

Mathematics

1. If $\left(\frac{15}{8}\right) + \left(\frac{15}{7}\right) = \left(\frac{n}{r}\right)$, then the values of n and r are [2020]

- (a) 16 and 7 (b) 16 and 8
(c) 16 and 9 (d) 30 and 15

Ans. (b)

Sol. ${}^{15}C_8 + {}^{15}C_7 = {}^nC_r$

As we know, ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$

$$\therefore {}^{15}C_8 + {}^{15}C_7 = {}^{15+1}C_8 \\ = {}^{16}C_8 = {}^nC_r$$

So, $n=16$ and $r=8$.

2. In a class of 50 students, it was found that 30 students read "Hitavad", 35 students read "Hindustan" and 10 read neither. How many students read both "Hitavad" and "Hindustan" newspapers? [2020]

- (a) 25 (b) 20 (c) 15 (d) 30

Ans. (a)

Sol. Let A be the set of students who read "Hitavad" and B the set of students who read "Hindustan".

$$n(A \cup B) = 50 - 10 = 40$$

$$n(A) = 30$$

$$n(B) = 35$$

By using,

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$

We get,

$$40 = 30 + 35 - n(A \cap B)$$

$$\Rightarrow n(A \cap B) = 25$$

$\therefore$ The number of students who read both "Hitavad" and "Hindustan" newspapers is $n(A \cap B) = 25$.

3. If $A = \{4^x - 3x - 1 : x \in \mathbb{N}\}$ and $B = \{9(x-1) : x \in \mathbb{N}\}$, where $\mathbb{N}$ is the set of natural numbers, then [2020]

- (a) $A \subset B$ (b) $A \subseteq B$
(c) $A \supset B$ (d) $A \supseteq B$

Ans. (a)

Sol. Let $A_n = 4^n - 3n - 1, n \in \mathbb{N}$

$$\text{then } A_1 = 4 - 3 - 1 = 0$$

And, for $n \geq 2$, we have,

$$A_n = 4^n - 3n - 1 = (1+3)^n - 3n - 1$$

$${}^nC_0 + {}^nC_1 \cdot 3 + {}^nC_2 \cdot 3^2 + \dots + {}^nC_n \cdot 3^n - 3n - 1$$

[using Binomial Theorem]

$$= 1 + 3n + {}^nC_2 3^2 + \dots + {}^nC_n \cdot 3^n - 3n - 1$$

$$= 3^2 [{}^nC_2 + {}^nC_3 \cdot 3 + \dots + {}^nC_n \cdot 3^{n-2}]$$

$$= 9 [{}^nC_2 + {}^nC_3 \cdot 3 + \dots + {}^nC_n \cdot 3^{n-2}]$$

Thus, A_n is some positive integral multiple of 9 for $n \geq 2$.

Hence, A consists of all positive integral multiples of 9 of the form $9 \{ {}^nC_2 + 3 \cdot {}^nC_3 + \dots + 3^{n-2} {}^nC_n \}$ together with 0.

Now, $B = \{9(x-1) : x \in \mathbb{N}\}$ this shows that B consists of all integral multiples of 9 together with 0.

We have,

$$A = \{0, 9, 54, 243, \dots\}$$

$$B = \{0, 9, 18, 27, 36, 54, \dots\}$$

Thus, $A \subset B$.

4. If $A = \{x, y, z\}$, then the number of subsets in powerset of A is [2020]

- (a) 6 (b) 8 (c) 7 (d) 9

Ans. (b)

Sol. Given, $A = \{x, y, z\}$

The power set (or power set) of a set A is defined as the set of all subsets, of the set A including the set itself and the null or empty set.

Power set of

$$A = \{\emptyset, x, y, z, \{x, y\}, \{y, z\}, \{x, z\}, \{x, y, z\}\}$$

Hence, the number of subsets in power set of A is 8.

5. How many words can be formed starting with letter D taking all letters from word DELHI so that the letters are not repeated? [2020]

- (a) 4 (b) 12 (c) 24 (d) 120

Ans. (c)

Sol. DELHI

$$\frac{1}{4 \times 3 \times 2 \times 1} = 24$$

6. Naresh has 10 friends and he wants to invite 6 of them to a party. How many times will 3 particular friends never attend the party? [2020]

- (a) 8 (b) 7 (c) 720 (d) 35

Ans. (b)

Sol. Remove the 3 particular friends and invite 6 friends from the remaining $7 (= 10 - 3)$ friends. This can be done in 7C_6 ways.

Therefore, required number of ways $= {}^7C_6$

$$= {}^7C_1 \quad \left[\because {}^nC_r = {}^nC_{(n-r)} \right]$$
$$= 7$$

7. There is a young boy's birthday party in which 3 friends have attended. The mother has arranged 10 games where a prize is awarded for a winning game. The prizes are identical. If each of the 4 children receives at least one prize, then how many distributions of prizes are possible? **[2020]**

(a) 80 (b) 84 (c) 70 (d) 72

Ans. (b)

Sol. Here, the number of objects is $n = 10$ and the number of people is $r = 4$

The total number of ways in which n objects can be distributed in r people if every person must get at least one object $= {}^{n-1}C_{r-1}$.

In the question also, every person must get at least one object, the total number of possible distributions is :

$${}^{n-1}C_{r-1} = {}^{10-1}C_{4-1} = {}^9C_3$$

$$= \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = 84$$

8. Three cities A, B, C are equidistant from each other.

A motorist travels from A to B at 30 km/h, from B to C at 40 km/h and from C to A at 50 km/h.

Then the average speed is **[2020]**

(a) 39 km/h (b) 40 km/h
(c) 38.3 km/h (d) 37.6 km/h

Ans. (c)

Sol. Let's say that the distance between each pair of cities is 600 km.

From A to B

Distance = 600 km

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{600}{30} = 20\text{hrs}$$

From B to C

Distance = 600 km

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{600}{40} = 15\text{hrs}$$

From C to A

Distance = 600 km

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{600}{50} = 12\text{hrs}$$

For overall journey

Total distance = $600 + 600 + 600$
 $= 1800$ km

Total time = $20 + 15 + 12$

$= 47\text{hrs}$

Average speed

$$= \frac{\text{Total distance}}{\text{Total time}} = \frac{1800}{47} \text{ km/h} = 38.29 \text{ km/h}$$

9. A problem in Mathematics is given to 3 students A, B and C . If the probability of A solving the problem is $1/2$ and B not solving it is $1/4$. The whole probability of the problem being solved is $63/64$, then what is the probability of solving it by C ? **[2020]**

(a) $\frac{1}{8}$ (b) $\frac{1}{64}$ (c) $\frac{7}{8}$ (d) $\frac{1}{2}$

Ans. (c)

Sol. Concept :

$$P(\text{not}E) = 1 - P(E)$$

Probability of a compound event $[(A \text{ and } B) \text{ or } (B \text{ and } C)]$ is calculated as :

$$P[(A \text{ and } B) \text{ or } (B \text{ and } C)]$$
$$= [P(A) \times P(B)] + [P(C) \times P(D)]$$

Calculations

It is given that $P(A) = \frac{1}{2}$ and $P(\text{not}B) = \frac{1}{4}$.

Let's say that, the probability of C solving the problem is $P(C) = x$

$\therefore$ Probability of A not solving the problem

$$= P(\text{not}A)$$

$$= 1 - P(A)$$

$$= 1 - \frac{1}{2} = \frac{1}{2}$$

And probability of C not solving the problem

$$= P(\text{not}C)$$

$$= 1 - P(C) = 1 - x$$

Now, the probability that the problem is not solved at all :

$$= P(\text{not}A) \text{ AND } P(\text{not}B) \text{ AND } P(\text{not}C)$$

$$= P(\text{not}A) \times P(\text{not}B) \times P(\text{not}C)$$

$$= \frac{1}{2} \times \frac{1}{4} \times (1 - x) = \frac{1 - x}{8}$$

And, the probability that the problem is solved

$= 1 - \text{Probability that the problem is not solved at all}$

$$= \frac{63}{64}$$

$$\Rightarrow 1 - \frac{(1 - x)}{8} = \frac{63}{64}$$

$$\Rightarrow \frac{1 - x}{8} = 1 - \frac{63}{64} = \frac{1}{64}$$

$$\Rightarrow 1-x = \frac{1}{8} \Rightarrow x = 1 - \frac{1}{8} = \frac{7}{8}$$

∴ The probability of C solving the problem is

$$P(C) = x = \frac{7}{8}$$

10. A and B play a game where each is asked to select a number from 1 to 25. If the two numbers match, both win a prize. The probability that they will not win a prize in a single trial is [2020]

- (a) $\frac{1}{25}$ (b) $\frac{24}{25}$ (c) $\frac{2}{25}$ (d) $\frac{3}{25}$

Ans. (b)

Sol. Both A and B win a prize if the number chosen by A matches with that of B .

Thus, probability of winning a prize

$$\Rightarrow \frac{25}{625} = \frac{1}{25} \times 1 = \frac{1}{25}$$

Thus, probability of not winning $= 1 - \frac{1}{25} = \frac{24}{25}$

11. A, B, C are three sets of values of x [2020]

$A: 2, 3, 7, 1, 3, 2, 3$

$B: 7, 5, 9, 12, 5, 3, 8$

$C: 4, 4, 11, 7, 2, 3, 4$

Select the correct statement among the following

- (a) Mean of A is equal to Mode of C .
 (b) Mean of C is equal to Median of B .
 (c) Median of B is equal to Mode of A .
 (d) Mean, Median and Mode of A are same.

Ans. (d)

Sol. For the data $A: 2, 3, 7, 1, 3, 2, 3$ of 7 numbers, we have

$$\text{MEAN} = \frac{2+3+7+1+3+2+3}{7} = \frac{21}{7} = 3$$

Arranging the data A in ascending order, we have

$A: 1, 2, 2, 3, 3, 3, 7$

$$\text{MEDIAN} = \left(\frac{7+1}{2} \right) \text{th term} = 4 \text{th term} = 3$$

Since, 3 occurs maximum number of times, $\text{MODE} = 3$

$$\text{MEAN} = \text{MEDIAN} = \text{MODE}$$

12. Standard deviation for the following distribution is

Size of item: 6 789 10 11 12 [2020]

Frequency: 3 6 9 13 8 5 4

- (a) 1.607 (b) 9.0 (c) 5.0 (d) 1.88

Ans. (a)

Sol. Concept

For a set $x, x_2, \dots, x_n$ of n observations.

$$\text{Mean: } \bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$$

Variance :

$$\sigma^2 = \frac{\left(x_1 - \bar{x}\right)^2 + \left(x_2 - \bar{x}\right)^2 + \dots + \left(x_n - \bar{x}\right)^2}{n}$$

Standard Deviation

$$\sigma = \sqrt{\sigma^2} = \sqrt{\text{Variance}}$$

Calculation

Total number of items in the distribution

$$= \Sigma f_i = 3 + 6 + 9 + 13 + 8 + 5 + 4 = 48$$

The Mean ($\bar{x}$) of the given set $= \frac{\Sigma f_i x_i}{\Sigma f_i}$

$$\Rightarrow \bar{x} = \frac{6 \times 3 + 7 \times 6 + 8 \times 9 + 9 \times 13 + 10 \times 8 + 11 \times 5 + 12 \times 4}{48} = 9$$

Let's calculate the variance using the formula :

$$\sigma^2 = \frac{\Sigma f_i x_i^2}{n} - \bar{x}^2$$

$$\begin{aligned} & \frac{\Sigma f_i x_i^2}{n} \\ &= \frac{6^2 \times 3 + 7^2 \times 6 + 8^2 \times 9 + 9^2 \times 13 + 10^2 \times 8 + 11^2 \times 5 + 12^2 \times 4}{48} \\ &= 83.58 \end{aligned}$$

$$\therefore \sigma^2 = 83.58 - 9^2 = 83.58 - 81 = 2.58$$

And Standard Deviation (σ) $= \sqrt{\sigma^2} = \sqrt{2.58} \approx 1.607$

13. If $A = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$, then for any positive

integer n , A^n is [2020]

- (a) $\begin{bmatrix} \sin n\alpha & \cos n\alpha \\ \cos n\alpha & -\sin n\alpha \end{bmatrix}$ (b) $\begin{bmatrix} \cos n\alpha & \sin n\alpha \\ \sin n\alpha & \cos n\alpha \end{bmatrix}$
 (c) $\begin{bmatrix} \cos n\alpha & \sin n\alpha \\ \sin n\alpha & -\cos n\alpha \end{bmatrix}$ (d) $\begin{bmatrix} \cos n\alpha & \sin n\alpha \\ -\sin n\alpha & \cos n\alpha \end{bmatrix}$

Ans. (d)

$$\text{Sol. } A = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$$

or

$$A^2 = \begin{bmatrix} \cos(\alpha) & \sin(\alpha) \\ -\sin(\alpha) & \cos(\alpha) \end{bmatrix}$$

$$A \cdot A = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix} \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$$

$$A^2 = \begin{bmatrix} \cos^2 \alpha - \sin^2 \alpha & \cos \alpha \sin \alpha + \sin \alpha \cos \alpha \\ -\sin \alpha \cos \alpha - \cos \alpha \sin \alpha & -\sin^2 \alpha + \cos^2 \alpha \end{bmatrix}$$

$$A^2 = \begin{bmatrix} \cos^2 \alpha - \sin^2 \alpha & 2 \sin \alpha \cos \alpha \\ -2 \sin \alpha \cos \alpha & \cos^2 \alpha - \sin^2 \alpha \end{bmatrix}$$

$$A^2 = \begin{bmatrix} \cos(2\alpha) & \sin(2\alpha) \\ -\sin(2\alpha) & \cos(2\alpha) \end{bmatrix}$$

$$\text{Similarly, } A^n = \begin{bmatrix} \cos(n\alpha) & \sin(n\alpha) \\ -\sin(n\alpha) & \cos(n\alpha) \end{bmatrix}$$

