratio of the two numbers is  
 A. 2 : 5                      B. 3 : 5                      C. 4 : 5                      D. 6 : 7
20. A bag contains 50 paisa, 20 paisa and 10 paisa coins in the ratio 5:3:1. If the total amount in the bag is 640 Rs, find the difference in the amounts contributed by 50 paisa and 20 paisa coins.  
 A. Rs.300                      B. Rs.400                      C. Rs.380                      D. None of these
21. Two ships are sailing in the sea on the two sides of a lighthouse. The angle of elevation of the top of the lighthouse is observed from the ships are  $30^\circ$  and  $45^\circ$  respectively. If the lighthouse is 100m high, the distance between the two ships is:  
 A. 173m                      B. 200m                      C. 273m                      D. 300m
22. A and B invest in a business in the ratio 3:2 if 5% of the total profit goes to charity and A's share is Rs.855 what would be the total profit?  
 a) Rs. 1425                      b) Rs. 1500                      c) Rs. 1537.50                      d) Rs. 1576
23. 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 liters of milk such that the ratio of water to milk is 3:3?  
 a) 4 liters ; 8 liters                      b) 6 liters ; 6 liters                      c) 5 liters ; 7 liters                      d) 7 liters ; 3 liters
24. Two vessels of equal volumes contain milk and water in the ratios 3:4 and 5:3 respectively. Find the ratio of milk and water if the contents of the two vessels are mixed in a third vessel.  
 A. 8:7                      B. 7:8                      C. 59:53                      D. 53:59
25. 20 lit of water and 80 lit of milk are mixed. Then  $\frac{1}{4}$ th of mixture is sold and replaced by 25 lit of water. Then, the ratio of water and milk in current mixture is  
 A. 2:3                      B. 3:2                      C. 4:5                      D. 1:4
26. X, Y and Z have a total of Rs.224 with them. If their shares are increased by Rs.5, 9 and 2 respectively, then the ratio of their amounts is 3:2:1. The original amount with B is  
 A. Rs.38                      B. Rs.115                      C. Rs.71                      D. Rs.80
27. Every element of S1 is made greater than or equal to every element of S2 by adding to each element of S1 an integer x. Then x cannot be less than:  
 A. 210                      B. The smallest value of S2                      C. The largest value of S2                      D. ( G-L )
28. Ashish is given Rs 158 in one rupee denomination. He has been asked to allocate them into a number of bags such that any amount required between Re 1 and Rs 158 can be given by handing out a certain number of bags without opening them. What is the minimum number of bags required?

- (a) 11                      (b) 12                      (c) 13                      (d) None of these

29. In a 4-digit number, the sum of the first two digits is equal to that of the last two digits. The sum of the first and last digits is equal to the third digit. Finally, the sum of the second and fourth digits is twice the sum of the other two digits. What is the third digit of the number?

- (a) 5                      (b) 8                      (c) 1                      (d) 4

30. A piece of string is 40 centimetres long. It is cut into three pieces. The longest piece is 3 times as long as the middle-sized piece and the shortest piece is 23 centimetres shorter than the longest piece. Find the length of the shortest piece.

- A. 27                      B. 5                      C. 4                      D. 9

31. The present ratio of student to teacher at a certain school is 30 to 1. If the student enrollment were to increase by 50 student and the number of teacher were to increase by 5, the ratio of student to teachers would then be 25 to 1. what is the present number of teachers?

- a) 10                      b) 12                      c) 15  
d) 16

### Simple Interest

**1. Principal:** The money borrowed or lent out for a certain period is called the principal or the sum.

**2. Interest:** Extra money paid for using other's money is called interest.

### 3. Simple Interest (S.I.):

If the interest on a sum borrowed for certain period is reckoned uniformly, then it is called simple interest.

Let Principal = P, Rate = R% per annum (p.a.) and Time = T years. Then

$$(i). \text{ Simple Interest} = \left( \frac{P \times R \times T}{100} \right)$$

$$(ii). P = \left( \frac{100 \times S.I.}{R \times T} \right); R = \left( \frac{100 \times S.I.}{P \times T} \right) \text{ and } T = \left( \frac{100 \times S.I.}{P \times R} \right)$$

### PRACTICE QUESTIONS

Find the SI for :-

P = Rs.1000, R = 10%, N = 2 years

P = Rs.1200, R = 15%, N = 4 years

P = Rs.8000, R = 21%, N = 2 years

1) P = Rs.1500, SI = Rs.450, N = 2 years. Find R.

2) 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. 00

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                      D.Rs.8925                      E. None of these

4) 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

5) 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?

A. 3.6    B. 6                      C. 18                      D. Cannot be determined                      E. None of these

6) 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

7) A sum of Rs.12,500 amounts to Rs.15,500 in 4 years at the rate of simple interest. What is the rate of interest?

A. 3%    B. 4%                      C. 5%                      D. 6%                      E. None of these

8) An automobile financier claims to be lending money at simple interest, but he includes the interest every six months for calculating the principal. If he is charging an interest of 10%, the effective rate of interest becomes:

A. 10%                      B. 10.25%                      C. 10.5%                      D. None of these

- 9) 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.  $7\frac{1}{8}\%$                       D. 10%
- 10) A sum of Rs. 725 is lent in the beginning of a year at a certain rate of interest. After 8 months, a sum of Rs. 362.50 more is lent but at the rate twice the former. At the end of the year, Rs. 33.50 is earned as interest from both the loans. What was the original rate of interest?  
A. 3.6%                      B. 4.5%                      C. 5%                      D. 6%                      E. None of these
- 11) A man took loan from a bank at the rate of 12% p.a. simple interest. After 3 years he had to pay Rs. 5400 interest only for the period. The principal amount borrowed by him was:  
A. Rs.2000                      B. Rs.10,000                      C. Rs.15,000                      D. Rs.20,000
- 12) A sum of money amounts to Rs.9800 after 5 years and Rs.12005 after 8 years at the same rate of simple interest. The rate of interest per annum is:  
A. 5%                      B. 8%                      C. 12%                      D. 15%
- 13) 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
- 14) 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. Cannot be determined      E. None of these
- 15) A person borrows Rs.5000 for 2 years at 4% p.a. simple interest. He immediately lends it to another person at 6 p.a for 2 years. Find his gain in the transaction per year.  
A. Rs.112.50                      B. Rs.125                      C. Rs.150                      D. Rs.167.50
- 16) John deposited \$10,000 to open a new saving account that earned 4 percent annual interests, compounded quarterly. If there were no other transactions in the account, what was the amount of money in John's account 6 month after the account was opened?  
A \$10,100      B. \$10,101                      C. \$10,200                      D. \$10,201      E. \$10,400
- 17) Pat invested x dollars in a fund that paid 8 percent annual interest, compounded annually. Which of the following represents the value, in dollars, of Pat's investment plus interest at the end of 5 years?  
A.  $5(0.08x)$       B.  $5(1.08x)$                       C.  $[1 + 5(0.08)] x$       D.  $(1.08)^5 x$                       E.  $(1.08x)^5$
- 18) A family made a down payment of \$75 and borrowed the balance on a set of encyclopedias that cost \$400. The balance with interest was paid in 23 monthly payments of \$16 each and a final payment of \$9. The amount of interest paid was what percent of the amount borrowed?  
A. 6%                      B. 12%                      C. 14%                      D. 16%                      E. 20%
- 19) If a certain sum of money at SI doubles itself in 5 years then what is the rate?  
a) 5%                      b) 20%                      c) 25%                      d) 14.8%

## Compound Interest

1. Let Principal = P, Rate = R% per annum, Time = n years.

2. When interest is compound Annually:

$$\text{Amount} = P \left[ 1 + \frac{(R/2)}{100} \right]^n$$

3. When interest is compounded Half-yearly:

$$\text{Amount} = P \left[ 1 + \frac{(R/2)}{100} \right]^{2n}$$

4. When interest is compounded Quarterly:

$$\text{Amount} = P \left[ 1 + \frac{(R/4)}{100} \right]^{4n}$$

5. When interest is compounded Annually but time is in fraction, say  $3\frac{2}{5}$  years.

$$\text{Amount} = P \left[ 1 + \frac{R}{100} \right]^3 \times \left[ 1 + \frac{\frac{2}{5}R}{100} \right]$$

6. When Rates are different for different years, say R<sub>1</sub>%, R<sub>2</sub>%, R<sub>3</sub>% for 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> year respectively.

$$\text{Then, Amount} = P \left[ 1 + \frac{R_1}{100} \right] \left[ 1 + \frac{R_2}{100} \right] \left[ 1 + \frac{R_3}{100} \right]$$

7. Present worth of Rs. x due n years hence is given by:

$$\text{Present Worth} = \frac{X}{\left[ 1 + \frac{R}{100} \right]^n}$$

### PRACTICE QUESTIONS

- 1) P = Rs.2000, R = 10%, N = 1 year. Find CI if interest compounded half-yearly.
- 2) P = Rs.2000, R = 20%, N = 0.5 years. Find CI if interest compounded quarterly.
- 3) A bank offers 5% compound interest calculated on half-yearly basis. A customer deposits Rs.1600 each on 1st January and 1st July of a year. At the end of the year, the amount he would have gained by way of interest is:  
A. Rs.120      B. Rs.121      C. Rs.122      D. Rs.123
- 4) The difference between simple and compound interests compounded annually on a certain sum of money for 2 years at 4% per annum is Re. 1. The sum (in Rs.) is:  
A. 625      B. 630      C. 640      D. 650
- 5) The difference between CI and SI for 3 years at 10% p.a is Rs.279. Find the principal.  
A. Rs.700      B. Rs.800      C. Rs.7000      D. Rs.9000
- 6) There is 60% increase in an amount in 6 years at simple interest. What will be the compound interest of Rs. 12,000 after 3 years at the same rate?  
A. Rs.2160      B. Rs.3120      C. Rs.3972      D. Rs.6240      E. None of these
- 7) The compound interest on Rs.30,000 at 7% per annum is Rs.4347. The period (in years) is:  
A. 2      B.  $2\frac{1}{2}$       C. 3      D. 4

- 8) The CI for two years on a principal of Rs.800 is Rs.352. Find the rate of interest.  
A. 5                      B. 10                      C. 15                      D. 20
- 9) Albert invested an amount of Rs. 8000 in a fixed deposit scheme for 2 years at compound interest rate 5 p.c.p.a. How much amount will Albert get on maturity of the fixed deposit?  
A. Rs.8600              B. Rs.8620              C. Rs.8820              D. None of these
- 10) The effective annual rate of interest corresponding to a nominal rate of 6% per annum payable half-yearly is:  
A. 6.06%              B. 6.07%              C. 6.08%              D. 6.09%
- 11) Simple interest on a certain sum of money for 3 years at 8% per annum is half the compound interest on Rs.4000 for 2 years at 10% per annum. The sum placed on simple interest is:  
A. Rs.1550              B. Rs.1650              C. Rs.1750              D. Rs.2000
- 12)  $P = \text{Rs.}1000$ ,  $R = 10\%$ ,  $N = 2$  years. Find the difference between CI and SI.
- 13) The difference between compound interest and simple interest on an amount of Rs.15,000 for 2 years is Rs.96. What is the rate of interest per annum?  
A. 8              B. 10              C. 12              D. Cannot be determined              E. None of these
- 14) The difference between CI and SI for 3 years at 10% p.a is Rs.279. Find the principal.  
A. Rs.700              B. Rs.800              C. Rs.7000              D. Rs.9000
- 15) What is the difference between the compound interests on Rs.5000 for 1 years at 4% per annum compounded yearly and half-yearly?  
A. Rs.2.04              B. Rs.3.06              C. Rs.4.80              D. Rs.8.30

## Stocks & Shares

### 1. Stock Capital:

The total amount of money needed to run the company is called the stock capital.

### 2. Shares or Stock:

The whole capital is divided into small units, called shares or stock.

For each investment, the company issues a 'share-certificate', showing the value of each share and the number of shares held by a person. The person who subscribes in shares or stock is called a shareholder or stock holder.

### 3. Dividend:

The annual profit distributed among shareholders is called dividend. Dividend is paid annually as per share or as a percentage.

### 4. Face Value:

The value of a share or stock printed on the share-certificate is called its Face Value or Nominal Value or Par Value.

### 5. Market Value:

The stock of different companies are sold and bought in the open market through brokers at stock-exchanges. A share or stock is said to be:

- i) At premium or Above par, if its market value is more than its face value.
- ii) At par, if its market value is the same as its face value.
- iii) At discount or Below par, if its market value is less than its face value.

Thus, if a Rs.100 stock is quoted at premium of 16, then market value of the stock = Rs.100 + 16 (= 116)

Likewise, if a Rs.100 stock is quoted at a discount of 7, then market value of the stock = Rs. 100 - 7 (= 93)

### 6. Brokerage:

The broker's charge is called brokerage.

- (i) When stock is purchased, brokerage is added to the cost price.
- (ii) When stock is sold, brokerage is subtracted from the selling price.

### 7. Remember:

- i) The face value of a share always remains the same.
- ii) The market value of a share changes from time to time.
- iii) Dividend is always paid on the face value of a share.
- iv) Number of shares held by a person

$$= \frac{\text{Total Investment}}{\text{Investment in 1 share}} = \frac{\text{Total Income}}{\text{Income from 1 share}} = \frac{\text{Total Face Value}}{\text{Face of 1 share}}$$

### 8. Thus, by a Rs.100, 9% stock at 120, we mean that:

- i) Face Value of stock = Rs.100.
- ii) Market Value (M.V) of stock = Rs.120.
- iii) Annual dividend on 1 share = 9% of face value = 9% of Rs.100 = Rs.9.
- iv) An investment of Rs.120 gives an annual income of Rs.9.
- v) Rate of interest p.a = Annual income from an investment of Rs.100

$$= \left[ \frac{9}{120} \times 100 \right] \% = 7\frac{1}{2} \%$$



**PRACTICE QUESTIONS**

1. In order to obtain an income of Rs.650 from 10% stock at Rs.96, one must make an investment of:  
A. Rs.3100                      B. Rs.6240                      C. Rs.6500                      D. Rs.9600
2. A man bought 20 shares of Rs.50 at 5 discount, the rate of dividend being 13 . The rate of interest obtained is:  
A.  $12\frac{1}{2}\%$                       B.  $13\frac{1}{2}\%$                       C. 15%                      D.  $16\frac{2}{3}\%$
3. Which is better investment: 11% stock at 143 or 9 % stock at 117?  
A. 11% stock at 143                      B.  $9\frac{3}{4}\%$  stock at 117                      C. Both are equally good  
D. Cannot be compared, as the total amount of investment is not given.
4. A man buys Rs.20 shares paying 9% dividend. The man wants to have an interest of 12% on his money. The market value of each share is:  
A. Rs.12                      B. Rs.15                      C. Rs.18                      D. Rs.21
5. By investing in 16 % stock at 64, one earns Rs.1500. The investment made is:  
A. Rs.5640                      B. Rs.5760                      C. Rs.500                      D. Rs.9600
6. A 6% stock yields 8%. The market value of the stock is:  
A. Rs.48                      B. Rs.75                      C. Rs.96                      D. Rs.133.33
7. A man invested Rs.4455 in Rs.10 shares quoted at Rs.8.25. If the rate of dividend be 12%, his annual income is:  
A. Rs.207.40                      B. Rs.534.60                      C. Rs.648                      D. Rs.655.60
8. Rs.9800 are invested partly in 9% stock at 75 and 10% stock at 80 to have equal amount of incomes. The investment in 9% stock is:  
A. Rs.4800                      B. Rs.5000                      C. Rs.5400                      D. Rs.5600
9. A man invests some money partly in 9% stock at 96 and partly in 12% stock at 120. To obtain equal dividends from both, he must invest the money in the ratio:  
A. 3 : 4                      B. 3 : 5                      C. 4 : 5                      D. 16 : 15
10. By investing Rs.1620 in 8% stock, Michael earns Rs.135. The stock is then quoted at:  
A. Rs.80                      B. Rs.96                      C. Rs.106                      D. Rs.108
11. A man invested Rs.1552 in a stock at 97 to obtain an income of Rs.128. The dividend from the stock is:  
A. 7.5%                      B. 8%                      C. 9.7%                      D. None of these
12. A 12% stock yielding 10% is quoted at:  
A. Rs.83.33                      B. Rs.110                      C. Rs.112                      D. Rs.120
13. The market value of a 10.5% stock, in which an income of Rs.756 is derived by investing Rs.9000, brokerage being  $\frac{1}{4}\%$ , is:  
A. Rs.108.25                      B. Rs.112.20                      C. Rs.124.75                      D. Rs.125.25
14. The cost price of a Rs.100 stock at 4 discount, when brokerage is  $\frac{1}{4}\%$

A. Rs.95.75

B. Rs.96

C. Rs.96.25

D. Rs.104.25

15. Sakshi invests a part of Rs.12,000 in 12% stock at Rs.120 and the remainder in 15% stock at Rs.125. If his total dividend per annum is Rs.1360, how much does he invest in 12% stock at Rs.120?

