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Master of Computer Applications (MCA)

Entrance Examination

Solved Paper 2017

Time Allowed : 2.5 hrs

Max. Marks : 170

Instructions for Candidates

(i) All questions in this paper are of objective type.
(ii) Their is a total of 100 questions.
(iii) (Q. Nos. 1-50) consist of Mathematics.
(iv) (Q. Nos 51-60) consist of English Language and Comprehension.
(v) (Q. Nos. 61-80) consist of Computer Awareness.
(vi) (Q. Nos. 81-100) consist of Logical and Analytical Ability.

MATHEMATICS

1. If $\theta = \tan^{-1}\frac{1}{1+2} + \tan^{-1}\frac{1}{1+(2)(3)} + \tan^{-1}\frac{1}{1+(3)(4)} + \ldots + \tan^{-1}\frac{1}{1+n(n+1)}$, then $\tan\theta$ is equal to

(a) $\frac{n}{n+1}$ (b) $\frac{n+1}{n+2}$ (c) $\frac{n}{n+2}$ (d) $\frac{n-1}{n+2}$

Ans. (c) $\theta = \tan^{-1}\frac{1}{1+2} + \tan^{-1}\frac{1}{1+(2)(3)} + \tan^{-1}\frac{1}{1+(3)(4)} + \ldots + \tan^{-1}\frac{1}{1+n(n+1)}$

$= \tan^{-1}\frac{2-1}{1+1.2} + \tan^{-1}\frac{3-2}{1+(2)(3)} + \tan^{-1}\frac{4-3}{1+(3)(4)} + \ldots + \tan^{-1}\frac{(n+1)-n}{1+n(n+1)}$

$= (\tan^{-1}2 - \tan^{-1}1) + (\tan^{-1}3 - \tan^{-1}2) + (\tan^{-1}4 - \tan^{-1}3) + \ldots + (\tan^{-1}(n+1) - \tan^{-1}n)$

$= \tan^{-1}(n+1) - \tan^{-1}1$

$= \tan^{-1}\frac{(n+1)-1}{1+1(n+1)} = \tan^{-1}\frac{n}{n+2} \Rightarrow \tan\theta = \frac{n}{n+2}$

2. The number of solutions for $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$ is

(a) zero (b) one
(c) two (d) infinite

Ans. (c) $\because \tan^{-1}\sqrt{x(x+1)} = \cos^{-1}\frac{1}{\sqrt{x^2+x+1}}$

$\therefore \tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$

Given, $\cos^{-1}\frac{1}{\sqrt{x^2+x+1}} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$

which holds if $\frac{1}{\sqrt{x^2+x+1}} = \sqrt{x^2+x+1}$

$\left(\because \sin^{-1}x + \cos^{-1}x = \frac{\pi}{2}\right)$

$\Rightarrow x^2+x+1 = 1 \Rightarrow x(x+1) = 0 \Rightarrow x = 0 \text{ or } -1$

3. Let ABC be an isosceles triangle with $AB = BC$. If base BC is parallel to X-axis and m_1, m_2 are slopes of medians drawn through the angular points B and C. then

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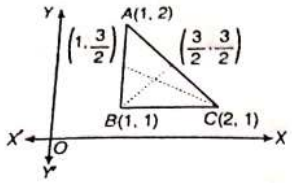
(a) $m_1 \cdot m_2 = \frac{1}{2}$ (b) $m_1 + m_2 = 0$

(c) $m_1 - m_2 = \frac{3}{2}$ (d) $(m_1 - m_2)^2 + 2m_1m_2 = 0$

Ans. (c)



From above figure $m_1 = 1; m_2 = -\frac{1}{2}$

But $m_1m_2 = -\frac{1}{2}$

$$m_1 + m_2 = \frac{1}{2}$$

$$m_1^2 + m_2^2 = (m_1 + m_2)^2 - 2m_1m_2 = \frac{1}{4} + 1$$

$$m_1^2 + m_2^2 = \frac{5}{4}$$

$$(m_1 - m_2)^2 = (m_1 + m_2)^2 - 4m_1m_2.$$

$$= \frac{1}{4} - 4(-1/2) = \frac{1}{4} + 2 = \frac{9}{4}$$

$$m_1 - m_2 = \frac{3}{2}$$

So, option (c) is correct.