14. Roots of equation $ax^2 - 2bx + c = 0$ are n and m , then the value of $\frac{b}{an^2 + c} + \frac{b}{am^2 + c}$ is [2020]

- (a) $\frac{c}{a}$ (b) $\frac{b}{a}$ (c) $\frac{a}{c}$ (d) $\frac{b}{c}$

Ans. (d)

Sol. Concept

If α and β are the roots of the quadratic equation

$$Ax^2 + Bx + c = 0, \text{ then } \alpha + \beta = -\frac{B}{A} \text{ and } \alpha \cdot \beta = \frac{C}{A}.$$

Calculation

$$\text{Given, } ax^2 - 2bx + c = 0$$

$$m + n = \frac{2b}{a}$$

$$m \cdot n = \frac{c}{a}$$

Now, the given expression

$$\begin{aligned} & \frac{b}{an^2 + c} + \frac{b}{am^2 + c} : \\ &= \frac{\frac{2b}{a}}{2\left(n^2 + \frac{c}{a}\right)} + \frac{\frac{2b}{a}}{2\left(m^2 + \frac{c}{a}\right)} \\ &= \frac{m+n}{2\left(n^2 + mn\right)} + \frac{m+n}{2\left(m^2 + mn\right)} \\ &= \frac{m+n}{2n(n+m)} + \frac{m+n}{2m(m+n)} \\ &= \frac{1}{2} \left(\frac{1}{n} + \frac{1}{m} \right) = \frac{1}{2} \left(\frac{m+n}{mn} \right) \\ &= \frac{1}{2} \left(\frac{\frac{2b}{a}}{\frac{c}{a}} \right) = \frac{b}{c} \end{aligned}$$

15. The number of values of k for which the linear equations [2020]

$$4x + ky + z = 0$$

$$kx + 4y + z = 0$$

$$2x + 2y + z = 0$$

posses a non-zero solution is

- (a) 2 (b) 1 (c) 0 (d) 3

Ans. (c)

Sol. Since, equation has non-zero solution $\Delta = 0$.

$$\begin{vmatrix} 4 & k & 1 \\ k & 4 & 1 \\ 2 & 2 & 1 \end{vmatrix} = 0$$

$$\Rightarrow 4(4-2) - k(k-2) + (2k-8) = 0$$

$$\Rightarrow 8 - k^2 + 2k + 2k - 8 = 0$$

$$\Rightarrow -k^2 + 4k = 0$$

$$\Rightarrow k^2 - 4k = 0$$

$$\Rightarrow k(k-4) = 0$$

$$\Rightarrow k = 0, 4$$

16. Let $A = (a_{ij})$ and $B = (b_{ij})$ be two square matrices of order n and $\det(A)$ denotes the determinant of A .

Then, which of the following is not correct? [2020]

(a) If A is a diagonal matrix, then

$$\det(A) = a_{11}a_{22} \dots a_{nn}.$$

$$(b) \det(AB) = \det(A)\det(B)$$

$$(c) \det(cA) = c\det(A)$$

(d) $\det(A) = \det(A^T)$ where A^T denotes the transpose of the matrix A .

Ans. (c)

Sol. Properties of determinants

The determinant of a diagonal matrix is the product of the diagonal entries.

If A and B are both $n \times n$ matrices, then

$$\det(AB) = \det(A) \cdot \det(B).$$

For a $n \times n$ matrix A , $\det(KA) = k^n \det(A)$.

The determinant of a square matrix is the same as the determinant of its transpose.

Calculation

From the properties state above, it can be seen that $\det(cA) = c[\det(A)]$ is not correct.

$$\therefore \det(cA) = C^n [\det(A)]$$

17. The tangent to an ellipse $x^2 + 16y^2 = 16$ and making angle 60° with X -axis is: [2020]

$$(a) x - \sqrt{3}y + 7 = 0 \quad (b) \sqrt{3}x - y + 8 = 0$$

$$(c) \sqrt{3}x - y + 7 = 0 \quad (d) x + \sqrt{3}y - 7 = 0$$

Ans. (c)

Sol. Tangents to an ellipse

If the line $y = mx + c$ touches the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$,

then $c^2 = a^2m^2 + b^2$.

The straight lines $y = mx \pm \sqrt{a^2m^2 + b^2}$ represents to the ellipse.

Calculation

The given tangent makes an angle of 60° with the positive direction of the x -axis.

$$\therefore m = \tan 60^\circ = \sqrt{3}$$

Ellipse equation : $x^2 + 16y^2 = 16$

In standard form : $\frac{x^2}{(4)^2} + \frac{y^2}{(1)^2} = 1$

$$a = 4, b = 1$$

Using the formula $y = mx \pm \sqrt{a^2m^2 + b^2}$ for the tangents to the ellipse, the required equation is :

$$y = \sqrt{3}x \pm \sqrt{4^2(\sqrt{3})^2 + 1^2}$$

$$y = \sqrt{3}x \pm \sqrt{49}$$

$$y = \sqrt{3}x \pm 7$$

$$y = \sqrt{3}x + 7$$

18. Find the number of point(s) of intersection of the ellipse $\frac{x^2}{4} + \frac{(y-1)^2}{9} = 1$ and the circle $x^2 + y^2 = 4$

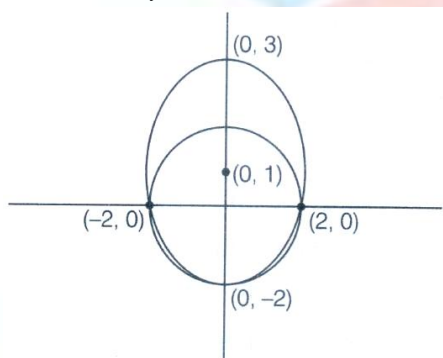
[2020]

- (a) 4 (b) 3 (c) 2 (d) 1

Ans. (b)

Sol. Ellipse $\frac{x^2}{2} + \frac{(y-1)^2}{3^2} = 1$

Circle $x^2 + y^2 = 2^2$



The number of points of intersection is 3.

19. An arithmetic progression has 3 as its first term. Also, the sum of the first 8 terms is twice the sum of the first 5 terms. Then what is the common difference?

[2020]

- (a) $3/4$ (b) $1/2$ (c) $1/4$ (d) $4/3$

Ans. (a)

Sol. $a = 3$

$$S_8 = 2S_5$$

$$\Rightarrow \frac{8}{2} [2 \times 3 + (8-1)d] = 2 \cdot \frac{5}{2} [2 \times 3 + (5-1)d]$$

$$\Rightarrow 4[6 + 7d] = 5[6 + 4d]$$

$$\Rightarrow 24 + 28d = 30 + 20d$$

$$\Rightarrow 8d = 6$$

$$\Rightarrow d = \frac{3}{4}$$

20. If $a + b + c = 0$, then the value of $\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab}$ is [2020]

- (a) 1 (b) 0 (c) 3 (d) -1

Ans. (c)

Sol. $a + b + c = 0$

(given)

$$\frac{a^2}{bc} = \frac{b^2}{ac} + \frac{c^2}{ab} = ?$$

If $a + b + c = 0$

Then $a^3 + b^3 + c^3 = 3abc$

$$\Rightarrow \frac{a^3 + b^3 + c^3}{abc} = 3$$

$$\Rightarrow \frac{a^2}{bc} + \frac{b^2}{ac} + \frac{c^2}{ab} = 3$$

21. Find $\lim_{x \rightarrow 0} x^2 e^{\sin(\frac{1}{x})}$

[2020]

- (a) 1 (b) limit does not exist
(c) infinity (d) None of these

Ans. (d)

Sol. $\lim_{x \rightarrow 0} x^2 \cdot e^{\sin(\frac{1}{x})}$

$\because \sin\left(\frac{1}{x}\right)$ varies from -1 to 1.

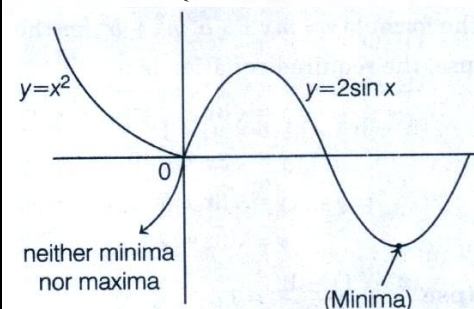
$$\therefore 0 \times e^{-1 \text{ to } 1} = 0$$

22. If $f(x) = \begin{cases} x^2, & x \leq 0 \\ 2\sin x, & x > 0 \end{cases}$, then $x = 0$ is [2020]

- (a) Point of minima (b) Point of maxima
(c) Point of discontinuity (d) None of these

Ans. (d)

Sol. $f(x) = \begin{cases} x^2, & x \leq 0 \\ 2\sin x, & x > 0 \end{cases}$



$x = 0$ is not a $\rightarrow$

$\rightarrow$ Point to minima

$\rightarrow$ Point of maxima

$\rightarrow$ Point of discontinuity

23. If $g(x) = \begin{cases} (x^2 - x)/2x, & x \neq 0 \\ k, & x = 0 \end{cases}$ is a continuous function at $x=0$, then the value of k is [2020]
 (a) 2 (b) 1/2 (c) 1 (d) None of these
Ans. (d)

Sol. $g(x) = \begin{cases} \frac{x^2 - x}{2x}, & x \neq 0 \\ 2\sin x, & x = 0 \end{cases}$

Condition of continuous function :

$$\lim_{x \rightarrow 0} f(x) = f(0)$$

$$\begin{aligned} \lim_{x \rightarrow 0} \frac{x^2 - x}{2x} \\ &= \lim_{x \rightarrow 0} \frac{x(x-1)}{2x} = \lim_{x \rightarrow 0} \frac{(x-1)}{2} \\ &= \frac{(0-1)}{2} = -\frac{1}{2} \end{aligned}$$

$$f(0) = k$$

As the given function is continuous at $x=0$

$$\text{So, } \lim_{x \rightarrow 0} \frac{x^2 - x}{2x} = f(0)$$

$$\Rightarrow \frac{-1}{2} = k \Rightarrow k = -\frac{1}{2}$$

24. Find the interval(s) on which the graph $y = 2x^3 e^x$ is increasing [2020]

- (a) $(-3, 0)$ and $(0, \infty)$ (b) $(-3/2, 0)$ and $(0, \infty)$
 (c) $(-3, \infty)$ only (d) None of these

Ans. (c)

Sol. $f(x) = 2x^3 e^x$

$$\begin{aligned} f'(x) &= 2[3x^2 \cdot e^x - x^3 e^x] \\ &= 2x^2 e^x [3 + x] \end{aligned}$$

The graph y or $f(x)$ increasing means $f'(x) > 0$

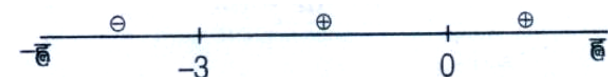
$$\Rightarrow 2e^x x^2 (x+3) > 0$$

$$\Rightarrow e^x x^2 (x+3) > 0$$

$$\Rightarrow x^2 (x+3) > 0$$

To get critical points, put $x^2 (x+3) = 0$

$$\Rightarrow x = 0, x = -3$$



$$x \in (-3, \infty)$$

25. If $\int \sec^2 x \operatorname{cosec}^4 x dx = -\frac{1}{3} \cot^3 x + k \tan x - 2 \cot x + C$,

the value of k is

[2020]

- (a) 1 (b) 2 (c) 3 (d) 4

Ans. (a)

Sol. $I = \int \sec^2 x \cdot \operatorname{cosec}^4 x dx$

$$= \int \frac{1}{\cos^2 x} \cdot \frac{1}{\frac{\sin^4 x}{\cos^4 x} \cdot \cos^4 x} dx$$

$$= \int \frac{\sec^4 x}{\tan^4 x} \cdot \sec^2 x dx$$

$$\tan x = t$$

$$\sec^2 x dx = dt$$

$$= \int \frac{(1+t^2)^2}{t^4} \cdot dt = \int (t^4 + 2t^{-2} + 1) dt$$

$$= \int \frac{t^{-3}}{-3} + \frac{2t^{-1}}{(-1)} + t$$

$$= -\frac{1}{3} (\tan x)^{-3} - 2(\tan x)^{-1} + \tan x$$

$$= -\frac{1}{3} (\cot x)^3 - 2(\cot x)^1 + \tan x$$

$$k = 1$$

26. Evaluate $\int e^x \left(\frac{1 + \sin x \cos x}{\cos^2 x} \right) dx$ [2020]

- (a) $e^x \cos x + c$ (b) $e^x \sec x \tan x + c$
 (c) $e^x \tan x + c$ (d) $e^x \cos^2 x - 1 + c$

Ans. (c)

Sol. $I = \int e^x \left(\frac{1 + \sin x \cdot \cos x}{\cos^2 x} \right) dx$

$$I = \int e^x (\sec^2 x + \tan x) dx$$

$$I = \int e^x (\tan x + \sec^2 x) dx$$

$$I = \int e^x (f(x) + f'(x)) dx$$

$$I = e^x f(x) + c$$

$$I = e^x \cdot \tan x + c$$

27. If $I_n = \int_0^a (a^2 - x^2)^n dx$ where n is a positive integer, then the relation between I_n and I_{n-1} is

[2020]

(a) $I_n = \frac{2na^2}{2n+1} I_{n-1}$ (b) $I_n = \frac{2n^2 a^2}{2n+1} I_{n-1}$

(c) $I_n = \frac{2na^2}{2n-1} I_{n-1}$ (d) $I_n = \frac{2n^2 a^2}{2n-1} I_{n-1}$

Ans. (a)

Sol. $I_n = \int_0^a (a^2 - x^2)^n dx$

To find a relation between I_n and I_{n-1} , we will try to find a relation between I_2 and I_1 .