A. Rs.4000

B. Rs.4500

C. Rs.5500

D. Rs.6000

16. Shabnam is considering three alternatives to invest her surplus cash for a week. She wishes to guarantee maximum returns on her investment. She has three options, each of which can be utilized fully or partially in conjunction with others.

Option A: Invest in a public sector bank. It promises a return of +0.10%.

Option B: Invest in mutual funds of ABC Ltd. A rise in the stock market will result in a return of +5%, while a fall will entail a return of -3%.

Option C: Invest in mutual funds of CBA Ltd. A rise in the stock market will result in a return of -2.5%, while a fall will entail a return of +2%.

The maximum guaranteed return to Shabnam is

A. 0.25%

B. 0.10%

C. 0.20%

D. 0.15%

E. 0.30%

17. Shabnam is considering three alternatives to invest her surplus cash for a week. She wishes to guarantee maximum returns on her investment. She has three options, each of which can be utilized fully or partially in conjunction with others.

Option A: Invest in a public sector bank. It promises a return of +0.10%.

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Option C: Invest in mutual funds of CBA Ltd. A rise in the stock market will result in a return of -2.5%, while a fall will entail a return of +2%.

What strategy will maximize the guaranteed return to Shabnam?

(1) 100 % in option A

(2) 36 % in option B and 64% in option C

(3) 64 % in option B and 36% in option C

(4) 1/3 in each of the three options

(5) 30 % in option A, 32% in option B and 38% in option C

## Profit, Loss and Discount

### 1. Cost Price:

The price, at which an article is purchased, is called its cost price, abbreviated as C.P.

### 2. Selling Price:

The price, at which an article is sold, is called its selling price, abbreviated as S.P.

### 3. Profit or Gain:

If S.P. is greater than C.P., the seller is said to have a profit or gain.

Loss:

If S.P. is less than C.P., the seller is said to have incurred a loss.

### IMPORTANT FORMULAE

a.  $\text{Gain} = (\text{S.P.}) - (\text{C.P.})$

b.  $\text{Loss} = (\text{C.P.}) - (\text{S.P.})$

c. Loss or gain is always reckoned on C.P.

d. Gain Percentage: (Gain %)  $\text{Gain \%} = \left( \frac{\text{Gain} \times 100}{\text{C.P.}} \right)$

e. Loss Percentage: (Loss %)  $\text{Loss \%} = \left( \frac{\text{Loss} \times 100}{\text{C.P.}} \right)$

f. Selling Price: (S.P.)  $\text{SP} = \left[ \frac{(100 + \text{Gain \%})}{100} \times \text{C.P.} \right]$

g. Selling Price: (S.P.)  $\text{SP} = \left[ \frac{(100 - \text{Loss \%})}{100} \times \text{C.P.} \right]$

h. Cost Price: (C.P.)  $\text{C.P.} = \left[ \frac{100}{(100 + \text{Gain \%})} \times \text{S.P.} \right]$

i. Cost Price: (C.P.)  $\text{C.P.} = \left[ \frac{100}{(100 - \text{Loss \%})} \times \text{S.P.} \right]$

j. If an article is sold at a gain of say 35%, then S.P. = 135% of C.P.

k. If an article is sold at a loss of say, 35% then S.P. = 65% of C.P.

l. When a person sells two similar items, one at a gain of say x%, and the other at a loss of x%, then the seller always incurs a loss given by:

$$\text{Loss \%} = \left[ \frac{\text{Common Loss and Gain \%}}{10} \right]^2 = \left( \frac{x}{y} \right)^2$$

m. If a trader professes to sell his goods at cost price, but uses false weights, then

$$\text{Gain \%} = \left[ \frac{\text{Error}}{(\text{True Value})(\text{Error})} \times 100 \right] \%$$

## PRACTICE QUESTIONS

1. Find the Profit/Loss percentage:-

- (1) CP = Rs.600, SP = Rs.900
- (2) CP = Rs.1600, SP = Rs.1200
- (3) CP = Rs.750, SP = Rs.1000
- (4) CP = Rs.900, SP = Rs.1050
- (5) CP = Rs.880, SP = Rs.990

2. Alfred buys an old scooter for Rs. 4700 and spends Rs. 800 on its repairs. If he sells the scooter for Rs. 5800, his gain percent is:

- A.  $4\frac{4}{7}\%$       B.  $5\frac{5}{11}\%$       C. 10%      D. 12%

3. If selling price is doubled, the profit triples. Find the profit percent.

- A.  $66\frac{2}{3}$       B. 100      C.  $105\frac{1}{3}$       D. 120

4. In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit?

- A. 30%      B. 70%      C. 100%      D. 250%

5. A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?

- A. 3      B. 4      C. 5      D. 6

6. The percentage profit earned by selling an article for Rs.1920 is equal to the percentage loss incurred by selling the same article for Rs.1280. At what price should the article be sold to make 25% profit?

- A. Rs.2000      B. Rs.2200      C. Rs.2400      D. Data inadequate

7. A shopkeeper expects a gain of 22.5% 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

8. A man buys a cycle for Rs.1400 and sells it at a loss of 15%. What is the selling price of the cycle?

- A. Rs.1090      B. Rs.1160      C. Rs.1190      D. Rs.1202

9. Sam purchased 20 dozens of toys at the rate of Rs.375 per dozen. He sold each one of them at the rate of Rs.33. What was his percentage profit?

- A. 3.5      B. 4.5      C. 5.6      D. 6.5

10. Some articles were bought at 6 articles for Rs.5 and sold at 5 articles for Rs.6. Gain percent is:

- A. 30%      B.  $33\frac{1}{3}\%$       C. 35%      D. 44%

11. On selling 17 balls at Rs.720, there is a loss equal to the cost price of 5 balls. The cost price of a ball is:

- A. Rs.45      B. Rs.50      C. Rs.55      D. Rs.60

12. When a plot is sold for Rs.18,700, the owner loses 15%. At what price must that plot be sold in order to gain 15%?

- A. Rs.21,000      B. Rs.22,500      C. Rs.25,300      D. Rs.25,800

13. 100 oranges are bought at the rate of Rs.350 and sold at the rate of Rs.48 per dozen. The percentage of profit or loss is:

- A.  $14\frac{2}{7}\%$  gain                      B. 15% gain                      C.  $14\frac{2}{7}\%$  loss                      D. 15 % loss

14. A shopkeeper sells one transistor for Rs.840 at a gain of 20% and another for Rs.960 at a loss of 4%. His total gain or loss percent is:

- A.  $5\frac{15}{17}\%$  loss                      B.  $5\frac{15}{17}\%$  gain                      C.  $6\frac{2}{3}\%$  gain                      D. None of these

15. A trader mixes 26 kg of rice at Rs.20 per kg with 30 kg of rice of other variety at Rs.36 per kg and sells the mixture at Rs.30 per kg. His profit percent is:

- A. No profit, no loss                      B. 5%                      C. 8%                      D. 10%                      E. None of these

16. A cycle dealer marks his goods 25% above the cost price and allows a discount of 8% on it. Find his profit margin.

17. Sam buys an article with 25% discount on its list price. He makes a profit of 10% by selling it at \$660. Find the list price.

18. The markup on a television set is 20 percent of the cost. The markup is what percent of the selling price? (markup = selling price - cost)

- (A) 8%                      (B) 10%                      (C)  $12\frac{1}{2}\%$                       (D) 15%                      (E)  $16\frac{2}{3}\%$

19. At Harry's discount hardware everything is at 20% less than the price marked. If harry buys a tool kit \$80, what price should he mark them if he wants to make 20% profit on his cost?

- A. \$96                      B. \$100                      C. \$112                      D. \$120                      E. \$125

20. The cost price of 20 articles is the same as the selling price of x articles. If the profit is 25%, then the value of x is:

- A. 15                      B. 16                      C. 18                      D. 25

21. Profit earned by selling an article for Rs.1060 is 20% more than the loss incurred by selling the article for Rs.950. At what price should the article be sold to earn 20% profit?

- (a)Rs.980                      (b) Rs.1080                      (c) Rs.1800                      (d) None of these

22. On an order of 5 dozen boxes of a consumer product, a retailer receives an extra dozen free. This is equivalent to allowing him a discount of:

- (a)15%                      (b) $16\frac{1}{6}\%$                       (c) $16\frac{2}{3}\%$                       (d)20%

23. If a company sells a car with a marked price of Rs.2,72,000 and gives a discount of 4% on Rs.2,00,000 and 2.5% on the remaining amount Of Rs.72,000, then the actual price charged by the company for the car is:

- (a)Rs.2,50,000                      (b)Rs.2,55,000                      (c)Rs.2,60,100                      (d)Rs.2,62,200

24. Find the selling price of an article if a shopkeeper allows two successive discounts of 5% each on the marked price of Rs.80.

- (a)Rs.70.10                      (b)Rs.1440                      (c)Rs.72                      (d)Rs.72.20

25. A trade marked the price of his commodity so as to include a profit of 25%. He allowed discount of 16% on the marked price .His actual profit was:

- (a)5%                      (b)9%                      (c)16%                      (d)25%

26. 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%

27. If on selling 12 notebooks, a seller makes a profit equal to the selling price of 4 notebooks, what is his percent profit?

- (a) $16\frac{2}{3}$                       (b)25                      (c)50                      (d)Data inadequate                      (e)None of these

28. A man buys eggs at 2 for Re.1 and an equal number at 3 for Rs.2 and sells the whole at 5 for Rs.3.His gain or loss percent is:

- (a) $2\frac{2}{7}$ loss                      (b)  $3\frac{6}{7}$ gain                      (c)  $3\frac{2}{7}$ loss                      (d)  $2\frac{6}{7}$  gain

29. A shopkeeper sells two watches for Rs.308each .On one he gets 12%profit and on the other 12%loss.His profit or loss in the entire transaction was:

- (a)Neither profit, nor loss                      (b)  $1\frac{11}{25}$ %loss                      (c)  $1\frac{11}{25}$ %profit                      (d)  $3\frac{2}{25}$ %loss

30. A business man sold  $\frac{2}{3}$  of his stock at a gain of 20% and the rest at a gain of 14%.The over all percentage of gain to the business man is:

- (a)12%                      (b)17%                      (c)18%                      (d)20%

31. A grocer sells rice at a profit of10%and weights which are 20%less than the market weight. The total gain earned by him will be :

- (a)30%                      (b)11%                      (c)37.5%                      (d)None of these

32. A man purchased a box full of pencils at the rate of 7 for Rs.9 and sold all of them at the rate of 8 for Rs.11.In this transaction, he gained Rs.10.How many pencils did the box contain?

- (a)Rs.4                      (b)Rs.5                      (c)Rs.6                      (d)Rs.7

33. If two articles are sold at Rs. 25.One at 25% gain and another at 20% loss. Then what is the overall loss or gain?

- a) 1% gain                      b) 1% loss                      c) 1.2%gain                      d) 1.2%loss                      e) None of them

34. Fun Shoes is selling all styles and sizes of shoes at a flat rate of Rs. 1,000, with a weekly sales volume of 500. It is making a handsome gross margin of 25% on all sales. Through consumer research it has found that if it drops its prices by 10%, its sales will go up by 25%. Should Fun Shoes go ahead with a price drop of 10%? Why or why not?

## Partnership

**Partnership:** When two or more than two persons run a business jointly, they are called **partners** and the deal is known as **partnership**.

**Ratio of Divisions of Gains:** When investments of all the partners are for the same time, the gain or loss is distributed among the partners in the ratio of their investments.

Suppose A and B invest Rs.  $x$  and Rs.  $y$  respectively for a year in a business, then at the end of the year:

(A's share of profit) : (B's share of profit) =  $x : y$ .

When investments are for different time periods, then equivalent capitals are calculated for a unit of time by taking (capital  $\times$  number of units of time). Now gain or loss is divided in the ratio of these capitals.

Suppose A invests Rs.  $x$  for  $p$  months and B invests Rs.  $y$  for  $q$  months then,

(A's share of profit) : (B's share of profit) =  $xp : yq$ .

**Working and Sleeping Partners:** A partner who manages the the business is known as a **working partner** and the one who simply invests the money is a **sleeping partner**.

### PRACTICE QUESTIONS

1. A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is:

- A. Rs. 1425                      B. Rs. 1500                      C. Rs. 1537.50                      D. Rs. 1576

2. 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

3. A, B and C enter into a partnership in the ratio : : . After 4 months, A increases his share 50%. If the total profit at the end of one year be Rs. 21,600, then B's share in the profit is:

- A. Rs. 2100                      B. Rs. 2400                      C. Rs. 3600                      D. Rs. 4000

4. A, B, C subscribe Rs. 50,000 for a business. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35,000, A receives:

- A. Rs. 8400                      B. Rs. 11,900                      C. Rs. 13,600                      D. Rs. 14,700

5. Three partners shared the profit in a business in the ratio 5 : 7 : 8. They had partnered for 14 months, 8 months and 7 months respectively. What was the ratio of their investments?

- A. 5 : 7 : 8                      B. 20 : 49 : 64                      C. 38 : 28 : 21                      D. None of these

6. A starts 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

7. A and B entered into partnership with capitals in the ratio 4 : 5. After 3 months, A withdrew of his capital and B withdrew of his capital. The gain at the end of 10 months was Rs. 760. A's share in this profit is:

- A. Rs.330                      B. Rs.360                      C. Rs.380                      D. Rs.430

8. 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

9. A and B started a partnership business investing some amount in the ratio of 3 : 5. C joined then after six months with an amount equal to that of B. In what proportion should the profit at the end of one year be distributed among A, B and C?

- A. 3 : 5 : 2                      B. 3 : 5 : 5                      C. 6 : 10 : 5                      D. Data inadequate

10. A began a business with Rs.85,000. He was joined afterwards by B with Rs.42,500. For how much period does B join, if the profits at the end of the year are divided in the ratio of 3 : 1?

- A. 4 months                      B. 5 months                      C. 6 months                      D. 8 months



## Mixtures and Alligations

### 1. Alligation:

It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of desired price.

### 2. Mean Price:

The cost of a unit quantity of the mixture is called the mean price.

### 3. Rule of Alligation:

If two ingredients are mixed, then

$$\left( \frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} \right) = \left( \frac{\text{C.P. of dearer} - \text{Mean Price}}{\text{Mean price} - \text{C.P. of cheaper}} \right)$$

We present as under:

C.P. of a unit quantity of cheaper (c)

C.P. of a unit quantity of dearer (d)

Mean Price (m)

(d - m) : (m - c)

∴ (Cheaper quantity) : (Dearer quantity) = (d - m) : (m - c).

4. Suppose 'a' container contains 'x' liquid from which 'y' units are taken out and replaced by water.

After n operations, the quantity of pure liquid =  $\left[ x \left( 1 - \frac{y}{x} \right)^n \right]$

### PRACTICE QUESTIONS

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?