4. The value of $\int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} dx$ is

(a) $\frac{\pi^2}{3}$ (b) $\frac{\pi^2}{4}$

(c) $\frac{\pi^2}{6}$ (d) $\frac{\pi^2}{2}$

Ans. (b) $I = \int_0^{\pi} \frac{x \sin x}{1 + \cos^2 x} dx = \int_0^{\pi} \frac{(\pi - x) \sin x}{1 + \cos^2 x} dx$

$$\left[\because \int_0^a f(x)\, dx = \int_0^a (a - x)\, dx\right]$$

$$2I = \pi \int_0^{\pi} \frac{\sin x}{1 + \cos^2 x} dx$$

$$\int_0^{2a} f(x)\, dx = 2\int_0^a f(x)\, dx, \text{ if } f(2a - x) = f(x)$$

$$= 2\pi \int_0^{\pi/2} \frac{\sin x}{1 + \cos^2 x} dx$$

$$\Rightarrow \quad I = \pi \int_0^{\pi/2} \frac{\sin x}{1 + \cos^2 x} dx$$

Let $\cos x = z \Rightarrow -\sin x\, dx = dz$

$$\therefore \quad I = \pi \int_1^0 -\frac{dz}{1 + z^2} = \pi \int_0^1 \frac{dz}{1 + z^2}$$

$$= \pi [\tan^{-1} z]_0^1 = \pi \left(\frac{\pi}{4}\right) = \frac{\pi^2}{4}$$

5. The vector $\mathbf{B} = 3\hat{\mathbf{i}} + 4\hat{\mathbf{k}}$ is to be written as the sum of a vector $\mathbf{B}_1$ parallel to $\mathbf{A} = \hat{\mathbf{i}} + \hat{\mathbf{j}}$ and a vector $\mathbf{B}_2$ perpendicular to $\mathbf{A}$, then $\mathbf{B}_1$ is

(a) $\frac{3}{2}(\hat{\mathbf{i}} + \hat{\mathbf{j}})$ (b) $\frac{2}{3}(\hat{\mathbf{i}} + \hat{\mathbf{j}})$

(c) $\frac{1}{2}(\hat{\mathbf{i}} + \hat{\mathbf{j}})$ (d) None of these

Ans. (a) Given, $\mathbf{B}_1 = \lambda\mathbf{A} = \lambda(\hat{\mathbf{i}} + \hat{\mathbf{j}})$

$$\mathbf{B}_2 \cdot \mathbf{A} = 0$$

$$\Rightarrow (\mathbf{B} - \mathbf{B}_1) \cdot \mathbf{A} = 0 \qquad [\because \mathbf{B} = \mathbf{B}_1 + \mathbf{B}_2 \text{ (given)}]$$

$$\Rightarrow \quad \mathbf{B} \cdot \mathbf{A} = \mathbf{B}_1 \cdot \mathbf{A}$$

$$(3\hat{\mathbf{i}} + 4\hat{\mathbf{k}}) \cdot (\hat{\mathbf{i}} + \hat{\mathbf{j}}) = \lambda(\mathbf{A} \cdot \mathbf{A}) = \lambda(1 + 1)$$

$$\Rightarrow \quad 3 = 2\lambda \quad \Rightarrow \lambda = \frac{3}{2}$$

$$\therefore \quad \mathbf{B}_1 = \frac{3}{2}(\hat{\mathbf{i}} + \hat{\mathbf{j}})$$

6. A and B throw a die in succession to win a bet with A starting first. Whoever throws '1' first wins an amount of ₹110. What are the respective expectations of A and B?

