

Aptitude & Quantitative Techniques

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Quantitative Techniques

NUMBER SYSTEM

DIGITS

0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 , 9

NUMERAL

A group of digits, denoting a number.

2 3 6 5

Th	H	T	O
2	3	6	5

TYPES OF NUMBERS

NATURAL NUMBER

1 , 2 , 3 , 4 , 5 ...

WHOLE NUMBER

All natural numbers including 0.

INTEGERS

All natural numbers, 0 & negative numbers

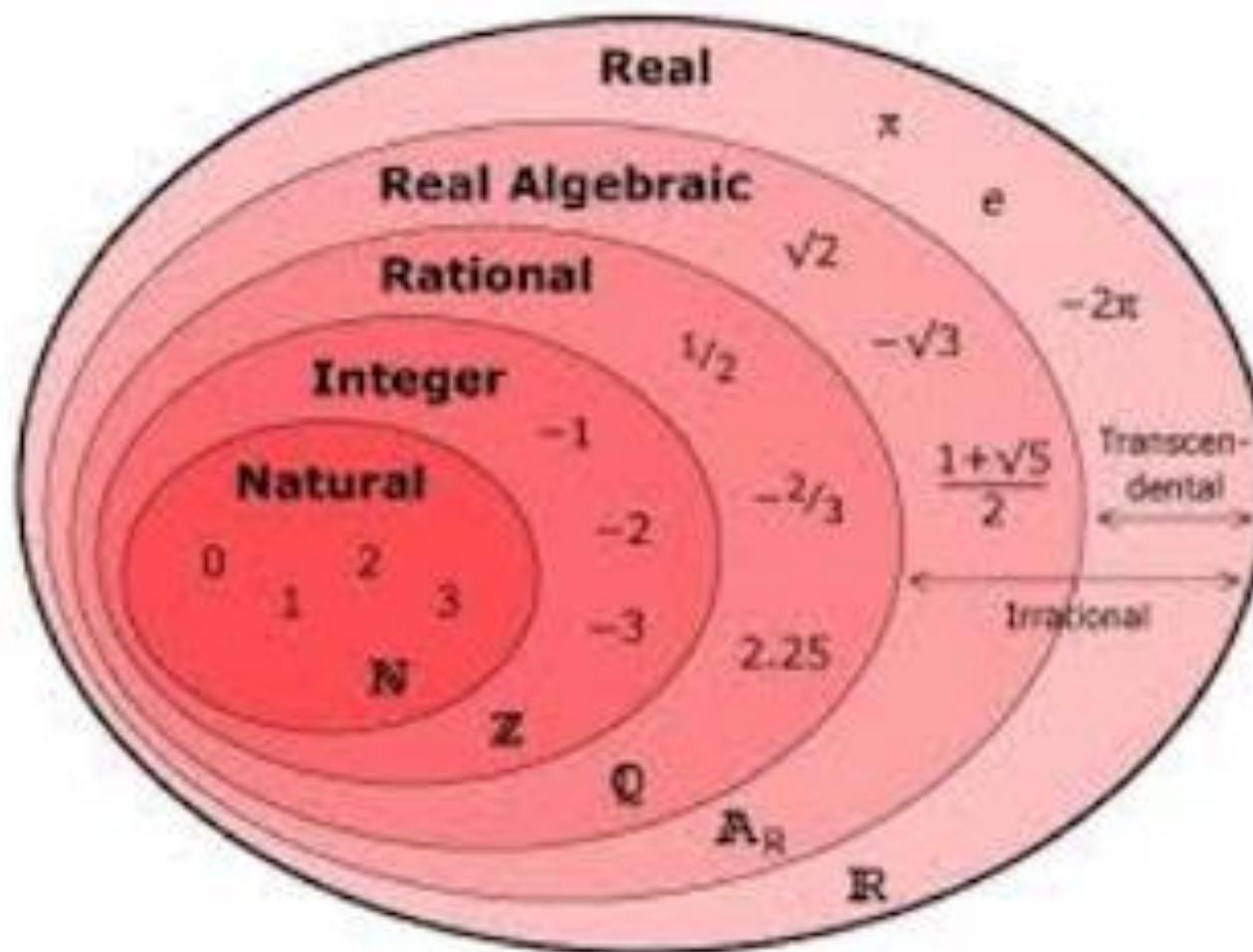
{..., -3, -2, -1, 0, 1, 2, 3, ...}

➤ Positive Integers {1, 2, 3, ...}

➤ Negative Integers {-1, -2, -3, ...}

➤ Non-Positive & Non-Negative Integer is 0.

TYPES OF NUMBERS



EVEN & ODD NUMBERS

EVEN NUMBER

No's divisible by 2.

ODD NUMBER

No's not divisible by 2.

Facts about Even & Odd No's

- ✓ Sum / Difference of two even numbers is an even number.
- ✓ Sum / Difference of two odd numbers is an even number.
- ✓ Sum / Difference of an even number and an odd numbers is an odd number.

TYPES OF NUMBERS –

Prime No

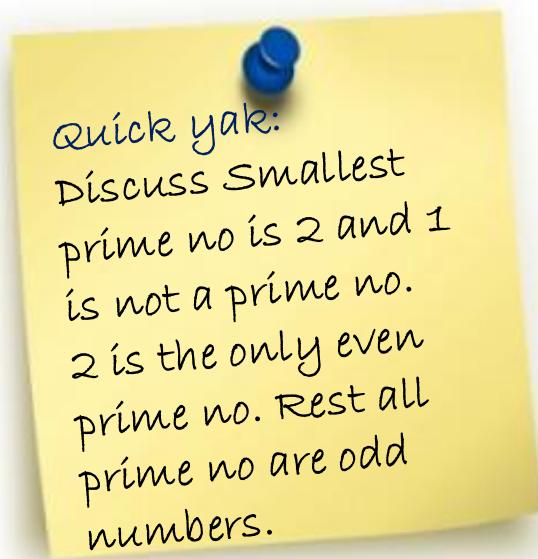
A **Prime No** is a natural no greater than 1 which has only two positive divisors other than 1 and the number itself.

Prime no's upto 100 are

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

A natural number greater than 1 which is not prime is called a **Composite No**.

Two no's a & b are said to be **Coprimes**, if their HCF is 1.



How to find whether a no is Prime or not

Suppose we have to find whether 191 is prime or not.

Now $14 > \sqrt{191}$

Prime no less than 14 are 2,3,5,7,11,13.

191 is not divisible by any of these prime no.

So 191 is a prime number.

Tests of Divisibility

A no is divisible by	If
2	Unit's digit is divisible by 2.
3	Sum of its digits is divisible by 3.
4	No formed by last 2 digits is divisible by 4.
5	Unit's digit is either 0 or 5.
6	It is divisible by both 2 & 3.
7	Eg 14 Double the unit digit i.e 8 subtract the remaining digit i.e $8-1 = 7$ ans will be either 0 or multiple of 7
8	No formed by last 3 digits is divisible by 8.
9	Sum of its digits is divisible by 9.
10	It ends with 0.

Tests of Divisibility

A no is divisible by	If
11	The difference of sum of its digits at odd places and sum of its digits at even places, is either 0 or a no divisible by 11.
12	It is divisible by both 3 & 4.
13	Eg 26 Multiply unit digit by 4 i.e $6 \times 4 = 24$ add Other digit = 26 ans will be divisible by 13
14	It is divisible by both 2 & 7.
15	It is divisible by both 3 & 5.
16	The no formed by last four digits is divisible by 16.
17	Eg 34 Multiply unit digit by 5 e.g $4 \times 5 = 20$ subtract the other digit i.e $20 - 3 = 17$ ans will be divisible by 17.
18	No must be divisible by 6 & 3 both
19	Eg 38 Multiply unit digit by 2 e.g $8 \times 2 = 16$ add the other digit i.e $16 + 3 = 19$ ans will be divisible by 19.

Division Algorithm

Dividend = (Divisor * Quotient) + Reminder

Basic Formulae

$$(a + b)(a - b) = (a^2 - b^2)$$

$$(a + b)^2 = (a^2 + b^2 + 2ab)$$

$$(a - b)^2 = (a^2 + b^2 - 2ab)$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$

$$(a^3 + b^3) = (a + b)(a^2 - ab + b^2)$$

$$(a^3 - b^3) = (a - b)(a^2 + ab + b^2)$$

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

When $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$.

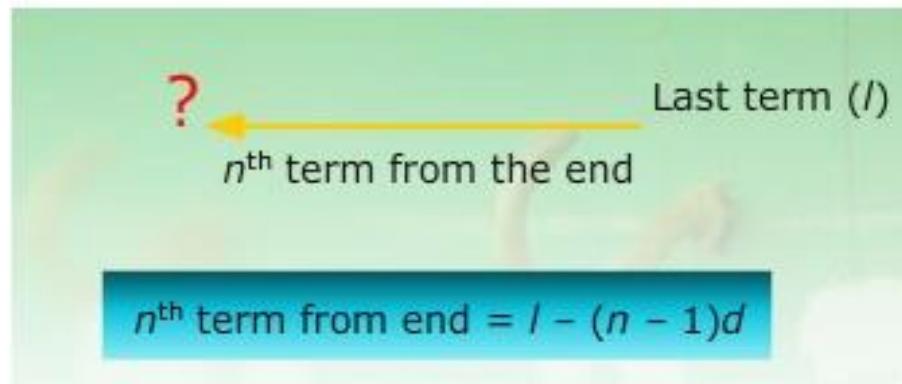
ARITHMATIC PROGRESSION

An Arithmetic Progression (A.P.) is a sequence in which the difference between any two consecutive terms is constant.

Let a = first term, d = common difference

Then nth term

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



Sum of an A.P.

The sum of n terms of an A.P. whose first term is a and common difference is d , is given by

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

The sum of n terms of an A.P. whose first term is a and last term is l is given by the formula:

$$S_n = \frac{n}{2} [a + l]$$

GEOMETRICAL PROGRESSION

A Geometric Progression or GP is a sequence where each new term after the first is obtained by multiplying the preceding term by a constant r , called the common ratio. If the first term of the sequence is a , then the geometric progression will be

$$a, ar, ar^2, ar^3, \dots$$

Where the n th term is ar^{n-1} .

GEOMETRICAL PROGRESSION

If the starting value is a and the common ratio is r , then the sum of first n terms is

$$S_n = \frac{a(1-r^n)}{1-r} \quad S_n = a(r^n - 1) / r-1$$

Provided that $r \neq 1$.

If $r > 1$

The sum to infinity of a geometric progression starting with a and common ratio r is

$$S_\infty = \frac{a}{1-r}$$

Where $-1 < r < 1$

HOW TO FIND THE CYCLICITY OF A NUMBER

FOR eg NUMBER IS 2

$$2^1 = 2 \quad \text{Unit Digit} = 2$$

$$2^2 = 4 \quad \text{Unit Digit} = 4$$

$$2^3 = 8 \quad \text{Unit Digit} = 8$$

$$2^4 = 16 \quad \text{Unit Digit} = 6$$

This cycle of unit digits will repeat itself after every 4 intervals so cyclicity of number 2 is 4 . Similarly cyclicity of number 9 is 2

HOW TO FIND THE UNIT DIGIT OF A NUMBER

Number	Cyclicity
1	1
2	4
3	4
4	2
5	1
6	1
7	4
8	4
9	2
10	1

Question Q 1.1

Which one of the following are prime number?

- A. 241
- B. 337
- C. 391
- D. 571

Solution Q1.1

Clearly, $16 > \sqrt{241}$

Prime numbers less than 16 are 2,3,5,7,11,13.

241 is not divisible by any one of them.

So, 241 is a prime number.

Question Q1.2

$$1397 \times 1397 = ?$$

- A. 1951609
- B. 1981709
- C. 18362619
- D. 2031719
- E. None of these

Solution Q1.2

Answer: Option A

Explanation:

$$1397 \times 1397 = (1397)^2$$

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

Question Q1.3

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
- E. None of these

Solution Q1.3

Answer: Option A

Question Q1.4

Find the unit digit of

$$2^{95}$$

Solution Q1.4

The cyclicity of 2 is 4.

$$2^1 = 2$$

$$2^2 = 4$$

$$2^3 = 8$$

$$2^4 = 16$$

Divide 95 by 4. Remainder is 3.

So, the unit digit is 8.

Practice P1.1

The largest 4 digit number exactly divisible by 88 is:

- A. 9944
- B. 9768
- C. 9988
- D. 8888
- E. None of these



Solution P1.1

Answer: Option A

Explanation:

Largest 4-digit number = 9999

Reminder of $9999 / 88 = 55$

Required number = $(9999 - 55) = 9944.$

Practice P1.2

Find the unit digit of

$$9^{99}$$

quick yak:
use concept
of Q1.4

Solution P1.2

The cyclicity of 9 is 2.

$$9^1 = 9$$

$$9^2 = 81$$

Divide 99 by 2. Remainder is 1.

So, the unit digit is 9.

Next Class: HCF & LCM

Factors and Multiples:

If number a divides another number b exactly, we say that a is a **factor** of b .

In this case, b is called a **multiple** of a .

***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 divided each of them exactly.

- Now, Suppose we have to find the H.C.F. of three numbers, then,
H.C.F. of three numbers = H.C.F. of [(H.C.F. of any two) and (the third number)]
Similarly, the H.C.F. of more than three numbers may be obtained.

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.

- ✓ *Product of two numbers = Product of their H.C.F. and L.C.M.*
- ✓ *Co-primes:* Two numbers are said to be co-primes if their H.C.F. is 1.

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

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

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

HCF and LCM Problem Solving

How can you tell if a word problem requires you
to use Highest Common Factor or
Least Common Multiple to solve?

Q 2.1 : HCF Example

Samantha has two pieces of cloth. One piece is 72 inches wide and the other piece is 90 inches wide. She wants to cut both pieces into strips of equal width that are as wide as possible. How wide should she cut the strips?

Samantha has two pieces of cloth. One piece is 72 inches wide and the other piece is 90 inches wide. She wants to cut both pieces into strips of equal width that are as wide as possible. How wide should she cut the strips?

The pieces of cloth are 72 and 90 inches wide.

How wide should she cut the strips so that they are the largest possible equal lengths.

Samantha has two pieces of cloth. One piece is 72 inches wide and the other piece is 90 inches wide. She wants to cut both pieces into strips of equal width that are as wide as possible.
How wide should she cut the strips?

This problem can be solved using Highest Common Factor because we are cutting or “dividing” the strips of cloth into smaller pieces (factor) of 72 and 90.

Find the HCF of 72 and 90

HCF Word Problem Solution

$$\begin{array}{r} 2 \mid \underline{72} \\ 2 \mid \underline{36} \\ 2 \mid \underline{18} \\ 3 \mid \underline{9} \\ 3 \mid \underline{3} \\ \quad 1 \end{array}$$

$$\begin{array}{r} 2 \mid \underline{90} \\ 3 \mid \underline{45} \\ 3 \mid \underline{15} \\ 5 \mid \underline{5} \\ \quad 1 \end{array}$$

$$72 = 2 \times 2 \times 2 \times 3 \times 3$$

$$90 = 2 \times 3 \times 3 \times 5$$

$$\text{HCF} = 2 \times 3 \times 3 = 18$$

Samantha should cut each piece to be 18 inches wide

If it is an LCM Problem

What is the question asking us?