- A.  $\frac{1}{3}$                       B.  $\frac{1}{4}$                       C.  $\frac{1}{5}$                       D.  $\frac{1}{7}$

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:

- A. Rs. 169.50                      B. Rs. 170                      C. Rs. 175.50                      D. Rs. 180

3. A can contains a mixture of two liquids A and B is 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?

- A. 10                      B. 20                      C. 21                      D. 25

4. 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

5. 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

6. 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 %

C. 20%

D. 25%

7. 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

8. A container contains 40 litres of milk. From this container 4 litres of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container?

A. 26.34 litres

B. 27.36 litres

C. 28 litres

D. 29.16 litres

9. 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.  $\frac{1}{3}$ 

B.  $\frac{2}{3}$ 

C.  $\frac{2}{5}$ 

D.  $\frac{3}{5}$ 

10. In what ratio must water be mixed with milk to gain 16 % on selling the mixture at cost price?

A. 1 : 6

B. 6 : 1

C. 2 : 3

D. 4 : 3

11. 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

12. 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

13. 8 litres are drawn from a cask full of wine and is then filled with water. This operation is performed three more times. The ratio of the quantity of wine now left in cask to that of water is 16 : 65. How much wine did the cask hold originally?

A. 18 litres

B. 24 litres

C. 32 litres

D. 42 litres

14. 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

15. In objective test a correct ans score is 4 marks and on a wrong ans 2 marks are negated a student scores 480 marks from 150 questions. How many ans were correct?

A. 120

B. 130

C. 110

D. 150

16. A man buys spirit at Rs.60 per litter, Adds water to it and then sells it at Rs.75 per litter. What is the ratio of spirit to water, If his profit in the fill is 37.5%?

a) 9:1

b) 10:1

c) 11:1

d) None of These

## Time Speed & Distance

1.  $\text{Speed} = \frac{\text{Distance}}{\text{Time}}$ ,  $\text{Time} = \frac{\text{Distance}}{\text{Speed}}$ ,  $\text{Distance} = \text{Speed} \times \text{Time}$

**2. km/hr to m/sec conversion:**

$$x \text{ km/hr} = \left( x \times \frac{5}{18} \right) \text{ m/sec.}$$

**3. m/sec to km/hr conversion:**

$$x \text{ m/sec} = \left( x \times \frac{18}{5} \right) \text{ km/hr.}$$

4. If the ratio of the speeds of A and B is  $a : b$ , then the ratio of the time taken by them to cover the same distance is  $\frac{1}{a} : \frac{1}{b}$  Or  $b : a$ .

5. Suppose a man covers a certain distance at  $x$  km/hr and an equal distance at  $y$  km/hr. Then, the average speed during the whole journey is  $\frac{2xy}{x+y}$  km/hr.

### PRACTICE QUESTIONS

1. 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

2. 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

3. If a person walks at 14 km/hr instead of 10 km/hr, he would have walked 20 km more. The actual distance travelled by him is:

- A. 50 km                      B. 56 km                      C. 70 km                      D. 80 km

4. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B, 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:

- A. 100 kmph                      B. 110 kmph                      C. 120 kmph                      D. 130 kmph

5. Excluding stoppages, the speed of a bus is 54 kmph and including stoppages, it is 45 kmph. For how many minutes does the bus stop per hour?

- A. 9                      B. 10                      C. 12                      D. 20

6. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is:

- A. 1 hour                      B. 2 hours                      C. 3 hours                      D. 4 hours

7. A man complete a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.

- A. 220 km                      B. 224 km                      C. 230 km                      D. 234 km

8. The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 km in 4 hours, then the speed of the first train is:  
A. 70 km/hr                      B. 75 km/hr                      C. 84 km/hr                      D. 87.5 km/hr
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. 71.11 km/hr                      D. 71 km/hr
10. If a car goes from 10 m/s to a full stop, then its change in velocity is 10 m/s. If it decelerates at a rate of 2.5 m/s<sup>2</sup>, it will take 4s to stop. How far will this car travel when braking to a stop?  
A. 2 mtrs                      B. 12 mtrs                      C. 20 mtrs                      D. 22 mtrs
11. In covering a distance of 30 km, Abhay takes 2 hours more than Sameer. If Abhay doubles his speed, then he would take 1 hour less than Sameer. Abhay's speed is:  
A. 5 kmph                      B. 6 kmph                      C. 6.25 kmph                      D. 7.5 kmph
12. Robert is travelling on his cycle and has calculated to reach point A at 2 P.M. if he travels at 10 kmph, he will reach there at 12 noon if he travels at 15 kmph. At what speed must he travel to reach A at 1 P.M.?  
A. 8 kmph                      B. 11 kmph                      C. 12 kmph                      D. 14 kmph
13. It takes eight hours for a 600 km journey, if 120 km is done by train and the rest by car. It takes 20 minutes more, if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of the cars is:  
A. 2 : 3                      B. 3 : 2                      C. 3 : 4                      D. 4 : 3
14. A farmer travelled a distance of 61 km in 9 hours. He travelled partly on foot @ 4 km/hr and partly on bicycle @ 9 km/hr. The distance travelled on foot is:  
A. 14 km                      B. 15 km                      C. 16 km                      D. 17 km
15. A man covered a certain distance at some speed. Had he moved 3 kmph faster, he would have taken 40 minutes less. If he had moved 2 kmph slower, he would have taken 40 minutes more. The distance (in km) is:  
A. 35                      B.  $36\frac{2}{3}$                       C.  $37\frac{1}{2}$                       D. 40
16. If an object is moving at a speed of 36 Kilometres per hour, how many meters does it travel in one second?  
A. 10                      B. 36                      C. 100                      D. 360                      E. 1000
17. An object travels for 8.00 seconds with an average speed of 160 metres per second. The distance traveled by the object is  
A. 20 m                      B. 200 m                      C. 1280 m                      D. 2560 m
18. If a jet travels 815 kms per hour how many kms will it travel in 12 hours and 45 minutes?  
A. 10,052 kms                      B. 10,391 kms                      C. 12,281 kms                      D. 12,815 kms
19. A bus crossed  $\frac{3}{8}$  of the way between two cities. To the half of the way it remains 12 km. What is the length of the way (road) between two cities?  
A. 80 km                      B. 90 km                      C. 96 km                      D. 105 km

20. Rajat had covered one third of the total distance of his trip when his scooter failed. He then parked it and covered the remaining distance on foot, spending 20 times as long walking as riding. How many times was his riding speed more than his walking speed?

21. A person cover the distance from P to Q at the speed of 3 km/hr, from Q to P he covers it at 6 km/hr. What is the average speed /hr.

- A. 5km/hr                      B. 4km/hr                      C. 4.5km/hr                      D. 3.5km/hr

22. A man goes to work daily. Everyday his wife picks him from railway station at 6 o'clock. One day, he left office early and reached the station at 5 o'clock. So, he started walking home. On the way, he met his wife, and they returned together in the car. They reached home ten minutes earlier than usual time.

How much time did the man walk?

23. A person cover the distance from P to Q at the speed of 3 km/hr, from Q to P he covers it at 6 km/hr. What is the average speed /hr.

- A. 5km/hr                      B. 4km/hr                      C. 4.5km/hr                      D. 3.5km/hr

24. Three wheels make 36, 24, 60 rev/min. Each has a black mark on it. It is aligned at the start of the qn. When does it align again for the first time?

- A. 14 sec                      B. 20 sec                      C. 22 sec                      D. 5 sec

25. If a jet travels 815 kms per hour how many kms will it travel in 12 hours and 45 minutes?

- A. 10,052 kms                      B. 10,391 kms                      c) 12,281 kms                      d) 12,815 kms

26. In a race from pt. X to pt Y and back, Jack averages 30miles/hr to pt Y and 10 miles/hr back to pr X. Sandy averages 20 miles/hr in both directions. If Jack and Sandy start race at same time, who'll finish 1st

- a) Jack                      b) Sandy                      c) They Tie                      d) Impossible To Tell

27. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is:

- a) 1 hour                      b) 2 hours                      c) 3 hours                      d) 4 hours

28. A car takes 2 hours more to cover a distance of 480 km when its speed is reduced by 8 kmph. Find its usual speed.

- a) 48 kmph                      b) 55 kmph                      c) 60 kmph                      d) 64 kmph

29. Two boys starting from the same place walk at a rate of 5kmph and 5.5kmph respectively. What time will they take to be 8.5km apart, if they walk in the same direction?

- a) 17 hrs                      b) 25 hrs                      c) 31 hrs                      d) 45 hrs

30. Ashish and Bali run towards each other from P and Q respectively with respective speeds of 36 kmph and 45 kmph. After meeting each other if Ashish reaches Q in 5 hours, in how many hours will Bali reach P?

31. A man complete a journey in 10 hours. He travels first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.

- a) 220 km                      b) 224 km                      c) 230 km                      d) 234 km

32. If a man runs at 3m/s. How many km does he run in 1hr 40 min.?

- a) 18 km                                      b) 7 km                                      c) 12 km                                      d) 17 km

33. If a man travels at 30 km/hr, then he reaches his destination late by 10 minutes, but if he travels at 42 km/hr, then he reaches 10 minutes earlier. Therefore, the distance travelled by him is

- a) 36 km                                      b) 35 km                                      c) 40 km                                      d) 45 km

35. Sam is driving from City A to City C, which is a distance of 240 Kms. City B is exactly mid-way between City A and City C. Sam drives from City A to City B at a speed of 40 Km/hr and from City B to City C at 60K/Hr. What is Sam's average driving speed for the entire trip from City A to City C.

36. A man swims 12 km downstream and 10 km upstream. If he takes 2 hours each time, what is the speed of the stream?

SHRIRAM MANTRI VITA

## Problems on Trains

### 1. km/hr to m/s conversion:

$$a \text{ km/hr} = \left( a \times \frac{5}{18} \right) \text{ m/s.}$$

### 2. m/s to km/hr conversion:

$$a \text{ m/s} = \left[ a \times \frac{18}{5} \right] \text{ km/hr.}$$

3. Time taken by a train of length  $l$  metres to pass a pole or standing man or a signal post is equal to the time taken by the train to cover  $l$  metres.

4. Time taken by a train of length  $l$  metres to pass a stationary object of length  $b$  metres is the time taken by the train to cover  $(l + b)$  metres.

5. Suppose two trains or two objects bodies are moving in the same direction at  $u$  m/s and  $v$  m/s, where  $u > v$ , then their relative speed is  $= (u - v)$  m/s.

6. Suppose two trains or two objects bodies are moving in opposite directions at  $u$  m/s and  $v$  m/s, then their relative speed is  $= (u + v)$  m/s.

7. If two trains of length  $a$  metres and  $b$  metres are moving in opposite directions at  $u$  m/s and  $v$  m/s, then:

$$\text{The time taken by the trains to cross each other} = \frac{(a + b)}{(u + v)} \text{ sec.}$$

8. If two trains of length  $a$  metres and  $b$  metres are moving in the same direction at  $u$  m/s and  $v$  m/s, then:

$$\text{The time taken by the faster train to cross the slower train} = \frac{(a + b)}{(u - v)} \text{ sec.}$$

9. If two trains (or bodies) start at the same time from points A and B towards each other and after crossing they take  $a$  and  $b$  sec in reaching B and A respectively, then:

$$(A's \text{ speed}) : (B's \text{ speed}) = (b : a)$$

### PRACTICE QUESTIONS

1. A train running at the speed of 60 km/hr crosses a pole in 9 seconds. What is the length of the train?  
A. 120 metres                      B. 180 metres                      C. 324 metres                      D. 150 metres

2. A train 125 m long passes a man, running at 5 km/hr in the same direction in which the train is going, in 10 seconds. The speed of the train is:  
A. 45 km/hr                      B. 50 km/hr                      C. 54 km/hr                      D. 55 km/hr

3. The length of the bridge, which a train 130 metres long and travelling at 45 km/hr can cross in 30 seconds, is:  
A. 200 m                      B. 225 m                      C. 245 m                      D. 250 m

4. Two trains running in opposite directions cross a man standing on the platform in 27 seconds and 17 seconds respectively and they cross each other in 23 seconds. The ratio of their speeds is:  
A. 1 : 3                      B. 3 : 2                      C. 3 : 4                      D. None of these

5. A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 54 km/hr, what is the length of the platform?  
A. 120 m                                      B. 240 m                                      C. 300 m                                      D. None of these
6. Two trains of equal length are running on parallel lines in the same direction at 46 km/hr and 36 km/hr. The faster train passes the slower train in 36 seconds. The length of each train is:  
A. 50 m                                      B. 72 m                                      C. 80 m                                      D. 82 m
7. Two trains are moving in opposite directions @ 60 km/hr and 90 km/hr. Their lengths are 1.10 km and 0.9 km respectively. The time taken by the slower train to cross the faster train in seconds is:  
A. 36                                      B. 45                                      C. 48                                      D. 49
8. A jogger running at 9 kmph alongside a railway track in 240 metres ahead of the engine of a 120 metres long train running at 45 kmph in the same direction. In how much time will the train pass the jogger?  
A. 3.6 sec                                      B. 18 sec                                      C. 36 sec                                      D. 72 sec
9. Two trains are running at 40 km/hr and 20 km/hr respectively in the same direction. Fast train completely passes a man sitting in the slower train in 5 seconds. What is the length of the fast train?  
A. 23 m                                      B.  $23\frac{2}{9}$  m                                      C.  $27\frac{7}{9}$  m                                      D. 29 m
10. A train overtakes two persons walking along a railway track. The first one walks at 4.5 km/hr. The other one walks at 5.4 km/hr. The train needs 8.4 and 8.5 seconds respectively to overtake them. What is the speed of the train if both the persons are walking in the same direction as the train?  
A. 66 km/hr                                      B. 72 km/hr                                      C. 78 km/hr                                      D. 81 km/hr
11. Two stations A and B are 110 km apart on a straight line. One train starts from A at 7 a.m. and travels towards B at 20 kmph. Another train starts from B at 8 a.m. and travels towards A at a speed of 25 kmph. At what time will they meet?  
A. 9 a.m.                                      B. 10 a.m.                                      C. 10.30 a.m.                                      D. 11 a.m.
12. Calculate the time taken by the train moving at 25 km/hr in crossing a man moving in the same direction at 5 km/hr, if the length of the train is 250 meters.  
A. 60 Sec                                      B. 53 Sec                                      C. 45 Sec                                      D. 30 Sec                                      E. 15 Sec
13. There is a 200 miles long tunnel. One train enters the tunnel at a speed of 200mph while the other train enters the tunnel in the opposite direction at a speed of 1000 mph. A bee travels at a speed of 1500 mph enters the tunnel goes to and back until it reaches the train. What is the distance covered by the bee when the two train collides (the bee survives).
14. Two trains starting at the same time from a station. 60km apart and going in opposite direction cross each other at a distance of 150km from one of the station what is the ratio of their speed?
15. A train running at the speed of 60km/hr crosses a pole 9 seconds. What is the length of the train?  
a) 120 meters                                      b) 180 meters                                      c) 324 meters                                      d) 150 meters
16. Two trains X and Y (80 km from each other) are running towards each other on the same track at a speed of 40km/hr. A bird starts from the train X and travels towards train Y with constant speed of 100km/hr. Once it reaches train Y, it turns and starts moving toward train X. Like this it goes back and forth between the two trains till the trains collide with each other. Find the total distance travelled by the bird?



SMAVITA

## Time & Work

### 1. Work from Days:

If A can do a piece of work in  $n$  days, then A's 1 day's work =  $\frac{1}{n}$ .

### 2. Days from Work:

If A's 1 day's work =  $\frac{1}{n}$ , then A can finish the work in  $n$  days.

### 3. Ratio: If A is thrice as good a workman as B, then:

Ratio of work done by A and B = 3 : 1.

Ratio of times taken by A and B to finish a work = 1 : 3.