(a) ₹ 70 and ₹ 40 (b) ₹ 60 and ₹ 50

(c) ₹ 75 and ₹ 35 (d) None of these

Ans. (b) $P(1) = \frac{1}{6}; P(\bar{1}) = \frac{5}{6}$

$$P(A \text{ wins}) = \frac{1}{6} + \frac{5}{6} \times \frac{5}{6} \times \frac{1}{6} + \ldots$$

$$= \frac{1}{6}\left[1 + \frac{25}{36} + \left(\frac{25}{36}\right)^2 + \ldots\right] = \frac{\frac{1}{6}}{1 - \frac{25}{36}} = \frac{1/6}{11/36} = \frac{6}{11}$$

$$P(B \text{ wins}) = 1 - P(A \text{ wins}) = 1 - \frac{6}{11} = \frac{5}{11}$$

$$E(\text{amount of } A) = 110 \times \frac{6}{11} = ₹60$$

$$E(\text{amount of } B) = 110 \times \frac{5}{11} = ₹50$$

7. The probability that a man who is 85 yr old will die before attaining the age of 90 yr is 1/3. A_1, A_2, A_3 and A_4 are four persons who are 85 yr old. The probability that A_1 will die before attaining the age of 90 yr and will be the first to die is

(a) $\frac{65}{81}$ (b) $\frac{13}{81}$

(c) $\frac{65}{324}$ (d) $\frac{13}{108}$

Ans. (c) Required probability = P (atleast one person dies before 90 yr) × P (first person to die is A_1)

$$= \left[1 - \left(\frac{2}{3}\right)^4\right] \times \left[\frac{3!}{4!}\right] = \left(1 - \frac{16}{81}\right) \times \frac{1}{4} = \frac{65}{324}$$

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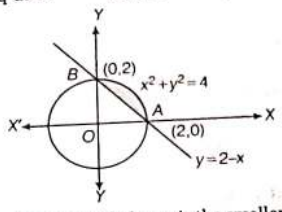
8. The smaller of the areas bound by $y = 2 - x$ and $x^2 + y^2 = 4$, is

(a) $(\pi - 1)$ sq units (b) $(\pi - 2)$ sq units
(c) $(2\pi - 1)$ sq units (d) $(2\pi - 2)$ sq units

Ans. (b)



From the above figure, shaded area is the smaller area bounded by the given line and circle.

$$= \frac{1}{4}(\text{Area of circle}) - \text{Area of } \Delta AOB$$

$$= \frac{1}{4}\pi(2)^2 - \frac{1}{2} \times 2 \times 2 = (\pi - 2) \text{ sq units}$$

9. The number of distinct integral values of 'a' satisfying the equation $2^{2a} - 3(2^{a+2}) + 2^5 = 0$ is

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

Ans. (c) $2^{2a} - 3(2^{a+2}) + 2^5 = 0$

Let $y = 2^a$

$\Rightarrow$ $y^2 - 12y + 32 = 0$

$\Rightarrow$ $(y - 4)(y - 8) = 0$

$\Rightarrow$ $y = 4, 8$

$2^a = 4 \Rightarrow a = 2$

$2^a = 8 \Rightarrow a = 3$

Thus, the number of integrals satisfying a is 2 (two).

10. If $y = f(x)$ is an odd and differentiable function defined on $(-\infty, \infty)$ such that $f'(3) = -2$, then $f'(-3)$ equals to

(a) 4 (b) 2 (c) -2 (d) 0

Ans. (c) As $f(x)$ is an odd function, so we have

$$f(x) = -f(-x)$$

$\Rightarrow$ $f'(x) = f'(-x)$

$\Rightarrow$ $f'(3) = f'(-3) = -2$

11. The straight lines $\frac{x}{a} - \frac{y}{b} = k$ and $\frac{x}{a} + \frac{y}{b} = \frac{1}{k}, k \neq 0$ meet on

(a) a parabola (b) an ellipse
(c) a hyperbola (d) a circle

Ans. (c) $\frac{x}{a} - \frac{y}{b} = k$ and $\frac{x}{a} + \frac{y}{b} = \frac{1}{k}$ is jointly satisfied by

$$\left(\frac{x}{a} - \frac{y}{b}\right)\left(\frac{x}{a} + \frac{y}{b}\right) = (k)\left(\frac{1}{k}\right)$$

$\Rightarrow$ $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, which is a hyperbola.