- ✓ Do we have an event that is or will be repeating over and over?
- ✓ Will we have to purchase or get multiple items in order to have enough?
- ✓ Are we trying to figure out when something will happen again at the same time?

Q 2.2 : LCM Example

Ben exercises every 12 days and Isabel every 8 days. Ben and Isabel both exercised today. How many days will it be until they exercise together again?

Ben exercises every 12 days and Isabel every 8 days. Ben and Isabel both exercised today. How many days will it be until they exercise together again?

Ben exercises every 12 days and Isabel every 8 days and they both exercised today.

How many days is it until they will both exercise on the same day again.

Ben exercises every 12 days and Isabel every 8 days. Ben and Isabel both exercised today. How many days will it be until they exercise together again?

This problem can be solved using Least Common Multiple. We are trying to figure out when will be the next time they are exercising together.

Find the LCM of 12 and 8.

LCM Word Problem Solution

$$2 \mid \underline{12}$$

$$2 \mid \underline{6}$$

$$3 \mid \underline{3}$$

1

$$2 \mid \underline{8}$$

$$2 \mid \underline{4}$$

$$2 \mid \underline{2}$$

1

$$12 = 2 \times 2 \times 3$$

$$8 = 2 \times 2 \times 2$$

$$\text{LCM} = 2 \times 2 \times 2 \times 3 = 24$$

Ben and Isabel would exercise on the same day every 24 days.

Practice P 2.1

Rosa is making a game board 36 inches by 24 inches. She wants to tile the board with square tiles. What is the largest size tile she can use?

quick yak:
question of
HCF.

Practice P 2.1

$$2 \mid \underline{16}$$

$$2 \mid \underline{8}$$

$$2 \mid \underline{4}$$

$$2 \mid \underline{2}$$

1

$$2 \mid \underline{24}$$

$$2 \mid \underline{12}$$

$$2 \mid \underline{6}$$

$$3 \mid \underline{3}$$

1

$$16 = 2 \times 2 \times 2 \times 2$$

$$24 = 2 \times 2 \times 2 \times 3$$

$$\text{HCF} = 2 \times 2 \times 2 = 8$$

The largest size tile that Rosa can use is tile of 8 inches.

Practice P 2.3

Two bikers are riding a circular path.
One rider completes a round in 12 minutes.
The second rider completes a round in 18 minutes.
If they both started at the same place and go in the same direction, after how many minutes will they meet again at the starting point?

Quick yak:
Question of
LCM.

Practice P 2.3

$$2 \mid \underline{12}$$

$$2 \mid \underline{6}$$

$$3 \mid \underline{3}$$

1

$$2 \mid \underline{18}$$

$$3 \mid \underline{9}$$

$$3 \mid \underline{3}$$

1

$$12 = 2 \times 2 \times 3$$

$$18 = 2 \times 3 \times 3$$

$$\text{LCM} = 2 \times 3 \times 2 \times 3 = 36$$

Both bikers will meet after 36 minutes.

Next Class: AVERAGE

➤ Average

$$\text{Average} = \frac{\text{Sum of Observations}}{\text{Number of Observations}}$$

➤ Average Speed

Suppose a man covers a certain distance at x kmph and an equal distance at y kmph.

Then, the average speed of whole journey is $(\frac{2xy}{x+y})$ kmph

Short-Cuts

- ✓ Average of first n natural no. = $n+1/2$
- ✓ Average of square of first n natural no. = $(n+1)(2n+1)/6$
- ✓ Average of first n odd no. = n
- ✓ Average of first n even no. = $n+1$
- ✓ Average of consecutive no. = (first term + last term)/2

Short-Cuts

- ✓ The average of consecutive numbers is always the middle number.

Question Q3.1

Find the average of following number:

1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21

- A. 9
- B. 11
- C. 12
- D. 13

Solution Q3.1

Average of Consecutive Numbers = Middle Number

Given numbers

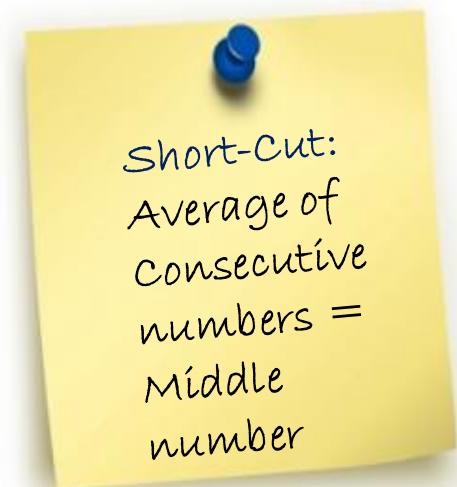
1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21

are 11 consecutive odd numbers.

So Average is middle no

i.e. 6th number

And 6th Number is 11.



Question Q3.2

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

- A. 0
- B. 1
- C. 10
- D. 19

Solution Q3.2

Answer: Option D

Explanation:

Average of 20 numbers = 0.

Sum of 20 numbers (0×20) = 0.

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

Question Q3.3

The average weight of 8 person's increases by 2.5 kg when a new person comes in place of one of them weighing 65 kg. What might be the weight of the new person?

- A. 76 kg
- B. 76.5 kg
- C. 85 kg
- D. Data inadequate
- E. None of these

Solution Q3.3

Answer: Option C

Explanation:

Total weight increased = (8×2.5) kg = 20 kg.

Weight of new person = $(65 + 20)$ kg = 85 kg.

Question Q3.4

The average weight of 16 boys in a class is 50.25 kg and that of the remaining 8 boys is 45.15 kg. Find the average weights of all the boys in the class.

- A. 47.55 kg
- B. 48 kg
- C. 48.55 kg
- D. 49.25 kg

Solution Q3.4

Answer: Option C

Question Q3.5

A library has an average of 510 visitors on Sundays and 240 on other days. The average number of visitors per day in a month of 30 days beginning with a Sunday is:

- A. 250
- B. 276
- C. 280
- D. 285

Solution Q3.5

Answer: Option D

Explanation:

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

Required average =

$$(510 \times 5 + 240 \times 25) / 30$$

$$= 8550 / 30 = 285$$

Question Q3.6

If the average marks of three batches of 55, 60 and 45 students respectively is 50, 55, 60, then the average marks of all the students is:

- A. 53.33
- B. 54.68
- C. 55
- D. None of these

Solution Q3.6

Answer: Option B

Question Q3.7

A pupil's marks were wrongly entered as 83 instead of 63. Due to that the average marks for the class got increased by half ($1/2$). The number of pupils in the class is:

- A. 10
- B. 20
- C. 40
- D. 73

Solution Q3.7

Answer: Option C

Explanation:

Let there be x pupils in the class.

I Total increase in marks = $83 - 63 = 20$

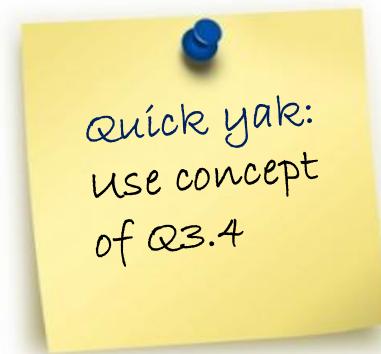
II Total increase in marks are $x * \frac{1}{2}$

So, $x * \frac{1}{2} = 20$ and $x = 40$.

Practice P3.1

The captain of a cricket team of 11 members is 25 years old and the wicket keeper is 3 years older. If these two are excluded, the average age of the remaining players is one year less than the average age of the whole team. What is the average age of the whole team?

- A. 23 years
- B. 24 years
- C. 25 years
- D. None of these



Solution P3.1

Answer: Option A

Explanation:

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

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

$$11x - 9x = 46$$

$$2x = 46$$

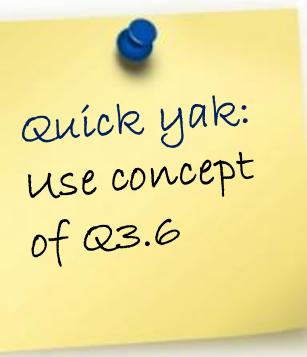
$$x = 23.$$

So, average age of the team is 23 years.

Practice P3.2

In the first 10 overs of a cricket game the run rate was only 3.2. What should be the run rate in the remaining 40 overs to reach 282 runs?

- A. 6.25
- B. 6.5
- C. 6.75
- D. 7



Solution P3.2

Answer: Option A

Explanation:

$$\begin{aligned}\text{Required run rate} &= (282 - (3.2 \times 10)) / 40 \\ &= 250 / 40 \\ &= 6.25\end{aligned}$$

Practice P3.3

The average of five consecutive odd numbers is 61. What is difference between the highest and lowest number?

- A. 6
- B. 7
- C. 8
- D. 9

Solution P3.3

Answer: Option C



**Next Class: PROBLEM ON
NUMBERS & AGES**

There are two ways to solve problems on ages :

- ✓ By forming Equation
- ✓ By Elimination Method

Question Q5.1

If Rajeev's age after 15 years will be 5 times his age 5 years back. What is the present age of Rajeev?

- A. 8 years
- B. 9 years
- C. 10 years
- D. None of these

Answer: Option C

Question Q5.2

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

Answer: Option A

Explanation:

Let the ages of children be x , $(x + 3)$, $(x + 6)$, $(x + 9)$ and $(x + 12)$ years.

$$\text{Then, } x + (x + 3) + (x + 6) + (x + 9) + (x + 12) = 50$$

$$5x = 20$$

$$x = 4.$$

Age of the youngest child = $x = 4$ years.

Question Q5.3

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

Answer: Option A

Explanation:

Let the son's present age be x years. Then, $(38 - x) = x$

$$2x = 38.$$

$$x = 19.$$

Son's age 5 years back $(19 - 5) = 14$ years.

Question P5.1

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

Answer: Option D

Explanation:

Let the son's present age be x years. Then,
man's present age = $(x + 24)$ years.

$$(x + 24) + 2 = 2(x + 2)$$

$$x + 26 = 2x + 4$$

$$x = 22.$$

Question P5.2

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

Answer: Option A

Explanation:

Let the ages of Kunal and Sagar 6 years ago be $6x$ and $5x$ years respectively.

$$\text{Then, } ((6x + 6) + 4) / ((5x + 6) + 4) = 11 / 10$$

$$10(6x + 10) = 11(5x + 10)$$

$$5x = 10$$

$$x = 2.$$

$$\text{Sagar's present age} = (5x + 6) = 16 \text{ years.}$$

PROBLEM ON NUMBERS

Question Q5.4

The difference between a number and its three-fifth is 50. What is the number ?

- A. 75
- B. 100
- C. 125
- D. None of these

Answer : C

Question Q5.5

A number is doubled and 9 is added. If the resultant is trebled, it becomes 75. What is that number ?

- A. 3.5
- B. 6
- C. 8
- D. None of these

Answer : C

Question Q5.6

When 24 is subtracted from a number, it reduces to its four-seventh. What is the sum of the digits of that number ?

- A. 1
- B. 9
- C. 11
- D. Data inadequate

Answer : C

Question P5.3

Find the number which when multiplied by 15 is increased by 196.

- A. 14
- B. 20
- C. 26
- D. 28

Answer : A

Question P5.4

Twenty times a positive integer is less than its square by 96. What is the integer ?

- A. 20
- B. 24
- C. 30
- D. Can not be determined

Answer : B



Next Class: PERCENTAGE

Percentage

- ✓ A fraction whose denominator is 100 is called a percentage, and the numerator of fraction is called the *rate percent*.
- ✓ To express $x\%$ as a fraction: we have, $x\% = \frac{x}{100}$

$$\text{So, } 20\% = \frac{20}{100} = \frac{1}{5}$$

- ✓ To express $\frac{a}{b}$ as a percent, we have $\frac{a}{b} = (\frac{a}{b} \times 100) \%$
- So, $\frac{1}{4} = (\frac{1}{4} \times 100) \% = 25\%$

Percentage Increase / Decrease

- If the price of a commodity increases by R%, then the reduction in consumption so as not to increase the expenditure is :

$$[\frac{R}{(100 + R)} \times 100] \%$$

- If the price of a commodity decreases by R%, then the increase in consumption so as not to decrease the expenditure is :

$$[\frac{R}{(100 - R)} \times 100] \%$$

Percentage Increase / Decrease

- If A is R% more than B, then B is less than A by :

$$\left[\frac{R}{(100 + R)} \times 100 \right] \%$$

- If A is R% less than B, then B is more than A by :

$$\left[\frac{R}{(100 - R)} \times 100 \right] \%$$

Continuous Percentage Increase / Decrease

If the salary of a person was first increased by $x\%$ and then again increased by $y\%$. Find total change in salary.

$$x + y + \frac{xy}{100}$$

If the salary of a person was first increased by $x\%$ and then decreased by $y\%$. Find total change in salary.

$$x - y - \frac{xy}{100}$$

Results on Population

Let the population of a town be P now and suppose it increases at the rate of R% per annum, then

✓ Population after n years = $P \left(1 + \frac{R}{100} \right)^n$

✓ Population n years ago = $\frac{P}{\left(1 + \frac{R}{100} \right)^n}$

Results on Depreciation

Let the present value of a machine be P.

Suppose it depreciates at the rate of R% per annum.
Then

✓ Value of the machine after n years = $P \left(1 - \frac{R}{100} \right)^n$

✓ Value of the machine n years ago = $\frac{P}{\left(1 - \frac{R}{100} \right)^n}$

Question Q6.1

A batsman scored 110 runs which included 3 boundaries and 8 sixes. What percent of his total score did he make by running between the wickets?

- A. 45%
- B. $45\frac{5}{11}\%$
- C. $54\frac{6}{11}\%$
- D. 55%

Answer: Option B

Explanation:

$$\text{Number of runs made by running} = 110 - (3 \times 4 + 8 \times 6)$$

$$= 110 - (60)$$

$$= 50.$$

$$\text{Required percentage} = 50/110 \times 100 \% = 45\frac{5}{11}\%$$

Question Q6.2

Two students appeared at an examination. One of them secured 9 marks more than the other and his marks was 56% of the sum of their marks. The marks obtained by them are:

- A. 39, 30
- B. 41, 32
- C. 42, 33
- D. 43, 34

Answer: Option C

Explanation:

Let their marks be $(x + 9)$ and x .

$$\text{Then, } (x + 9) / (x + 9 + x) * 100 = 56$$

$$x = 33$$

So, their marks are 42 and 33.

Question Q6.3

If 2 liters of water is evaporated on boiling from 8 liters of sugar solution containing 5% sugar, find the percentage of sugar in the remaining solution.