### PRACTICE QUESTIONS

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.  $\frac{1}{4}$       B.  $\frac{1}{10}$       C.  $\frac{7}{15}$       D.  $\frac{8}{15}$

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.  $9\frac{1}{5}$  days      B.  $9\frac{2}{5}$  days      C.  $9\frac{3}{5}$  days      D. 10

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

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.  $22\frac{1}{2}$  days      C. 25 days      D. 30 days

5. A alone can do a piece of work in 6 days and B alone in 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

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

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

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

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 days      D. 40 days

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.

11. 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. Cannot be determined                      E. None of these

12. 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.  $20\frac{3}{17}$  days                      D. None of these

13. 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

14. A certain number of persons could do a piece of work in 50 days. If there were 8 persons less, it would have been complete in 10 days more. The number of persons in the beginning was

- A. 56                      B. 48                      C. 40                      D. 32                      E. None of the above

15. 1400 men in a fort have a food grain stock for 28 days. After 3 days, 400 men leave the fort. How long will the stocks last now?

- A. 35 days    B. 32 days    C. 28 days    D. 30 days                      E. None of the above

16. Nine large pipes will drain a pond in eight hours and six small pipes will drain the same pond in sixteen hours. How long will it take 3 large pipes and 5 small pipes to drain the pond?

- A. 3 hours and 50 minutes                      B. 14 hours and 15 minutes  
C. 12 hours and 20 minutes                      D. 10 hours and 40 minutes

17. A lion can eat a sheep in 2, wolf in 3, and a dog in 6 hours. In what time would they all eat a sheep?

- A. 1 hour                      B. 2 hour                      C.  $\frac{1}{2}$  hour                      D. 3 hour

18. Peter can create 8 applications in 16 hours, and Patrik can format 18 applications in 12 hours. Working together, how many applications can they format in 20 hours?

19. Two pipes A and B can fill a tank in 36 hours and 46 hours respectively. If both the pipes are opened simultaneously, how much time will be taken to fill the tank?

- a) 18 hours                      b) 20 hours                      c) 16 hours                      d) 10 hours

20. In the middle of a round pool lays a beautiful water-lily. The water –lily doubles in size every day. After exactly 20 days the complete pool will be covered by the lily after how many days will half of the pool be covered by the water-lily?

21. The petrol tank of an automobile can hold g liters. If 'A' liters was removed when the tank was full, what part of the full tank was removed?

- a) g-a                      b) g/ a                      c) a/ g                      d) (g-a)/ a

22. If there are 20 people and 20 breads, A man can eat 3 breads, A women eats 2 bread and A child eats half bread. A man cannot eat more than 3 or less than 3 same with women and child. Find the no. of women, man and child.

23. 8 Kigs and 14 Ligs can do 510 tors of work in 10 days. 13 Kigs and 6 Ligs can do 484 tors of work in 12 days. Then find work done by Kigs and Ligs individually in tors/hr?

24. A tap can fill a cistren in 8 hrs and another can empty it in 16 hrs. If both the taps are open simultaneously the time in hrs to fill the tank is?

a) 8                                      b) 10                                      c) 16                                      d) 24

1. 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?

## Boats & Streams

### 1. Downstream/Upstream:

In water, the direction along the stream is called **downstream**. And, the direction against the stream is called **upstream**.

2. If the speed of a boat in still water is  $u$  km/hr and the speed of the stream is  $v$  km/hr, then:

Speed downstream =  $(u + v)$  km/hr.

Speed upstream =  $(u - v)$  km/hr.

3. If the speed downstream is  $a$  km/hr and the speed upstream is  $b$  km/hr, then:

Speed in still water =  $\frac{1}{2} (a + b)$  km/hr.

Rate of stream =  $\frac{1}{2} (a - b)$  km/hr.

### PRACTICE QUESTIONS

1. 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                      B. 3 hours                      C. 4 hours                      D. 5 hours

2. 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

3. A boat running upstream takes 8 hours 48 minutes to cover a certain distance, while it takes 4 hours to cover the same distance running downstream. What is the ratio between the speed of the boat and speed of the water current respectively?

A. 2 : 1                      B. 3 : 2                      C. 8 : 3                      D. Cannot be determined                      E. None of these

4. A motorboat, whose speed in 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                      B. 5                      C. 6                      D. 10

5. In one hour, a boat goes 11 km/hr along the stream and 5 km/hr against the stream. The speed of the boat in still water (in km/hr) is:

A. 3 km/hr                      B. 5 km/hr                      C. 8 km/hr                      D. 9 km/hr

6. 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

7. 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. 4 mph

8. A boat covers a certain distance downstream in 1 hour, while it comes back in 1 hours. If the speed of the stream be 3 kmph, what is the speed of the boat in still water?

A. 12 km/ph                      B. 13 kmph                      C. 14 kmph                      D. 15 kmph                      E. None of these

9. If man can travel with river 12 kmph and speed of river is 1.5 kmph. Find the speed of man upstream.

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### Chain Rule

**1. Direct Proportion:** Two quantities are said to be directly proportional, if on the increase (or decrease) of the one, the other increases (or decreases) to the same extent.

Eg. Cost is directly proportional to the number of articles.  
(More Articles, More Cost)

**2. Indirect Proportion:** Two quantities are said to be indirectly proportional, if on the increase of the one, the other decreases to the same extent and vice-versa.

Eg. The time taken by a car is covering a certain distance is inversely proportional to the speed of the car. (More speed, Less is the time taken to cover a distance.)

**Note:** In solving problems by chain rule, we compare every item with the term to be found out.

### PRACTICE QUESTIONS

- 3 pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day?  
A. 9                      B. 10                      C. 11                      D. 12
- If the cost of x metres of wire is d rupees, then what is the cost of y metres of wire at the same rate?  
A. Rs.  $(\frac{xy}{d})$                       B. Rs. (xd)                      C. Rs. (yd)                      D. Rs.  $(\frac{yd}{x})$
- Running at the same constant rate, 6 identical machines can produce a total of 270 bottles per minute. At this rate, how many bottles could 10 such machines produce in 4 minutes?  
A. 648                      B. 1800                      C. 2700                      D. 10800
- A fort had provision of food for 150 men for 45 days. After 10 days, 25 men left the fort. The number of days for which the remaining food will last, is:  
A.  $29\frac{1}{5}$                       B.  $37\frac{1}{4}$                       C. 42                      D. 54
- 39 persons can repair a road in 12 days, working 5 hours a day. In how many days will 30 persons, working 6 hours a day, complete the work?  
A. 10                      B. 13                      C. 14                      D. 15
- In a dairy farm, 40 cows eat 40 bags of husk in 40 days. In how many days one cow will eat one bag of husk?  
A. 1                      B.  $\frac{1}{40}$                       C. 40                      D. 80
- A wheel that has 6 cogs is meshed with a larger wheel of 14 cogs. When the smaller wheel has made 21 revolutions, then the number of revolutions made by the larger wheel is:  
A. 4                      B. 9                      C. 12                      D. 49
- If 7 spiders make 7 webs in 7 days, then 1 spider will make 1 web in how many days?  
A. 1                      B.  $\frac{7}{2}$                       C. 7                      D. 49

## Clocks

### 1. Minute Spaces:

The face or dial of watch is a circle whose circumference is divided into 60 equal parts, called minute spaces.

### 2. Hour Hand and Minute Hand:

A clock has two hands, the smaller one is called the **hour hand** or **short hand** while the larger one is called **minute hand** or **long hand**.

- i) In 60 minutes, the minute hand gains 55 minutes on the hour on the hour hand.
- ii) In every hour, both the hands coincide once.
- iii) The hands are in the same straight line when they are coincident or opposite to each other.
- iv) When the two hands are at right angles, they are 15 minute spaces apart.
- v) When the hands are in opposite directions, they are 30 minute spaces apart.
- vi) Angle traced by hour hand in 12 hrs =  $360^\circ$
- vii) Angle traced by minute hand in 60 min. =  $360^\circ$ .
- viii) If a watch or a clock indicates 8.15, when the correct time is 8, it is said to be 15 minutes too fast.  
On the other hand, if it indicates 7.45, when the correct time is 8, it is said to be 15 minutes too slow.

### PRACTICE QUESTIONS

- 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.  $180^\circ$
- 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.  $197\frac{1}{2}^\circ$
- A clock is started at noon. By 10 minutes past 5, the hour hand has turned through:  
A.  $145^\circ$       B.  $150^\circ$       C.  $155^\circ$       D.  $160^\circ$
- A watch which gains 5 seconds in 3 minutes was set right at 7 a.m. In the afternoon of the same day, when the watch indicated quarter past 4 o'clock, the true time is:  
A.  $59\frac{7}{15}$  min. past 3      B. 4 p.m.      C.  $58\frac{7}{11}$  min. past 3      D.  $2\frac{3}{11}$  min. past 4
- At what time between 7 and 8 o'clock will the hands of a clock be in the same straight line but, not together?  
A. 5 min. past 7      B.  $5\frac{2}{11}$  min. past 7      C.  $5\frac{3}{11}$  min. past 7      D.  $5\frac{5}{11}$  min. past 7
- At what time between 5.30 and 6 will the hands of a clock be at right angles?



- A.  $43\frac{5}{11}$  min. past 5                      B.  $43\frac{7}{11}$  min. past 5                      C. 40 min. past 5                      D. 45 min. past 5
7. 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.  $20^\circ$
8. How many times are the hands of a clock at right angle in a day?  
A. 22                      B. 24                      C. 44                      D. 48
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
10. 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
11. A watch which gains uniformly is 2 minutes low at noon on Monday and is 4 min. 48 sec fast at 2 p.m. on the following Monday. When was it correct?  
A. 2 p.m. on Tuesday                      B. 2 p.m. on Wednesday  
C. 3 p.m. on Thursday                      D. 1 p.m. on Friday
12. At what time after 4.00 p.m. is the minute's hand of a clock exactly aligned with the hour hand?  
4:21:49.5

## Calendars

### 1. Odd Days:

We are supposed to find the day of the week on a given date.

For this, we use the concept of 'odd days'.

In a given period, the number of days more than the complete weeks are called odd days.

### 2. Leap Year:

(i). Every year divisible by 4 is a leap year, if it is not a century.

(ii). Every 4th century is a leap year and no other century is a leap year.

Note: A leap year has 366 days.

### Examples:

i) Each of the years 1948, 2004, 1676 etc. is a leap year.

ii) Each of the years 400, 800, 1200, 1600, 2000 etc. is a leap year.

iii) None of the years 2001, 2002, 2003, 2005, 1800, 2100 is a leap year.

### 3. Ordinary Year:

The year which is not a leap year is called an **ordinary years**. An ordinary year has 365 days.

### 4. Counting of Odd Days:

i) 1 ordinary year = 365 days = (52 weeks + 1 day.)

∴ 1 ordinary year has 1 odd day.

ii) 1 leap year = 366 days = (52 weeks + 2 days)

∴ 1 leap year has 2 odd days.

iii) 100 years = 76 ordinary years + 24 leap years

=  $(76 \times 1 + 24 \times 2)$  odd days = 124 odd days.

= (17 weeks + days)  $\equiv$  5 odd days.

∴ Number of odd days in 100 years = 5.

Number of odd days in 200 years =  $(5 \times 2) \equiv 3$  odd days.

Number of odd days in 300 years =  $(5 \times 3) \equiv 1$  odd day.

Number of odd days in 400 years =  $(5 \times 4 + 1) \equiv 0$  odd day.

Similarly, each one of 800 years, 1200 years, 1600 years, 2000 years etc. has 0 odd days.

### 5. Day of the Week Related to Odd Days:

No. of days:	0	1	2	3	4	5	6
Day:	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.

### PRACTICE QUESTIONS

1. It was Sunday on Jan 1, 2006. What was the day of the week Jan 1, 2010?

A. Sunday

B. Saturday

C. Friday

D. Wednesday

2. What was the day of the week on 28th May, 2006?

A. Thursday

B. Friday

C. Saturday

D. Sunday

3. What was the day of the week on 17th June, 1998?

A. Monday

B. Tuesday

C. Wednesday

D. Thursday

4. What will be the day of the week 15th August, 2010?

- A. Sunday                      B. Monday                      C. Tuesday                      D. Friday

5. Today is Monday. After 61 days, it will be:

- A. Wednesday                      B. Saturday                      C. Tuesday                      D. Thursday

6. If 6th March, 2005 is Monday, what was the day of the week on 6th March, 2004?

- A. Sunday                      B. Saturday                      C. Tuesday                      D. Wednesday

7. On what dates of April, 2001 did Wednesday fall?

- A. 1st, 8th, 15th, 22nd, 29<sup>th</sup>                      B. 2nd, 9th, 16th, 23rd, 30th  
C. 3rd, 10th, 17th, 24<sup>th</sup>                      D. 4th, 11th, 18th, 25th

8. The last day of a century cannot be

- A. Monday                      B. Wednesday                      C. Tuesday                      D. Friday

9. The calendar for the year 2007 will be the same for the year:

- A. 2014                      B. 2016                      C. 2017                      D. 2018

10. On 8th Dec, 2007 Saturday falls. What day of the week was it on 8th Dec, 2006?

- A. Sunday                      B. Thursday                      C. Tuesday                      D. Friday

11. January 1, 2007 was Monday. What day of the week lies on Jan. 1, 2008?

- A. Monday                      B. Tuesday                      C. Wednesday                      D. Sunday

## Probability

**1. Experiment:** An operation which can produce some well-defined outcomes is called an experiment.

### **2. Random Experiment:**

An experiment in which all possible outcomes are known and the exact output cannot be predicted in advance, is called a random experiment.

Examples:

- i) Rolling an unbiased dice.
- ii) Tossing a fair coin.
- iii) Drawing a card from a pack of well-shuffled cards.
- iv) Picking up a ball of certain colour from a bag containing balls of different colours.

Details:

- v) When we throw a coin, then either a Head (H) or a Tail (T) appears.
- vi) A dice is a solid cube, having 6 faces, marked 1, 2, 3, 4, 5, 6 respectively. When we throw a die, the outcome is the number that appears on its upper face.
- vii) A pack of cards has 52 cards. It has 13 cards of each suit, name Spades, Clubs, Hearts and Diamonds.

Cards of spades and clubs are black cards. Cards of hearts and diamonds are red cards.

There are 4 honours of each unit. There are Kings, Queens and Jacks. These are all called face cards.

### **3. Sample Space:**

When we perform an experiment, then the set S of all possible outcomes is called the sample space.

Examples:

1. In tossing a coin,  $S = \{H, T\}$
2. If two coins are tossed, the  $S = \{HH, HT, TH, TT\}$ .
3. In rolling a dice, we have,  $S = \{1, 2, 3, 4, 5, 6\}$ .
4. Event:

Any subset of a sample space is called an event.

### **4. Probability of Occurrence of an Event:**

Let S be the sample and let E be an event. Then,  $E \subseteq S$ .

$$P(E) = \frac{n(E)}{n(S)}$$

### **5. Results on Probability:**

- i)  $P(S) = 1$
- ii)  $0 \leq P(E) \leq 1$
- iii)  $P(\phi) = 0$
- iv) For any events A and B we have:  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- v) If A denotes (not-A), then  $P(A) = 1 - P(A)$ .

## **PRACTICE QUESTIONS**

1. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5?