12. Let A and B be two events such that $P(\overline{A \cup B}) = \frac{1}{6}$, $P(A \cap B) = \frac{1}{4}$ and $P(\bar{A}) = \frac{1}{4}$.

Then, events A and B are

(a) independent but not equally likely.
(b) mutually exclusive and independent.
(c) equally likely and mutually exclusive
(d) equally likely but not independent.

Ans. (a) $P(\overline{A \cup B}) = \frac{1}{6} \Rightarrow P(A \cup B) = 1 - \frac{1}{6} = \frac{5}{6}$

$$P(\bar{A}) = \frac{1}{4}$$

$\Rightarrow$ $P(A) = 1 - \frac{1}{4} = \frac{3}{4}$

$$P(B) = P(A \cup B) + P(A \cap B) - P(A) = \frac{5}{6} + \frac{1}{4} - \frac{3}{4} = \frac{1}{3}$$

$\Rightarrow$ $P(A) = \frac{3}{4}; P(B) = \frac{1}{3}$

$\because$ $P(A \cap B) = P(A) \cdot P(B)$

$$\frac{1}{4} = \frac{3}{4} \cdot \frac{1}{3} = \frac{1}{4}$$

$\therefore A$ and B are independent but not equally likely.

13. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $I + A + A^2 + \ldots \infty$ equals to

(a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} -1 & -2 \\ -3 & -4 \end{bmatrix}$

(c) $\begin{bmatrix} \frac{1}{2} & -\frac{1}{3} \\ -\frac{1}{2} & 0 \end{bmatrix}$ (d) $\begin{bmatrix} -\frac{1}{4} & \frac{1}{3} \\ \frac{1}{2} & 0 \end{bmatrix}$

Ans. (c) Let λ be an eigen value of given matrix A.

Now, $1 + \lambda + \lambda^2 + \ldots \infty = \frac{1}{1 - \lambda}$

$\Rightarrow$ $(1 - \lambda)(1 + \lambda + \lambda^2 + \ldots \infty) = 1$

By Cayley-Hamilton's theorem, "Every square matrix satisfy its characteristic equation".

$$(I - A)(I + A + A^2 + \ldots \infty) = I$$

$\Rightarrow$ $I + A + A^2 + \ldots + \infty = (I - A)^{-1}$

$$= \begin{bmatrix} 0 & -2 \\ -3 & -3 \end{bmatrix}^{-1} = -\frac{1}{6}\begin{bmatrix} -3 & 2 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} & -\frac{1}{3} \\ -\frac{1}{2} & 0 \end{bmatrix}$$

14. a, b, c are non-coplanar unit vectors such that $a \times (b \times c) = \frac{b + c}{\sqrt{2}}$, then the angle between a and b is

(a) $\frac{\pi}{4}$ (b) $\frac{3\pi}{4}$
(c) $\frac{\pi}{2}$ (d) π

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Ans. (b) $\mathbf{a}\times(\mathbf{b}\times\mathbf{c}) = (\mathbf{a}\cdot\mathbf{c})\,\mathbf{b} - (\mathbf{a}\cdot\mathbf{b})\mathbf{c}$ ...(i)

$$\mathbf{a}\times(\mathbf{b}\times\mathbf{c}) = \frac{\mathbf{b}+\mathbf{c}}{\sqrt{2}} \quad ...(ii)$$

From Eqs. (i) and (ii)

$$\mathbf{a}\cdot\mathbf{c} = \frac{1}{\sqrt{2}} \text{ and } \mathbf{a}\cdot\mathbf{b} = -\frac{1}{\sqrt{2}}$$