- A. 6%
- B. $6\frac{1}{2}\%$
- C. $6\frac{2}{3}\%$
- D. $6\frac{1}{3}\%$

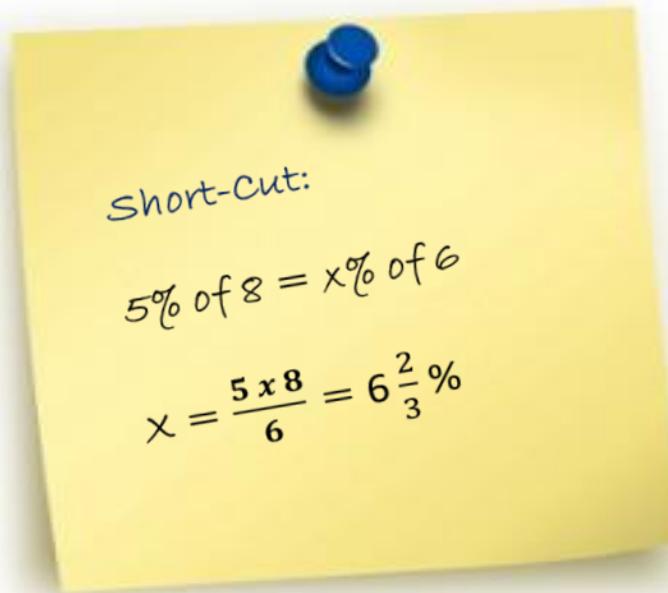
Answer: Option C

Explanation:

% of sugar in the original solution = $\frac{5}{100} \times 8 = 0.4$

After evaporation of 2 l water, the quantity of remaining solution = $8 - 2 = 6$ l

$$\text{Required \% of sugar} = \frac{0.4}{6} \times 100\% = 6\frac{2}{3}\%$$



Question Q6.4

A fruit seller had some apples. He sells 40% apples and still has 420 apples. Originally, he had:

- A. 588 apples
- B. 600 apples
- C. 672 apples
- D. 700 apples

Answer: Option D

Explanation:

Suppose originally he had x apples.

Then, $(100 - 40)\%$ of $x = 420$.

$$60 / 100 * x = 420$$

$$x = 420 \times 100 / 60 = 700$$

Question Q6.5

If $A = x\%$ of y and $B = y\%$ of x , then which of the following is true?

- A. A is smaller than B.
- B. A is greater than B
- C. Relationship between A and B cannot be determined.
- D. If x is smaller than y , then A is greater than B.
- E. None of these

Answer: Option E

Explanation:

$$x\% \text{ of } y = (x/100) \times y = (y/100) \times x = y\% \text{ of } x$$

A = B.

Question Q6.6

If $20\% \text{ of } a = b$, then $b\%$ of 20 is the same as:

- A. 4% of a
- B. 5% of a
- C. 20% of a
- D. None of these

Answer: Option A

Explanation:

$20\% \text{ of } a = b$ So, $20 a / 100 = b$.

$b\% \text{ of } 20 = b / 100 \times 20$

By putting value of b

$b\% \text{ of } 20 = (20 a \times 1 \times 20) / (100 * 100) =$
 $4/100 * a = 4\% \text{ of } a$.

Question P6.1

In an election between two candidates, one got 55% of the total valid votes, 20% of the votes were invalid. If the total number of votes was 7500, the number of valid votes that the other candidate got, was:

- A. 2700
- B. 2900
- C. 3000
- D. 3100

Answer: Option A

Explanation:

$$\begin{aligned}\text{Number of valid votes} &= 80\% \text{ of } 7500 \\ &= 6000.\end{aligned}$$

Valid votes polled by other candidate = 45% of
6000

$$= 45/100 \times 6000 = 2700.$$

Question P6.2

Gauri went to the stationers and bought things worth Rs. 25, out of which 30 paise went on sales tax on taxable purchases. If the tax rate was 6%, then what was the cost of the tax free items?

- A. Rs. 15
- B. Rs. 15.70
- C. Rs. 19.70
- D. Rs. 20

Answer: Option C

Explanation:

Let the amount taxable purchases be Rs. x .

Then, 6% of $x = 30 / 100$

$$x = (30/100) \times (100/6) = 5.$$

Cost of tax free items = Rs. $[25 - (5 + 0.30)] = \text{Rs. } 19.70$

Question P6.3

Rajeev buys good worth Rs. 6650. He gets a rebate of 6% on it. After getting the rebate, he pays sales tax @ 10%. Find the amount he will have to pay for the goods.

- A. Rs. 6876.10
- B. Rs. 6999.20
- C. Rs. 6654
- D. Rs. 7000

Answer: Option A

Explanation:

Rebate = 6% of Rs. 6650 = Rs. $6/100 \times 6650$ = Rs. 399.

Sales tax = 10% of Rs. $(6650 - 399)$

$$= \text{Rs. } 625.10$$

Final amount = Rs. $(6251 + 625.10)$ = Rs. 6876.10



Next Class: PROFIT & LOSS

Cost Price:

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

Selling Price:

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

Profit or Gain:

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

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

Important Formulae

- ✓ Gain = SP – CP
- ✓ Loss = CP – SP
- ✓ Gain or Loss is always calculated on CP.
- ✓ Gain Percentage : (Gain %)

$$\text{Gain \%} = \left(\frac{\text{Gain} \times 100}{CP} \right)$$

- ✓ Loss Percentage : (Loss %)

$$\text{Loss \%} = \left(\frac{\text{Loss} \times 100}{CP} \right)$$

Important Formulae

✓ Selling Price : (SP)

$$SP = \left[\left(\frac{100 + Gain\%}{100} \right) \times CP \right]$$

✓ Selling Price : (SP)

$$SP = \left[\left(\frac{100 - Loss\%}{100} \right) \times CP \right]$$

✓ Cost Price : (CP)

$$CP = \left[\frac{100}{(100 + Gain\%)} \times SP \right]$$

✓ Cost Price : (CP)

$$CP = \left[\frac{100}{(100 - Gain\%)} \times SP \right]$$

Important Formulae

- ✓ If an article is sold at a gain of say, 25%, then

$$SP=125\% \text{ of } CP$$

- ✓ If an article is sold at a loss of say, 25%, then

$$SP=65\% \text{ of } CP$$

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

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

Short Cut

✓ If $C_1 = C_2$ and $P\% = L\%$ then

No Profit No Loss

✓ If $S_1 = S_2$ and $P\% = L\% = x$ then

This is case of Loss always and

$$\text{Loss \%} = \frac{x^2}{100} \%$$

Question Q7.1

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%

Answer: Option B

Explanation:

Cost Price (C.P.) = Rs. $(4700 + 800)$ = Rs. 5500.

Selling Price (S.P.) = Rs. 5800.

Gain = (S.P.) - (C.P.) = Rs.(5800 - 5500) = Rs. 300.

Gain % = $300 / 5500 \times 100\% = 5\frac{5}{11}\%$

Question Q7.2

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

Answer: Option B

Explanation:

Let C.P. of each article be Re. 1

C.P. of x articles = Rs. x .

S.P. of x articles = Rs. 20.

Profit = Rs. $(20 - x)$.

$$20 - x / x * 100 = 25$$

$$2000 - 100x = 25x$$

$$125x = 2000$$

$$x = 16.$$

Question Q7.3

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

Answer: Option C

Explanation:

C.P. of 6 toffees = Re. 1

S.P. of 6 toffees = 120% of Re. 1 = Rs. 1.20

S.P. of 1 toffee = Rs. 0.20

For Re. 1, toffees sold = 5

Question Q7.4

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

Answer: Option C

Explanation:

If CP=Rs.100 then SP=Rs.122.5

If SP=122.5 then profit = 22.5

If SP=392 the profit = $22.5/122.5 * 392 = \text{Rs}72$

Profit = Rs. 72.

Question Q7.5

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

Answer: Option C

Explanation:

S.P. = 85% of Rs. 1400 = Rs. $85/100 \times 1400$ = Rs. 1190

Question Q7.6

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

Answer: Option C

Explanation:

Cost Price of 1 toy = Rs. $375/12$ = Rs. 31.25

Selling Price of 1 toy = Rs. 33

So, Gain = Rs. $(33 - 31.25)$ = Rs. 1.75

Profit % = $1.75/31.25 \times 100\% = 5.6\%$

Question P7.1

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 1/3 %
- C. 35%
- D. 44%

Answer: Option D

Explanation:

Suppose, number of articles = 30.
6 and 5 = 30.

C.P. of 30 articles = Rs. 5

S.P. of 30 articles = Rs. 6

Gain % = $11 / 25 \times 100\% = 44\%$.

Short-Cut:
Purchase 6 for 5
Sell 5 for 6
 $\frac{6 \times 6 - 5 \times 5}{5 \times 5} \times 100$

$= 44\%$
Sign is +ve, there is gain of 44%.

Question P7.2

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

- A. 3% loss
- B. 3 % gain
- C. 4 % loss
- D. None of these

Answer: Option B

Explanation:

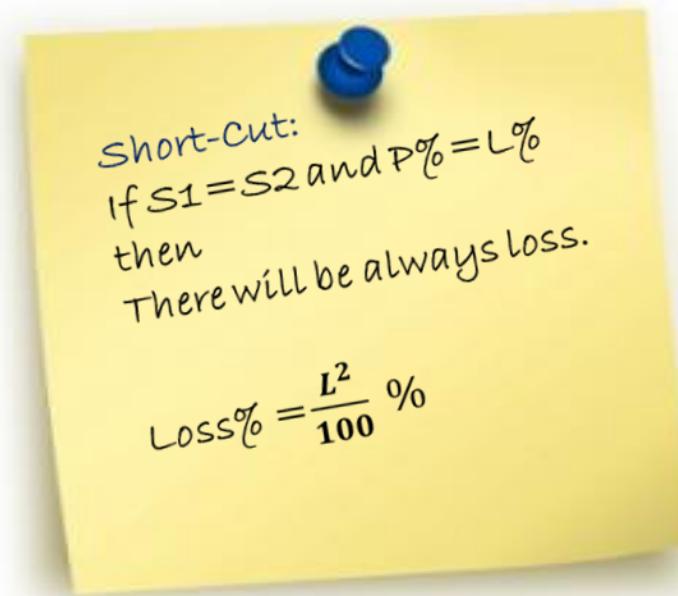
C.P. of 1st transistor = Rs. 10

C.P. of 2nd transistor = Rs. 10

So, total C.P. = Rs. (700 + 10

Total S.P. = Rs. (840 + 840) =

Gain % = $70 / 1750 \times 100 \% = 4 \%$



Question P7.3

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

Answer: Option B

Explanation:

C.P. of 56 kg rice = Rs. $(26 \times 20 + 30 \times 36) = \text{Rs.}$
 $(520 + 1080) = \text{Rs. } 1600.$

S.P. of 56 kg rice = Rs. $(56 \times 30) = \text{Rs. } 1680.$

Gain = $80 / 1600 \times 100 \% = 5\%.$

Question P7.4

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

Answer: Option C

Explanation:

$$85 : 18700 = 115 : x$$

$$x = 18700 \times 115 / 85 = 25300.$$

Hence, S.P. = Rs. 25,300.



Next Class: RATIO & PROPORTION

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 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, $4 : 6 = 2 : 3$.

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, if $a : b :: c : d$ then $(b \times c) = (a \times d)$.

✓ ***Fourth Proportional:***

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

✓ ***Third Proportional:***

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

✓ ***Mean Proportional:***

Mean proportional between a and b is \sqrt{ab} .

Duplicate Ratio

- ✓ Duplicate ratio of (a : b) is ($a^2 : b^2$)
- ✓ Sub-duplicate ratio of (a : b) is ($\sqrt{a} : \sqrt{b}$)
- ✓ Triplicate ratio of (a : b) is ($a^3 : b^3$)
- ✓ Sub-triplicate ratio of (a : b) is ($\sqrt[3]{a} : \sqrt[3]{b}$)
- ✓ If $\frac{a}{b} = \frac{c}{d}$ then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$ (Componendo and dividendo)

Question Q9.1

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

Answer: Option C

Explanation:

Let the third number be x .

Then, first number = 120% of x = $120x/100 = 6x/5$

Second number = 150% of x = $150x/100 = 3x/2$

Ratio of first two numbers = $6x/5 : 3x/2 = 4 : 5$.

Question Q9.2

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

- A. 20
- B. 30
- C. 48
- D. None of these

Answer: Option B

Explanation:

Let 1st number = 2x

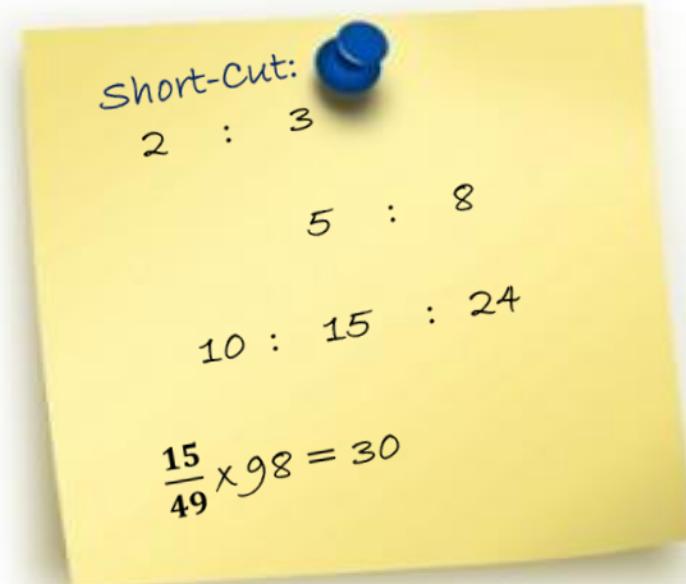
So, 2nd number = 3x and 3^r

Ratio between 1st and 2nd |

Ratio between 2nd and 3rd

1st : 2nd : 3rd = 10x : 15x : 24x or 10 : 15 : 24

So, 2nd number = $\frac{15}{49} \times 98 = 30$



Question Q9.3

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

Answer: Option C

Explanation:

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

Then, $4x - 3x = 1000$

$x = 1000$.

B's share = Rs. $2x$ = Rs. (2×1000) = Rs. 2000.

Question Q9.4

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

Answer: Option A

Explanation:

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

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

$\frac{140}{100} \times 5x$, $\frac{150}{100} \times 7x$ and $\frac{175}{100} \times 8x$

$7x$, $\frac{21x}{2}$ and $14x$.

The required ratio = $7x : \frac{21x}{2} : 14x$

$14x : 21x : 28x$

$2 : 3 : 4$.

Question Q9.5

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

Answer: Option C

Explanation:

Let 40% of A = $\frac{2}{3}$ B

Then, $\frac{40}{100} A = \frac{2}{3} B$

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

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

$A : B = 5 : 3.$

Question P9.1

Two numbers are in the ratio 3 : 5. If 9 is subtracted from each, the new numbers are in the ratio 12 : 23. The smaller number is:

- A. 27
- B. 33
- C. 49
- D. 55

Answer: Option B

Explanation:

Let the numbers be $3x$ and $5x$.

$$\text{Then, } 3x - 9/5x - 9 = 12/23$$

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

$$9x = 99$$

$$x = 11.$$

The smaller number = $(3 \times 11) = 33$.