- A.  $\frac{1}{2}$       B.  $\frac{2}{5}$       C.  $\frac{8}{15}$       D.  $\frac{9}{20}$

2. A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

- A.  $\frac{10}{21}$       B.  $\frac{11}{21}$       C.  $\frac{2}{7}$       D.  $\frac{5}{7}$

3. In a box, there are 8 red, 7 blue and 6 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green?  
A.  $\frac{1}{3}$                       B.  $\frac{3}{4}$                       C.  $\frac{7}{19}$                       D.  $\frac{8}{21}$                       E.  $\frac{9}{21}$
4. What is the probability of getting a sum 9 from two throws of a dice?  
A.  $\frac{1}{6}$                       B.  $\frac{1}{8}$                       C.  $\frac{1}{9}$                       D.  $\frac{1}{12}$
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.  $\frac{7}{8}$
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.  $\frac{5}{16}$
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.  $\frac{25}{117}$                       C.  $\frac{1}{50}$                       D.  $\frac{3}{25}$
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.  $\frac{5}{7}$
9. From a pack of 52 cards, two cards are drawn together at random. What is the probability of both the cards being kings?  
A.  $\frac{1}{15}$                       B.  $\frac{25}{57}$                       C.  $\frac{35}{256}$                       D.  $\frac{1}{221}$
10. Two dice are tossed. The probability that the total score is a prime number is:  
A.  $\frac{1}{6}$                       B.  $\frac{5}{12}$                       C.  $\frac{1}{2}$                       D.  $\frac{7}{9}$
11. 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.  $\frac{1}{52}$
12. 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.  $\frac{2}{77}$
13. 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.  $\frac{13}{102}$
14. 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.  $\frac{1}{13}$                       B.  $\frac{3}{13}$                       C.  $\frac{1}{4}$                       D.  $\frac{9}{52}$

15. 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.  $\frac{3}{7}$

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## Permutation & combinations

### 1. Factorial Notation:

Let  $n$  be a positive integer. Then, factorial  $n$ , denoted  $n!$  is defined as:  $n! = n(n-1)(n-2) \dots 3 \cdot 2 \cdot 1$ .

Examples:

- i. We define  $0! = 1$ .
- ii.  $4! = (4 \times 3 \times 2 \times 1) = 24$ .
- iii.  $5! = (5 \times 4 \times 3 \times 2 \times 1) = 120$ .

### 2. Permutations:

The different arrangements of a given number of things by taking some or all at a time, are called permutations.

Examples:

- i) All permutations (or arrangements) made with the letters  $a, b, c$  by taking two at a time are  $(ab, ba, ac, ca, bc, cb)$ .
- ii) All permutations made with the letters  $a, b, c$  taking all at a time are:  
(  $abc, acb, bac, bca, cab, cba$  )

### 3. Number of Permutations:

Number of all permutations of  $n$  things, taken  $r$  at a time, is given by:

$${}^n P_r = n(n-1)(n-2) \dots (n-r+1) = \frac{n!}{(n-r)!}$$

Examples:

- i)  ${}^6 P_2 = (6 \times 5) = 30$ .
- ii)  ${}^7 P_3 = (7 \times 6 \times 5) = 210$ .
- iii) Cor. number of all permutations of  $n$  things, taken all at a time  $= n!$ .

### 4. An Important Result:

If there are  $n$  subjects of which  $p_1$  are alike of one kind;  $p_2$  are alike of another kind;  $p_3$  are alike of third kind and so on and  $p_r$  are alike of  $r$ th kind, such that  $(p_1 + p_2 + \dots + p_r) = n$ .

Then, number of permutations of these  $n$  objects is =  $\frac{n!}{(p_1!)(p_2!) \dots (p_r!)}$

### 5. Combinations:

Each of the different groups or selections which can be formed by taking some or all of a number of objects is called a combination.

Examples:

1. Suppose we want to select two out of three boys  $A, B, C$ . Then, possible selections are  $AB, BC$  and  $CA$ .
2. Note:  $AB$  and  $BA$  represent the same selection.
3. All the combinations formed by  $a, b, c$  taking  $ab, bc, ca$ .
4. The only combination that can be formed of three letters  $a, b, c$  taken all at a time is  $abc$ .
5. Various groups of 2 out of four persons  $A, B, C, D$  are:
6.  $AB, AC, AD, BC, BD, CD$ .
7. Note that  $ab$   $ba$  are two different permutations but they represent the same combination.
8. Number of Combinations:
9. The number of all combinations of  $n$  things, taken  $r$  at a time is:

$${}^n C_r = \frac{n!}{(r!)(n-r)!} = \frac{n(n-1)(n-2) \dots \text{to } r \text{ factors}}{r!}$$

**Note:**

$${}^n C_n = 1 \text{ and } {}^n C_0 = 1.$$

$${}^nC_r = {}^nC_{(n-r)}$$

### Examples:

$$\text{i) } {}^{11}C_4 = \frac{(11 \times 10 \times 9 \times 8)}{(4 \times 3 \times 2 \times 1)} = 330.$$

$$\text{ii) } {}^{16}C_{13} = {}^{16}C_{(16-13)} = {}^{16}C_3 = \frac{16 \times 15 \times 14}{3!} = \frac{16 \times 15 \times 14}{3 \times 2 \times 1} = 560.$$

### PRACTICE QUESTIONS

- 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
- 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
- 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. 5760
- 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
- In how many ways can the letters of the word 'LEADER' be arranged?  
A. 72      B. 144      C. 360      D. 720      E. None of these
- In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?  
A. 159      B. 194      C. 205      D. 209      E. None of these
- How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9, which are divisible by 5 and none of the digits is repeated?  
A. 5      B. 10      C. 15      D. 20
- A box contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the box, if at least one black ball is to be included in the draw?  
A. 32      B. 48      C. 64      D. 96      E. None of these
- In how many different ways can the letters of the word 'DETAIL' be arranged in such a way that the vowels occupy only the odd positions?  
A. 32      B. 48      C. 36      D. 60      E. 120
- How many 4-letter words with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed?  
A. 40      B. 400      C. 5040      D. 2520
- In how many different ways can the letters of the word 'MATHEMATICS' be arranged so that the vowels always come together?  
A. 10080      B. 4989600      C. 120960      D. None of these



12. In a chess tournament each of six players will play every other player exactly once. How many matches will be played during the tournament?  
A. 12                      B. 15                      C. 30                      D. 36
13. From a set of 16 points out of which 12 are collinear, how many triangles can be made.  
A. 240                      B. 290                      C. 340                      D. 390
14. A Certain organization has three committees. Only two persons are members of all committees. But every pair of committee has three members in common. What is the list possible no of members in any on committee?  
A. 4                      B. 5                      C. 6                      D. None of these
15. There are 12 yes or no questions. How many ways can these be answered?  
A. 1024                      B. 2048                      C. 4096m                      D. 12
16. How many numbers are there between 100 and 1000 such that at least one of their digits is 6?  
A. 312                      B. 128                      C. 256                      D.272
17. The number of diagonals that can be formed vertices of a heptagon is:  
A. 2                      B. 13                      C.14                      D.15
18. Five Speaker A, B, C, D, and E are to be scheduled to such that A must Speak immediately before B. In how many ways can their speeches be scheduled?  
A. 24                      B. 48                      C. 72                      D. 96
19. In a tournament 7 teams are participating. Each team plays with every other participating team once and the winner is decided by the total points accumulated by the teams at the end of all these matches. Find the total number of matches in the tournament.  
A. 7!                      B. 7! – 1                      C. 20                      D. 21
20. There are 5 letters and 5 directed envelopes. The number of ways in which all the letters can be put into correct envelope is:  
A. 119                      B. 44                      C. 59                      D. 1
21. There are 5 letters and 5 directed envelopes. The number of ways in which exactly 4 letters can be put into wrong envelope is:  
A. 119                      B. 0                      C. 59                      D. 40
22. Amit is an e-mail freak. He forwards every mail he receives to five of his friends. But if he receives a mail from Ramya (one of the five) he only forwards it to the remaining four. If all his five friends send him one e-mail each on Sunday then how many mails will he forward?  
A. 25                      B.24                      C. 22
2. Find the number of ways in which two socks can be chosen from 12 pair of socks such that they do not form a correct pair.  
A. 256                      B. 264                      C. 272                      D. 144
3. In a railway compartment there are two of seats facing each other with accommodation for 5in each. 4 wish to sit facing forward and 3 facing towards the rear while 3 others are indifferent. In how many ways can the 10 passengers be seated?  
A. 120                      B. 43200                      C. 720

4. The number of ways in which a committee of 5 can be chosen from 10 candidates so as to exclude the youngest if it includes the oldest is 164
- A. 176                      B. 184                      C. 196
5. Consider the set of numbers  $S = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10$ . You take every distinct two-element subset of  $S$  and write down the number that is larger. For example, if you take the subset 4, 6 you would write down the number 6 because it is larger than 4. What is the sum of all of the numbers that you write down?
- A. 330                      B. 360                      C. 340                      D. 380
6. In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?

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## Races & games

- 1. Races:** A contest of speed in running, riding, driving, sailing or rowing is called a race.
- 2. Race Course:** The ground or path on which contests are made is called a race course.
- 3. Starting Point:** The point from which a race begins is known as a starting point.
- 4. Winning Point or Goal:** The point set to bound a race is called a winning point or a goal.
- 5. Winner:** The person who first reaches the winning point is called a winner.
- 6. Dead Heat Race:** If all the persons contesting a race reach the goal exactly at the same time, the race is said to be dead heat race.
- 7. Start:** Suppose A and B are two contestants in a race. If before the start of the race, A is at the starting point and B is ahead of A by 12 metres, then we say that 'A gives B, a start of 12 metres'.

To cover a race of 100 metres in this case, A will have to cover 100 metres while B will have to cover only  $(100 - 12) = 88$  metres.

In a 100 race, 'A can give B 12 m' or 'A can give B a start of 12 m' or 'A beats B by 12 m' means that while A runs 100 m, B runs  $(100 - 12) = 88$  m.

**8. Games:** 'A game of 100, means that the person among the contestants who scores 100 points first is the winner'.

If A scores 100 points while B scores only 80 points, then we say that 'A can give B 20 points'.

### **PRACTICE QUESTIONS**

1. In a 100 m race, A can give B 10 m and C 28 m. In the same race B can give C:  
A. 18 m                      B. 20 m                      C. 27 m                      D. 9 m
2. A and B take part in 100 m race. A runs at 5 kmph. 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
3. 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
4. In a 100 m race, A beats B by 10 m and C by 13 m. In a race of 180 m, B will beat C by:  
A. 5.4 m                      B. 4.5 m                      C. 5 m                      D. 6 m
5. At a game of billiards, A can give B 15 points in 60 and A can give C to 20 points in 60. How many points can B give C in a game of 90?  
A. 30 points                      B. 20 points                      C. 10 points                      D. 12 points
6. In a race of 200 m, A can beat B by 31 m and C by 18 m. In a race of 350 m, C will beat B by:  
A. 22.75 m                      B. 25 m                      C. 19.5 m                      D.  $7\frac{4}{7}$  m

7. In a game of 100 points, A can give B 20 points and C 28 points. Then, B can give C:

- A. 8 points                      B. 10 points                      C. 14 points                      D. 40 points

8. Running a full marathon, Sundar ran the first half at an average pace of 13 kmph and the second half at 9 kmph. Tim averaged 11 kmph through the race. If they're starting time was the same, who finished first? \*\*\* A full marathon is 42 km.

9. In a race from pt. X to pt Y and back, Jack averages 30miles/hr to pt Y and 10 miles/hr back to pr X. Sandy averages 20 miles/hr in both directions. If Jack and Sandy start race at same time, who'll finish 1st

- a) Jack                      b) Sandy                      c) They Tie                      d) Impossible To Tell

10. In a race where 12 cars are running, the chance that car X will win is  $\frac{1}{6}$ , that Y will win is  $\frac{1}{10}$  and that Z will win is  $\frac{1}{8}$ . Assuming that a dead heat is impossible. Find the chance that one of them will win.

- a)  $\frac{47}{120}$                       b)  $\frac{1}{480}$                       c)  $\frac{1}{160}$                       d)  $\frac{1}{240}$

11. I participated in a race  $\frac{1}{5}$ th of those before me are equal to  $\frac{5}{6}$ th of those behind me. What is the minimum number of contestants in the race?

- a) 31                      b) 62                      c) 24                      d) 32

12. In a race, the odd favour of cars P, Q, R and S are 1:3, 1:4, 1:5 and 1:6 respectively. Find the probability that one of them wins the race.

- a)  $\frac{9}{17}$                       b)  $\frac{114}{121}$                       c)  $\frac{319}{420}$                       d)  $\frac{27}{111}$

13. David gets on the elevator at the 11th floor of a building and rides up at the rate of 57 floors per minute. At the same time, Albert gets on an elevator at the 51st floor of the same building and rides down at the rate of 63 floors per minute. If they continue travelling at these rates, then at which floor will their paths cross?

- A. 19                      B. 28                      C. 30                      D. 37

## Problems Based On Ages

### Important Formulas on "Problems on Ages":

1. If the current age is  $x$ , then  $n$  times the age is  $nx$ .
2. If the current age is  $x$ , then age  $n$  years later/hence =  $x + n$ .
3. If the current age is  $x$ , then age  $n$  years ago =  $x - n$ .
4. The ages in a ratio  $a : b$  will be  $ax$  and  $bx$ .
5. If the current age is  $x$ , then  $\frac{1}{n}$  of the age is  $\frac{x}{n}$ .

### PRACTICE QUESTIONS

1. 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
2. The sum of 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. None of these
3. A father said to his son, "I was as old as you are at the 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
4. 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. Cannot be determined                      E. None of these
5. 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 his son is:  
 A. 14 years                      B. 18 years                      C. 20 years                      D. 22 years
6. Six years ago, the ratio of the ages of Kunal and Sagar was 6 : 5. Four years hence, the ratio of their ages will be 11 : 10. What is Sagar's age at present?  
 A. 16 years                      B. 18 years                      C. 20 years                      D. Cannot be determined  
 E. None of these
7. The sum of the present ages of a father and his son is 60 years. Six years ago, father's age was five times the age of the son. After 6 years, son's age will be:  
 A. 12 years                      B. 14 years                      C. 18 years                      D. 20 years
8. 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 and half                      D. 21 years
9. Sachin is younger than Rahul by 7 years. If their ages are in the respective ratio of 7 : 9, how old is Sachin?  
 A. 16 years                      B. 18 years                      C. 28 years                      D. 24.5 years  
 E. None of these

10. The present ages of three persons in proportions 4 : 7 : 9. Eight years ago, the sum of their ages was 56. Find their present ages (in years).  
 A. 8, 20, 28                      B. 16, 28, 36                      C. 20, 35, 45                      D. 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. 8 years
12. 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
13. 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. Data inadequate  
 E. None of these
14. 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
15. Father is elder than son 3 times, and son is elder than sister 3 times. How old is father, if the sum of his and sisters years is 50?  
 A. 40 years                      B. 42 years                      C. 45 years                      D. 50 years
16. When a father had 31 year, his son had 8. Now is father two times older than son. How old is son now?  
 A. 18 years                      B. 20 years                      C. 23 years                      D. 25 years
17. The total of the ages of Amar, Akbar and Anthony is 80 years. What was the total of their ages three years ago?  
 A. 71 years                      B. 72 years                      C. 74 years                      D. 77 years
18. A is two years older than B who is twice as old as C. If the total of the ages of A, B and C be 27, the how old is B?  
 A. 7                      B. 8                      C. 9                      D. 10                      E. 11

## Volume & Surface Area

### 1. CUBOID

Let length = l, breadth = b and height = h units. Then

- i. Volume = (l x b x h) cubic units.
- ii. Surface area =  $2(lb + bh + lh)$  sq. units.
- iii. Diagonal =  $\sqrt{l^2 + b^2 + h^2}$  units.

### 2. CUBE

Let each edge of a cube be of length a. Then,

- i. Volume =  $a^3$  cubic units.
- ii. Surface area =  $6a^2$  sq. units.
- iii. Diagonal =  $3a$  units.

### 3. CYLINDER

Let radius of base = r and Height (or length) = h. Then,

- i. Volume = ( $\pi r^2 h$ ) cubic units.
- ii. Curved surface area =  $(2\pi rh)$  sq. units.
- iii. Total surface area =  $2\pi r(h + r)$  sq. units.