Let θ be the angle between $\mathbf{a}$ and $\mathbf{b}$.

$$\Rightarrow |\mathbf{a}|\cdot|\mathbf{b}|\cos\theta = -\frac{1}{\sqrt{2}} \Rightarrow \cos\theta = -\frac{1}{\sqrt{2}}$$

$$\Rightarrow \theta = \frac{3\pi}{4}$$

15. If $f(x) + f(1-x) = 2$, then the value of

$$f\left(\frac{1}{2001}\right) + f\left(\frac{2}{2001}\right) + \ldots\ldots + f\left(\frac{2000}{2001}\right) \text{ is}$$

(a) 2000 (b) 2001 (c) 1999 (d) 1998

Ans. (a) $f(x) + f(1-x) = 2$

$$\Rightarrow f\left(\frac{1}{2001}\right) + f\left(\frac{2000}{2001}\right) = 2$$

$$\Rightarrow f\left(\frac{2}{2001}\right) + f\left(\frac{1999}{2001}\right) = 2$$

.....

.....

$$\Rightarrow f\left(\frac{1000}{2001}\right) + f\left(\frac{1001}{2001}\right) = 2$$

Which are 1000 pairs in all.

So, $f\left(\frac{1}{2001}\right) + f\left(\frac{2}{2001}\right) + \ldots + f\left(\frac{2000}{2001}\right) = 2000$

16. If $y = mx$ bisects the angle between the lines $x^2(\tan^2\theta + \cos^2\theta) + 2xy\tan\theta - y^2\sin^2\theta = 0$ when $\theta = \frac{\pi}{3}$, then the value of $\sqrt{3}\,m^2 + 4m$ is

(a) 1 (b) $\frac{1}{\sqrt{3}}$

(c) $\sqrt{3}$ (d) $7\sqrt{3}$

Ans. (c) Equation of angle bisectors of $ax^2 + 2hxy + by^2 = 0$ is

$$\frac{x^2 - y^2}{a - b} = \frac{xy}{h}$$

$\Rightarrow$ Angle bisectors of $x^2(\tan^2\theta + \cos^2\theta) + 2xy\tan\theta - y^2\sin^2\theta = 0$ is

$$\frac{x^2 - y^2}{\tan^2\theta + \cos^2\theta + \sin^2\theta} = \frac{xy}{\tan\theta}$$

$$\Rightarrow \frac{x^2 - y^2}{\sec^2\theta} = \frac{xy}{\tan\theta} \quad [\because \theta = \pi/3]$$

$$\Rightarrow \frac{x^2 - y^2}{4} = \frac{xy}{\sqrt{3}} \quad ...(i)$$

As $y = mx$ satisfy Eq. (i), so

$$\frac{x^2 - m^2x^2}{4} = \frac{mx^2}{\sqrt{3}} \Rightarrow \frac{1 - m^2}{4} = \frac{m}{\sqrt{3}}$$

$$\Rightarrow \sqrt{3} - \sqrt{3}\,m^2 = 4m$$

$$\Rightarrow \sqrt{3}\,m^2 + 4m = \sqrt{3}$$

17. A line L has intercepts 'a' and 'b' on the coordinate axes. When the axes are rotated through a given angle, keeping the origin fixed, the same line has intercepts 'p' and 'q' which of the following statements is true?

(a) $a^2 + b^2 = p^2 + q^2$ (b) $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2} + \frac{1}{q^2}$

(c) $a^2 + p^2 = b^2 + q^2$ (d) $\frac{1}{a^2} + \frac{1}{p^2} = \frac{1}{b^2} + \frac{1}{q^2}$

Ans. (b) The line L will be $\frac{x}{a} + \frac{y}{b} = 1$ in xy-coordinate system.