Put $n=2$

$$\begin{aligned} I_2 &= \int_0^a (a^2 - x^2)^2 dx \\ &= \int_0^a (a^4 + x^4 - 2x^2 a^2) dx \\ &= \left[a^4 x + \frac{x^5}{5} - 2 \frac{x^3}{3} \cdot a^2 \right]_0^a \\ &= a^5 + \frac{a^5}{5} - \frac{2a^5}{3} = \frac{8}{15} a^5 \end{aligned}$$

Put $n=1$

$$\begin{aligned} I_1 &= \int_0^a (a^2 - x^2) dx \\ &= \left[a^2 x - \frac{x^3}{3} \right]_0^a = a^3 - \frac{a^3}{3} = \frac{2a^3}{3} \end{aligned}$$

Let's put $n=2$ in the given options.

$$I_2 = \frac{2 \times 2 \times a^2}{2 \times 2 + 1} I_1$$

$$I_2 = \frac{40^2}{5} I_1$$

$$\frac{8a^5}{15} = \frac{4a^2}{5} \cdot \frac{2a^3}{3}$$

$$\frac{8a^5}{15} = \frac{8a^5}{15}$$

Hence, option (a) is correct.

28. The value of $\int_{-2}^2 (ax^5 + bx^3 + c) dx$ depends on the [2020]

- (a) Value of b (b) Value of c
(c) Value of a (d) Value of a and b .

Ans. (b)

Sol. $I = \int_{-2}^2 (ax^5 + bx^3 + c) dx \dots (i)$

$$\therefore f(x) = f(a+b-x)$$

$$\therefore I = \int_{-2}^2 (a(-x)^5 + b(-x)^3 + c) dx$$

$$I = \int_{-2}^2 (-ax^5 - bx^3 + c) dx \dots (ii)$$

Adding Eq. (i) and Eq. (ii),

$$2I = \int_{-2}^2 (2c) dx$$

$$I = \int_{-2}^2 c dx$$

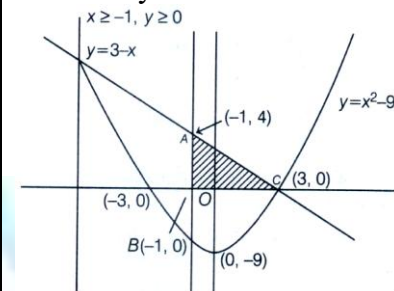
Hence, we can say that the given integration depends on value of c .

29. Find the area bounded by the line $y = 3 - x$, the parabola $y = x^2 - 9$ and $x \geq -1, y \geq 0$. [2020]

- (a) $7/2$ (b) $11/2$
(c) $9/2$ (d) None of these

Ans. (d)

Sol. Firstly we have to find intersection point.



$$f(x, y) = x + y - 3 = 0$$

$$g(x, y) = x^2 - y - 9 = 0$$

$$x + y - 3 = x^2 - y - 9 = 0$$

$$x^2 - x - 12 = 0$$

$$x^2 + 4x - 3x - 12 = 0$$

$$x(x+4) - 3(x+4) = 0$$

$$(x-3)(x+4) = 0$$

$$x = -4 \text{ or } x = 3$$

Hence the curves intersect at the points $B(3, 0)$ and $C(-4, 7)$.

$$\Rightarrow \int_{-4}^3 (3-x) dx - \int_{-2}^3 (x^2-9) dx$$

$$\Rightarrow \left[3x - \frac{x^2}{2} \right]_{-4}^3 - \left[\frac{x^3}{3} - 9x \right]_{-2}^3$$

$$\Rightarrow \left[9 - \frac{9}{2} \right] - \left[-12 - 8 \right] - \left\{ \left[9 - 27 \right] - \left[\frac{-8}{3} + 18 \right] \right\}$$

$$\Rightarrow \frac{29}{2} + \frac{54-46}{3} = \frac{29}{2} + \frac{8}{3} = \frac{29 \times 3 + 8 \times 2}{6}$$

$$= \frac{87+16}{6} = \frac{103}{6}$$

30. If $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are three non-coplanar vectors, then

$$(\mathbf{a} + \mathbf{b} + \mathbf{c}) \cdot [(\mathbf{a} + \mathbf{b}) \times (\mathbf{a} + \mathbf{c})] = \quad [2020]$$

- (a) 0 (b) $[\mathbf{abc}]$ (c) $2[\mathbf{abc}]$ (d) $-[\mathbf{abc}]$

Ans. (d)

Sol. $(\mathbf{a} + \mathbf{b} + \mathbf{c}) \cdot [(\mathbf{a} + \mathbf{b}) \times (\mathbf{a} + \mathbf{c})]$

$$(\mathbf{a} + \mathbf{b} + \mathbf{c}) \cdot (\mathbf{b} \times \mathbf{a} + \mathbf{a} \times \mathbf{c} + \mathbf{b} \times \mathbf{c})$$

$$= (\mathbf{a} + \mathbf{b} + \mathbf{c}) \cdot (\mathbf{b} \times \mathbf{a}) + (\mathbf{a} + \mathbf{b} + \mathbf{c}) \cdot (\mathbf{a} \times \mathbf{c})$$

$$+ (\mathbf{a} + \mathbf{b} + \mathbf{c}) \cdot (\mathbf{b} \times \mathbf{c})$$

$$= [-\mathbf{a}, \mathbf{b}, \mathbf{c}] - [\mathbf{a}, \mathbf{b}, \mathbf{c}] + [\mathbf{a}, \mathbf{b}, \mathbf{c}] = -[\mathbf{a}, \mathbf{b}, \mathbf{c}]$$

31. Two forces F_1 and F_2 are used to pull a car, which met an accident. The angle between the two forces is θ

. Find the values of θ for which the resultant force is equal to $\sqrt{F_1^2 + F_2^2}$ [2020]

- (a) $\theta = 0^\circ$ (b) $\theta = 45^\circ$
(c) $\theta = 90^\circ$ (d) $\theta = 135^\circ$

Ans. (c)

Sol. Resultant of forces F_1 and $F_2 = |\mathbf{F}_1 + \mathbf{F}_2|$

$$|\mathbf{F}_1 + \mathbf{F}_2| = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$$

$$\sqrt{F_1^2 + F_2^2} = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$$

$$\Rightarrow 0 = 2F_1F_2\cos\theta$$

$$\Rightarrow 0 = \cos\theta$$

$$\Rightarrow \theta = 90^\circ$$

32. If $\mathbf{a}, \mathbf{b}, \mathbf{c}, \mathbf{d}$ are four vectors such that $\mathbf{a} + \mathbf{b} + \mathbf{c}$ is collinear with $\mathbf{d}$ and $\mathbf{b} + \mathbf{c} + \mathbf{d}$ is collinear with $\mathbf{a}$, then $\mathbf{a} + \mathbf{b} + \mathbf{c} + \mathbf{d}$ is [2020]

- (a) 0 (b) collinear with $\mathbf{a} + \mathbf{d}$
(c) collinear with $\mathbf{a} - \mathbf{d}$ (d) collinear with $\mathbf{b} - \mathbf{c}$

Ans. (a)

Sol. $\mathbf{a} + \mathbf{b} + \mathbf{c} = \lambda \mathbf{d}$

$$\mathbf{b} + \mathbf{c} = \lambda \mathbf{d} - \mathbf{a} \dots (i)$$

$$\mathbf{b} + \mathbf{c} + \mathbf{d} = \mu \mathbf{a}$$

$$\mathbf{b} + \mathbf{c} = \mu \mathbf{a} - \mathbf{d} \dots (ii)$$

From Eqs. (i) & (ii)

$$\Rightarrow \lambda \mathbf{d} - \mathbf{a} = \mu \mathbf{a} - \mathbf{d}$$

$$\Rightarrow (\lambda + 1)\mathbf{d} = (\mu + 1)\mathbf{a}$$

$$\Rightarrow \mathbf{d} = \frac{(\mu + 1)}{(\lambda + 1)} \mathbf{a}$$

$$\mathbf{d} = n\mathbf{a} \quad \left\{ \because n = \frac{\mu + 1}{\lambda + 1} = \text{constant} \right\}$$

$\mathbf{d} \parallel \mathbf{a} \Rightarrow \mathbf{a}$ and $\mathbf{d}$ are collinear.

Put $\mathbf{d} = n\mathbf{a}$ into Eq. (i)

$$\mathbf{b} + \mathbf{c} = \lambda n\mathbf{a} - \mathbf{a}$$

$$\Rightarrow \mathbf{b} + \mathbf{c} = (\lambda n - 1)\mathbf{a}$$

$$\Rightarrow (\mathbf{b} + \mathbf{c}) \parallel \mathbf{a} \parallel \mathbf{d}$$

If $\mathbf{a}$ and $\mathbf{d}$ are collinear and vector $(\mathbf{b} + \mathbf{c})$ is in the line of $\mathbf{a}$ and $\mathbf{d}$ then it implies that the vector sum of all vectors will be zero.

Hence, $\mathbf{a} + \mathbf{b} + \mathbf{c} + \mathbf{d} = 0$

33. Forces of magnitude 5, 3, 1 units act in the

directions $6\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}, 3\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 6\hat{\mathbf{k}}, 2\hat{\mathbf{i}} - 3\hat{\mathbf{j}} - 6\hat{\mathbf{k}}$ respectively on a particle which is displaced from the point $(2, -1, -3)$ to $(5, -1, 1)$. The total work done by the force is [2020]

(a) 21 units

(b) 5 units

(c) 33 units

(d) 105 units

Ans. (c)

Sol. The unit vectors in the direction of $6\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$ is

$$\frac{6\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}}{\sqrt{6^2 + 2^2 + 3^2}}$$

$$= \frac{6}{7}\hat{\mathbf{i}} + \frac{2}{7}\hat{\mathbf{j}} + \frac{3}{7}\hat{\mathbf{k}}$$

Similarly, the unit vectors in the direction of

$3\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 6\hat{\mathbf{k}}$ and $2\hat{\mathbf{i}} - 3\hat{\mathbf{j}} - 6\hat{\mathbf{k}}$ are $\frac{3}{7}\hat{\mathbf{i}} - \frac{2}{7}\hat{\mathbf{j}} + \frac{6}{7}\hat{\mathbf{k}}$ and

$\frac{2}{7}\hat{\mathbf{i}} - \frac{3}{7}\hat{\mathbf{j}} - \frac{6}{7}\hat{\mathbf{k}}$ respectively.

Since $\mathbf{F}_1, \mathbf{F}_2$ and $\mathbf{F}_3$ are the forces of magnitude 5, 3 and 1 units respectively, then

$$\mathbf{F}_1 = \frac{5}{7}(6\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}})$$

$$\mathbf{F}_2 = \frac{3}{7}(3\hat{\mathbf{i}} - 2\hat{\mathbf{j}} + 6\hat{\mathbf{k}})$$

$$\mathbf{F}_3 = \frac{1}{7}(2\hat{\mathbf{i}} - 3\hat{\mathbf{j}} - 6\hat{\mathbf{k}})$$

Resultant force $= \mathbf{F}_1 + \mathbf{F}_2 + \mathbf{F}_3$

$$\mathbf{R} = \frac{1}{7}[41\hat{\mathbf{i}} + \hat{\mathbf{j}} + 27\hat{\mathbf{k}}]$$

Let $A(2, -1, -3)$ and $B(5, -1, 1)$ $\mathbf{AB} = 3\hat{\mathbf{i}} + 4\hat{\mathbf{k}}$

Work done is $\mathbf{R} \cdot \mathbf{AB}$

$$= \frac{1}{7}(41\hat{\mathbf{i}} + \hat{\mathbf{j}} + 27\hat{\mathbf{k}}) \cdot (3\hat{\mathbf{i}} + 4\hat{\mathbf{k}}) = \frac{1}{7}(123 + 108) = \frac{1}{7} \times 231$$

$$\Rightarrow 33 \text{ units}$$

34. The position vectors of points A and B are $\mathbf{a}$ and $\mathbf{b}$. Then the position vector of point P dividing AB in the ratio $m:n$ is [2020]

(a) $\frac{n\mathbf{a} + m\mathbf{b}}{m + n}$

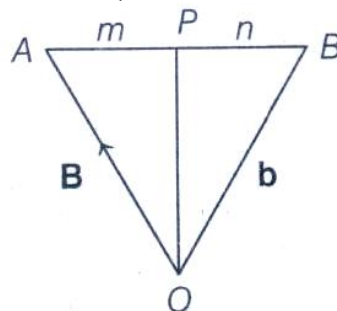
(b) $\frac{n\mathbf{a} + m\mathbf{b}}{m - n}$

(c) $\frac{n\mathbf{a} - m\mathbf{b}}{m + n}$

(d) None of these

Ans. (a)

Sol. Here, P divides AB internally in the ratio $m:n$.



∴ P divides vector such that

$$\frac{AP}{PB} = \frac{m}{n}$$

$$nAP = mPB \quad (i)$$

Where m and n are positive scalar.

Here, $\mathbf{r}, \mathbf{a}, \mathbf{b}$ are position vector of OP, OA and OB respectively.

∴ From the figure we have

$$AP = OP - OA = \mathbf{r} - \mathbf{a}$$

$$PB = OB - OP = \mathbf{b} - \mathbf{r}$$

Substituting in Eq. (i),

$$nAP = mPB$$

$$n(\mathbf{r} - \mathbf{a}) = m(\mathbf{b} - \mathbf{r})$$

$$n\mathbf{r} - n\mathbf{a} = m\mathbf{b} - m\mathbf{r}$$

$$m\mathbf{r} + n\mathbf{r} = n\mathbf{a} + m\mathbf{b}$$

$$\mathbf{r}(m+n) = n\mathbf{a} + m\mathbf{b}$$

$$\mathbf{r} = \frac{n\mathbf{a} + m\mathbf{b}}{n+m}$$

35. If $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are three non-zero vectors with no two of which are collinear, $\mathbf{a} + 2\mathbf{b}$ is collinear with $\mathbf{c}$ and $\mathbf{b} + 3\mathbf{c}$ is collinear with $\mathbf{a}$, then $|\mathbf{a} + 2\mathbf{b} + 6\mathbf{c}|$ will be equal to [2020]

- (a) Zero (b) 9
(c) 1 (d) None of these

Ans. (a)

Sol. $\mathbf{a}, \mathbf{b}, \mathbf{c}$ are non-zero vectors.