Question P9.2

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

Answer: Option C

Explanation:

Let the number of 25 p, 10 p and 5 p coins be x , $2x$, $3x$ respectively.

Then, sum of their values

$$= \text{Rs. } 25x/100 + 10 \times 2x/100 + 5 \times 3x/100 = \text{Rs. } 30$$

$$60x/100 = 30$$

$$x = 50.$$

Hence, the number of 5 p coins = $(3 \times 50) = 150$.



Next Class: PARTNERSHIP

Partnership

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

Working and Sleeping Partners

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

Ratio of Division 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) = $x : y$.

Ratio of Division of Gains

- ✓ When investments are for different time periods, then equivalent capitals are calculated for a unit of time by taking (capital x 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,

$$(\text{A's share of profit}) : (\text{B's share of profit}) = xp : yq.$$

Question Q10.1

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

Answer: Option B

Explanation:

Let the total profit be Rs. 100.

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

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

If A's share Rs. 855, total profit = $100/57 \times 855 = 1500$.

Question Q10.2

Simran started a software business with a capital of Rs. 50,000. After six months, Nanda joined her with a capital of Rs. 80,000. After 3 years, they had a profit of Rs. 24,500. What was Simran's share of profit?

- A. Rs. 9,423
- B. Rs. 10,250
- C. Rs. 12,500
- D. Rs. 10,500



Answer: Option D

Explanation:

Simran : Nanda = $(50000 \times 36) : (80000 \times 30) = 3 : 4$.

Simran's share = Rs. $24500 \times \frac{3}{7} = \text{Rs. } 10,500$.

Question Q10.3

Arun, Kamal and Vinay invested Rs. 8000, Rs. 4000 and Rs. 8000 respectively in a business. Arun left after six months. If after eight months, there was a gain of Rs. 4005, then what will be the share of Kamal?

- A. Rs. 890
- B. Rs. 1335
- C. Rs. 1602
- D. Rs. 1780

Answer: Option A

Explanation:

$$\begin{aligned}\text{Arun : Kamal : Vinay} &= (8,000 \times 6) : (4,000 \times 8) : (8,000 \times 8) \\&= 48 : 32 : 64 \\&= 3 : 2 : 4\end{aligned}$$

$$\text{Kamal's share} = \text{Rs. } 4005 \times 2 = \text{Rs. } 890.9$$

Question P10.1

A, B, C subscribe Rs. 50,000 for
subscribes Rs. 4000 more than
more than C. Out of a total prof
A receives:

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

quick yak:
Time of
investment
is equal.

Answer: Option D

Explanation:

Let $C = x$.

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

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

$$3x = 36000$$

$$x = 12000$$

$$A : B : C = 21000 : 17000 : 12000 = 21 : 17 : 12.$$

$$A's \text{ share} = \text{Rs. } 35000 \times \frac{21}{50} = \text{Rs. } 14,700.$$

Question P10.2

Kamal started a business investing Rs. 12000. After five months, Sameer joined him with an investment of Rs.8000. If at the end of the year, they get a profit of Rs.6970, then What will be the share of Sameer in the profit?

- A. Rs. 1883
- B. Rs. 2380
- C. Rs. 3690
- D. None of these

quick yak:
Time of
investment
is different.

Answer: Option B

Explanation:

$$\text{Kamal : Sameer} = (9000 \times 12) : (8000 \times 7) = 27 : 14$$

$$\text{Sameer's share} = \text{Rs. } 6970 \times \frac{14}{41} = \text{Rs. } 2380$$

Question P10.3

Three partners shared the profit
the ratio 5 : 7 : 8. They had part
months, 8 months and 7 month
What was the ratio of their inve

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

quick yak:
Time of
investment
is different.

Answer: Option D

Explanation:

Let their investments be Rs. X for 14 months, Rs. Y for 8 months and Rs.z for 7 months respectively.

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

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

$$98x = 40y \text{ and } y = \frac{49}{20}x$$

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

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

$$\begin{aligned} \text{So, } x : y : z &= x : \frac{49}{20}x : \frac{16}{5}x \\ &= 20 : 49 : 64 \end{aligned}$$



Next Class: Chain Rule

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)

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 time taken

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

Question Q11.1

If 15 toys cost Rs234, what

- A. Rs.540
- B. Rs.546
- C. Rs.548
- D. Rs.556



Answer: Option B

Explanation:

Let the required cost be Rs x . Then

More toys, More Cost (Direct Proportion)

$$15 : 35 :: 234 : x$$

$$(15x) = (35 \times 234)$$

$$X = 546$$

Question Q11.2

If 36 men can do a piece of work in 24 days,
how many hours will 15 men do it in?

- A. 60 hours
- B. 50 hours
- C. 66 hours
- D. 70 hours



Answer: Option A

Explanation:

Let the required number of hours be Rs x. Then

Less men, More hours (Indirect Proportion)

$$15 : 36 :: 25 : x$$

$$(15x) = (36 \times 25)$$

$$X = 60$$

Question P11.1

If the wages of 6 men for 15 days be Rs2100,
then find the wages of 9 men for 12 days.

- A. Rs 2520
- B. Rs 2560
- C. Rs 2620
- D. Rs 2650

Answer: Option A

Explanation:

Let the required wages be Rs x . Then

More men, More wages (Direct Proportion)

Less days, Less wages (Direct Proportion)

Men 6 : 9

Days 15 : 12 :: 2100 : x

$$6 \times 15 \times x = 9 \times 12 \times 2100$$

$$x = 2520$$

**ALLIGATION
OR
MIXTURE**

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.

Mean Price

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

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)

$$\therefore (\text{Cheaper quantity}) : (\text{Dearer quantity}) = (d - m) : (m - c).$$

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

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

Question Q11.3

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

Answer : Option B

By the rule of alligation:



∴ Required ratio = 60 : 90 = 2 : 3.

Question Q11.4

How many kilogram of sugar costing Rs. 9 per kg must be mixed with 27 kg of sugar costing Rs. 7 per kg so that there may be a gain of 10% by selling the mixture at Rs. 9.24 per kg?

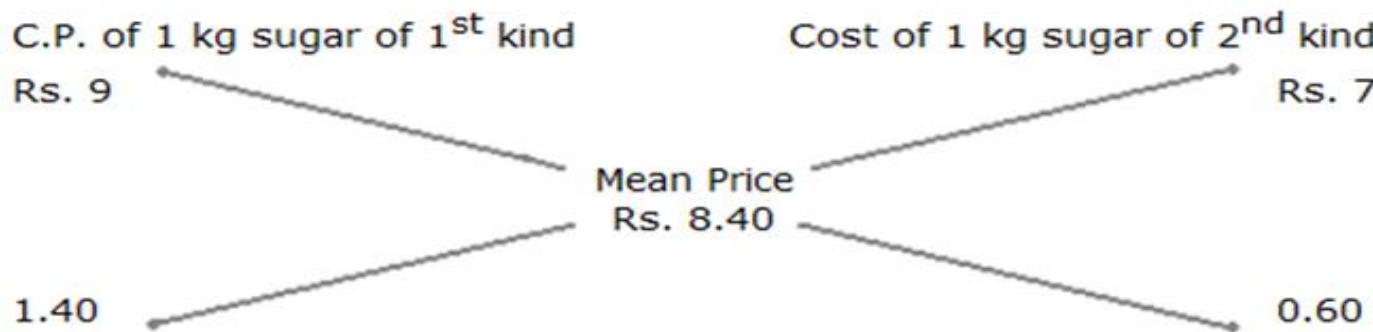
- A. 36 kg
- B. 42 kg
- C. 54 kg
- D. 63 kg

Answer : Option D

S.P. of 1 kg of mixture = Rs. 9.24, Gain 10%.

$$\therefore \text{C.P. of 1 kg of mixture} = \text{Rs. } \left(\frac{100}{110} \times 9.24 \right) = \text{Rs. 8.40}$$

By the rule of alligation, we have:



\therefore Ratio of quantities of 1st and 2nd kind = 14 : 6 = 7 : 3.

Let x kg of sugar of 1st be mixed with 27 kg of 2nd kind.

Then, 7 : 3 = x : 27

$$\Rightarrow x = \left(\frac{7 \times 27}{3} \right) = 63 \text{ kg.}$$

Question 11.5

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%

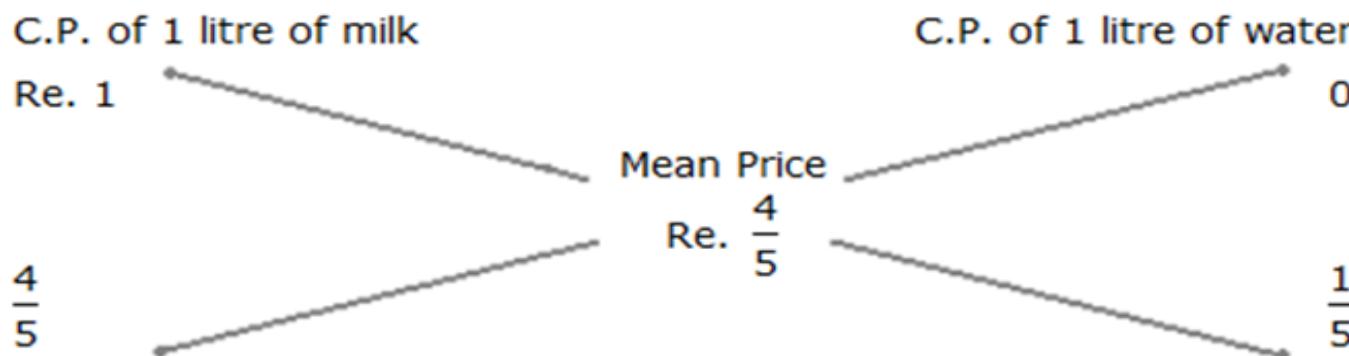
Answer : Option C

Let C.P. of 1 litre milk be Re. 1

Then, S.P. of 1 litre of mixture = Re. 1, Gain = 25%.

$$\text{C.P. of 1 litre mixture} = \text{Re. } \left(\frac{100}{125} \times 1 \right) = \frac{4}{5}$$

By the rule of alligation, we have:



$$\therefore \text{Ratio of milk to water} = \frac{4}{5} : \frac{1}{5} = 4 : 1.$$

$$\text{Hence, percentage of water in the mixture} = \left(\frac{1}{5} \times 100 \right)\% = 20\%.$$

Question P11.2

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

Answer : Option D

Amount of milk left after 3 operations =

$$[40 \left(1 - \frac{4}{40}\right)^3] \text{ liters}$$

$$= \left(40 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10} \right)$$

$$= 29.16 \text{ liters}$$



Next Class: Time & Work

Work from Days

If A can do a piece of work in n days,

then A's 1 day's work = $\frac{1}{n}$

Days from Work

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

Ratio

If A is thrice as good a workman as B, then

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

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

SHORT CUTS

- ✓ If A can do a piece of work in x days and B can do it in y days, then A and B working together will do the same work in $\frac{xy}{x+y}$ days.
- ✓ If A, B and C can do a work in x , y and z days respectively, then all of them working together will finish the work in $\frac{xyz}{xy+yz+xz}$ days.
- ✓ If A and B together can do a work in x days and A alone can do it in y days, then B alone can do the work in $\frac{xy}{y-x}$ days.

Question Q13.1

Worker A takes 8 hours to do a job. Worker B takes 10 hours to do the same job. How long should it take both A and B, working together, to do the same job?

- A. $4 \frac{2}{9}$ days
- B. $4 \frac{4}{9}$ days
- C. $4 \frac{5}{9}$ days
- D. $4 \frac{7}{9}$ days

Answer: Option B

Explanation:

A's 1 hour's work = $1/8$

B's 1 hour's work = $1/10$

(A+B)'s 1 hour's work = $(1/8 + 1/10) = 9/40$

Both A and B will finish the work in $40/9 = 4 \frac{4}{9}$ days

Short-cut:

$$\frac{xy}{x+y} = \frac{80}{18} = 4\frac{4}{9} \text{ days}$$

Question Q13.2

A and B together can complete a piece of work in 4 days. If A alone can complete the same work in 12 days, in how many days can B alone complete that work?

- A. 6 days
- B. 4 days
- C. 8 days
- D. 9 days

Answer: Option A

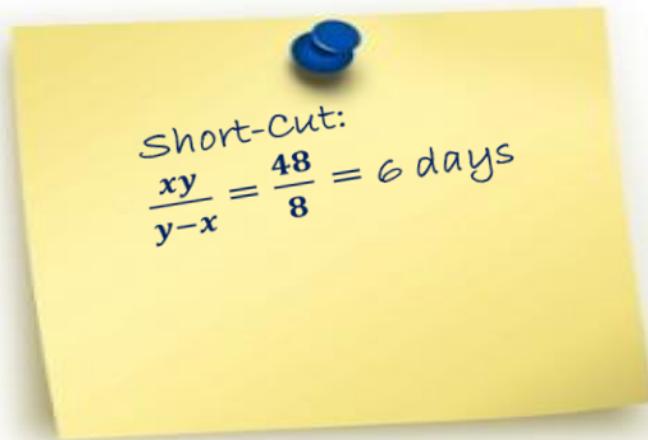
Explanation:

(A+B)'s 1 day's work = $\frac{1}{4}$

A's 1 day's work = $1/12$

B's 1 day's work = $\frac{1}{4} - \frac{1}{12} = \frac{1}{6}$

B alone can complete the work in 6 days.



Question Q13.3

A is twice as good a workman as B and together they finish a piece of work in 18 days. In how many days will A alone finish the work?

- A. 27 days
- B. 24 days
- C. 28 days
- D. 29 days

Answer: Option A

Explanation:

(A's 1 day's work) : (B's 1 day's work) = 2 : 1

(A+B)'s 1 day's work = $1/18$

Divide $1/18$ in the ratio 2 : 1

A's 1 days work = $1/18 \times 2/3 = 1/27$

So, A alone can finish the work in 27 days.

Question Q13.4

7 spiders can make 7 webs in 7 days. 1 spider will make 1 web in how many days?

- A. 1 day
- B. 7 days
- C. 14 days
- D. 49 days

Answer: Option B

Question P13.1

A and B working separately can do a piece of work in 9 and 12 days respectively. If they work for a day alternately, A beginning, in how many days, the work will be completed?

- A. $10\frac{1}{4}$ days
- B. $10\frac{1}{2}$ days
- C. $8\frac{1}{4}$ days
- D. $8\frac{1}{2}$ days

Answer: Option A

Explanation:

(A+B)'s 2 day's work = $1/9 + 1/12 = 7/36$

Work done in 5 pairs of days = $5 \times 7/36 = 35/36$

Remaining work = $1 - 35/36 = 1/36$

On 11th day, it is A's turn.

$1/9$ work done by him in 1 day.

$1/36$ work done by him in $(9 \times 1/36) = \frac{1}{4}$ days.

Total time taken = $10 + \frac{1}{4} = 10 \frac{1}{4}$ days.

Question P13.2

45 men can complete a work in 16 days. Six days after they started working, 30 more men joined them. How many days will they now take to complete the remaining work?