When the axes are rotated by an angle 'θ' in anti-clockwise direction.

$$x' = x\cos\theta + y\sin\theta$$

$$y' = -x\sin\theta + y\cos\theta$$

$$\Rightarrow x = x'\cos\theta - y'\sin\theta$$

$$y = x'\sin\theta + y'\cos\theta$$

$\Rightarrow$ Line is $\frac{x'\cos\theta - y'\sin\theta}{a} + \frac{x'\sin\theta + y'\cos\theta}{b} = 1$

$$\Rightarrow x'\left[\frac{\cos\theta}{a} + \frac{\sin\theta}{b}\right] + y'\left[\frac{\cos\theta}{b} - \frac{\sin\theta}{a}\right] = 1$$

$\Rightarrow$ Intercept p and q are

$$p = \frac{ab}{b\cos\theta + a\sin\theta};\ q = \frac{ab}{a\cos\theta - b\sin\theta} \text{ [given]}$$

$$\Rightarrow \frac{1}{p^2} + \frac{1}{q^2} = \frac{\left[\begin{array}{l}a^2\sin^2\theta + b^2\cos^2\theta \\ + a^2\cos^2\theta + b^2\sin^2\theta\end{array}\right]}{a^2b^2} = \frac{a^2 + b^2}{a^2b^2}$$

$$= \frac{1}{a^2} + \frac{1}{b^2}$$

18. If a, b, c are the roots of the equation $x^3 - 3px^2 + 3qx - 1 = 0$, then the centroid of the triangle with vertices $\left(a, \frac{1}{a}\right), \left(b, \frac{1}{b}\right)$ and $\left(c, \frac{1}{c}\right)$ is at the point

(a) (p, q) (b) $\left(\frac{p}{3}, \frac{q}{3}\right)$

(c) $(p+q, p-q)$ (d) $(3p, 3q)$

Ans. (a) a, b and c are roots of $x^3 - 3px^2 + 3qx - 1 = 0$

$$\Rightarrow a + b + c = 3p;\ ab + bc + ca = 3q$$

and $abc = 1$

$$\Rightarrow \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = \frac{3q}{abc}$$

$\Rightarrow \frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 3$

Now, centroid of triangle $\left(\frac{a+b+}{3}\right.$

19. A letter is know TATANAGAR or C two consecutive probability that CALCUTTA is

(a) 4/11

(c) 5/12

Ans. (a) TATANAGAR two consecutive le there are 2 ways CALCUTTA, ther letters, from whic

Here, required pr

20. If $\cos\alpha + \cos$ Arithmetic M $\sin 2\theta + \cos 2$

(a) $\frac{(a+b)^2}{(a^2+b^2)}$

(c) $\frac{a^2 - b^2}{a^2 + b^2}$

Ans. (d) Given, co

$\Rightarrow$ 2

$\Rightarrow$

Also, sin c

$\Rightarrow$

$\Rightarrow$

$\Rightarrow \frac{a}{\cos}$

$\Rightarrow$

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$$\Rightarrow \quad \frac{1}{a}+\frac{1}{b}+\frac{1}{c}=3q$$

Now, centroid of triangle with vertices $\left(a,\frac{1}{a}\right),\left(b,\frac{1}{b}\right),\left(c,\frac{1}{c}\right)$ is

$$\left(\frac{a+b+c}{3},\frac{\frac{1}{a}+\frac{1}{b}+\frac{1}{c}}{3}\right)=(p,q)$$

19. A letter is known to have come from either TATANAGAR or CALCUTTA. On the envelope, just two consecutive letters, TA, are visible. The probability that the letter has come from CALCUTTA is

(a) 4/11 (b) 1/3
(c) 5/12 (d) None of these

Ans. (a) TATANAGAR has 9 letters, so number of ways in which two consecutive letters can be printed will be 8, out of which there are 2 ways in which TA can be printed. Similarly, for CALCUTTA, there are 7 ways of printing two consecutive letters, from which there is only one way to print 'TA'.