### 4. CONE

Let radius of base = r and Height = h. Then,

- i. Slant height, l =  $\sqrt{h^2 + r^2}$  units.
- ii. Volume =  $\left(\frac{1}{3}\pi r^2 h\right)$  cubic units.
- iii. Curved surface area =  $(\pi rl)$  sq. units.
- iv. Total surface area =  $(\pi rl + \pi r^2)$  sq. units.

### 5. SPHERE

Let the radius of the sphere be r. Then,

- i. Volume =  $\frac{4}{3}\pi r^3$  cubic units.
- ii. Surface area =  $(4\pi r^2)$  sq. units.

### 6. HEMISPHERE

Let the radius of a hemisphere be r. Then,

- i. Volume =  $\frac{2}{3}\pi r^3$  cubic units.
- ii. Curved surface area =  $(2\pi r^2)$  sq. units.
- iii. Total surface area =  $(3\pi r^2)$  sq. units.

Note: 1 litre = 1000 cm<sup>3</sup>.

### PRACTICE QUESTIONS

1. A right triangle with sides 3 cm, 4 cm and 5 cm is rotated the side of 3 cm to form a cone. The volume of the cone so formed is:

- A.  $12\pi$  cm<sup>3</sup>                      B.  $15\pi$  cm<sup>3</sup>                      C.  $16\pi$  cm<sup>3</sup>                      D.  $20\pi$  cm<sup>3</sup>

2. A hall is 15 m long and 12 m broad. If the sum of the areas of the floor and the ceiling is equal to the sum of the areas of four walls, the volume of the hall is:

- A. 720                                      B. 900                                      C. 1200                                      D. 1800

3. 66 cubic centimetres of silver is drawn into a wire 1 mm in diameter. The length of the wire in metres will be:  
A. 84                      B. 90                      C. 168                      D. 336
4. A hollow iron pipe is 21 cm long and its external diameter is 8 cm. If the thickness of the pipe is 1 cm and iron weighs  $8 \text{ g/cm}^3$ , then the weight of the pipe is:  
A. 3.6 kg                      B. 3.696 kg                      C. 36 kg                      D. 36.9 kg
5. 50 men took a dip in a water tank 40 m long and 20 m broad on a religious day. If the average displacement of water by a man is  $4 \text{ m}^3$ , then the rise in the water level in the tank will be:  
A. 20 cm                      B. 25 cm                      C. 35 cm                      D. 50 cm
6. The slant height of a right circular cone is 10 m and its height is 8 m. Find the area of its curved surface.  
A.  $30\pi \text{ m}^2$                       B.  $40\pi \text{ m}^2$                       C.  $60\pi \text{ m}^2$                       D.  $80\pi \text{ m}^2$
7. A metallic sheet is of rectangular shape with dimensions 48 m x 36 m. From each of its corners, a square is cut off so as to make an open box. If the length of the square is 8 m, the volume of the box (in  $\text{m}^3$ ) is:  
A. 4830                      B. 5120                      C. 6420                      D. 8960
8. The curved surface area of a cylindrical pillar is  $264 \text{ m}^2$  and its volume is  $924 \text{ m}^3$ . Find the ratio of its diameter to its height.  
A. 3:7                      B. 7:3                      C. 6:7                      D. 7: 6
9. What is the total surface area of a right circular cone of height 14 cm and base radius 7 cm?  
A.  $344.35 \text{ cm}^2$                       B.  $462 \text{ cm}^2$                       C.  $498.35 \text{ cm}^2$                       D. None of these
10. A large cube is formed from the material obtained by melting three smaller cubes of 3, 4 and 5 cm side. What is the ratio of the total surface areas of the smaller cubes and the large cube?  
A. 2:1                      B. 3:2                      C. 25:18                      D. 27:20
11. How many bricks, each measuring 25 cm x 11.25 cm x 6 cm, will be needed to build a wall of 8 m x 6 m x 22.5 cm?  
A. 5600                      B. 6000                      C. 6400                      D. 7200
12. There exists a cube x, to each face of which an identical cube is attached. What is the percentage increase in volume?  
A. 400%                      B. 500%                      C. 600%                      D. 800%



## Area

### 1. Results on Triangles:

- i) Sum of the angles of a triangle is  $180^\circ$ .
- ii) The sum of any two sides of a triangle is greater than the third side.
- iii) Pythagoras Theorem:  
In a right-angled triangle,  $(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Height})^2$ .
- iv) The line joining the mid-point of a side of a triangle to the opposite vertex is called the median.
- v) The point where the three medians of a triangle meet, is called centroid. The centroid divides each of the medians in the ratio 2:1.
- vi) In an isosceles triangle, the altitude from the vertex bisects the base.
- vii) The median of a triangle divides it into two triangles of the same area.
- viii) The area of the triangle formed by joining the mid-points of the sides of a given triangle is one-fourth of the area of the given triangle.

### 2. Results on Quadrilaterals:

- i. The diagonals of a parallelogram bisect each other.
- ii. Each diagonal of a parallelogram divides it into triangles of the same area.
- iii. The diagonals of a rectangle are equal and bisect each other.
- iv. The diagonals of a square are equal and bisect each other at right angles.
- v. The diagonals of a rhombus are unequal and bisect each other at right angles.
- vi. A parallelogram and a rectangle on the same base and between the same parallels are equal in area.
- vii. Of all the parallelogram of given sides, the parallelogram which is a rectangle has the greatest area.

### IMPORTANT FORMULAE :

- 1) i. Area of a rectangle = (Length x Breadth).  

$$\text{Length} = \left[ \frac{\text{Area}}{\text{Breadth}} \right] \text{ and } \text{Breadth} = \left[ \frac{\text{Area}}{\text{Length}} \right]$$
- ii. Perimeter of a rectangle =  $2(\text{Length} + \text{Breadth})$ .
- iii. Area of a square =  $(\text{side})^2 = (\text{diagonal})^2$ .
- iv. Area of 4 walls of a room =  $2(\text{Length} + \text{Breadth}) \times \text{Height}$ .
- 2) i. Area of a triangle =  $\frac{1}{2} \times \text{Base} \times \text{Height}$ .
- ii. Area of a triangle =  $s(s-a)(s-b)(s-c)$   
where a, b, c are the sides of the triangle and  $s = \frac{a+b+c}{2}$ .
- iii. Area of an equilateral triangle =  $\frac{\sqrt{3}}{4} \times (\text{side})^2$ .
- iv. Radius of incircle of an equilateral triangle of side a =  $\frac{a}{2\sqrt{3}}$
- v. Radius of circumcircle of an equilateral triangle of side a =  $\frac{a}{\sqrt{3}}$
- vi. Radius of incircle of a triangle of area  $\Delta$  and semi-perimeter  $s$   $r = \frac{\Delta}{s}$
- 3) i. Area of parallelogram = (Base x Height).
- ii. Area of a rhombus =  $\frac{1}{2} \times (\text{Product of diagonals})$ .
- iii. Area of a trapezium =  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{distance between them}$ .
- 4) i. Area of a circle =  $\pi R^2$ , where R is the radius.
- ii. Circumference of a circle =  $2\pi R$ .
- iii. Length of an arc =  $\frac{2\pi R\theta}{360}$ , where  $\theta$  is the central angle.

- iv. Area of a sector =  $\frac{1}{2} (\text{arc} \times R) = \frac{\pi R^2 \theta}{360}$
- 5) i. Circumference of a semi-circle =  $\pi R$ .
- ii. Area of semi-circle =  $\frac{\pi R^2}{2}$

### PRACTICE QUESTIONS

- The ratio between the length and the breadth of a rectangular park is 3 : 2. If a man cycling along the boundary of the park at the speed of 12 km/hr completes one round in 8 minutes, then the area of the park (in sq. m) is:  
A. 15360      B. 153600      C. 30720      D. 307200
- An error 2% in excess is made while measuring the side of a square. The percentage of error in the calculated area of the square is:  
A. 2%    B. 2.02%      C. 4%      D. 4.04%
- The ratio between the perimeter and the breadth of a rectangle is 5 : 1. If the area of the rectangle is 216 sq. cm, what is the length of the rectangle?  
A. 16 cm      B. 18 cm      C. 24 cm      D. Data inadequate      E. None of these
- 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%
- A rectangular park 60 m long and 40 m wide has two concrete crossroads running in the middle of the park and rest of the park has been used as a lawn. If the area of the lawn is 2109 sq. m, then what is the width of the road?  
A. 2.91 m      B. 3 m      C. 5.82 m      D. None of these
- The diagonal of the floor of a rectangular closet is  $7\frac{1}{2}$  feet. The shorter side of the closet is  $4\frac{1}{2}$  feet. What is the area of the closet in square feet?  
A.  $5\frac{1}{4}$       B.  $13\frac{1}{2}$       C. 27      D. 37
- A towel, when bleached, was found to have lost 20% of its length and 10% of its breadth. The percentage of decrease in area is:  
A. 10%      B. 10.08%      C. 20%      D. 28%
- A man walked diagonally across a square lot. Approximately, what was the percent saved by not walking along the edges?  
A. 20    B. 24      C. 30      D. 33
- The diagonal of a rectangle is  $\sqrt{41}$  cm and its area is 20 sq. cm. The perimeter of the rectangle must be:  
A. 9 cm      B. 18 cm      C. 20 cm      D. 41 cm
- What is the least number of square tiles required to pave the floor of a room 15 m 17 cm long and 9 m 2 cm broad?  
A. 814    B. 820      C. 840      D. 844
- The difference between the length and breadth of a rectangle is 23 m. If its perimeter is 206 m, then its area is:

- A.  $1520 \text{ m}^2$       B.  $2420 \text{ m}^2$       C.  $2480 \text{ m}^2$       D.  $2520 \text{ m}^2$

12. The length of a rectangle is halved, while its breadth is tripled. What is the percentage change in area?

- A. 25% increase      B. 50% increase      C. 50% decrease      D. 75% decrease

13. The length of a rectangular plot is 20 metres more than its breadth. If the cost of fencing the plot @ 26.50 per metre is Rs.5300, what is the length of the plot in metres?

- A. 40      B. 50      C. 120      D. Data inadequate      E. None of these

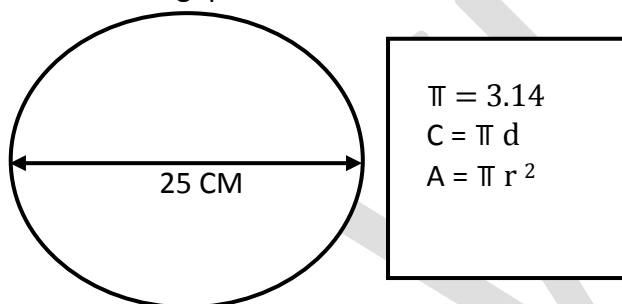
14. A rectangular field is to be fenced on three sides leaving a side of 20 feet uncovered. If the area of the field is 680 sq. feet, how many feet of fencing will be required?

- A. 34      B. 40      C. 68      D. 88

15. A tank is 25 m long, 12 m wide and 6 m deep. The cost of plastering its walls and bottom at 75 paise per sq. m, is:

- A. Rs.456      B. Rs.458      C. Rs.558      D. Rs.568

16. To answer the following questions refer to the circle illustrated below, and the formulas



I. The radius of the circle is

- A. 12.5 cm      B. 125 cm      C. 500 cm      D. 750 cm      E. 300 cm

II. The circumference of the circle is

- A. 38.25 cm      B. 39.25 cm      C. 78.50 cm      D. 79.50 cm      E. 80 cm

III. The area of the circle is

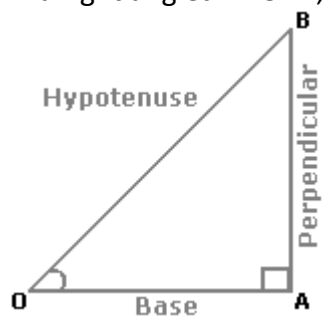
- A.  $500.5 \text{ cm}^2$       B.  $490.6 \text{ cm}^2$       C.  $780.5 \text{ cm}^2$       D.  $1490.6 \text{ cm}^2$       E.  $1236.7 \text{ cm}^2$

17. If you increase the length of the diagonal of a square by 50%, what would be the increase in the area of the Square?

## Heights & Distance

### 1. Trigonometry:

In a right angled  $\triangle OAB$ , where  $\angle BOA = \theta$ ,



$$\text{i. } \sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{AB}{OB} ;$$

$$\text{ii. } \cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{OA}{OB} ;$$

$$\text{iii. } \tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{AB}{OA} ;$$

$$\text{iv. } \operatorname{cosec} \theta = \frac{1}{\sin \theta} = \frac{OB}{AB} ;$$

$$\text{v. } \sec \theta = \frac{1}{\cos \theta} = \frac{OB}{OA} ;$$

$$\text{vi. } \cot \theta = \frac{1}{\tan \theta} = \frac{OA}{AB} ;$$

### 2. Trigonometrical Identities:

$$\text{i. } \sin^2 \theta + \cos^2 \theta = 1.$$

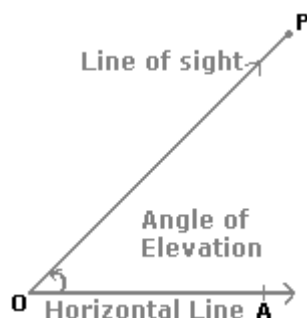
$$\text{ii. } 1 + \tan^2 \theta = \sec^2 \theta.$$

$$\text{iii. } 1 + \cot^2 \theta = \operatorname{cosec}^2 \theta.$$

### 3. Values of T-ratios:

$\theta$	$0^\circ$	$\left(\frac{\pi}{6}\right)$ $30^\circ$	$\left(\frac{\pi}{4}\right)$ $45^\circ$	$\left(\frac{\pi}{3}\right)$ $60^\circ$	$\left(\frac{\pi}{2}\right)$ $90^\circ$
$\sin \theta$	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{2}$	1
$\cos \theta$	1	$\frac{3}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	0
$\tan \theta$	0	$\frac{1}{3}$	1	3	not defined

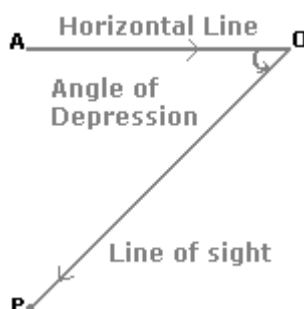
#### 4. Angle of Elevation:



Suppose a man from a point O looks up at an object P, placed above the level of his eye. Then, the angle which the line of sight makes with the horizontal through O, is called the angle of elevation of P as seen from O.

∴ Angle of elevation of P from O =  $\angle AOP$ .

Angle of Depression:



Suppose a man from a point O looks down at an object P, placed below the level of his eye, then the angle which the line of sight makes with the horizontal through O, is called the angle of depression of P as seen from O.

#### PRACTICE QUESTIONS

1. Two ships are sailing in the sea on the two sides of a lighthouse. The angle of elevation of the top of the lighthouse is observed from the ships are  $30^\circ$  and  $45^\circ$  respectively. If the lighthouse is 100 m high, the distance between the two ships is:

- A. 173 m                      B. 200 m                      C. 273 m                      D. 300 m

2. A man standing at a point P is watching the top of a tower, which makes an angle of elevation of  $30^\circ$  with the man's eye. The man walks some distance towards the tower to watch its top and the angle of the elevation becomes  $60^\circ$ . What is the distance between the base of the tower and the point P?