- A. 6 days
- B. 4 days
- C. 8 days
- D. 9 days

Answer: Option A

Explanation: Trick 1 $45 * 10 = (45+30) * x$ Or

45 men can complete the work in 16 days.

(45x16) men can complete the work in 1 day.

1 man's 1 day's work = $1/720$

45 men's 6 day's work = $45/720 \times 6 = 3/8$

Remaining work = $1 - 3/8 = 5/8$

75 men's 1 day's work = $75/720 = 5/48$.

Now, $5/48$ work is done by them in 1 day.

So, $5/8$ work is done by them in $48/5 \times 5/8 = 6$ days



Next Class: Time & Distance

TIME & DISTANCE

✓ Speed, Time and Distance

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad \text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

✓ km/hr to m/sec conversion:

$$a \text{ km/hr} = a \times \frac{5}{18} \text{ m/sec}$$

✓ m/sec to km/hr conversion:

$$a \text{ m/sec} = a \times \frac{18}{5} \text{ km/hr}$$

- ✓ If the ratio of speeds of A and B is $a : b$, then the ratio of the time taken by them to cover the same distance will be $\frac{1}{a} : \frac{1}{b}$ or $b : a$
- ✓ Suppose a man covers a certain distance at x km/hr and an equal distance at y km/hr, then the average speed of whole journey = $\frac{2xy}{x+y}$ km/hr

Question Q16.1

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

Answer: Option B

Explanation:

$$\text{Speed} = \frac{600}{5 \times 60} = 2 \text{ m/sec}$$

Converting to km/hr:

$$2 \times \frac{18}{5} = 7.2 \text{ km/hr}$$

Question Q16.2

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

Answer: Option A

Explanation:

Let the actual distance travelled is x km

$$\text{Then, } \frac{x}{10} = \frac{x + 20}{14}$$

$$14x = 10x + 200$$

$$x = 50 \text{ km}$$

Question Q16.3

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

Answer: Option B

Explanation:

Due to stoppages, it covers 9 km less.

Time taken to cover 9 km = $\frac{9}{54} \times 60 = 10$ min

Question Q16.4

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

Answer: Option C

Explanation:

Let the speed of car is x kmph.

Then, speed of train = $\frac{150}{100}x = \frac{3}{2}x$ kmph

$$\frac{75}{x} - \frac{75}{\left(\frac{3}{2}x\right)} = \frac{125}{10 \times 60} \quad \text{or} \quad \frac{75}{x} - \frac{50}{x} = \frac{5}{24}$$

$$X = \frac{25 \times 24}{5} = 120 \text{ kmph}$$

Question Q16.5

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

Answer: Option B

Explanation:

$$\frac{(1/2)x}{21} + \frac{(1/2)x}{24} = 10$$

$$\Rightarrow \frac{x}{21} + \frac{x}{24} = 20$$

$$\Rightarrow 15x = 168 \times 20$$

$$\Rightarrow x = \left(\frac{168 \times 20}{15} \right) = 224 \text{ km.}$$

Question P16.1

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

Answer: Option C

Explanation:

$$\text{Total time taken} = \left(\frac{160}{64} + \frac{160}{80} \right) \text{hrs.} = \frac{9}{2} \text{ hrs.}$$

$$\therefore \text{Average speed} = \left(320 \times \frac{2}{9} \right) \text{km/hr} = 71.11 \text{ km/hr.}$$

Question P16.2

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

Answer: Option A

Explanation:

Let Abhay's speed be x km/hr.

$$\text{Then, } \frac{30}{x} - \frac{30}{2x} = 3$$

$$\Rightarrow 6x = 30$$

$$\Rightarrow x = 5 \text{ km/hr.}$$

Question P16.3

A man covers a certain distance between his house and office by scooter. At an average speed of 30Km/hr, he is late by 10min. However at a speed of 40 km/hr, he reaches is office 5 min earlier. Find the distance between his house and office.

- A. 30 km
- B. 35 km
- C. 40 km
- D. 45 km

Answer : Option A

Question P16.4

A monkey tries to ascend a greased pole 14 meters high. He ascends 2 meters in first minute and slips down 1 meter in the alternate minute. If he continues to ascend in this fashion, how long does he take to reach the top?

- A. 20 min
- B. 22 min
- C. 25 min
- D. 30 min

Answer : Option C

PROBLEM ON TRAINS

✓ Speed, Time and Distance

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \quad \text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Distance} = \text{Speed} \times \text{Time}$$

✓ km/hr to m/sec conversion:

$$a \text{ km/hr} = a \times \frac{5}{18} \text{ m/sec}$$

✓ m/sec to km/hr conversion:

$$a \text{ m/sec} = a \times \frac{18}{5} \text{ km/hr}$$

- ✓ Time taken by a train of length l meters to pass a pole or standing man or signal post is equal to the time taken by the train to cover l meters.
- ✓ Time taken by a train of length l meters to pass a stationary object of length b meters is equal to the time taken by the train to cover $(l + b)$ meters.
- ✓ Suppose two trains are moving in same direction at u m/s and v m/s, where $u > v$, then their relative speed will be $(u - v)$ m/s.
- ✓ Suppose two trains are moving in opposite direction at u m/s and v m/s, then their relative speed will be $(u + v)$ m/s.

- ✓ If two trains of length a meters and b meters are moving in opposite direction at u m/s and v m/s, then:

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

- ✓ If two trains of length a meters and b meters are moving in same direction at u m/s and v m/s, then:

$$\text{Time taken by trains to cross each other} = \frac{(a + b)}{(u - v)} \text{ sec}$$

- ✓ Two trains start at the same time from point A and B towards each other and after crossing each other, they

.....

Question Q17.1

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 meters
- B. 180 meters
- C. 324 meters
- D. 150 meters

Answer: Option D

Explanation:

$$\text{Speed} = \left(60 \times \frac{5}{18} \right) \text{m/sec} = \left(\frac{50}{3} \right) \text{m/sec.}$$

$$\text{Length of the train} = (\text{Speed} \times \text{Time}) = \left(\frac{50}{3} \times 9 \right) \text{m} = 150 \text{ m.}$$

Question Q17.2

The length of the bridge, which a train 130 meters 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

Answer: Option C

Explanation:

$$\text{Speed} = \left(45 \times \frac{5}{18} \right) \text{m/sec.} = \left(\frac{25}{2} \right) \text{m/sec.}$$

Time = 30 sec.

Let the length of bridge be x metres.

$$\text{Then, } \frac{130 + x}{30} = \frac{25}{2}$$

$$\Rightarrow 2(130 + x) = 750$$

$$\Rightarrow x = 245 \text{ m.}$$

Question Q17.3

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

Answer: Option B

Explanation:

$$\text{Speed} = \left(54 \times \frac{5}{18} \right) \text{m/sec} = 15 \text{ m/sec.}$$

Length of the train = (15×20) m = 300 m.

Let the length of the platform be x metres.

$$\text{Then, } \frac{x + 300}{36} = 15$$

$$\Rightarrow x + 300 = 540$$

$$\Rightarrow x = 240 \text{ m.}$$

Question Q17.4

A train 240 m long passes a pole in 24 seconds.
How long will it take to pass a platform 650 m
long?

- A. 65 sec
- B. 89 sec
- C. 100 sec
- D. 150 sec

Answer: Option B

Explanation:

$$\text{Speed} = \left(\frac{240}{24} \right) \text{m/sec} = 10 \text{ m/sec.}$$

$$\therefore \text{Required time} = \left(\frac{240 + 650}{10} \right) \text{sec} = 89 \text{ sec.}$$

Question Q17.5

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

Answer: Option A

Explanation:

Let the length of each train be x metres.

Then, distance covered = $2x$ metres.

Relative speed = $(46 - 36)$ km/hr

$$= \left(10 \times \frac{5}{18} \right) \text{m/sec}$$

$$= \left(\frac{25}{9} \right) \text{m/sec}$$

$$\therefore \frac{2x}{36} = \frac{25}{9}$$

$$\Rightarrow 2x = 100$$

$$\Rightarrow x = 50.$$

Question P17.1

The distance between two stations Delhi and Kolkata is 1500 km. Two trains starts at 7am from Delhi to Kolkata and from Kolkata to Delhi and moved towards each other with a speed of 60km/hr and 90km/hr respectively. At what time they will meet each other?

- A. 15:00 PM
- B. 17:00 AM
- C. 17:00 PM
- D. None of these

Answer : Option C

Question P17.2

The distance between two stations Delhi and Amritsar is 450km. A train starts at 4 PM from Delhi and moves towards Amritsar at an average speed of 60Km/hr. Another train starts from Amritsar at 3.20pm and moves towards Delhi at an average speed of 80km/hr. How far from Delhi will the two trains meet and at what time?

- A. 06:50 AM
- B. 12:50 PM
- C. 06:15 PM
- D. 06:50 PM

Answer : Option D

Train from Delhi to Amritsar will be travelling for 2 hr 50 min @60 km/hr = 170 km

Train from Amritsar to Delhi will be travelling for 3 hr 30 min @ 80 Km/hr = 280 Km

i.e $170 + 280 = 450$ Km

Question P17.3

Two trains starts from Delhi to Patna and Patna to Delhi at the same time. After passing each other, they complete their journey in 9 and 16 hrs respectively. If the train from Delhi to Patna goes with a speed of 80km/hr, what is the speed of the train from Patna to Delhi?

- A. 30 km/hr
- B. 45 km/hr
- C. 75 km/hr
- D. 90 km/hr

Answer : Option B

BOATS & STREAMS

✓ Downstream / Upstream

In water, the direction along the stream is called Downstream and the direction against the stream is called Upstream.

- ✓ If the speed of a boat in still water is u km/hr and the speed of stream is v km/hr, then

$$\text{Speed Downstream} = (u + v) \text{ km / hr}$$

$$\text{Speed Upstream} = (u - v) \text{ km / hr}$$

- ✓ If the speed downstream is a km/hr and speed upstream is b km/hr, then:

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

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

Question Q18.1

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

Answer: Option C

Explanation:

Speed downstream = $(13 + 4)$ km/hr = 17 km/hr.

Time taken to travel 68 km downstream = $68/17$ hrs = 4 hrs.

Question Q18.2

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

Answer: Option C

Explanation:

Man's rate in still water = $(15 - 2.5)$ km/hr = 12.5 km/hr.

Man's rate against the current = $(12.5 - 2.5)$ km/hr = 10 km/hr.

Question Q18.3

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

Answer: Option B

Explanation:

Let the speed of the stream be x km/hr. Then,

Speed downstream = $(15 + x)$ km/hr,

Speed upstream = $(15 - x)$ km/hr.

$$\therefore \frac{30}{(15 + x)} + \frac{30}{(15 - x)} = 4\frac{1}{2}$$

$$\Rightarrow \frac{900}{225 - x^2} = \frac{9}{2}$$

$$\Rightarrow 9x^2 = 225$$

$$\Rightarrow x^2 = 25$$

$$\Rightarrow x = 5 \text{ km/hr.}$$

Question Q18.4

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

Answer: Option B

Explanation:

Rate downstream = $16/2$ kmph = 8 kmph.

Rate upstream = $16/4$ kmph = 4 kmph.

Speed in still water = $1/2 (8 + 4)$ kmph = 6 kmph.

Question Q18.5

A boatman goes 2 km against the current of the stream in 1 hour and goes 1 km along the current in 10 minutes. How long will it take to go 5 km in stationary water?

- A. 40 minutes
- B. 1 hour
- C. 1 hr 15 min
- D. 1 hr 30 min

Answer: Option C

Explanation:

$$\text{Rate downstream} = \left(\frac{1}{10} \times 60 \right) \text{ km/hr} = 6 \text{ km/hr.}$$

$$\text{Rate upstream} = 2 \text{ km/hr.}$$

$$\text{Speed in still water} = \frac{1}{2}(6 + 2) \text{ km/hr} = 4 \text{ km/hr.}$$

$$\therefore \text{Required time} = \left(\frac{5}{4} \right) \text{ hrs} = 1\frac{1}{4} \text{ hrs} = 1 \text{ hr } 15 \text{ min.}$$

Question P18.1

Three cities (A, B, C) are along side a river. B is the exact midway between A and C. A man takes 4hr30m to row from A to C. And takes 6 hr to row from A to B and back. How much time will he take to row from C to A

- A. 3 hours 45 minutes
- B. 7 hours 15 minutes
- C. 7 hours 30 minutes
- D. 7 hours 45 minutes

Answer: Option B

Explanation:

Question P18.2

A man can row 18km/hr in still water. It takes him twice as long to row up as to row down the river. Find the rate of stream.

- A. 3 km/hr
- B. 6 km/hr
- C. 8 km/hr
- D. 12 km/hr

Answer: Option B

Explanation:

Question P18.3

A man can row 12km/hr in still water. When the river is running at 3km/hr it takes him 2 hr to row to a place and back. How far is the place?

- A. 11.25 km
- B. 22.50 km
- C. 25.50 km
- D. 28.25 km

Answer: Option B

Explanation:

Question P18.4

A man can row a certain distance down stream in 6hrs and return the same distance in 9hrs. If the stream flows at the rate of the 3 km/hr. Find the speed of the man in still water.

- A. 6 km/hr
- B. 8 km/hr
- C. 12 km/hr
- D. 16 km/hr

Answer: Option C

Explanation:

Question P18.5

A boat covers 24km upstream and 36 km down stream in 6hrs. While it covers 36km upstreams and 24 km downstream in 6.5 hrs. Find the speed of the current.

- A. 1 km/hr
- B. 1.5 km/hr
- C. 2 km/hr
- D. 4 km/hr

Answer: Option C

Explanation:

INTEREST

SIMPLE INTEREST

SIMPLE INTEREST

✓ *Principal*

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

✓ *Interest*

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

✓ Simple Interest (S.I.)

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

SIMPLE INTEREST

Let Principal = P,

Rate = R% per annum (p.a.) and

Time = T years. Then

$$\text{Simple Interest} = \frac{P \times R \times T}{100}$$

$$P = \frac{100 \times SI}{R \times T}$$

$$R = \frac{100 \times SI}{P \times T}$$

$$T = \frac{100 \times SI}{P \times R}$$

COMPOUND INTEREST

COMPOUND INTEREST

Money is said to be lent on Compound Interest (C.I.) when at the end of a year or other fixed period the interest that has become due is not paid to the lender, but is added to the sum lent, and the amount thus obtained become the principal for the next period. The process is repeated until the last period. The difference between the original principal and the final amount is called Compound Interest (C.I.).