As $\mathbf{a} + 2\mathbf{b}$ is collinear with $\mathbf{c}$

$$(\mathbf{a} + 2\mathbf{b}) = \lambda\mathbf{c}$$

As $\mathbf{b} + 3\mathbf{c}$ is collinear with $\mathbf{a}$

$$(\mathbf{b} + 3\mathbf{c}) = \mu\mathbf{a}$$

$$\mathbf{a} + 2\mathbf{b} + 6\mathbf{c} = \lambda\mathbf{c} + 6\mathbf{c} = (\lambda + 6)\mathbf{c}$$

$$\mathbf{a} + 2\mathbf{b} + 6\mathbf{c} = \mathbf{a} + 2(\mathbf{b} + 3\mathbf{c})$$

$$= \mathbf{a} + 2\mu\mathbf{a} = (1 + 2\mu)\mathbf{a}$$

$$\therefore (\lambda + 6)\mathbf{c} = (1 + 2\mu)\mathbf{a}$$

As, $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ are non-collinear and non-zero vector,

$$\lambda + 6 = 0 \text{ and } 1 + 2\mu = 0$$

$$\lambda = -6 \quad \mu = -\frac{1}{2}$$

$$a + 2b + 6c = 0$$

$$|a + 2b + 6c| = 0$$

36. Vertices of the vectors $\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}, 2\mathbf{i} + \mathbf{j} - \mathbf{k}$ and $3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ form a triangle. This triangle is [2020]

- (a) Equilateral triangle
(b) Right angle triangle
(c) Two sides are equal in length
(d) None of the above

Ans. (b)

Sol. Let position vector of A is $\mathbf{a} = \mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$

Position vector of B is $\mathbf{b} = 2\mathbf{i} + \mathbf{j} - \mathbf{k}$

and position vector of C is $\mathbf{c} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$

$$\mathbf{AB} = \mathbf{b} - \mathbf{a}$$

$$= \mathbf{i} + 3\mathbf{j} - 3\mathbf{k}$$

$$|\mathbf{AB}| = \sqrt{1 + 3^2 + (-3)^2}$$

$$= \sqrt{1 + 9 + 9} = \sqrt{19}$$

$$\mathbf{BC} = \mathbf{c} - \mathbf{b}$$

$$= \mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$$

$$|\mathbf{BC}| = \sqrt{1 + (-2)^2 + (3)^2}$$

$$= \sqrt{1 + 4 + 9}$$

$$= \sqrt{14}$$

$$\mathbf{CA} = \mathbf{a} - \mathbf{c}$$

$$= -2\mathbf{i} - \mathbf{j}$$

$$|\mathbf{CA}| = \sqrt{4 + 1} = \sqrt{5}$$

$$|\mathbf{AB}|^2 = (\sqrt{19})^2 = 19$$

$$|\mathbf{BC}|^2 + |\mathbf{CA}|^2$$

$$= (\sqrt{14})^2 + (\sqrt{5})^2$$

$$= 19$$

Hence, ABC is a right angle triangle with AB as hypotenuse or $\angle C = 90^\circ$.

37. If the volume of a parallelopiped whose adjacent edges $\mathbf{a} = 2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$, are $\mathbf{b} = \mathbf{i} + a\mathbf{j} + 2\mathbf{k}$ is 15, then

$$a = \mathbf{c} = \mathbf{i} + 2\mathbf{j} + a\mathbf{k} \quad [2020]$$

- (a) 1 (b) 5/2 (c) 9/2 (d) 0

Ans. (c)

Sol. Volume of parallelopiped = $[\mathbf{a} \quad \mathbf{b} \quad \mathbf{c}]$

$$\therefore \begin{vmatrix} 2 & 3 & 4 \\ 1 & a & 2 \\ 1 & 2 & a \end{vmatrix} = 15$$

(Given)

$$\begin{aligned} \Rightarrow 2(a^2 - 4) - 3(a - 2) + 4(2 - a) &= 15 \\ \Rightarrow 2a^2 - 8 - 3a + 6 + 8 - 4a &= 15 \\ \Rightarrow 2a^2 - 7a - 9 &= 0 \\ \Rightarrow 2a^2 - 9a + 2a - 9 &= 0 \\ \Rightarrow a(2a - 9) + 1(2a - 9) &= 0 \\ \Rightarrow (a + 1)(2a - 9) &= 0 \\ \Rightarrow a + 1 = 0 \text{ or } 2a - 9 &= 0 \\ \Rightarrow a = -\frac{9}{2}, a = \frac{9}{2} \end{aligned}$$

38. Solve the equation $\sin^2 x - \sin x - 2 = 0$ for x on the interval $0 \leq x < 2\pi$ [2020]

- (a) $x = -\frac{\pi}{2}$ only (b) $x = \frac{\pi}{4}$ and $\frac{2\pi}{7}$
(c) $x = \frac{2\pi}{3}$ and $\frac{2\pi}{5}$ (d) None of these

Ans. (d)

Sol. $\sin^2 x - \sin x - 2 = 0$

$$\begin{aligned} \Rightarrow \sin^2 x - 2\sin x + \sin x - 2 &= 0 \\ \Rightarrow \sin x(\sin x - 2) + 1(\sin x - 2) &= 0 \\ \Rightarrow (\sin x + 1)(\sin x - 2) &= 0 \\ \Rightarrow \sin x + 1 = 0 \text{ or } \sin x - 2 &= 0 \\ \Rightarrow \sin x = -1 \text{ or } \sin x = 2 \\ \Rightarrow \sin x = \sin \frac{3\pi}{2} \\ \Rightarrow x = n\pi + (-1)^n \frac{3\pi}{2} \end{aligned}$$

39. If $\frac{\tan x}{2} = \frac{\tan y}{3} = \frac{\tan z}{5}$ and $x + y + z = \pi$, then the value of $\tan^2 x + \tan^2 y + \tan^2 z$ is [2020]

- (a) 38/3 (b) 38
(c) 114 (d) None of these

Ans. (a)

Sol. $\tan(x + y + z) = \frac{z \tan x - \pi \tan x}{1 - z \tan x \tan y}$

$$\begin{aligned} \Rightarrow 0 &= z \tan x - \pi \tan x \\ \Rightarrow z \tan x &= \pi \tan x \\ \Rightarrow \tan x + \tan y + \tan z &= \tan x \tan y \tan z \quad (i) \\ \Rightarrow \frac{\tan x}{2} = \frac{\tan y}{3} = \frac{\tan z}{5} &= k \quad (\text{let}) \end{aligned}$$

$$\Rightarrow \tan x = 2k, \tan y = 3k \text{ and } \tan z = 5k$$

$\therefore$ From (i)

$$\begin{aligned} \Rightarrow 2k + 3k + 5k &= 2k \cdot 3k \cdot 5k \\ 10k &= 30k^3 \\ \Rightarrow 3k^2 &= 1 \end{aligned}$$

$$\Rightarrow k = \frac{1}{\sqrt{3}}$$

$$\therefore \tan x = 2k = \frac{2}{\sqrt{3}}$$

$$\tan y = 3k = \frac{3}{\sqrt{3}}$$

$$\text{and } \tan z = 5k = \frac{5}{\sqrt{3}}$$

$$\begin{aligned} \therefore \tan^2 x + \tan^2 y + \tan^2 z \\ = \frac{4}{3} + \frac{9}{3} + \frac{25}{3} = \frac{38}{3} \end{aligned}$$

40. Find the value of $\sin 12^\circ \sin 48^\circ \sin 54^\circ$ [2020]

- (a) 1/8 (b) 1/6 (c) 1/2 (d) 1/4

Ans. (a)

Sol. $\sin 12^\circ \sin 48^\circ \sin 54^\circ$

$$\begin{aligned} &= \frac{1}{2} (2 \sin 12^\circ \sin 48^\circ) \sin 54^\circ \\ &= \frac{1}{2} [\cos 36^\circ - \cos 60^\circ] \sin 54^\circ \\ &= \frac{1}{2} \left(\cos 36^\circ - \frac{1}{2} \right) \sin 54^\circ \\ &= \frac{1}{2} (2 \cos 36^\circ \sin 54^\circ - \sin 54^\circ) \\ &= \frac{1}{4} [\sin 90^\circ + \sin 18^\circ - \sin 54^\circ] \\ &= \frac{1}{4} \left[1 + \frac{\sqrt{5}-1}{4} + \frac{\sqrt{5}+1}{4} \right] \\ &= \frac{1}{4} \left(1 - \frac{1}{2} \right) = \frac{1}{8} \end{aligned}$$

41. If $\cos x = \tan y$, $\cot y = \tan z$ and $\cot z = \tan x$, then $\sin x =$ [2020]

- (a) $\frac{\sqrt{5}-1}{2}$ (b) $\frac{\sqrt{5}+1}{2}$
(c) $\frac{\sqrt{5}+1}{4}$ (d) $\frac{\sqrt{5}-1}{4}$

Ans. (a)

Sol. We have, $\cot y = \tan z$

$$\Rightarrow \frac{1}{\tan y} = \frac{1}{\cot z} = \frac{1}{\tan x}$$

$$\Rightarrow \tan y = \tan x \dots (i)$$

$$(\because \cot z = \tan x)$$

$$(\text{using Eq. (i)})$$

$$\text{Now, } \cos x = \tan y = \tan x$$

$$\Rightarrow \cos x = \tan x$$

$$\Rightarrow \cos x = \frac{\sin x}{\cos x}$$

$$\Rightarrow \cos^2 x = \sin x$$

$$\Rightarrow 1 - \sin^2 x = \sin x$$

$$\Rightarrow \sin^2 x + \sin x - 1 = 0$$

$$\Rightarrow \sin x = \frac{-1 \pm \sqrt{1+4}}{2}$$

$$= \frac{-1 \pm \sqrt{5}}{2}$$

$$\Rightarrow \sin x = \frac{-1 + \sqrt{5}}{2}, \frac{-1 - \sqrt{5}}{2}$$

42. The value of $\tan\left(45^\circ + \frac{\theta}{2}\right)$ is [2020]

(a) $\tan\theta - \sec\theta$

(b) $\tan\theta + \sec\theta$

(c) $\cot\theta - \sec\theta$

(d) $\cot\theta + \sec\theta$

Ans. (b)

Sol. $\tan\left(45^\circ + \frac{\theta}{2}\right)$

$$= \frac{\tan 45^\circ + \tan \frac{\theta}{2}}{1 - \tan 45^\circ \tan \frac{\theta}{2}}$$

$$= \frac{1 + \tan \frac{\theta}{2}}{1 - \tan \frac{\theta}{2}}$$

$$= \frac{1 + \frac{\sin \frac{\theta}{2}}{\cos \frac{\theta}{2}}}{1 - \frac{\sin \frac{\theta}{2}}{\cos \frac{\theta}{2}}}$$

$$= \frac{\cos \frac{\theta}{2} + \sin \frac{\theta}{2}}{\cos \frac{\theta}{2} - \sin \frac{\theta}{2}}$$

$$= \frac{\left(\cos \frac{\theta}{2} + \sin \frac{\theta}{2}\right)^2}{\cos \frac{\theta}{2} - \sin \frac{\theta}{2}}$$

$$= \frac{1 + 2\cos \frac{\theta}{2} \cdot \sin \frac{\theta}{2}}{\cos \theta}$$

$$= \frac{1 + \sin \theta}{\cos \theta} = \tan \theta + \sec \theta$$

43. The value of $\sin 10^\circ \sin 50^\circ \sin 70^\circ$ is [2020]

(a) $1/4$ (b) $1/2$ (c) $3/4$ (d) $1/8$

Ans. (d)

Sol. $\sin 10^\circ \sin 50^\circ \sin 70^\circ$

$$= \frac{1}{2} \sin 10^\circ (2 \sin 70^\circ \sin 50^\circ)$$

$$= \frac{1}{2} \sin 10^\circ [\cos(70^\circ - 50^\circ) - \cos(70^\circ + 50^\circ)]$$

$$= \frac{1}{2} \sin 10^\circ [\cos 20^\circ - \cos 120^\circ]$$

$$= \frac{1}{2} \sin 10^\circ \left[\cos 20^\circ + \frac{1}{2} \right] \left(\because \cos 120^\circ = -\frac{1}{2} \right)$$

$$= \frac{1}{4} (2 \cos 20^\circ \sin 10^\circ) + \frac{1}{4} \sin 10^\circ$$

$$= \frac{1}{4} [\sin(20^\circ + 10^\circ) - \sin(20^\circ - 10^\circ)] + \frac{1}{4} \sin 10^\circ$$

$$= \frac{1}{4} \sin 30^\circ - \frac{1}{4} \sin 10^\circ + \frac{1}{4} \sin 10^\circ$$

$$= \frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

44. The expression $\frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A}$ can be written as [2020]

(a) $\sin A \cos A + 1$

(b) $\sec A \operatorname{cosec} A + 1$

(c) $\tan A + \cot A$

(d) $\sec A + \operatorname{cosec} A$

Ans. (b)

Sol. $\frac{\tan A}{1 - \cot A} + \frac{\cot A}{1 - \tan A}$

$$= \frac{\frac{\sin A}{\cos A}}{1 - \frac{\cos A}{\sin A}} + \frac{\frac{\cos A}{\sin A}}{1 - \frac{\sin A}{\cos A}}$$

$$= \frac{\sin A}{\cos A} \times \frac{\sin A}{\sin A - \cos A} + \frac{\cos A}{\sin A} \times \frac{\cos A}{1 - \sin A}$$

$$= \frac{\sin^2 A}{\cos A (\sin A - \cos A)} - \frac{\cos^2 A}{\sin A (\sin A - \cos A)}$$

$$= \frac{\sin^3 A - \cos^3 A}{\cos A \sin A (\sin A - \cos A)}$$

$$= \frac{(\sin A - \cos A)(\sin^2 A + \cos^2 A + \sin A \cos A)}{\cos A \sin A (\sin A - \cos A)}$$

$$= \frac{1 + \sin A \cos A}{\cos A \sin A}$$

$$= 1 + \sec A \operatorname{cosec} A$$

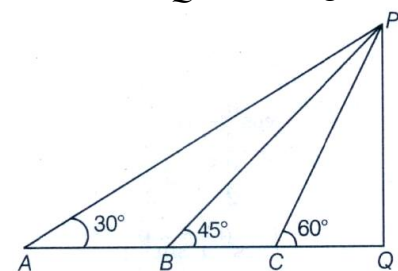
45. Angle of elevation of the top of the tower from 3 points (collinear) A, B and C on a road leading to the foot of the tower are $30^\circ, 45^\circ$ and 60° , respectively.