- A.  $4\sqrt{3}$  units                      B. 8 units                      C. 12 units                      D. Data inadequate                      E. None of these

3. The angle of elevation of a ladder leaning against a wall is  $60^\circ$  and the foot of the ladder is 4.6 m away from the wall. The length of the ladder is:

- A. 2.3 m                      B. 4.6 m                      C. 7.8 m                      D. 9.2 m

4. An observer 1.6 m tall is 203 away from a tower. The angle of elevation from his eye to the top of the tower is  $30^\circ$ . The heights of the tower is:

- A. 21.6 m                      B. 23.2 m                      C. 24.72 m                      D. None of these

5. From a point P on a level ground, the angle of elevation of the top tower is  $30^\circ$ . If the tower is 100 m high, the distance of point P from the foot of the tower is:

- A. 149 m                      B. 156 m                      C. 173 m                      D. 200 m

6. The angle of elevation of the sun, when the length of the shadow of a tree 3 times the height of the tree, is:  
A.  $30^\circ$       B.  $45^\circ$       C.  $60^\circ$       D.  $90^\circ$
7. Two ships are sailing in the sea on the two sides of a lighthouse. The angle of elevation of the top of the lighthouse is observed from the ships are  $30^\circ$  and  $45^\circ$  respectively. If the lighthouse is 100m high, the distance between the two ships is:  
A. 173m      B. 200m      C. 273m      D. 300m

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## Logical Reasoning

### **DIRECTIONS: 1 to 3**

Painter Lulu started painting a solid cube of side 5 centimeters (cm) with red color. When he completed painting four faces of the cube, he ran out of red paint. Now this partially coloured cube is broken into maximum number of cube of size 1 cm.

1. At least how many cubes are painted on one side or more than one side?  
 A. 75                      B. 77                      C. 80                      D. 92
2. How many cubes are painted on 3-sides?  
 A. 0                      B. 2                      C. 4                      D. cannot be Determined
3. What can be said about the value of one sided coloured cubes?  
 A. It is multiple of 3      B. It is multiple of 4      C. It is multiple of 5      D. It is multiple of 6

### **DIRECTIONS: 4 to 6**

Seema and Rinku do not like burger. Kamal does not like Pizza and Burger. Pudding is not liked by Rinku and Manju. Manju and Amita do not like Pizza. Kamal and Amita do not like Pudding and Ice-cream. A person eats only those eatable which he/she likes and one type of eatable is consumed by only one person. One of the eatables is Chocolate.

4. Which eatable is liked by Manju?  
 A. Burger                      B. Pizza                      C. Pudding                      D. Ice-cream
5. Who eats Pudding?  
 A. Seema                      B. Rinku                      C. Kamal                      D. Manju
6. Who likes Chocolate?  
 A. Seema                      B. Rinku                      C. Kamal                      D. Manju

### **DIRECTIONS: 7 to 8**

SSB Allahabad is known for its stringent policies of selecting army cadet. Six contestants namely Ashish, Ishan, Nilesh, Vipul, Vishal, and Utsav are selected at SSB Allahabad. At there medical examination their height and weight were noted down and the medical officer then tabulated their names according to height and weight. The final medical report got misplaced by the medical officer, but he was able to recall some of medical examination.

- i. Vishal is taller and heavier than Utah.
  - ii. Ashish is shorter than Ishan and lighter than Vipul.
  - iii. Vipul is taller than Vipul and lighter than Ishan.
  - iv. Nilesh is shorter than Utsav and lighter than Ashish.
  - v. Ishan is shorter than Nilesh and heavier than Ashish.
  - vi. Utsav is taller and heavier than Ishan.
7. Who is shortest among the six selected contestants?  
 A. Utsav                      B. Ashish                      C. Ishan                      D. Nilesh

8. Which of the following is/are both shorter and heavier than Nilesh?

- A. Vipul only                      B. Ishan only                      C. Utsav only                      D. Ishan and Ashish only

**DIRECTIONS: 9 to 11**

*Indian Basket-ball team qualified for the Olympics this year. The coach Gill has taken with him a mixed squad of state champions and experienced players. The squad consists of two groups one of 5 state-champions namely Dhoni, Zaheer, Yuvraj, Gautam and Suresh and other group of 4 experienced players – Sachin, Saurav, Rahul and Veeru. Gill has to finally select the 5 players for the match, but there are some conditions to which the playing 5 team has to abide:*

C1: If either Zaheer or Gautam is selected to play, the other must also be selected.

C2: If either Yuvraj or Suresh is selected to play, the other must also be selected.

C3: If Saurav is selected to play, neither Dhoni nor Veeru can be selected.

C4: At least two players from each group must be selected to play in the match.

9. Which of the following could be the five players selected to play in a match at Olympics?

- A. Zaheer, Suresh, Sachin, Rahul, Veeru.                      B. Zaheer, Yuvraj, Gautam, Sachin, Saurav  
C. Dhoni, Yuvraj, Suresh, Sachin, Veeru                      D. Dhoni, Zaheer, Gautam, Sachin, Saurav

10. If Dhoni is selected to play in the match, then which one of the following must be false?

- A. Exactly two state-champions are selected to play in the match  
B. Veeru is selected to play in the match  
C. Suresh is selected to play in the match  
D. Zaheer is selected to play in the match

11. All of the following could be true EXCEPT:

- A. Neither Sachin nor Rahul are selected to play in the match  
B. Both Saurav and Rahul are selected to play in the match  
C. Both Zaheer and Saurav are selected to play in the match  
D. Both Dhoni and Yuvraj are selected to play in the match

**Directions for questions 12 to 14:**

*Six products, namely U, V, W, X, Y and Z are to be placed in the display windows of a shop. There are six display windows numbered 1, 2, 3, 4, 5 and 6 from left to right in such a way that one product is showcased in one window only. However, U cannot be placed adjacent to V, W must be immediately to the left of X and Z cannot be in window number 6.*

**Note:** The directions (left or right) should be determined with respect to the observer / shopper.

12. Which of the following products CANNOT be placed in window number 1?

- A. U                      B. V                      C. W                      D. X

13. If X is placed in window number 3, in which window can w be placed?

- A. 1                      B. 2                      C. 4                      D. 5

14. If U is placed in window number 5, which of the following products must be placed in window number 6?



A. V

B. W

C. Y

D. X

**Directions for questions 15 to 19:**

A newspaper agent sells TOI, IE and Herald in equal number to 302 people. 7 get IE and Herald, 12 get TOI and IE, 9 get TOI and Herald and 3 get all three.

15. How many get exactly one paper?

A. 280

B. 327

C. 109

D. None of these

16. What percent get TOI and IE only but not Herald?

A. More than 65%

B. Less than 60%

C. 64%

D. None of these

17. Number of persons buying TOI and IE only, TOI and Herald only and IE and Herald only are in the ratio

A. 6:4:9

B. 6:9:4

C. 4:9:6

D. None of these

18. The difference between the number reading IE and Herald only and IE only is

A. 77

B. 78

C. 83

D. None of these

19. How many read TOI alone?

A. 109

B. 91

C. 89

D. None of these

**Directions for questions 20 to 24:**

A cube is coloured orange on one face, pink on the opposite face, brown on one face and silver on a face adjacent to the brown face. The other two faces are left uncoloured. It is then cut into 125 smaller cubes of equal size. Now, answer the following questions based on the above statements:

20. How many cubes have at least one face coloured pink?

A. 1

B. 9

C. 16

D. 25

21. How many cubes have all the faces uncoloured?

A. 24

B. 36

C. 48

D. 64

22. How many cubes have at least two faces coloured?

A. 19

B. 20

C. 21

D. 23

23. How many cubes are coloured orange on one face and have the remaining faces in coloured?

A. 8

B. 12

C. 14

D. 16

24. How many cubes one coloured silver on one face, orange or pink on another face and have four uncoloured faces?

A. 8

B. 10

C. 12

D. 16

**Directions for Questions 25 to 29 :**

At the start of a game of cards, J and B between them had 4 times as much money as T while T and B together had 3 times as much as J. At the end of the evening, J and B between them had 3 times as much as T, while T and B together had twice as much as J. B finished Rs.200 poorer at the end.

25. What fraction of the total money did T have at the beginning of the game.

- A.  $\frac{1}{3}$                       B.  $\frac{1}{8}$                       C.  $\frac{2}{9}$                       D.  $\frac{1}{5}$

26. What fraction of the total money did J win (lose)?

- A. Won 1/12th                      B. Lost 1/6th                      C. Lost 1/3rd                      D. Won 1/5th

27. What amount did B start with?

- A. Rs.575                      B. Rs.375                      C. Rs.825                      D. Rs.275

28. What amount did T win (lose)?

- A. Lost Rs.50                      B. Won Rs.75                      C. Lost Rs.125                      D. Won Rs.175

29. How much money did J have at the end of the game?

- A. Rs.375                      B. Rs.500                      C. Rs.325                      D. Rs.1100

**Directions for Q. 30 – 31:**

Six participants in the National Billiards Championship, who played in the super six stage of the championship all belonged to different states. The six states are Gujarat, Orissa, Karnataka, Maharashtra, MP and UP. The six participants are aged 18, 26, 32, 34, 38, 44 years (not necessarily in order).

1. Pravin is the oldest while Laxman is the youngest player.
2. Player from MP is aged 32
3. Minal comes from Orissa but Laxman is not from Gujarat
4. Pankaj and Kunal belong to Karnataka and UP resp. They are not aged 38 or 18
5. Asim, 32 is not from Maharashtra or Gujarat
6. Minal, Laxman and Pankaj are neither the oldest nor in their twenties.

30. Which of the following statements must be true?

- A. Pravin 44, is from Orissa                      B. Kunal, 26, is from MP  
C. Pankaj, 26, is from Karnataka                      D. Laxman, 18, is from Maharashtra

31. Which of the following statements must not be true?

- A. Pravin 44, belongs to Gujarat                      B. Pankaj, 34, belongs to Karnataka  
C. Asim, 32, belongs to Orissa                      D. Laxman, 18, belongs to Maharashtra

32. Pravin belongs to the state of

- A. Gujarat                      B. Orissa                      C. Maharashtra                      D. None of these

33. Which player is aged 34?

- A. Kunal                      B. Pankaj                      C. Pravin                      D. Kunal or Pankaj

34. Which player is in his 20s?

- A. Minal                      B. Pankaj                      C. Kunal                      D. Pravin

### Directions for Q. 35 – 37:

- a. There is a group of six persons Angophora, Bakralu, Chaparganju, Drakula, Engumakora and Fasoolara from a family. They are Professor, Clerk, Trader, Tailor, Surgeon and Pilot.
- b. The Surgeon is the grandfather of Fasoolara, who is a Professor.
- c. The clerk 'Drakula' is married to Angapooru.
- d. Chaparganju, the Tailor is married to the Trader.
- e. Bakralu is the mother of Engumakora and Fasoolara.
- f. There are two married couples in the family.

35. What is the profession of Engumakora?

- A. Surgeon                      B. Clerk.                      C. Professor                      D. Pilot                      E. None of these

36. How is Angapooru related to Engumakora?

- A. Brother                      B. Uncle                      C. Father                      D. Grandfather                      E. None of these

37. How many male members are there in the family?

- A. One                      B. Three                      C. Four                      D. Data inadequate                      E. None of these

### DIRECTIONS for 38 – 42:

American Airlines has 4 classes of passengers viz.. Business, Economy, Executive and Commercial. Smoking/ Non-smoking zone is another distinction.

- (i) Five people viz. A, B, C, D and E buy a ticket of American Airlines for a particular class.
- (ii) The smokers have to buy a ticket of the smokers zone and the non-smokers buy non-smoking zone tickets.
- (iii) A, smokers, travels either by Business or Economy class.
- (iv) D take tickets which belong to either Business or Economy and he also smokes.
- (v) C and B are both non-smokers and belong to neither Business nor Economy class.
- (vi) E takes a Business-class ticket.
- (vii) Also, A, B; C and D do not travel by business class.

38. If B travels by Executive class, then D may travel by \_\_\_\_\_ class \_\_\_\_\_ zone.

- A. Commercial, Smoking                      B. Commercial, Non-smoking  
C. Economy, Smoking                      D. Commercial, Smoking and Economy, Smoking

39. If only 2 out of 5 friends are non-smokers, who does C definitely not accompany?

- I. A.    II. B                      III. D                      IV. E  
A. I, III, IV only                      B. I and III only                      C. I, II, III, and IV                      D. I and IV only

40. If B and C take the tickets of the same, what are the total number of possible combinations in which the five people can travel?

- A. 4                      B. 8                      C. 16                      D. 32

41. Which of the following is definitely true?

- A. C and D travel together                      B. B and C travel together  
C. A and D travel together                      D. A and E travel together

42. If C travels in Commercial class of Non-Smoking zone, then which class ticket should B buy to definitely accompany C?

- A. Economy class      B. Executive class      C. Commercial class      D. Business class

**DIRECTIONS for question 43 -**

Eight friends A, B, C, D, E, F, G and H decide to go to a birthday party.

- (i) If A doesn't go, B will go.  
(ii) If D goes, F will definitely go.  
(iii) If H doesn't go, E will go.  
(iv) A goes only if D goes.  
(v) B and E always go together.  
(vi) C and D can't go together.  
(vii) H and G can't go together  
(viii) G and C always go together.  
(ix) F goes only if H goes.

43. If A goes, then which one of the following friends cannot go to the party?

- A. B      B. G      C. E      D. H

44. If G goes, who will definitely go to the party?

- A. C      B. E      C. B      D. All of these

45. Which of the following groups of friends can go together to the party?

- A. GCDHA      B. BEFHG      C. DFABH      D. ADFH

46. With all possible combinations, maximum how many friends can go to the party?

- A. 5      B. 6      C. 7      D. 4

47. If condition (vi) is dissolved, then maximum how many friends can go to the party?

- A. 5      B. 6      C. 7      D. 4

**DIRECTIONS for questions 48 - 49:**

B \$ 2 5 E ! # D 1 3 K @ U 3 ! E 5

48. If the middle five elements are dropped out from the series, then which will be the third element to the left of the ninth element from the left?

- A. @      B. U      C. !      D. E

49. How many letters in the series are immediately preceded by a number and immediately followed by a symbol/character?

- A. 2      B. 3      C. 1      D. 4

## SELECTION CRITERIA

### **DIRECTIONS for questions 50 – 55:**

A recruitment company is looking for Data Warehousing Consultants for their client, a CMM Level 5 company based in Bangalore.

For the candidate to be selected, he/she should fulfill the following criteria as on 1st March, 2009.

- i. He/She should have completed 25 years of age and should not be more than 35 years of age.
- ii. He/She should have scored more than 70% in the final year of MBA (Systems) or B.E. (Computer).
- iii. He/She should have more than 5 years experience in at least two of the four mentioned technologies:  
Informatics, Business objects Data Integrator, Oracle Warehouse Builder, SQL Server DTS.
- iv. He/She should hold an Oracle Database Administrator certification.
- v. He/She should have scored at least 80% in the technical test.

If the candidate satisfies all the conditions, except:

1. Condition (iv), but holds a Six Sigma certification, he should be referred to the Manager-Quality.
- II. Condition (iii), but has minimum 3 years experience in either Micro Strategy, Hyerion, or Cognos, he should be referred to the Manager-BI.

Mark [1]: if the candidate is to be selected.

Mark [2]: if the candidate is to be rejected.

Mark [3] : if the data is inadequate.

Mark [4]; if the candidate is to be referred to Manager-Quality / Manager-BI.

50. Jayanti Shah scored 72% in the final year MBA exams and holds an Oracle Database Administrator certification. She has been working with ABC Informatics for the past 6 years, wherein she has worked on Business Objects Data Integrator and Oracle Warehouse Builder. She will turn 27 on 25th July, 2009. She scored 81% in the technical test.
51. 15. Prakash Kumar completed his Engineering (Computer) in 2001, scoring 75% in his final year. He has been working with XYZ Research and Analytics since then and has hands-on experience on Informatics and Oracle Warehouse. Builder. He has successfully completed his Oracle Database Administrator certification. He scored 82% in the technical test. He was born on 23rd November, 1979.
52. 16. Sunder Kadam was born on 13th January, 1979. He was completed his Computer Engineering in the year 2000, securing 82% in his final year. Since then, he has been working with BO Data Analytics on SQL Server DTS and Informatics. He has successfully completed his Six Sigma certification. He scored 82% in the technical test.
53. 17. Kartik Rege has been working with TRS Info systems for the past seven years on. Business Objects Data Integrator, Oracle Warehouse Builder, and SQL Server DTS. He is a certified Oracle Database Administrator. He was born on 22nd December, 1975. He scored 82% in his final year Computer Engineering exams, in the year 1997. He scored 92% in the technical test.