COMPOUND INTEREST

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

- ✓ When interest is Compound Yearly:

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

- ✓ When interest is Compound Half-yearly:

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

- ✓ When interest is Compound Quarterly:

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

COMPOUND INTEREST

- ✓ When interest is Compound Yearly but time is in fraction, say $2\frac{3}{5}$ years:

$$\text{Amount} = P \left(1 + \frac{R}{100}\right)^2 \left(1 + \frac{\frac{3}{5}R}{100}\right)$$

- ✓ When interest rates are different for different years, say R1%, R2%, R3% for 1st, 2nd and 3rd year respectively:

$$\text{Amount} = P \left(1 + \frac{R1}{100}\right) \left(1 + \frac{R2}{100}\right) \left(1 + \frac{R3}{100}\right)$$

Question Q20.1

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

Answer : Option D

Question Q20.2

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

Answer : Option B

Question Q20.3

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

Answer : Option A

Question Q20.4

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

Answer : Option B

Question Q20.5

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:

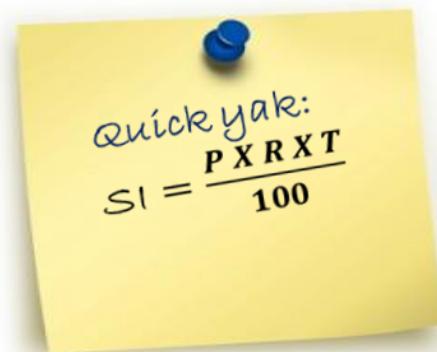
- A. 625
- B. 630
- C. 640
- D. 650

Answer : Option A

Question P20.1

If a sum of money at simple interest doubles in 6 years, it will become 4 times in:

- A. 12 years
- B. 14 years
- C. 16 years
- D. 18 years

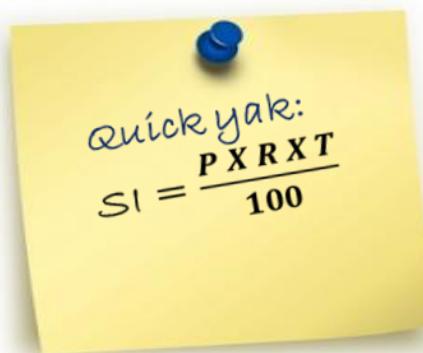


Answer : Option D

Question P20.2

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



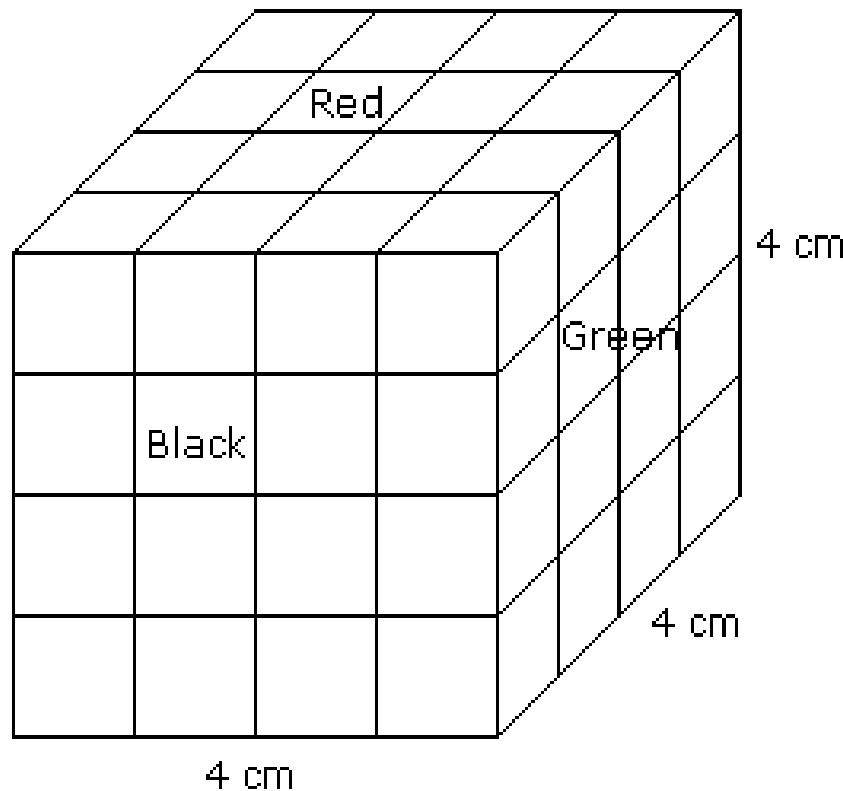
Answer : Option C

CUBE & CUBOID

- ✓ In a cube length, breadth and height are same while in cuboid, these are different.
- ✓ In a cube, the numbers of unit cubes = $(\text{side})^3$
- ✓ In a cuboid, the numbers of unit cubes= $(l \times b \times h)$

Example

A cube of each side 4cm, has been painted black, red and green on opposite faces. It is then cut into small cubes of each side 1cm.



Question Q21.1

How many small cubes will be there?

- A. 36
- B. 62
- C. 64
- D. 84

Answer : Option C

Total number of cubes = $(side)^3 = (4)^3 = 64$

Question Q21.2

How many small cubes will have three faces painted ?

- A. 4
- B. 8
- C. 12
- D. 16

Answer : Option B

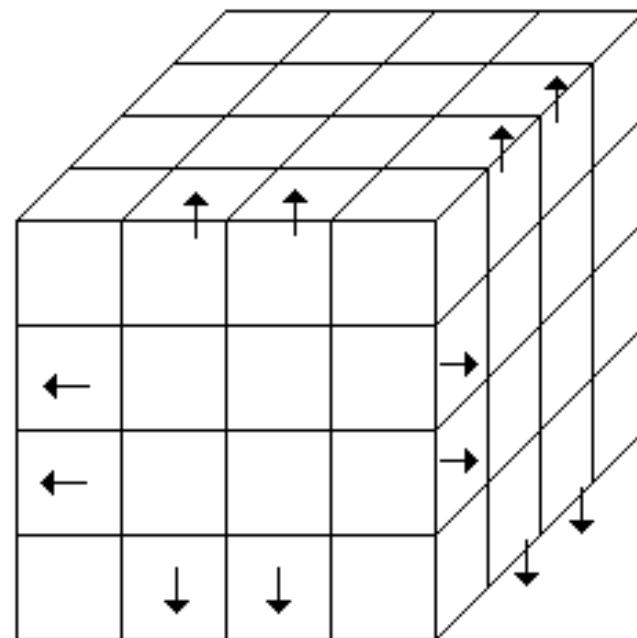
From the figure it is clear that the small cube having three faces coloured are situated at the corners of the big cube because at these corners only three faces of the big cube meet.

Therefore the required number of such cubes is always 8, because there are 8 corners.

Question Q21.3

How many small cubes will have only two faces painted ?

- A. 12
- B. 18
- C. 24
- D. 30



Answer : Option C

From the figure it is clear that to each edge of the big cube 4 small cubes are connected and two out of them are situated at the corners of the big cube which have all three faces painted.

Thus, to edge two small cubes are left which have two faces painted.
As the total no. of edges in a cube are 12.

Hence the no. of small cubes with two faces coloured = $12 \times 2 = 24$

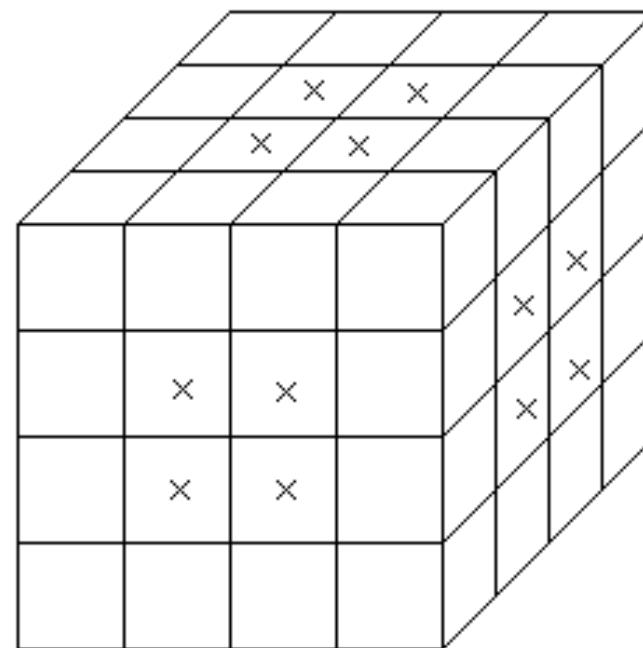
(or)

No. of small cubes with two faces coloured = $(x - 2) \times \text{No. of edges}$
where $x = (\text{side of big cube} / \text{side of small cube})$

Question Q21.4

How many small cubes will have only one faces painted ?

- A. 12
- B. 18
- C. 24
- D. 30



Answer : Option C

The cubes which are painted on one face only are the cubes at the centre of each face of the big cube.

Since there are 6 faces in the big cube and each of the face of big cube there will be four small cubes.

Hence, in all there will be $6 \times 4 = 24$ such small cubes (or) $(x - 2)^2 \times 6$.

Question Q21.5

How many small cubes will have no faces painted ?

- A. 6
- B. 8
- C. 12
- D. 16

Answer : Option B

No. of small cubes will have no faces painted = No. of such small cubes

$$= (x - 2)^3 \quad [\text{Here } x = (4/1) = 4]$$

$$= (4 - 2)^3$$

$$= 8.$$

Question Q21.6

How many small cubes will have only two faces painted in black and green and all other faces unpainted ?

- A. 6
- B. 8
- C. 10
- D. Cannot be determined

Answer : Option B

There are 4 small cubes in layer II and 4 small cubes in layer III which have two faces painted green and black.

Required no. of such small cubes = $4 + 4 = 8$.

Question Q21.7

How many small cubes will have only two faces painted green and red ?

- A. 4
- B. 6
- C. 8
- D. 10

Answer : Option C

No. of small cubes having two faces painted green
and red = $4 + 4 = 8$.

Question P21.1

How many small cubes will have only two faces painted black and red ?

- A. 2
- B. 4
- C. 6
- D. 8

Answer : Option D

No. of small cubes having two faces painted black
and red = $4 + 4 = 8$.

Question P21.2

How many small cubes will have only black painted ?

- A. 4
- B. 6
- C. 8
- D. 10

Answer : Option C

No. of small cubes having only black paint. There will be 8 small cubes which have only black paint. Four cubes will be form one side and 4 from the opposite side.

Question P21.3

How many small cubes will have at least one face painted ?

- A. 48
- B. 52
- C. 56
- D. 64

Answer : Option C

No. of small cubes having at least one face painted

$$\begin{aligned} &= \text{No. of small cubes having 1 face painted} + \\ &\quad \text{2 faces painted} + \text{3 faces painted} \end{aligned}$$

$$= 24 + 24 + 8$$

$$= 56.$$

Question P21.4

How many small cubes will have at least two faces painted ?

- A. 16
- B. 28
- C. 32
- D. 48

Answer : Option C

No. of small cubes having at least two faces painted
= No. of small cubes having two faces painted +

3 faces painted

$$= 24 + 8$$

$$= 32.$$

CALENDAR

CALENDAR

Leap Year:

- ✓ Every year divisible by 4 is a leap year, if it is not a century.
- ✓ Every 4th century is a leap year and no other century is a leap year.
- ✓ A leap year has 366 days.

Ordinary Year:

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

CALENDAR

Examples:

- ✓ Each of the years 1948, 2004, 1676 etc. is a leap year.
- ✓ Each of the years 400, 800, 1200, 1600, 2000 etc. is a leap year.
- ✓ None of the years 2001, 2002, 2003, 2005, 1800, 2100 is a leap year.

Odd Days:

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

Counting of Odd Days

- ✓ 1 ordinary year = 365 days = (52 weeks + 1 day.)
So, 1 ordinary year has 1 odd day.
- ✓ 1 leap year = 366 days = (52 weeks + 2 days)
So, 1 leap year has 2 odd days.
- ✓ 100 years = 76 ordinary years + 24 leap years
= $(76 \times 1 + 24 \times 2)$ odd days = 124 odd days.
= (17 weeks + 5 days)
So, Number of odd days in 100 years = 5.

Counting of Odd Days

- ✓ Number of odd days in 200 years = 3 odd days.
- ✓ Number of odd days in 300 years = 1 odd day.
- ✓ Number of odd days in 400 years = $(5 \times 4 + 1)$
= 0 odd day.

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

Day of the Week Related to Odd Days

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

Question Q22.1

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

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

Answer: Option B

Explanation:

The year 2007 is an ordinary year.

So, It has 1 odd day.

1st day of year 2007 was Monday.

So, 1st day of the year 2008 will be a day after Monday.

This day will be Tuesday.

Question Q22.2

January 1,2008 was Tuesday. What day of the week was on January 1,2009?

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

Answer: Option C

Explanation:

The year 2008 is a leap year.

So, It has 2 odd day.

1st day of year 2008 was Tuesday.

So, 1st day of the year 2009 will be 2 days after
Tuesday.

This day will be Thursday.

Question Q22.3

What was the day of week on 15th August, 1947 ?

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

Answer

15th Aug 1947 = 1946 years + Period from 1.1.1947 to
15.8.1947

Odd days in 1600 years = 0

Odd days in next 300 years(1601-1900) = $5 * 3 = 15 = 1$

46 years = 11 leap years + 35 ordinary years

$$= (11 * 2) + (35 * 1) = 57 = 1$$

Odd days is 1946 years = $0 + 1 + 1 = 2$

Jan + Feb + Mar + Apr + May + Jun + July + Aug =

$$31 + 28 + 31 + 30 + 31 + 30 + 31 + 15 = 227 \text{ days}$$

$$227 \text{ days} = 32 \text{ weeks} + 3 \text{ days} = 3 \text{ odd days}$$

Total odd days = $2 + 3 = 5$

So, the day on 15th Aug 1947 was **Friday**.

Question Q22.4

How many days are there in x weeks x days?

- A. $7x^2$
- B. $8x$
- C. $14x$
- D. 7

Answer: Option B

Explanation:

$$x \text{ weeks } x \text{ days} = (7x + x) \text{ days} = 8x \text{ days.}$$

Question Q22.5

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

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

Answer: Option B

Explanation:

Each day of the week is repeated after 7 days.

So, after 63 days, it will be Monday.

After 61 days, it will be Saturday.

Question P22.1

The last day of a century cannot be

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

Answer: Option C

Explanation:

100 years contain 5 odd days.

Last day of 1st century is Friday.

200 years contain (5×2) 3 odd days.

Last day of 2nd century is Wednesday.

300 years contain $(5 \times 3) = 15$ 1 odd day.

Last day of 3rd century is Monday.

400 years contain 0 odd day.

Last day of 4th century is Sunday.

This cycle is repeated.

Last day of a century cannot be Tuesday or Thursday or Saturday.

Question P22.2

The calendar for the year 2003 will be the same for the year.

- A. 2008
- B. 2012
- C. 2014
- D. 2016

Answer : Option C

2003 is ordinary year. So odd day = 1

2004 is leap year. So odd day = 2

2005 is ordinary year. So odd day = 1

2006 is ordinary year. So odd day = 1

2007 is ordinary year. So odd day = 1

2008 is leap year. So odd day = 2

2009 is ordinary year. So odd day = 1

2010 is ordinary year. So odd day = 1

2011 is ordinary year. So odd day = 1

2012 is leap year. So odd day = 2

2013 is ordinary year. So odd day = 1

In 2013, no of odd days are zero.

So, calendar for the year 2003 will be the same for 2014.