The ratio of AB and BC is [2020]

- (a) $\sqrt{3}:1$ (b) $\sqrt{3}:2$ (c) $1:2$ (d) $2:\sqrt{3}$

Ans. (a)

Sol. Here, PQ is the height of tower,



In $\triangle PCQ$,

$$\tan 60^\circ = \frac{PQ}{CQ} = \sqrt{3} = \frac{PQ}{CQ}$$

$$\Rightarrow CQ = \frac{PQ}{\sqrt{3}}$$

In $\triangle PBQ$,

$$\tan 45^\circ = \frac{PQ}{BQ}$$

$$\Rightarrow 1 = \frac{PQ}{BQ}$$

$$\Rightarrow BQ = PQ$$

$$\Rightarrow BC + CQ = PQ$$

$$\Rightarrow BC = PQ - \frac{PQ}{\sqrt{3}}$$

$$\Rightarrow BC = \frac{PQ(\sqrt{3}-1)}{\sqrt{3}}$$

and $\triangle PQA$, $\tan 30^\circ = \frac{PQ}{AQ}$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{PQ}{AQ}$$

$$\Rightarrow AQ = \sqrt{3}PQ$$

$$\Rightarrow AB + BC + CQ = \sqrt{3}PQ$$

$$\Rightarrow AB + \frac{PQ(\sqrt{3}-1)}{\sqrt{3}} + \frac{PQ}{\sqrt{3}} = \sqrt{3}PQ$$

$$\Rightarrow AB + \frac{PQ(\sqrt{3})}{\sqrt{3}} - \frac{PQ}{\sqrt{3}} + \frac{PQ}{\sqrt{3}} = \sqrt{3}PQ$$

$$\Rightarrow AB + PQ = \sqrt{3}PQ$$

$$\Rightarrow AB = PQ(\sqrt{3}-1)$$

$$\therefore \frac{AB}{BC} = \frac{PQ(\sqrt{3}-1)}{PQ(\sqrt{3}-1)} = \sqrt{3}$$

$$\Rightarrow AB:BC = \sqrt{3}:1$$

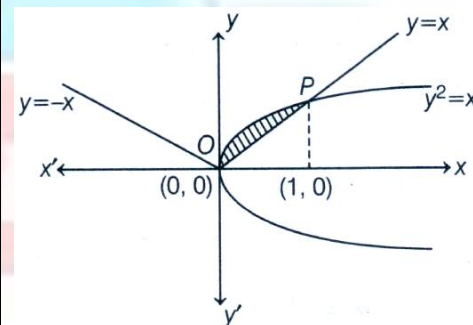
$$\Rightarrow AB$$

46. The area enclosed between the curves $y^2 = x$ and $y = |x|$ is [2020]

- (a) $2/3$ sq. unit (b) 1 sq. unit
(c) $1/6$ sq. unit (d) $1/3$ sq. unit

Ans. (c)

Sol. Firstly we can find point of intersection P .
Intersection points of $y^2 = x$ and $y = x$ is $(1,1)$.



$$\therefore \text{Required area} = \int_0^1 (\sqrt{x} - x) dx$$

$$= \left(\frac{x^{3/2}}{3/2} - \frac{x^2}{2} \right)_0^1 = \left(\frac{2}{3} x^{3/2} - \frac{x^2}{2} \right)_0^1$$

$$= \frac{2}{3} - \frac{1}{2} = \frac{1}{6} \text{ sq. unit.}$$

47. Test the continuity of the function at

$$x = 2f(x) = \begin{cases} \frac{5}{2} - x, & x < 2 \\ x - \frac{3}{2}, & x > 2 \end{cases}$$

[2020]

- (a) Continuous at $x = 2$
(b) Discontinuous at $x = 2$
(c) Semicontinuous at $x = 2$
(d) None of these

Ans. (b)

$$\text{Sol. } \lim_{x \rightarrow 2^-} f(x) = \lim_{h \rightarrow 0} f(2-h)$$

$$\begin{aligned}
&= \lim_{h \rightarrow 0} \left\{ \frac{5}{2} - (2-h) \right\} \\
&= \lim_{h \rightarrow 0} \left(\frac{1}{2} + h \right) = \frac{1}{2} \\
\lim_{h \rightarrow 2^+} f(x) &= \lim_{h \rightarrow 0} f(2+h) \\
&= \lim_{h \rightarrow 0} \left\{ (2+h) - \frac{3}{2} \right\} \\
&= \lim_{h \rightarrow 0} \left(\frac{1}{2} + h \right) = \frac{1}{2}
\end{aligned}$$

and $f(2) = 1$

$$\therefore \lim_{h \rightarrow 2^-} f(x) = \lim_{h \rightarrow 2^+} f(x) \neq f(2)$$

$\Rightarrow f(x)$ is discontinuous at $x = 2$

48. The value of $2 \tan^{-1} [\operatorname{cosec}(\tan^{-1} x) - \tan(\cot^{-1} x)]$ is

- (a) $\tan x$ (b) $\cot x$ (c) $\tan^{-1} x$ (d) $\operatorname{cosec}^{-1} x$

[2020]

Ans. (c)

Sol. $2 \tan^{-1} [\operatorname{cosec}(\tan^{-1} x) - \tan(\cot^{-1} x)]$

$$= 2 \tan^{-1} \left[\operatorname{cosec} \left\{ \operatorname{cosec}^{-1} \frac{\sqrt{1+x^2}}{x} \right\} - \tan \left\{ \tan^{-1} \frac{1}{x} \right\} \right]$$

$$= 2 \tan^{-1} \left[\frac{\sqrt{1+x^2}}{x} - \frac{1}{x} \right]$$

$$= 2 \tan^{-1} \left[\frac{\sqrt{1+x^2} - 1}{x} \right]$$

$$= 2 \tan^{-1} \left[\frac{\sec \theta - 1}{\tan \theta} \right] \text{ (put } x = \tan \theta \text{)}$$

$$= 2 \tan^{-1} \left[\frac{1 - \cos \theta}{\sin \theta} \right]$$

$$= 2 \tan^{-1} \left[\frac{2 \sin^2 \frac{\theta}{2}}{2 \sin \frac{\theta}{2} \cdot \cos \frac{\theta}{2}} \right] = 2 \tan^{-1} \left(\tan \frac{\theta}{2} \right)$$

$$= 2 \cdot \frac{\theta}{2} = \theta = \tan^{-1} x$$

49. If $3 \sin x + 4 \cos x = 5$, then $6 \tan \frac{x}{2} - 9 \tan^2 \frac{x}{2} =$

[2020]

- (a) 1 (b) 3 (c) 4 (d) 6

Ans. (a)

Sol. We have, $3 \sin x + 4 \cos x = 5$

$$\Rightarrow 3 \cdot \frac{2 \tan \frac{x}{2}}{1 + \tan^2 \frac{x}{2}} + 4 \cdot \frac{1 - \tan^2 \frac{x}{2}}{1 + \tan^2 \frac{x}{2}} = 5$$

$$\Rightarrow 6 \tan \frac{x}{2} + 4 - 4 \tan^2 \frac{x}{2} = 3 + 5 \tan^2 \frac{x}{2}$$

$$\Rightarrow -9 \tan^2 \frac{x}{2} + 6 \tan \frac{x}{2} = 1$$

$$\Rightarrow 6 \tan \frac{x}{2} - 9 \tan^2 \frac{x}{2} = 1$$

50. If A is a subset of B and B is a subset of C , then cardinality of $A \cup B \cup C$ is equal to [2020]

- (a) Cardinality of C (b) Cardinality of B
(c) Cardinality of A (d) None of these

Ans. (a)

Sol. Given, $A \subset B$ and $B \subset C$

$$\Rightarrow A \subseteq B \subseteq C$$

$$\Rightarrow A \cup B \cup C = C, n(A \cup B \cup C) : n(C)$$

$\therefore$ Cardinality of $A \cup B \cup C$ is equal to cardinality of C

Analytical Ability & Logical Reasoning

51. A set of consecutive positive integers beginning with 1 is written on the blackboard. A student came along and erased one number. The average of the remaining numbers is 35717. What was the number erased? [2020]

- (a) 7 (b) 8 (c) 9 (d) None of the above

Ans. (a)

Sol. Since all the values are integers, their sum must be an integer

$$\text{Sum} = \text{Number} \times \text{Average}$$

Number of integers after erasing must be a multiple of 17.

As the average of n consecutive numbers is $\left(\frac{n+1}{2} \right)$,

then number of integers must be around 69.

After erasing the number of integers is 68 (as 68 is a multiple of 17) and before erasing, the number of integers is 69.

Let the erased number be x

$$\frac{69 \times 35 - x}{68} = \frac{602}{17}$$

$$2415 - x = 2408$$

$$x = 2415 - 2408$$

$$x = 7$$

52. Four friends A, B, C and D need to cross a bridge in the night. A maximum of 2 people can cross at a time. They have only one lamp. A takes one min to cross the bridge. B takes 2 min, C takes 8 min and D takes 11 min to cross the bridge respectively. A pair must walk together at the speed of the person who walks slowly. What is the minimum time required to cross the bridge by all the four people? [2020]

(a) 23 min (b) 20 min (c) 18 min (d) 16 min

Ans. (c)

Sol. First A and B will go in 2 min, then A returns in 1 min.

Then C and D will go in 11 min. B returns in 2 min.

A & B will go in 2 min.

The total time taken would be

$$(2+1+11+2+2)=18 \text{ min.}$$

53. In a city, 40.1% of the adults are illiterate while 85.1% of the children are literate. If the ratio of the adults to that of the children is 2:3, then what percent of the population is literate? [2020]

(a) 20% (b) 25% (c) 50% (d) 75%

Ans. (d)

Sol. Let the number of adults is $2x$ and number of children be $3x$.

$$\text{Number of literate adults} = 60\% \text{ of } 2x = \frac{6x}{5}$$

$$\text{Number of literate children} = 85\% \text{ of } 3x = \frac{51x}{20}$$

$$\text{Total literate population} = \frac{6x}{5} + \frac{51x}{20} = \frac{75x}{20}$$

$$\% \text{ of literate} = \frac{\frac{75x}{20}}{5x} \times 100$$

$$\Rightarrow 75\%$$

54. A runs $1\frac{2}{3}$ times as fast as B . If A gives B a start of 80 m, how far must the winning post be so that A and B might reach it at the same time? [2020]

(a) 200 m (b) 400 m (c) 300 m (d) 160 m

Ans. (a)

Sol. We have,

$$\text{Speed of } A : \text{Speed of } B = \frac{5}{3} : 1 = 5 : 3$$

$\Rightarrow$ In a race of 5 metres, A runs 5 metres and B runs 3 metres

$\Rightarrow A$ gain 2 metres over B in race of 5 metres

$\Rightarrow A$ gains 80 metres over B in a race of

$$\frac{5}{2} \times 80 = 200 \text{ m.}$$

55. A person's present age is two fifth of the age of his mother. After 8 years, he will be one-half of the age of his mother. What is the present age of his mother?

[2020]

(a) 60 yr (b) 50 yr (c) 40 yr (d) 30 yr

Ans. (c)

Sol. Let the mother's present age be x years.

Then, the person's present age = $\frac{2}{5}x$ years

According to questions,

$$\left(\frac{2x}{5} + 8\right) = \frac{1}{2}(x+8)$$

$$\Rightarrow \frac{2x+40}{5} = \frac{1}{2}(x+8)$$

$$\Rightarrow 4x+80 = 5x+40$$

$$\Rightarrow x = 40 \text{ yr}$$

56. Mr. Kumar drives to work at an average speed of 48 Km/hr. The time taken to cover the first 60% of the distance is 10 min more than the time taken to cover the remaining distance. How far is his office?

[2020]

(a) 30 km (b) 40 km (c) 45 km (d) 48 km

Ans. (b)

Sol. Let the total distance be x km.

Time taken to cover remaining 40% of x distance is

$$t_1 = \frac{40 \times x}{100 \times 48}$$

Since, time taken to cover first 60% of x distance is

$$t_2 = t_1 + \frac{10}{60} \text{ hrs.}$$

$$\Rightarrow t_2 = \frac{60 \times x}{100 \times 48}$$

$$\therefore \frac{60 \times x}{100 \times 48} = \frac{40 \times x}{100 \times 48} + \frac{10}{60}$$

$$\Rightarrow \frac{60 \times x}{100 \times 48} - \frac{40 \times x}{100 \times 48} = \frac{10}{60}$$

$$\Rightarrow \frac{20x}{4800} = \frac{10}{60}$$

$$\Rightarrow x = \frac{10}{60} \times \frac{4800}{20}$$

$$\Rightarrow x = 40 \text{ km}$$

57. Two pipes A and B can fill the cistern in 37.5 min and 45 min respectively. Both pipes are opened. The cistern will be filled in just half an hour, if the B is

turned off after [2020]

(a) 5 min (b) 9 min (c) 10 min (d) 15 min

Ans. (b)

Sol. Let B be turned off after x minutes. Then, part filled by $(A+B)$ in x min. + part filled by A is

$(30-x)$ min. = 1

$$\therefore x \left(\frac{2}{75} + \frac{1}{45} \right) + (30-x) \frac{2}{75} = 1$$

$$\Rightarrow \frac{11x}{225} + \frac{60-2x}{75} = 1$$

$$\Rightarrow 11x + 180 - 6x = 225$$

$$\Rightarrow 5x + 180 = 225$$

$$\Rightarrow 5x = 45$$

$$\Rightarrow x = 9 \text{ min}$$

58. In a certain code, DOES is written as 5\$3% and SITE is written as %4#3. How is EDIT written in that code? [2020]

(a) 3#4\$ (b) %3#5 (c) 354# (d) 4#5\$

Ans. (c)

Sol. As per the given question,

DOES

5\$3%

SITE

%4#3

Edit is coded as 354 #

$\therefore$ The correct answer is option (c).