54. 18. Preksha Joshi topped her MBA (Systems) final year exams with 89% in the year 2003. She has been working with TRS Info systems since August 2003. She has worked on technologies like Informatics, Hyperion, and Congo's. She has successfully completed her Oracle Database Administrator certification. She is 26 years of age. She scored more than 90% in the technical test.

**DIRECTIONS for questions 55 - 58:**

*A multinational company wants to recruit a Personnel Manager with the following conditions:*

*The candidate must:*

- i. be a graduate with at least first class marks.*
- ii. have work experience of at least five years.*
- iii. not be more than 35 years of age as of 1st July, 2009.*
- iv. be willing to sign a bond agreeing to work with the company for at least three years.*

*However, if a candidate satisfies all conditions, except:*

- I. (ii) above, but has a postgraduate degree in Personnel Management, his/her case may be referred to the Director-Personnel.*
- II. (iii). above, but has work experience as an Assistant Personnel Manager in an organization for at least 10 years, his/her case may be referred to the General Manager-Personnel.*

*Mark [1]: if the candidate is to be recruited.*

*Mark [2]; if the candidate is not to be recruited.*

*Mark [3]; if data is inadequate.*

*Mark [4]; if the case is to be referred to the Director-Personnel/General Manager-Personnel.*

55. Atul Agrawal is a first-class graduate and was born on 24th July 1976. He has been working in the same organization of the past 10 years as a Personnel Officer.
56. Meena Srivastava was born in 1979. She is a first-class graduate and a second-class postgraduate in Personnel Management. She is working as an Assistant Personnel Manager in an organization for the past three years and is ready to sign the requisite bond.
57. Rishi Soni passed his graduation with first-class marks in 1989, when he was 21 years old and, since then, has been working in an organization as a Personnel Officer. He is ready to sign the requisite bond.
58. Mayer Kashap was born in 1977. He has done his post-graduation in Personal Management. He has served OCM International for 5 years and is ready to sign the requisite bond.

**SEQUENTIAL OUTPUT TRACING**

**DIRECTIONS for questions 59 to 59:**

*An alphabetical machine, when given an input of a line of words, rearranges them following a particular rule in each step.*

*Input: create a new sentence with pictures*

*Step1: a create new sentence with pictures.*

*Step II: a create new sentence pictures with*

*StepIII: a create new pictures sentence with Step III is the output.*

56. If the input sentence is 'Machines All Repair Nuts Bolts Oil Lever', then which one of the following will be the third step?

- A. All Machines Nuts Bolts Oil Lever Repair  
 B. All Machines Nuts Bolts Repair Oil Lever  
 C. All Bolts Machines Nuts Lever Oil Repair  
 D. All Machines Repairs Bolts Nuts Oil Lever

57. If the input is 'Blue All Liquids Green Yellow Transparent', then which step number will be the final step?

- A. II  
 B. III  
 C. IV  
 D. V

58. If the input is 'Cold Coffee Cools completely and competitively', then what will be the output?

- A. And Coffee Cold Completely Competitively Cools  
 B. And Coffee Cold Cools Competitively Completely.  
 C. And coffee Cold Competitively Completely Cools  
 D. And Cold Coffee Completely competitively Cools

59. Step III of the machine is: 'Cinderella Dopey Dwarfs Grumpy Happy Seven' which of the following could have been the input?

- A. Dwarfs Cinderella grumpy Dopey Happy Seven.  
 B. Dwarfs Grumpy Happy Cinderella Dopey Seven.  
 C. Grumpy Happy Dwarfs Seven Cinderella Dopey.  
 D. Seven Happy Dopey Grumpy Dwarfs Cinderella.

#### **DIRECTIONS for questions 60 - 63:**

A set of numbers when put through a machine comes out in a particular sequence. The table is given below which has six steps. Study the table and answer the questions that follow.

Input	99	32	54	18		8	17	21	68	77	84	92
Step I	99	32	54	18	9	17	21	68	77	84	92	8
Step II	99	92	32	54	18	17	21	68	77	84	9	8
Step III	99	92	84	32	54	18	21	68	77	17	9	8
Step IV	99	92	84	77	32	54	21	68	18	17	9	8
Step V	99	92	84	77	68	32	54	21	18	17	9	8
Step VI	99	92	84	77	68	54	32	21	18	17	9	8

60. If two new numbers, 30 and 22, are added to the sequence, then the position of number 32 from left would be:

- A. 7th  
 B. 9th  
 C. 10th  
 D. 8<sup>th</sup>



61. A sequence is given as:

24, 28, 37, 11, 77, 89, 96, 68, 48, 54

By putting this sequence in the same machine, what would be the third step in the sequence?

- A. 96, 89, 77, 11, 24, 28, 37, 68, 54, 48  
 B. 96, 77, 37, 89, 68, 54, 48, 28, 24, 11  
 C. 96, 89, 77, 37, 68, 48, 54, 28, 24, 11  
 D. 89, 77, 96, 37, 68, 54, 11, 28, 48, 24

62. For sequence in Q. 28, in step IV, what will be the 7th number from left?

- A. 37  
 B. 54  
 C. 48  
 D. 24

63. What would be the middle of the following sequence in the final step, after it is put through the same machine: 24, 36, 48, 54, 09, 11, 7, 26, 96?

- A. 26  
 B. 36  
 C. 24  
 D. 48

**DIRECTIONS for questions 64 - 68:**

A set of numbers when put through a machine comes out in a particular sequence. The table is given below which has five steps. Identify the logic and answer the questions that follow.

Input:	23	5	10	6	19
Step- I	28	9	13	8	20
Step-2	56	18	26	16	40
Step-3	16	18	26	40	56
Step-4	61	81	62	4	65
Step-5	7	9	8	4	11

64. For the input, 17, 25, 8, 9, 13, what will be the output?

- A. 8, 10, 9, 8, 6  
 B. 2, 2, 4, 5, 11  
 C. 4, 4, 8, 10, 13  
 D. 4, 4, 10, 8, 13

65. If step-3 for an input is, 8, 14, 24, 26, 30 then what was the input?

- A. 4, 9, 12, 5, 3  
 B. 12, 13, 15, 7, 4  
 C. -1, 3, 9, 11, 14  
 D. Cannot be determined.

66. If Step-2 for an input is, 12, 22, 8, 56, 38, then the sequence, 8, 21, 22, 83, 65, belongs to which step?

- A. Step – 3  
 B. Step – 4  
 C. Step – 5  
 D. Cannot be determined.

67. For the input: 76, 23, 55, 49, 15, what will be the middle number of step 4?

- A. 201  
 B. 102  
 C. 116  
 D. 611

68. If for a given input: step-1 is omitted and the output is 4, 3, 7, 9, 6 then what is the input?

- A. 6, 9, 12, 2, 8  
 B. 15, 15, 17, 18, 30  
 C. 11, 15, 17, 27, 30  
 D. cannot be determined.



## Family Relationship

### 1) Representing basic relationships using codes

Male Gender:

Female Gender:

### 2) Parent-Child Relationship

(Father-Son)

(Father-Daughter)

(Mother-Son) (Mother-Daughter)

### 3) Siblings

(Brother-Sister) (Two Brothers) (Two Sisters)

### 4) Couple:

Questions involving Family Relationships

### PRACTICE QUESTIONS

1. Varun is the son of Tarun. Sunita is the daughter of Anita and Umang's son while Ramesh is Sunita's mother-in-law's son. If Umang has only one son Tarun, how is Ramesh related to Varun?

- A. Brother      B. Father      C. Brother-in-law      D. Son      E. Cannot be determined

2. After looking at a woman's photograph, Anjali said, "This woman's mother is my mother's daughter". How is Anjali related to the woman in the photograph?

- A. Aunt      B. Mother      C. Niece      D. Sister      E. Cannot be determined

#### Set 1

There are 7 members in the family Hi, Fi, Bi, Ki, Si, Ti and Li out of which two are women.

- ☐ Hi has 2 unmarried sons and a daughter who is married
- ☐ Si is Ki's mother – in – law
- ☐ Li is Ti's son, who is unmarried

1. How is Fi related to Ki?

- A. Brother-in-law      B. Father-in-law      C. Brother      D. Father      E. None of these

2. How is Li related to Hi?

- A. Son      B. Grandson      C. Son-in-law      D. Nephew      E. None of these

#### Set 2

A family of 8 people ; 5 males – P, Q, R, S and T, 3 females – U, V, W; extends to three generations

- ☐ Q has one daughter and two sons with only one son married and having children
- ☐ V is S's mother
- ☐ U is R's grandmother

1. How is „W“ related to „S“?

- A. Mother      B. Aunt      C. Sister      D. Grandmother      E. None of these

2. How is „R“ related to „S“?

- A. Grandfather      B. father      C. brother      D. uncle      E. None of these

3. Who is S's father?

- A. V      B. T      C. R      D. None of these      E. cannot be determined

4. If  $A + B$  means A is the mother of B;  $A - B$  means A is the brother of B;  $A \% B$  means A is the father of B and  $A \times B$  means A is the sister of B, which of the following shows that P is the maternal uncle of Q?  
 A.  $Q - N + M \times P$       B.  $P + S \times N - Q$       C.  $P - M + N \times Q$       D.  $Q - S \% P$

5. If  $A + B$  means A is the brother of B;  $A - B$  means A is the sister of B and  $A \times B$  means A is the father of B. Which of the following means that C is the son of M?  
 A.  $M - N \times C + F$       B.  $F - C + N \times M$       C.  $N + M - F \times C$       D.  $M \times N - C + F$

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## Arrangements

### Set 1

- ☐ There are five friends.
- ☐ They are standing in a row facing north.
- ☐ Sahdev is to the immediate right of Yudhishtir.
- ☐ Only Bhim is between Arjun and Nakul.
- ☐ Only Nakul is between Bhim and Sahdev.

1. Who is at the extreme right end in the arrangement?

- A. Yudhishtir                      B. Sahdev                      C. Arjun                      D. Bhim                      E. Cannot be determined

2. Who is in the middle?

- A. Nakul                      B. Bhim                      C. Sahdev                      D. Yudhishtir                      E. Cannot be determined

3. Which of the given statements can be dispensed with to find the answers of the above questions?

- A. 2 only                      B. 3 only                      C. 5 only                      D. 1 only                      E. 4 only

### Set 2

Eight friends P, R, T, V, W, J, F and K are sitting around a circle facing the centre not necessarily in the same order.

- ☐ T is third to the right of F and second to the left of W
- ☐ P & R are not neighbours of W
- ☐ R is third to the right of K
- ☐ J is between W and K.

1. Which of the following is the correct position of P with respect to K's position?

- A. Third to the left                      B. Third to the right                      C. Fifth to the right  
D. Second to the right                      E. Second to the left

2. Which of the following pairs has the first person to the immediate left of the second person?

- A. K and J                      B. W and V                      C. T and P                      D. F and R                      E. T and V

3. Who is to the immediate right of V?

- A. F                      B. J                      C. K                      D. T                      E. W

4. Which of the following is the correct position of W?

- A. Three places to the right of R                      B. Two places to the left of T  
C. Three places to the left of R                      D. Immediate left of V (5) Two places to the right of F

5. Which of the following pairs is sitting diametrically opposite each other?

- A. R and J                      B. F and T                      C. K and V                      D. R and V                      E. W and R

6. 8 persons E, F, G, H, I, J, K and L are seated around a square table -two on each side.

### Set 3

There are 3 ladies who are not seated next to each other.

J is between L and F.

G is between I and F.

H, a lady member is second to the left of J.

F, a male member is seated opposite to E, a lady member.

There is a lady member between F and I.

1. Who among the following is to the immediate left of F?

- A.G B. I C.J D.H

2. What is true about J and K?

- A.J is male, K is female B.J is female, K is male C. Both are female D. Both are male

3. How many persons are seated between K and F?

- A.1 B.2 C.3 D.4

4. Who among the following are three lady members?

- A. E, H and J B. E, F and G C. E, H and G D. C, H and J

5. Who among the following is seated between E and H?

- A.F B. I C.K D. Cannot be determined

#### Set 4

Seven friends B, R, K, M, Y, T and F study in three different schools i.e. A, C and X. not more than three or less than two study in any of the schools. Each one has a favorite fruits among pineapple, banana, pear, mango, watermelon, sweet lime and papaya, not necessarily in that order. R studies in School X and likes mango whereas Y studies in school A and likes pineapple. None in school C likes the fruit pear. T studies in the same school as only Y whereas M does not study in school C. M likes papaya whereas F like watermelon. B does not like sweet lime and only two of them study in School X.

1. Which fruit does T like?

- A. Banana B. Sweet lime C. Pear D. Watermelon E. None of these

2. Which fruit does B like?

- A. Banana B. Sweet lime C. Pear D. Watermelon E. None of these

3. Which is the complete list of people who study in school A?

- A. B and K B. K and F C. M and R D. Y and T E. Cannot be determined

4. Which is the complete list of people who are F's colleagues in his school?

- A. B and K B. B and M C. Only R D. Only B E. Cannot be determined

5. Who likes sweet lime?

- A. F B. T C. Y D. K E. None of these

### Set 5

From a group of six boys P, Q, R, S, T and U and five girls A, B, C, D and E a basketball team of six members is chosen under the following conditions:

1. D and E have to be together.
2. R cannot go with D.
3. P and S have to be together.
4. S cannot go with A.
5. R and B have to be together.
6. Q and C have to be together.
7. Q and T cannot be teamed together.

1. If the team consists of four girls, the members of the team are:

- A. QTACDE      B. TUACDE      C. QUACDE      D. QRACDE      E. None of these

2. If the team consists of five boys and there is only one girl, then the girl would be:

- A. A      B. B      C. C      D. D      E. None of these

3. If the team consists of four boys including T, then the other members of the team are:

- A. PSUDE      B. PQSDE      C. PRSAB      D. PQSCB      E. None of these

4. If the team consists of three girls including A, then the other members of the team are:

- A. PQSCD      B. QRUCD      C. PSTDE      D. QRUBC      E. None of these

5. If the team including R consists of four boys, then the other members of the team are:

- A. PSTDE      B. PQSBC      C. PQSAB      D. PQSAC      E. None of these

### Set 6

Three friends P, Q and R respectively have Rs.160, Rs.120 and Rs.80. They started playing a game in which the person who has the maximum money gives to both the persons an amount equal to half the difference between his amount and the respective person's account. The game stops when the difference between the amount any two of them has, is less than Rs.5.

1. What would be the amount with P at the end of the game?

- A. Rs.117.5      B. Rs.122.5      C. Rs.120      D. Rs.125      E. None of these

2. What would be the amount with Q at the end of the game?

- A. Rs.115      B. Rs.117.5      C. Rs.120      D. Rs.122.5      E. None of these

3. What would be the amount with R at the end of the game?

- A. Rs.115      B. Rs.117.5      C. Rs.120      D. Rs.122.5      E. None of these

### Set 7

A cube is painted black on all six faces. Each edge of cube is then cut into five pieces with four equi-spaced straight lines cuts parallel to every face, such that there are 125 smaller cubes.

1. How many of these smaller cubes would have none of its faces painted black?

- A. 9      B. 16      C. 27      D. 64      E. None of these

2. How many of these smaller cubes would have exactly one of its faces painted black?  
A. 8                      B. 16                      C. 36                      D. 54                      E. None of these
3. How many of these smaller cubes would have exactly two of its faces painted black?  
A. 8                      B. 16                      C. 36                      D. 48                      E. None of these
4. How many of these smaller cubes would have exactly three of its faces painted black?  
A. 8                      B. 12                      C. 16                      D. 32                      E. None of these

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