Here, required probability $=\frac{\frac{1}{7}\cdot\frac{1}{7}}{\frac{1}{7}+\frac{2}{8}}=\frac{\frac{1}{7}}{\frac{1}{7}+\frac{1}{4}}=\frac{4}{11}$

20. If $\cos\alpha+\cos\beta=a$, and $\sin\alpha+\sin\beta=b$ and θ is the Arithmetic Mean between α and β, then $\sin 2\theta+\cos 2\theta$ is equal to

(a) $\frac{(a+b)^2}{(a^2+b^2)}$ (b) $\frac{(a-b)^2}{(a^2+b^2)}$
(c) $\frac{a^2-b^2}{a^2+b^2}$ (d) None of these

Ans. (d) Given, $\cos\alpha+\cos\beta=a$

$$\Rightarrow \quad 2\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)=a$$

$$\Rightarrow \quad 2\cos\theta\cos\left(\frac{\alpha-\beta}{2}\right)=a \qquad ...(i)$$

$$\left[\because \theta=\frac{\alpha+\beta}{2}\text{ (AM of }\alpha,\beta)\right]$$

Also, $\sin\alpha+\sin\beta=b$

$$\Rightarrow \quad 2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)=b$$

$$\Rightarrow \quad 2\sin\theta\cos\left(\frac{\alpha-\beta}{2}\right)=b \qquad ...(ii)$$

$$\Rightarrow \quad \frac{a}{\cos\theta}=\frac{b}{\sin\theta}=\frac{\sqrt{a^2+b^2}}{\sqrt{\sin^2\theta+\cos^2\theta}}=\sqrt{a^2+b^2}$$

[from Eqs. (i) and (ii)]

$$\Rightarrow \quad \cos\theta=\frac{a}{\sqrt{a^2+b^2}} \text{ and } \sin\theta=\frac{b}{\sqrt{a^2+b^2}}$$

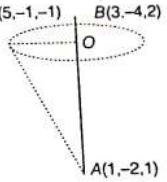
$$\Rightarrow \quad \sin 2\theta=\frac{2ab}{a^2+b^2};\ \cos 2\theta=\frac{a^2-b^2}{a^2+b^2}$$

$$\Rightarrow \quad \sin 2\theta+\cos 2\theta=\frac{a^2-b^2+2ab}{a^2+b^2}$$

21. A rigid body is rotating at the rate of 3 radians about an axis AB, where A and B are the points $(1,-2,1)$ and $(3,-4,2)$. The velocity of the point P at $(5,-1,-1)$ of the body is

(a) $3\hat{i}+8\hat{j}+10\hat{k}$ (b) $\frac{3\hat{i}+8\hat{j}+10\hat{k}}{3}$
(c) $\frac{2\hat{i}+2\hat{j}+\hat{k}}{3}$ (d) $4\hat{i}+\hat{j}+2\hat{k}$

Ans. (b)



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

$$\mathbf{AP}=4\hat{i}+\hat{j}-2\hat{k}$$

$$\Rightarrow AB\times AP=\begin{vmatrix}\hat{i}&\hat{j}&\hat{k}\\2&-2&1\\4&1&-2\end{vmatrix}=3\hat{i}+8\hat{j}+10\hat{k}$$

$$\Rightarrow \quad V=\frac{AB\times AP}{w}=\frac{3\hat{i}+8\hat{j}+10\hat{k}}{3}$$

22. The value of $\int_0^{\pi/2}\frac{dx}{1+\tan^3 x}$ is

(a) 0 (b) 1
(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

Ans. (c) $I=\int_0^{\pi/2}\frac{dx}{1+\tan^3 x}=\int_0^{\pi/2}\frac{dx}{1+\tan^3\left(\frac{\pi}{2}-x\right)}$

$$=\int_0^{\pi/2}\frac{dx}{1+\cot^3 x}$$

$$\Rightarrow \quad 2I=\int_0^{\pi/2}\left(\frac{1}{1+\tan^3 x}+\frac{1}{1+\cot^3 x}\right)dx$$

$$\Rightarrow \quad 2I=\int_0^{\pi/2}dx=\frac{\pi}{2} \quad \Rightarrow \quad I=\frac{\pi}{4}$$