59. In a shower, 5 cm of rain falls. The volume of water that falls on 1.5 hectares of ground is [2020]

(a) 75 m³ (b) 750 m³
(c) 7500 m³ (d) 75000 m³

Ans. (b)

Sol. 1 hectare = 10000 m²

So, Area = (1.5×10000) m²

= 15000 m²

Depth = $\frac{5}{100}$ m = $\frac{1}{20}$ m

$\therefore$ Volume = (Area $\times$ Depth)

$$= \left(15000 \times \frac{1}{20} \right) \text{ m}^3$$

$$= 750 \text{ m}^3$$

= 750 cubic metre.

$\therefore$ The correct answer is option (b).

60. Eight friends A through H , are sitting around a circular table, playing a game of cards. They belong to two different teams X and Y . No two persons of the same team sit in adjacent seats. [2020]

• A sits neither opposite to D nor to H but is sitting in between C and G .

• B sits neither opposite to A nor to G but is sitting in between F and D .

B and H belong to team X and D sits opposite to E . Who are the members of team X ?

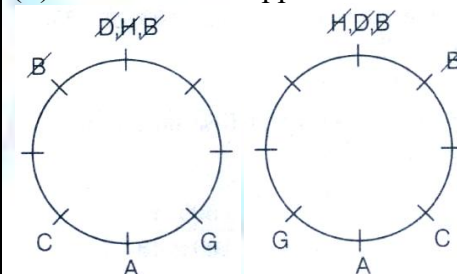
(a) A, D, F and E (b) B, H, C and E
(c) B, D, H and G (d) B, H, C and G

Ans. (d)

Sol. Given person : A, B, C, D, E, F, G and H

(i) A sits neither opposite of D nor to H but is sitting in between C and G .

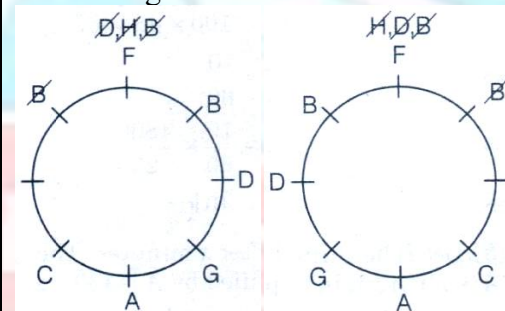
(ii) B sits neither opposite to A nor to G .



Case 1

Case 2

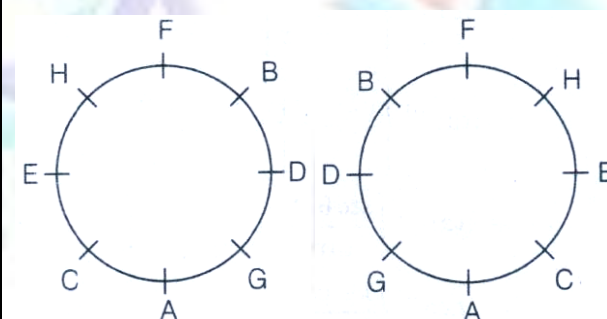
B is sitting in between F and D



Case 1

Case 2

(iii) B and H belong to team X and D sits opposite to E



Case 1

Case 2

As B and H belong to team X , so is C and G . Remaining F, E, A and D belong to team Y . Hence, B, H, C and G is the correct answer.

61. Eight friends A through H , are sitting around a circular table, playing a game of cards. They belong to two different teams X and Y . No two persons of the same team sit in adjacent seats. [2020]

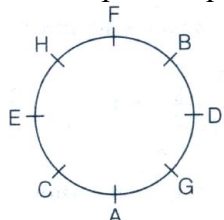
- A sits neither opposite to D nor to H but is sitting in between C and G .
- B sits neither opposite to A nor to G but is sitting in between F and D
- B and H belong to team X and D sits opposite to E

Who are sitting adjacent to E ?

- (a) B and H (b) B and G
(c) H and G (d) H and C

Ans. (d)

Sol. As per the question, the arrangement is



$\therefore$ H and C are sitting adjacent to E .

$\therefore$ The correct answer is option (d).

62. Four students A, B, C and D distributed 30 marbles among themselves. No two students got equal number of marbles. No student got more than 10 marbles. No student got less than 5 marbles. A and C got odd number of marbles. B and D got even number of marbles. A got more marbles than B, C got more marbles than D, B got more marbles than D .

What is the number of marbles with A ? [2020]

- (a) 6 (b) 7 (c) 8 (d) 9

Ans. (d)

Sol. Given 4 students: A, B, C, D

$\Rightarrow$ They distributed 30 marbles among themselves.

- (a) No two students got equal number of marbles.
(b) No student got more than 10 marbles.
(c) No student got less than 5 marbles.
(d) A and C got odd number of marbles. It can be 7 or 9 .
(e) B and D got even number of marbles. It can be 6, 8 or 10.

(f) A got more marbles than B, C got more marbles than D .

$A > B > D; C > D$

$A(7, 9) > B(6, 8) > D(6, 8), C(7, 9) > D(6, 8)$

So, D got the least number of marbles.

$\therefore D$ got 6 marbles.

So, B got 8 marbles as B got more marbles than D .

$\Rightarrow A$ got 9 marbles as A got more marbles than B .

$\Rightarrow C$ got 7 marbles as C got more marbles than D .

Students	Definite number of marbles
A	9
B	8
C	7

D	6
---	---

$\therefore$ The number of marbles with A is 9 .

$\therefore$ The correct answer is option (d).

63. Four students A, B, C and D distributed 30 marbles among themselves. No two students got equal number of marbles. No student got more than 10 marbles. No student got less than 5 marbles. A and C got odd number of marbles. B and D got even number of marbles. A got more marbles than B, C got more marbles than D, B got more marbles than D .

Mean of number of marbles with B, C, D is [2020]

- (a) 6 (b) 7 (c) 8 (d) None of the above

Ans. (b)

Sol. As per the question, the different number of marbles

Students	Definite number of marbles
A	9
B	8
C	7
D	6

Mean of number of marbles with B, C, D is

$$\frac{8+7+6}{3} = \frac{21}{3} = 7$$

$\therefore$ The correct answer is option (b).

64. Nine individuals- Z, Y, X, W, V, U, T, S and R - are the only candidates, who can serve on three committees K_1, K_2 and K_3 , and each candidate should serve on exactly one of the committees. Committee K_1 should consist of exactly one member more than committee K_2 . It is possible that there are no members in committee K_3 . Among Z, Y and X none can serve on committee K_1 . Among W, V and U none can serve on committee K_2 . Among T, S and R none can serve on committee K_3 .

In case committee K_2 is served by T and Z only, how many of the nine individuals should serve on committee K_3 ? [2020]

- (a) 3 (b) 4 (c) 5 (d) 6

Ans. (b)

Sol. Given, Nine individuals: Z, Y, X, W, V, U, T, S and R . Three committees : K_1, K_2 and K_3

1. Each candidate should serve on exactly one of the committees

2. Among Z, Y and X none can serve on committee K_1 .

3. Among T, S and R none can serve on committee K_3

Among W, V and U none can serve on committee K_2 .
In case committee K_2 is served by T and Z

Committees	Individuals who can serve	Individuals who can't serve
K_1		Z, Y, X
K_2	T, Z	W, V, U
K_3		T, S, R

K_1 should consist of exactly one member more than committee K_2 .

So, K_1 is served by three members as K_2 is served by two members only.

So, remaining individuals will serve committee K_3 .

$$\begin{aligned}\text{Remaining persons} &= 9 - (2 + 3) \\ &= 9 - 5 = 4\end{aligned}$$

The correct answer is option (b).

65. Nine individuals - Z, Y, X, W, V, U, T, S and R - are the only candidates, who can serve on three committees K_1, K_2 and K_3 , and each candidate should serve on exactly one of the committees. Committee K_1 should consist of exactly one member more than committee K_2 . It is possible that there are no members in committee K_3 . Among Z, Y and X none can serve on committee K_1 . Among W, V and U none can serve on committee K_2 .

Among T, S and R none can serve on committee K_3 .

Of the nine individuals, the largest number that can serve together on committee K_3 is [2020]

- (a) 8 (b) 7 (c) 6 (d) 5

Ans. (c)

Sol. As per the given question,

Committees	Individuals who can serve	Individuals who can't serve
K_1		Z, Y, X
K_2		W, V, U
K_3		T, S, R

It is possible that there are no members in committee K_3 .

Of the nine individuals, the largest number that can serve together on committee $K_3 = 9$ - Number of members who can't serve K_3 .

$$= 9 - 3 = 6$$

$\therefore$ The correct answer is option (c).

66. Fill in the blank in the series ELFA, GLHA, ILJA, ____ . MLNA: [2020]

- (a) OLPA (b) KLMA (c) LLMA (d) KLLA

Ans. (d)

Sol. According to the given question, First letter of each term;

$$E \rightarrow G \rightarrow I \rightarrow K \rightarrow M$$

+2 +2 +2 +2

Second letter of each term, is same

$$L \rightarrow L \rightarrow L \rightarrow L \rightarrow L$$

Third letter of each term:

$$F \rightarrow H \rightarrow J \rightarrow L \rightarrow N$$

+2 +2 +2 +2

Fourth letter of each term: (is same)

$$A \rightarrow A \rightarrow A \rightarrow A \rightarrow A$$

$\therefore$ The series in the blank is KLLA.

$\therefore$ The correct answer is option (d).

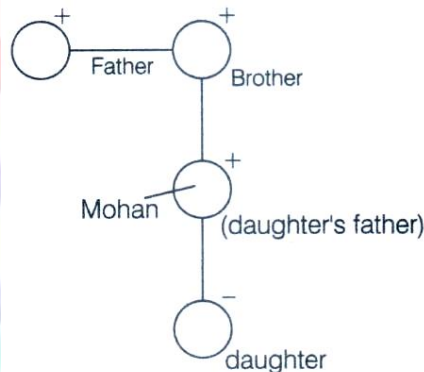
67. Pointing to a gentleman, Mohan said, 'His only brother is the father of my daughter's father'. The gentleman is Mohan's [2020]

- (a) Brother (b) Father
(c) Uncle (d) None of the above

Ans. (c)

Sol. In the diagram, '+' shows male, '-' shows female, Vertical line shows the son / father, Horizontal line shows the brother / sister. Double horizontal line shows the couple.

According to the question,



The gentleman is uncle to Mohan.

$\therefore$ The correct answer is option (c).

68. It was 9.35 am in Garvita's watch, which kept correct time, when Manya informed her that the last bus left the bus stop at 9.25 am. Manya's watch is 5 min fast. The frequency of the bus is every 20 min. For how long Garvita must wait to catch the next bus? [2020]

- (a) 5 min (b) 10 min
(c) 15 min (d) 20 min

Ans. (a)

Sol. It was 9.35 AM in Garvita's watch, which kept correct time.

$\Rightarrow$ Manya informed her that the last bus left the bus

stop at 9.25 am. Manya's watch is 5 min fast.
 $\Rightarrow$ So, the actual line when the bus left the bus stop
 $= 9.25 - 0:05\text{AM} = 9:20\text{AM}$
 $\Rightarrow$ The frequency of the bus is every 20 min .
 So, the next bus will arrive at bus stop at 9:40AM.
 $\Rightarrow$ As it was 9.35 AM in Garvita's watch, she should
 wait 5 more minutes to catch the next bus.
 $\therefore$ The correct answer is option (a).

69. A total of 324 notes comprising of ₹ 20 and ₹ 50 denominations make a sum of ₹12450. The number of ₹ 20 notes is [2020]

(a) 200 (b) 144 (c) 125 (d) 110

Ans. (c)

Sol. Given, 324 notes comprised of ₹ 20 and ₹ 50 total sum is ₹ 12450 .

Let the number of ₹ 20 notes = x the number of ₹ 50 notes = y

According to the question,

$$x + y = 324 \dots (i)$$

$$20x + 50y = 12450 \dots (ii)$$

Solving Eqs. (i) and (ii) we get,

$$1 \times \text{Eq. (i)} \quad 20x + 50y = 12450$$

$$20 \times \text{Eq (ii)}$$

$$20x + 20y = 6480$$

$$30y = 5970$$

$$y = 199$$

$$\therefore x = 125$$

$\therefore$ Number of Rs 20 notes is 125 .

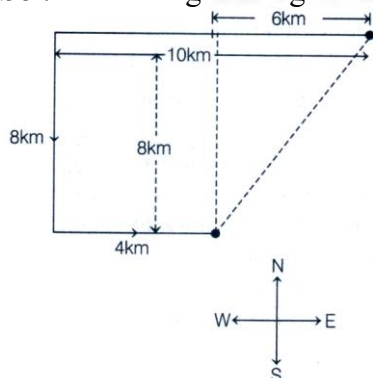
$\therefore$ The correct answer is option (c).