PIPES & CISTERNS

Inlet

A pipe connected with a tank or a cistern or a reservoir, that fills it, is known as an inlet.

Outlet

A pipe connected with a tank or cistern or reservoir, emptying it, is known as an outlet.

- ✓ If a pipe can fill a tank in x hours, then

$$\text{Part of tank filled in 1 hour} = \frac{1}{x}$$

- ✓ If a pipe can empty a tank in y hours, then

$$\text{Part of tank emptied in 1 hour} = \frac{1}{y}$$

Question Q15.1

Pipe A and B can fill a tank in 5 and 6 hours respectively. Pipe C can empty it in 12 hours. If all the three pipes are opened together, then the tank will be filled in :

A $1\frac{13}{17}$ hours

B $2\frac{8}{11}$ hours

C $3\frac{9}{17}$ hours

Answer: Option C

Explanation:

Net part filled in 1 hour $\frac{1}{5} + \frac{1}{6} - \frac{1}{12} = \frac{17}{60}$

The tank will be full in $\frac{60}{17}$ hours or $3\frac{9}{17}$ hours

Question Q15.2

Three pipes A, B and C can fill a tank from empty to full in 30, 20 and 10 minutes respectively. When the tank is empty, all the three pipes are opened. A, B and C discharge chemical solutions P, Q and S respectively. What is the proportion of solution R in the liquid in the tank after 3 minutes?

A $\frac{5}{11}$

B $\frac{6}{11}$

C $\frac{7}{11}$

D $\frac{7}{17}$

Answer: Option B

Explanation:

$$\text{Part filled by (A+B+C) in 1 minutes} = \frac{1}{30} + \frac{1}{20} + \frac{1}{10} = \frac{11}{60}$$

$$\text{Part filled by (A+B+C) in 3 minutes} = 3 \times \frac{11}{60} = \frac{11}{20}$$

$$\text{Part filled by C in 3 minutes} = \frac{3}{10}$$

$$\text{Required Ratio} = \frac{3}{10} \times \frac{20}{11} = \frac{6}{11}$$

Question Q15.3

A tank is filled in 5 hours by three pipes A,B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank?

- A. 20 hours
- B. 25 hours
- C. 35 hours
- D. None of these

Answer: Option C

Explanation:

Suppose pipe A alone takes x hours to fill the tank.

Then pipe B and C will take $\frac{x}{2}$ and $\frac{x}{4}$ hours respectively to fill the tank.

$$\text{So, } \frac{1}{x} + \frac{2}{x} + \frac{4}{x} = \frac{1}{5}$$

$$\frac{7}{x} = \frac{1}{5} \quad \text{and } x = 35 \text{ hours}$$

Question Q15.4

Two pipes A and B together can fill a cistern in 4 hours. Had they been opened separately, then B would have taken 6 hours more than A to fill the cistern. How much time A will take to fill the cistern separately?

- A. 1 hour
- B. 2 hours
- C. 6 hours
- D. 8 hours

Answer: Option C

Explanation:

Let the cistern filled by A alone in x hours.

Then, B will fill it in $(x + 6)$ hours

$$\text{So, } \frac{1}{x} + \frac{1}{x+6} = \frac{1}{4} \text{ and } \frac{x+6+x}{x(x+6)} = \frac{1}{4}$$

$$x^2 - 2x - 24 = 0$$

$$(x - 6)(x + 4) = 0$$

Question Q15.5

Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are opened together but after 4 minutes, pipe A is turned off. What is the total time required to fill the tank?

- A. 10 min 20 seconds
- B. 11 min 45 seconds
- C. 12 min 30 seconds
- D. 14 min 40 seconds

Answer: Option D

Explanation:

$$\text{Part filled in 4 minutes} = 4 \left(\frac{1}{15} + \frac{1}{20} \right) = \frac{7}{15}$$

$$\text{Remaining Part} = 1 - \frac{7}{15} = \frac{8}{15}$$

$$\text{Part filled by B in 1 minutes} = \frac{1}{20}$$

$$\frac{1}{20} : \frac{8}{15} :: 1 : x$$

$$x = 10^{\frac{2}{3}} \text{ min} = 10 \text{ min } 40 \text{ sec}$$

Question P15.1

Two pipes can fill a tank in 12 hours and 15 hours respectively while a third pipe empties the full tank in 20 hours. If all the three pipes operate simultaneously, in how much time the tank will be filled?

- A. 5 hours
- B. 10 hours
- C. 15 hours
- D. 20 hours

Answer: Option B

Explanation:

Question P15.2

Two pipes can fill a tank in 12 hours and 15 hours respectively while a third pipe empties the full tank in 20 hours. Pipe A and B open together at 6:00 AM and C is also open at 10:00 AM, then the tank will be filled at what time?

- A. 12 PM
- B. 2 PM
- C. 3 PM
- D. 4 PM

Answer: Option B

Explanation:

DATA INTERPRETATION

Table Chart

Study the following table and answer the questions based on it.

Expenditures of a Company (in Lakh Rupees) per Annum Over the given Years.

Year	Item of Expenditure				
	Salary	Fuel and Transport	Bonus	Interest on Loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	101	3.84	41.6	74
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

Question Q27.1

What is the average amount of interest per year which the company had to pay during this period?

- A. Rs. 32.43 lakhs
- B. Rs. 33.72 lakhs
- C. Rs. 34.18 lakhs
- D. Rs. 36.66 lakhs

Answer: Option D

Explanation:

Average amount of interest paid by the Company during the given period

$$= \text{Rs. } (23.4 + 32.5 + 41.6 + 36.4 + 49.4)/5 \text{ lakhs}$$

$$= \text{Rs. } 183.3 / 5 \text{ lakhs}$$

$$= \text{Rs. } 36.66 \text{ lakhs}$$

Question Q27.2

The total amount of bonus paid by the company during the given period is approximately what percent of the total amount of salary paid during this period?

- A. 0.1%
- B. 0.5%
- C. 1%
- D. 1.25%

Answer: Option C

Explanation:

$$\text{Required Percentage} = \frac{17}{1710} \times 100$$

$\approx 1\%$

Question P27.1

Total expenditure on all these items in 1998 was approximately what percent of the total expenditure in 2002?

- A. 62%
- B. 66%
- C. 69%
- D. 71%

Answer: Option C

Explanation:

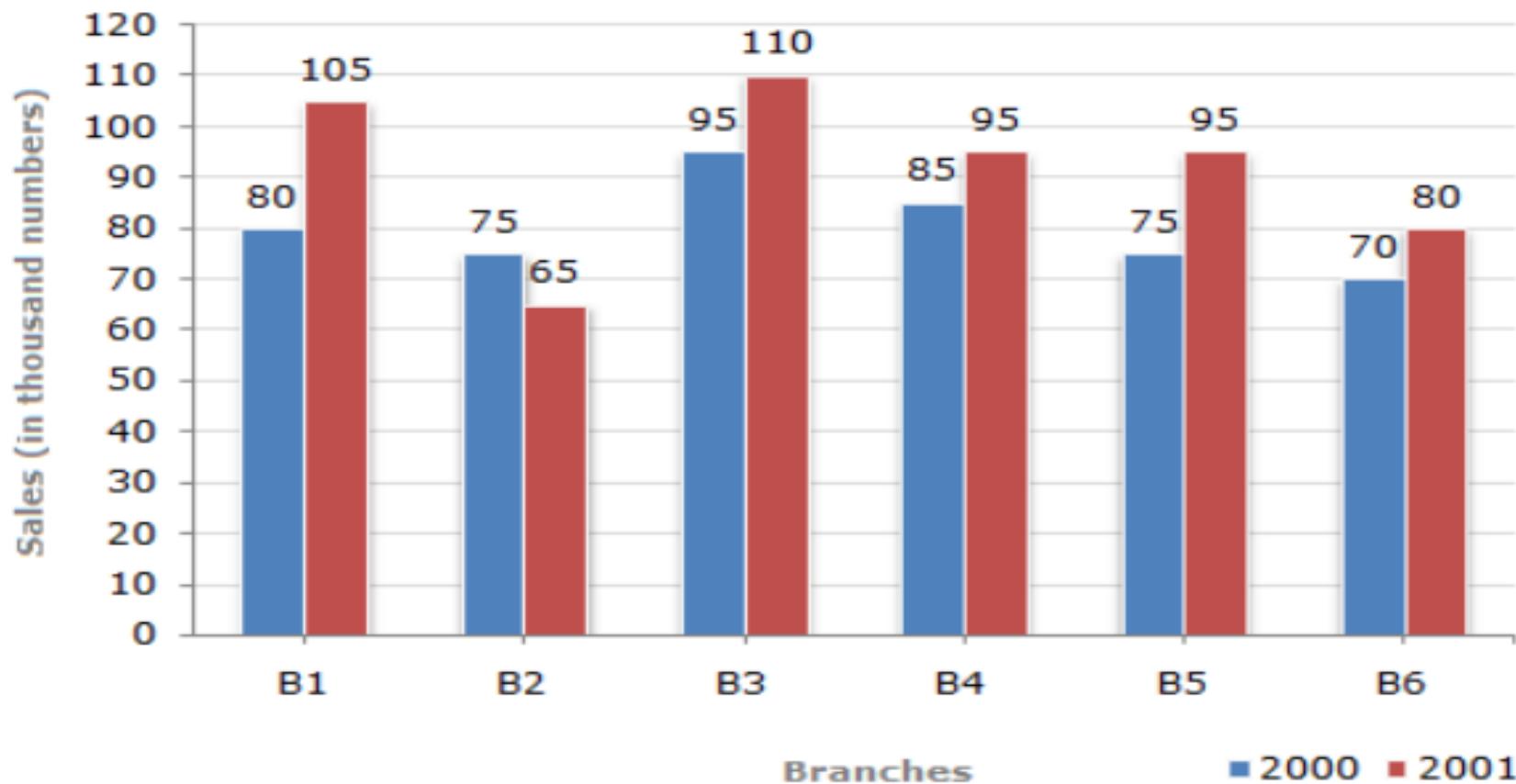
$$\text{Required Percentage} = \frac{495}{713.36} \times 100$$

$$\approx 69.45\%$$

Bar Chart

The bar graph given below shows the sales of books (in thousand number) from six branches of a publishing company during two consecutive years 2000 and 2001.

Sales of Books (in thousand numbers) from Six Branches - B1, B2, B3, B4, B5 and B6 of a publishing Company in 2000 and 2001.



Question Q27.3

What is the ratio of the total sales of branch B2 for both years to the total sales of branch B4 for both years?

- A. 2:3
- B. 3:5
- C. 4:5
- D. 7:9

Answer: Option D

Explanation:

$$\begin{aligned}\text{Required ratio} &= (75 + 65) / (85 + 95) \\ &= 140 / 180 \\ &= 7 / 9\end{aligned}$$

Question Q27.4

Total sales of branch B6 for both the years is what percent of the total sales of branches B3 for both the years?

- A. 68.54%
- B. 71.11%
- C. 73.17%
- D. 75.55%

Answer: Option C

Explanation:

$$\text{Required Percentage} = \frac{150}{205} \times 100$$

$$\approx 73.17\%$$

Question P27.2

What percent of the average sales of branches B1, B3 and B6 in 2000 is the average sales of branches B1, B2 and B3 in 2001?

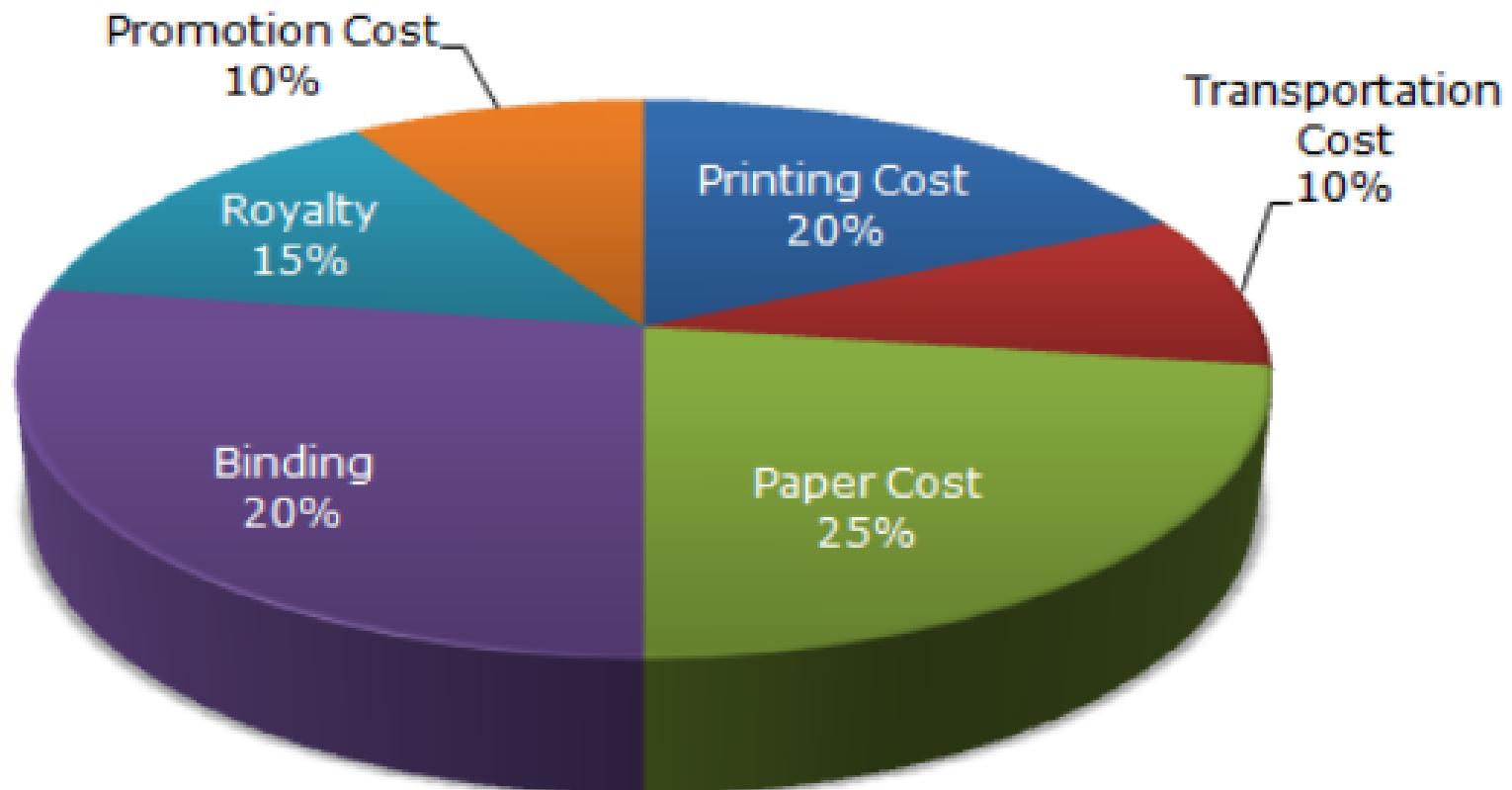
- A. 75%
- B. 77.5%
- C. 82.5%
- D. 87.5%

Answer: Option D

Pie Chart

The following pie-chart shows the percentage distribution of the expenditure incurred in publishing a book. Study the pie-chart and the answer the questions based on it.