70. Rishabh stops after going 10 km towards west from his office. Then he goes 8 km turning to his left. After this he goes 4 km turning to his left. How far is he from the fixed point? [2020]

(a) 18 km (b) 8 km
 (c) 10 km (d) None of these

Ans. (c)

Sol. According to the given question,



Distance between his starting point and final point

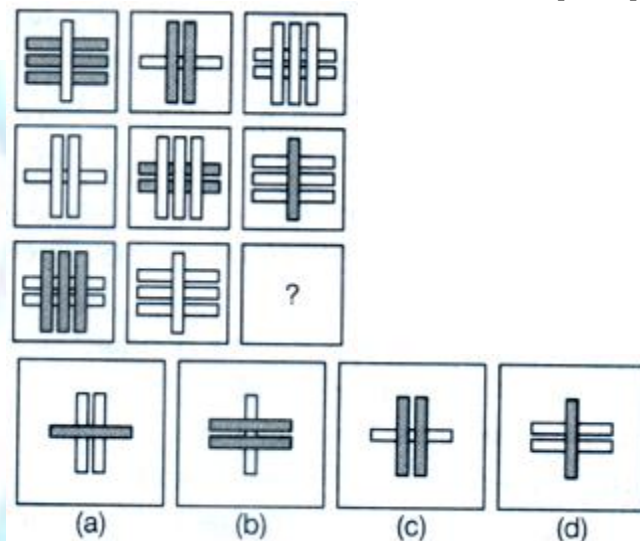
Apply pythagoras theorem = $\sqrt{8^2 + 6^2}$ km

$$= \sqrt{64 + 36}$$

$$= \sqrt{100} = 10 \text{ km}$$

$\therefore$ The correct answer is option (c).

71. Which of the four options should fill the missing cell? [2020]



(a) 1 (b) 2 (c) 3 (d) 4

Ans. (a)

Sol. We can see from the given figure.

From 1st row, the format of horizontal lines are 3, 1, 2 and the format of vertical lines are 1, 2, 3.

From IIInd row, the format of horizontal lines are 1, 2, 3 and the format of vertical lines are 2, 3, 1.

From IIIrd row, the format of horizontal lines must be 2, 3, 1 and the format of the vertical line must be 3, 1, 2.

In the third column, only strip must be shaded, so.

Option (a) is correct answer.

72. In the following questions, the symbols \$, #, @, % and * illustrate the following meanings. [2020]

> P\$Q - P is not smaller than Q

> P#Q - P is neither greater than nor equal to Q.

> P@Q - P is neither smaller than nor equal to Q .

> P%Q - P is not greater than Q

> P*Q - P is neither greater than nor smaller than Q .

Statements: K#L, L%M, M*N, N#0

Conclusions:

I. K#M III. L%O

(a) I only (b) Either I or II only

(c) III only (d) All I, II and III

Ans. (a)

Sol. As per the given data, K#L means K is neither greater than nor equal to Q . It means K is smaller than 'L'. L%M means L is not greater than M , it means L is smaller or equal to M. M*N means M is nether

greater than nor smaller than Q, it means M is equal to N. N#O means N is neither greater than nor equal to O, it means N is smaller than O.

$K < L \leq M = N < O$

By this, K#M is correct,

K * M is incorrect,

L%O is incorrect.

$\therefore$ K#M means I only correct.

$\therefore$ The correct answer is option (a).

73. Study the following arrangement carefully and answer the question given below: [2020]

W1R%4JE#7MT2I9BH3A\$9FQ5DG6USP

Three of the following are alike in a certain way on the basis of above arrangement and hence form a group.

Which one does not belong to that group?

(a) R W 4 (b) 9 Q A (c) 3 B\$ (d) 5 F G

Ans. (b)

Sol. In all except, 9QA the second element is second to the left of first element and third element is second to the right of first element.

W1R % 4 JE# 7 MT 219 BH 3(A)\$ (9)F@5 DG 6 USP

$\therefore$ The correct answer is option (b).

74. If there are no dancers that aren't slim and no singers that aren't dancers, then which statements are always true? [2020]

Choose the correct answer.

(a) There is not one slim person that is not a dancer.

(b) All singers are slim.

(c) Anybody slim is also a singer.

(d) None of the above

Ans. (d)

Sol. According to the given statements,

If there are no dancers that aren't slim

All dancer are slim

No singers that aren't dancers.

All singers are dancers.

The venn diagram of above two statements are:



Statement I $\rightarrow$ False

Statement II $\rightarrow$ True

Statement III $\rightarrow$ False

Statement IV $\rightarrow$ False

$\therefore$ The correct statement is "All singers are slim".

$\therefore$ The correct answer is option (d).

75. If in a certain language, ITNIETAM is the code for INTIMATE, which word has the code TREVNIETARBI? [2020]

(a) INVRETIBRATE

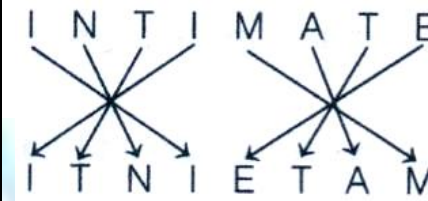
(b) INVERTIBARTE

(c) INVERTIBRATE

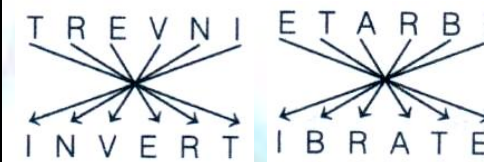
(d) INVERTIBRETA

Ans. (c)

Sol. As per the given question,



Similarly,



$\therefore$ The correct answer is option (c).

76. Sum of ages of Anu and Bhanu is 10 yr more than sum of ages of Bhanu, Chanu and Dhanu. Average age of Chanu and Dhanu is 19 yrs. Find the average age of Anu and Dhanu if Dhanu is 10 yr elder than Chanu. [2020]

(a) 36 yr (b) 30 yr (c) 25 yr (d) 31 yr

Ans. (a)

Sol. Sum of ages of Anu and Bhanu is 10 years more than sum of ages of Bhanu, Chanu and Dhanu.

Anu + Bhanu = (Bhanu + Chanu + Dhanu) + 10

Chanu + Dhanu + 10 = Anu

Average age of Chanu and Dhanu is 19 years.

$\frac{(Chanu + Dhanu)}{2} = 19 \dots (i)$

Chanu + Dhanu = 38 year

Putting the value of (ii) in (i) we get,

38 + 10 = Anu $\dots (ii)$

So, age of Anu is 48 years.

Dhanu is 10 years elder than Chanu.

Dhanu - 10 = Chanu

Putting the value of (iii) in (ii), we get

Dhanu - 10 + Dhanu = 38

2 Dhanu = 38 + 10

2 Dhanu = 48

Dhanu = 24yr

Average age of Anu and Dhanu (48+24)

$= \frac{72}{2} = 36yr$

$\therefore$ The answer is 36 yr.

$\therefore$ The correct answer is option (a).

77. In a competitive examination in Maharashtra state 9% candidates got selected from the total appeared candidates. Tripura state had an equal number of candidates appeared and 12% candidates got selected with 102 more candidates got selected than Maharashtra state. What was the number of candidates appeared from each state? **[2020]**

- (a) 3400 (b) 3000 (c) 2850 (d) 3200

Ans. (a)

Sol. Given,

⇒ Selected candidate in Maharashtra from the total appeared candidates = 9%

⇒ Selected candidate in Tripura from the total appeared candidates = 12%

⇒ In Tripura number of selected candidates more than that of Maharashtra = 102

Let total number of candidates from each state be 100 unit.

Selected candidate in Maharashtra from the total

$$\text{appeared candidates} = \left(\frac{9}{100}\right) \times 100 = 9 \text{ unit}$$

⇒ Selected candidate in Tripura from the total

$$\text{appeared candidates} = \left(\frac{12}{100}\right) \times 100 = 12 \text{ unit}$$

In Tripura number of selected candidates more than that of Maharashtra = 102

$$\Rightarrow (12 - 9) \text{ unit} = 102$$

$$\Rightarrow 3 \text{ unit} = 102$$

$$\Rightarrow 1 \text{ unit} = 102 / 3$$

$$\Rightarrow 1 \text{ unit} = 34$$

$$\Rightarrow (1 \times 100) \text{ unit} = 34 \times 100$$

$$\Rightarrow 100 \text{ unit} = 3400$$

∴ The number of candidates appeared from each state was 3400.

∴ The correct answer is option (a).

78. Shiva gave 40% of his monthly salary to his mother from the remaining he used 7% for electronic gadgets and 23% he kept aside for his monthly expenses. The remaining amount he transferred to his friend's account. The sum of the amount he gave to his mother and he transferred to his friend account was ₹ 41000. What was Shiva's monthly salary? **[2020]**

- (a) ₹50500 (b) ₹49000
(c) ₹50000 (d) ₹45000

Ans. (c)

Sol. Salary given to his mother = $40\% = \frac{2}{5}$ from the remaining, he used for electronic gadgets and monthly

$$\text{expenses} = (7 + 23)\% = 30\% = \frac{3}{10}$$

Sum of the amount he gave to his mother and transferred to his friend accounts = ₹ 41000

Let the sum of amount be 50 unit (where 50 = product of denominator of given fraction 5×10)

$$\text{Salary given to his mother} = \left(\frac{2}{5} \times 50\right)$$

$$= 20 \text{ unit}$$

Remaining salary after giving to his mother

$$= 50 - 20 = 30 \text{ unit}$$

Electronics gadgets and monthly expenses from the

$$\text{remaining} = \left(\frac{3}{10} \times 30\right) = 9 \text{ unit}$$

Remaining amount which transferred to his friend's account = 41000

$$\Rightarrow (20 + 21) \text{ unit} = 41000$$

$$\Rightarrow 41 \text{ unit} = 41000$$

$$\Rightarrow 1 \text{ unit} = 1000$$

$$\Rightarrow 50 \text{ unit} = 50000$$

∴ The monthly salary of Shiva is ₹ 50000.

∴ The correct answer is option (c).

79. Read the information given below and answer the questions that follow: **[2020]**

(i) $A * B$ means $\rightarrow A$ and B are of the same age

(ii) $A - B$ means $\rightarrow B$ is younger than A

(iii) $A + B$ means $\rightarrow A$ is younger than B

Sachin * Madan - Reena means?

(a) Reena is youngest

(b) Reena is oldest

(c) Madan is younger than Reena

(d) Madan is the youngest

Ans. (a)

Sol. Given question,

Sachin * Madan - Reena

⇒ It means Sachin and Madan are of the same age and Reena is younger than Madan. The means that Reena is the youngest.

∴ The correct answer is option (a).

80. Read the information given below and answer the questions that follow: **[2020]**

(i) $A * B$ means $\rightarrow A$ and B are of the same age

(ii) $A - B$ means $\rightarrow B$ is younger than A

(iii) $A + B$ means $\rightarrow A$ is younger than B $X + Y + Z$ is same as

..... ?

(a) $Y - X - Z$

(b) $Z - Y - X$

(c) $Z - X - Y$

(d) $X - Y - Z$

Ans. (b)

Sol. As per the given question,
 $\Rightarrow X+Y+Z$ means X is younger than Y and Y is younger than Z . This means that x is the youngest.
 Similarly,
 $\Rightarrow Z-Y-X$ means Y is younger than Z and X is younger than Y . This also means X is the youngest.
 $\therefore$ The $X+Y+Z$ is same as $Z-Y-X$.
 $\therefore$ The correct answer is option (b).

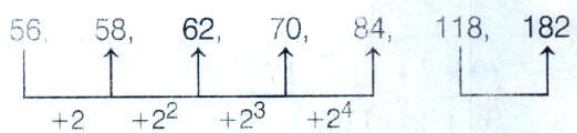
81. Find out the wrong number in the following number series: [2020]

56, 58, 62, 70, 84, 118, 182

(a) 58 (b) 62 (c) 84 (d) 118

Ans. (c)

Sol. Given series,



The pattern follows is $2+2^2+2^3, 2^4$

So, 84 is wrong and must be replaced by $(70+16)$ i.e. 86.

The correct answer is option (c).

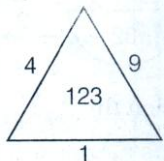
82. Find out the missing number [2020]



(a) 2 (b) 6 (c) 4 (d) 16

Ans. (c)

Sol. As per the given question,



$\Rightarrow$ It follows the sequence

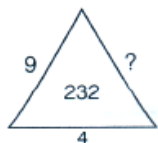
$$1 \rightarrow 1^2$$

$$4 \rightarrow 2^2$$

$$9 \rightarrow 3^2$$

So, in triangle it is written as 123.

In the same way,



$\Rightarrow$ It also follows the sequence

$$4 \rightarrow 2^2$$

$$9 \rightarrow 3^2$$

$$4 \rightarrow 2^2$$

So, the missed term is 4.

$\therefore$ The correct answer is option (c).

83. In an examination, 78% of the total students who appeared were successful. If the total number of failures was 176 and 34% got first class, then how many students got first class? [2020]

(a) 272 (b) 112 (c) 210 (d) 254

Ans. (a)

Sol. Given,

Students who were successfully appeared = 78%

Total number of failure = 176

Students who got first class = 34%

Students who failed = $(100 - 78)\% = 22\%$

22% of total students = 176

$$1\% \text{ of total students} = \frac{176}{22} = 8$$

34% of total students = $8 \times 34 = 272$

The number of students who got first class = 272

$\therefore$ The correct answer is option (a).

84. Which number should come in place of the question mark (?) in the following chart: [2020]

1	7	9
2	14	?
3	105	117

(a) 16 (b) 26 (c) 20 (d) 12

Ans. (d)

Sol. Given question,

1	7	9
2	14	?
3	105	117

The pattern follows in the series is :

$$\Rightarrow (2 \times 1 + 1) = (2 + 1) = 3$$

$$\Rightarrow (7 \times 14 + 7) = (98 + 7) = 105$$

$\Rightarrow$ In the same way

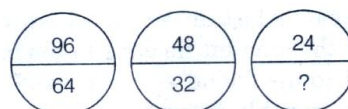
$$(9 \times ? + 9) = 117$$

$$9x + 9 = 117$$

$$9x = 108 \Rightarrow x = 12$$

$\therefore$ The correct answer is option (d).

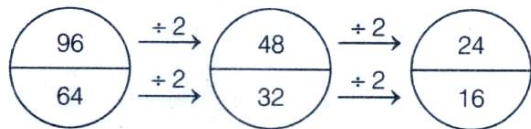
85. Find the missing number [2020]



- (a) 21 (b) 16 (c) 10 (d) 8

Ans. (b)

Sol. As per the given question,



∴ The correct answer is option (b).

86. How many minimum numbers of colours will be required to paint all the sides of a cube without the adjacent sides having the same colours? [2020]

- (a) 3 (b) 4 (c) 5 (d) 6

Ans. (a)

Sol. Cube has 6 sides.

As no two adjacent sides have the same colour, any pair of two opposite sides can have the same colour.

Hence, minimum number of colour required = $\frac{6}{2} = 3$

∴ The correct answer is option (a).

87. If a man walks at the rate of 4 km/hr, he misses a train by only 6 min. However, if he walks at the rate of 5 km/hr, he reaches the station 6 min before the arrival of the train. The distance covered by him to reach the station is [2020]

- (a) 4 km (b) 7 km (c) 9 km (d) 5 km

Ans. (a)

Sol. Let the correct time of train arrival be t and distance to reach the station be d .

Distance = Speed × Time

$$1 \text{ min} = \frac{1}{60} \text{ h}$$

$$d = \frac{4 \times (t + 6)}{60} \dots (i)$$

$$d = \frac{5 \times (t - 6)}{60} \dots (ii)$$

From Eqs. (i) and (ii)

$$\frac{4 \times (t + 6)}{60} = \frac{5 \times (t - 6)}{60}$$

$$4t + 24 = 5t - 30$$

$$5t - 4t = 30 + 24$$

$$t = 54 \text{ min}$$

Putting the value of ' t ' in Eq. (i)

$$d = \frac{4 \times (54 + 6)}{60}$$

$$d = 4 \times \frac{60}{60}$$

$$d = 4 \text{ km}$$

∴ The distance covered by him to reach the station is 4 km.

∴ The correct answer is option (a).

88. If the numerator of a fraction is increased by 25% and denominator decreased by 20%, the new value is $\frac{5}{4}$. What is the original value? [2020]

- (a) $\frac{3}{5}$ (b) $\frac{4}{5}$ (c) $\frac{7}{8}$ (d) $\frac{3}{7}$

Ans. (b)

Sol. Let the initial value of fraction be x .

Then new value of fraction is $= \frac{5}{4}$

$$\frac{5}{4} = x \times \frac{125}{0.8}$$

$$\therefore \frac{5}{4} = x \times \frac{25}{16}$$

$$x = \frac{5}{4} \times \frac{16}{25} \Rightarrow x = \frac{4}{5}$$

∴ The correct answer is option (b).

89. Read the following information carefully and answer the questions given below

(i) Five friends Amar, Kapil, Sarvesh, Rohan and Nagesh put on five shirts of different colours, i.e., Red, Yellow, Blue, White, and Green, while they were going to attend a party. These colours are not in the order.

(ii) They have different hobbies as reading, playing, outing, singing and writing.

(iii) Kapil, who likes singing, does not wear Yellow shirt. Sarvesh wears Red shirt and he does not like reading or writing. Nagesh likes playing and he does not wear Blue or Yellow shirt. Amar likes writing and Rohan does not wear Yellow or Green shirt.

What is the colour of Kapil's shirt? [2020]

- (a) White (b) Green
(c) Blue (d) Insufficient data to answer

Ans. (d)

Sol. Five friends Amar, Kapil, Sarvesh, Rohan and Nagesh.

Different colours Red, Yellow, Blue, White, Green (White they were going in attend a party. These colours are not in order).

Different Hobbies Reading, Playing, Outing, Singing and Writing.

1. Kapil, who likes singing, does not wear Yellow shirt.

2. Sarvesh wears Red Shirt and he does not like reading or writing.

3. Nagesh likes playing and he does not wear Blue or Yellow shirt.

4. Amar likes Writing and Rohan does not wear Yellow or Green shirt.

Friends	Colour	Hobbies
Amar		Writing
Kapil		Singing
Sarvesh	Red	

Rohan		
Nagesh		Playing

Amar wears Yellow shirt and Rohan likes Reading. Sarvesh likes outing.

The colour of Kapil's shirt may be Green or Blue or White.

The colour of Rohan's shirt may be white or Blue.

The colour of Nagesh's shirt may be white or Green.

Rohan likes Reading

Friends	Colour	Hobbies
Amar	Yellow	Writing
Kapil	Green/Blue/White	Singing
Sarvesh	Red	Outing
Rohan	Blue/White	Reading
Nagesh	Green/White	Playing

The colour of Kapil's shirt can't be answer (d) as data is insufficient.

∴ The correct answer is option (d).

90. Read the following information carefully and answer the questions given below

(i) Five friends Amar, Kapil, Sarvesh, Rohan and Nagesh put on five shirts of different colours, i.e., Red, Yellow, Blue, White, and Green, while they were going to attend a party. These colours are not in the order.

(ii) They have different hobbies as reading, playing, outing, singing and writing.

(iii) Kapil, who likes singing, does not wear Yellow shirt. Sarvesh wears Red shirt and he does not like reading or writing. Nagesh likes playing and he does not wear Blue or Yellow shirt. Amar likes writing and Rohan does not wear Yellow or Green shirt.

Who likes writing? **[2020]**

- (a) Rohan (b) Amar
(c) Kapil (d) Insufficient data to answer

Ans. (b)

Sol. The arrangement as per data given is :

Friends	Colour	Hobbies
Amar	Yellow	Writing
Kapil	Green/Blue/White	Singing
Sarvesh	Red	Outing
Rohan	Blue/White	Reading
Nagesh	Green/White	Playing

∴ 'Amar' likes writing.

∴ The correct answer is option (b).

Computer Awareness

91. Assume x' represents negation of x the Boolean function $x'y' + xy + x'y$ is equivalent to? **[2020]**

- (a) $x' + y$ (b) $x + y$ (c) $x + y'$ (d) $x' + y'$

Ans. (a)

Sol. $x'y' + xy + x'y$

$$= xy + x'y' + x'y$$

$$= xy + x'(y' + y)$$

$$= xy + x' \cdot 1$$

$$= xy + x'$$

$$= (x + x')(y + x') \quad [\because (A + BC) = (A + B)(A + C)]$$

$$= 1 \cdot (y + x') \quad [\because A + A' = 1]$$

$$= x' + y$$

92. The memory unit which directly communicates with the CPU is known as **[2020]**

- (a) Primary Memory (b) Secondary Memory
(c) Shared Memory (d) Auxiliary Memory

Ans. (a)

Sol. The memory unit which directly communicates with the CPU is known as primary memory. Primary memory or main memory refers to physical memory that is internal to the computer. Every program you execute and every file you access must be copied from a storage device into main memory.

93. Dynamic RAM consumes _____ power and than Static RAM **[2020]**

- (a) More, Faster (b) More, Slower
(c) Less, Slower (d) Less, Faster

Ans. (c)

Sol. Dynamic RAM consumes less power and slower than static RAM, because of the need of charging and discharging of capacitor in DRAM, it consumes less power than SRAM also slow too.

94. The binary equivalent of $(234.125)_{10}$? **[2020]**

- (a) $(11101010.101)_2$ (b) $(10101010.011)_2$
(c) $(11101010.001)_2$ (d) $(10101110.011)_2$

Ans. (c)

Sol. First convert $(234)_{10}$ to binary

2	234	0
2	117	1
2	58	0
2	29	1
2	14	0
2	7	1
2	3	1
2	1	1
	0	

Here, $(234)_{10} = (11101010)_2$

Now, convert $(0.125)_{10}$ to Binary

0.125×2	0.250	0
0.250×2	0.500	0
0.500×2	1.000	1

Here, $(0.125)_{10} = (.001)_2$

Hence, $(234.125)_{10} = (11101010.001)_2$.

95. Determine the octal equivalent of $(432267)_{10}$?
[2020]

- (a) $(432267)_8$ (b) $(346731)_8$
(c) $(2164432)_8$ (d) None of these

Ans. (d)

Sol.

8	432267	3
8	54033	1
8	6754	2
8	844	4
8	105	1
8	13	5
8	1	1
	0	

Hence, $(432267)_{10} = (1514213)_8$.

96. One Exabyte is equal to ... [2020]

- (a) 1018 Bytes
(b) 1 Zetta Bytes divided (/) by one thousand
(c) 1 Peta Bytes multiplied (x) by one thousand
(d) All of the above

Ans. (d)

Sol. Exabyte is a unit to measure memory which is equal to 10^{18} Bytes, 1000×1 PB and $\frac{12 \text{ B}}{1000}$.

97. Consider the following circuit. [2020]

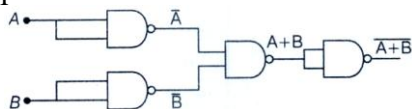


How many minimum numbers of two input NAND gates are required to design the above circuit?

- (a) 6 (b) 4 (c) 5 (d) 3

Ans. (b)

Sol. We need to create NOR gate using NAND gates using the boolean expression, the following diagram is possible.



So, minimum number of two input NAND gates are 4.

98. The time required for fetching and execution of one simple machine instruction is known as [2020]

- (a) Delay time (b) CPU cycle
(c) Real Time (d) Seek Time

Ans. (b)

Sol. The time required for the fetching and execution of one simple machine instruction is CPU cycle. The speed of a computer processor or CPU, is determined by the clock cycle, which is the amount of time between two pulses of an oscillator. The higher number of pulses per second, the faster the computer processor will be able to process information.

99. The equivalence of given expression $x + x'y$ with Boolean theorem is [2020]

- (a) x (b) $x + y$ (c) x' (d) 0

Ans. (b)

Sol. $x + x'y$

$$= x \cdot 1 + x'y \quad [\because A \cdot 1 = A]$$

$$= x(1 + y) + x'y \quad [\because A' + A = 1]$$

$$= x + xy + x'y$$

$$= x + y(x + x')$$

$$= x + y \cdot 1 \quad [\because A + A' = 1]$$

$$= x + y$$

100. The logic XOR operation of $(4ACO)_{16}$ and $(B53F)_{16}$ results [2020]

- (a) AACB (b) 0000
(c) FFFF (d) ABCD

Ans. (c)

Sol. Binary equivalent of $(4ACO)_{16} = 0100101011000000$

Binary equivalent of

$$(B53F)_{16} = 1011010100111111$$

Now, perform the XOR operation on $(4ACO)_{16}$ and

$$(B53F)_{16} = (0100101011000000)$$

$$\text{XOR } (0100101011000000)$$

$$= (1111111111111111)_2$$

It is equivalent of $(FFFF)_{16}$.

General English

101. Choose the correct expression of approval [2020]

- (a) Super! (b) Rotten!
(c) Damn! (d) Hell!

Ans. (a)

Sol. 'Super!' is the word for approval.

102. Which of the following is a Noun? [2020]

- (a) Carelessness (b) Careless
(c) Carelessly (d) Caring

Ans. (a)

Sol. 'Carelessness' is the abstract noun. 'Careless' and 'caring' are adjectives and 'carelessly' is an adverb.

103. Choose the word that accurately signifies a student who avoids attending classes. [2020]

- (a) Diligent (b) Callous
(c) Morose (d) Truant

Ans. (d)

Sol. Truant is the correct word for a student who avoids attending classes.

104. Identify the type of error in the following sentence
Some of the books, were destroyed. [2020]

- (a) Syntactical error (b) Punctuation error
(c) Grammatical error (d) Conflicting error

Ans. (b)

Sol. Punctuation error is there. 'Comma (,)' should be removed after 'books'.

105. Pick the word similar in meaning ALLEVIATE [2020]

- (a) Clear (b) Lessen
(c) Match (d) Incite

Ans. (b)

Sol. 'Lessen' is same as 'alleviate' which means to reduce.

106. Pick the word opposite in meaning ABSURD [2020]

- (a) Cruel (b) Sensible
(c) Calm (d) Sturdy

Ans. (b)

Sol. 'Absurd' means illogical or insensible, so 'sensible' is its antonym.

107. Identify the meaning of the following It was all Greek to me means difficult of understanding. [2020]

- (a) Difficult to speak
(b) Difficult to write
(c) Difficult to arrange
(d) Difficult to understand

Ans. (d)

Sol. 'The given idiom 'it was all Greek to me' means difficult to understand.

108. "To vouch for" means [2020]

- (a) To confirm (b) To degrade
(c) To follow (d) To supersede

Ans. (a)

Sol. 'To vouch for' means to confirm.

109. "To hold your horses" means [2020]

- (a) To be ready (b) To be patient
(c) To be eager (d) To be impatient

Ans. (b)

Sol. The idiom 'to hold your horses' means to be patient or to wait a moment.

110. Choose the right option. [2020]

Blessing in disguise is ?

- (a) Something good
(b) Something unrecognised
(c) Something known to all
(d) Something good but not recognised at first

Ans. (d)

Sol. Blessing in disguise is something good but not recognised at first.

111. He was accused _____ theft. [2020]

- (a) on (b) about (c) in (d) of

Ans. (d)

Sol. 'Accused' takes preposition 'of'.

112. I never listen _____ the radio. [2020]

- (a) to (b) of (c) about (d) in

Ans. (a)

Sol. 'Listen' takes the preposition 'to'.

113. I don't think I've ever on that sofa. [2020]

- (a) been sitting (b) sat
(c) sit (d) sitting

Ans. (b)

Sol. 'Have' takes the third form of the verb 'sat'.

114. Name the letter that is sent along with the CV (Curriculum Vitae). [2020]

- (a) Formal letter (b) Covering letter
(c) Introductory letter (d) Business letter

Ans. (b)

Sol. Covering letter is sent along with the CV.

115. What is not included in a resume? [2020]

- (a) Work experience (b) Education
(c) Projects (d) Family history

Ans. (d)

Sol. Family history is not included in the resume.

116. Choose the correct sentence of the following [2020]

- (a) I prefer coffee to tea.
(b) I prefer coffee for tea.
(c) I prefer coffee than tea.
(d) I prefer coffee by tea.

Ans. (a)