Various Expenditures (in percentage) Incurred in Publishing a Book



Question Q27.5

If for a certain quantity of books, the publisher has to pay Rs. 30,600 as printing cost, then what will be amount of royalty to be paid for these books?

- A. Rs. 19,450
- B. Rs. 21,200
- C. Rs. 22,950
- D. Rs. 26,150

Answer: Option C

Question Q27.6

What is the central angle of the sector corresponding to the expenditure incurred on Royalty?

- A. 15°
- B. 24°
- C. 54°
- D. 48°

Answer: Option C

Question P27.3

The price of the book is marked 20% above the C.P. If the marked price of the book is Rs. 180, then what is the cost of the paper used in a single copy of the book?

- A. Rs. 36
- B. Rs. 37.50
- C. Rs. 42
- D. Rs. 44.25

Answer: Option B

Marked price of book = 120% of CP

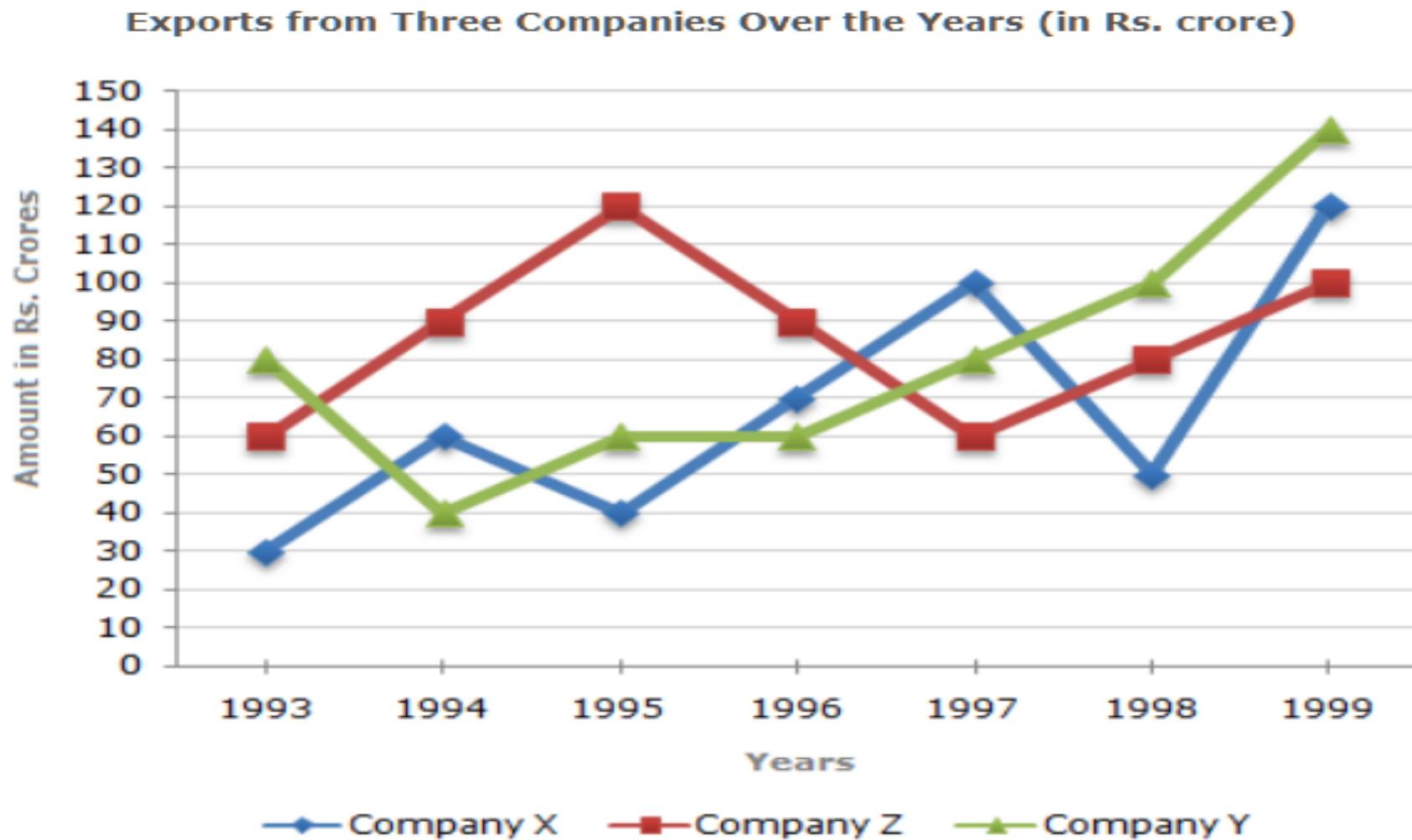
So, marked price = $\frac{180}{1.20}$ = Rs.150

Cost of paper = 25% of CP

So, cost of paper = 25% of 150 = Rs.37.50

Line Chart

Study the following line graph and answer the questions.



Question Q27.7

For which of the following pairs of years the total exports from the three Companies together are equal?

- A. 1995 and 1998
- B. 1996 and 1998
- C. 1997 and 1998
- D. 1995 and 1996

Answer: Option D

Explanation:

Total exports of the three Companies X, Y and Z together, during various years are:

In 1993 = Rs. $(30 + 80 + 60)$ crores = Rs. 170 crores.

In 1994 = Rs. $(60 + 40 + 90)$ crores = Rs. 190 crores.

In 1995 = Rs. $(40 + 60 + 120)$ crores = Rs. 220 crores.

In 1996 = Rs. $(70 + 60 + 90)$ crores = Rs. 220 crores.

In 1997 = Rs. $(100 + 80 + 60)$ crores = Rs. 240 crores.

In 1998 = Rs. $(50 + 100 + 80)$ crores = Rs. 230 crores.

In 1999 = Rs. $(120 + 140 + 100)$ crores = Rs. 360 crores.

Clearly, the total exports of the three Companies X, Y and Z together are same during the years 1995 and 1996.

Question Q27.8

Average annual exports during the given period for Company Y is approximately what percent of the average annual exports for Company Z?

- A. 87.12%
- B. 89.64%
- C. 91.21%
- D. 93.33%

Answer: Option D

Question P27.4

In which year was the difference between the exports from Companies X and Y the minimum?

- A. 1994
- B. 1995
- C. 1996
- D. 1997

Answer: Option C

Explanation:

The difference between the exports from the Companies X and Y during the various years are:

In 1993 = Rs. (80 - 30) crores = Rs. 50 crores.

In 1994 = Rs. (60 - 40) crores = Rs. 20 crores.

In 1995 = Rs. (60 - 40) crores = Rs. 20 crores.

In 1996 = Rs. (70 - 60) crores = Rs. 10 crores.

In 1997 = Rs. (100 - 80) crores = Rs. 20 crores.

In 1998 = Rs. (100 - 50) crores = Rs. 50 crores.

In 1999 = Rs. (140 - 120) crores = Rs. 20 crores.

Clearly, the difference is minimum in the year 1996

Clocks

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°
- B. 150°
- C. 168°
- D. 180°

Answer: Option D

Explanation:

Angle traced by the hour hand in 6 hours = $360 / 12 \times 6$ $^{\circ}$ = 180° .

The angle between the minute hand and the hour hand of a clock when the time is 4.20, is:

- A. 0°
- B. 10°
- C. 5°
- D. 20°

Answer: Option B

Explanation:

Angle traced by hour hand in $13/3$ hrs = $360/12 \times 13/3$ $^{\circ}$ = 130° .

Angle traced by min. hand in 20 min. = $360/60 \times 20$ $^{\circ}$ = 120° .

Required angle = $(130 - 120)^{\circ}$ = 10° .

How many times are the hands of a clock at right angle in a day?

- A. 22
- B. 24
- C. 44
- D. 48

Answer: Option C

Explanation:

In 12 hours, they are at right angles 22 times.

In 24 hours, they are at right angles 44 times.

How many times in a day, are the hands of a clock in straight line but opposite in direction?

- A. 20
- B. 22
- C. 24
- D. 48

Answer: Option B

Explanation:

The hands of a clock point in opposite directions (in the same straight line) 11 times in every 12 hours. (Because between 5 and 7 they point in opposite directions at 6 o'clock only).

So, in a day, the hands point in the opposite directions 22 times.

How many times in a day, hands of a clock are in straight line?

- A. 22
- B. 24
- C. 44
- D. 48

Answer : Option C

At 3:40, the hour hand and the minute hand of a clock form an angle of:

- A. 120
- B. 125
- C. 130
- D. 135

Answer: Option c

How many times in a day, hands of a clock coincide?

- A. 20
- B. 21
- C. 22
- D. 24

Answer: Option C

Permutation and Combination

Factorial Notation

Let n be a positive integer. Then, factorial n , denoted $n!$ is defined as:

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

Examples:

We define $0! = 1$.

$$4! = (4 \times 3 \times 2 \times 1) = 24.$$

$$5! = (5 \times 4 \times 3 \times 2 \times 1) = 120.$$

Permutations

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

Examples:

All permutations (or arrangements) made with the letters a , b , c by taking two at a time are (ab , ba , ac , ca , bc , cb).

All permutations made with the letters a , b , c taking all at a time are:

(abc , acb , bac , bca , cab , cba)

Combinations

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

Examples:

- ✓ Suppose we want to select two out of three boys A, B, C. Then possible selections are AB, BC, CA. Here AB and BA represent the same selection.
- ❖ Note that AB and BA are two different permutations but they represent the same combination.

In how many ways a 4 digit no. can be formed out of digits
1,2,3,4,5,6,7

Case I. Odd Number (4 digit)

- a) If repetition is not allowed
- b) If Repetition is allowed

Case II. Even Number (4 digit)

- a) If repetition is not allowed
- b) If Repetition is allowed

Answer:

Case-I

- a) $6*5*4*4$
- b) $7*7*7*4$

Case-II

- a) $6*5*4*3$
- b) $7*7*7*3$

In how many ways a 4 digit no. can be formed out of digits 0,1,2,3,4,5,6,7

Case I. Odd Number (4 digit)

- a) If repetition is not allowed
- b) If Repetition is allowed

Case II. Even Number (4 digit)

- a) If repetition is not allowed
- b) If Repetition is allowed

Answer:

Case-I

- a) $6*6*5*4$
- b) $7*8*8*4$

Case-II

- a) $6*6*5*3+7*6*5*1$
- b) $7*8*8*4$

In how many ways no. of words can be formed with the letters of the word COMMITTEE.

Case I. All Vowels are together

Case II. Vowels are never together

Answer:

Case-I

$$(6!*4!)/(2!*2!*2!)$$

Case-II

$$9!/(2!*2!*2!) - (6!*4!)/(2!*2!*2!)$$

In how many ways no. of words can be formed with the letters of the word EXAMINATION.

Case I. All Vowels are together

Case II. Vowels are never together

Answer:

Case-I

$$(6!*6!)/(2!*2!*2!)$$

Case-II

$$11!/(2!*2!*2!) - (6!*6!)/(2!*2!*2!)$$

How many straight lines and triangle can be formed out of 15 different points in a plane.

Answer

Straight line- ${}^{15}C_2$

Triangle- ${}^{15}C_3$

How many ways a committee of 6 members can be formed out of 7 Men and 6 women so that

Case I. Exactly 5 woman must be selected in each committee

Case II. At least 5 Women must be selected in each committee

Answer:

$$\text{Case-I} = {}^6C_5 * {}^7C_1$$

$$\text{Case-II} = {}^6C_5 * {}^7C_1 + {}^6C_6 * {}^7C_0$$

The number of ways in which 8 persons can be seated at a round table if 2 particular persons must always sit together

Answer:

Circular Arrangement = $(n-1)!$

$6! * 2!$

Probability

An operation which can produce some well-defined outcomes is called an experiment.

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:

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

- 52 cards
- There are 4 suits- Diamonds, Hearts, spade, club
- 13 cards for each suit ($13 \times 4 = 52$)
- Diamond and Heart – Red (total 26 Red card)
- Spade and Club- Black (total 26 black card)
- There are 4 honors of each suit (total 16 honours card)
- 4 honour cards are
 - King(4)- 2R, 2B; Queen(4)- 2R, 2B;
 - Ace(4)- 2R, 2B; Jack(4)- 2R, 2B

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

Examples:

In tossing a coin, $S = \{H, T\}$

If two coins are tossed,

$$S = \{HH, HT, TH, TT\}.$$

In rolling a dice, we have, $S = \{1, 2, 3, 4, 5, 6\}$.

Event:

Any subset of a sample space is called an *event*.

Probability of Occurrence of an Event

Let S be the sample and let E be the event,

Then $P(E) = n(E)/n(S)$

Two unbiased coins are tossed. What is probability of getting at most one head?

- (a) $\frac{1}{4}$
- (b) $\frac{1}{2}$
- (c) $\frac{3}{4}$
- (d) 1

Answer: Option C

Explanation:

$$S = \{ HH, HT, TH, TT \}$$

$$E = \{ TT, HT, TH \}$$

$$P(E) = \frac{3}{4}$$

Determine the probability that a digit chosen at random from digits 1, 2, 3, 100 will be even.

- (a) $\frac{1}{4}$
- (b) $\frac{1}{2}$
- (c) $\frac{3}{4}$
- (d) 1

Answer: Option B

A card is drawn from a pack of 52 cards. What is the probability that the card is a king?

- (a) $1/4$
- (b) $1/2$
- (c) $1/13$
- (d) 1

Answer: Option C

Two cards are drawn in succession from a pack of 52 cards, without replacement. What is the probability, that the first is a king and the second is a queen of a different suit.

Answer:

$${}^4C_1 * {}^3C_1 / {}^{52}C_1 * {}^{51}C_1$$

Two dices are thrown, what is the probability that both the dices are having the same number.

- (a) $1/4$
- (b) $1/6$
- (c) $5/4$
- (d) 1

Answer: Option B

If on a paper all the natural numbers from 1 to 100 are written, if a finger is kept on a number, what is the probability that the number is a prime?

- (a) $\frac{1}{4}$
- (b) $\frac{1}{2}$
- (c) $\frac{3}{4}$
- (d) 1

Answer: Option A

If an alphabet is selected from the whole alphabetic order, what is the probability that it is a vowel?

- (a) $1/26$
- (b) $1/2$
- (c) $5/26$
- (d) $26/5$

Answer: Option C

A bag Contains 6 White and 4 RED balls. Two balls are drawn at random, find the probability that they are from same colour.

Answer:

$$({}^6C_2 + {}^4C_2) / {}^{10}C_2$$

A bag contains 4 white, 5 Red and 6 blue balls.
Three balls are drawn at random from the bag, the probability that atleast one is red.

Answer:

$$({}^5C_1 * {}^{10}C_2 + {}^5C_2 * {}^{10}C_1 + {}^5C_3 * {}^{10}C_0) / {}^{15}C_3$$

THANK YOU & ALL THE BEST