23. The integer n for which $\lim_{x\to 0}\frac{(\cos x-1)(\cos x-e^x)}{x^n}$ is a finite non-zero number is

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

Ans. (c) $\lim_{x\to 0}=\frac{(\cos x-1)(\cos x-e^x)}{x^n}$

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$$= \lim_{x\to 0} \frac{\left(1-\frac{x^2}{2!}+\ldots-1\right)\left(1-\frac{x^2}{2!}+\ldots-\left(1+\frac{x}{1!}+\ldots\right)\right)}{x^n}$$

$$= \lim_{x\to 0} \frac{\left(-\frac{x^2}{2!}+\frac{x^4}{4!}+\ldots\right)\left(-\frac{x}{1!}-\frac{2x^2}{2!}-\frac{x^3}{3!}+\frac{x^4}{4!}\ldots\right)}{x^n}$$

$$= \lim_{x\to 0} \frac{x^3\left(-\frac{1}{2!}+\frac{x^2}{4!}+\ldots\right)\left(-1-\frac{2x}{2!}-\frac{x^2}{3!}\ldots\right)}{x^n}$$

Which will be finite non-zero value, if $n = 3$ and the value is $\frac{1}{2}$.

24. If $y = \sec^{-1}\left(\frac{x+1}{x-1}\right) + \sin^{-1}\left(\frac{x-1}{x+1}\right) x \in [0, \infty)$ and $x \neq 1$, then $\frac{dy}{dx}$ is equal to

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

(c) 0 (d) $\frac{x+1}{x-1}$

Ans. (c) $y = \sec^{-1}\left(\frac{x+1}{x-1}\right) + \sin^{-1}\left(\frac{x-1}{x+1}\right)$ $\left[\because \sec^{-1} x = \cos^{-1}\frac{1}{x}\right]$

$\Rightarrow y = \cos^{-1}\left(\frac{x-1}{x+1}\right) + \sin^{-1}\left(\frac{x-1}{x+1}\right)$

$\left[\because \sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}\right]$

$\Rightarrow y = \frac{\pi}{2} \Rightarrow \frac{dy}{dx} = 0$

25. The inverse of the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 8 & 2 \end{bmatrix}$ is

(a) $\begin{bmatrix} 10 & -6 & 1 \\ -2 & -1 & 0 \\ -7 & -5 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 10 & -6 & 1 \\ -2 & -1 & 0 \\ -7 & -5 & 1 \end{bmatrix}$

(c) $\begin{bmatrix} 10 & -6 & -1 \\ -2 & 1 & 0 \\ -7 & 5 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 10 & -6 & 1 \\ -2 & 1 & 0 \\ -7 & 5 & -1 \end{bmatrix}$

Ans. (d) Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 8 & 2 \end{bmatrix}$

$|A| = 1(6-16) - 1(4-6) + 1(16-9)$

$= -10 + 2 + 7 = -1$

$\text{adj}(A) = \begin{bmatrix} -10 & 2 & 7 \\ 6 & -1 & -5 \\ -1 & 0 & 1 \end{bmatrix}^T = \begin{bmatrix} -10 & 6 & -1 \\ 2 & -1 & 0 \\ 7 & -5 & 1 \end{bmatrix}$

$A^{-1} = \frac{\text{adj } A}{|A|} = \begin{bmatrix} 10 & -6 & 1 \\ -2 & 1 & 0 \\ -7 & 5 & -1 \end{bmatrix}$

26. The differential equation

$\frac{dy}{dx} + (\tan x)\, y = \cos x, x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

has the solution

(a) $y = (x + C)\cos x$ (b) $y = (x + C)\sec x$

(c) $y = (x + C)\sin x$ (d) $y = (x + C)\text{cosec } x$

Ans. (a) Given differential equation is,

$\frac{dy}{dx} + (\tan x)\, y = \cos x,\ x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

IF $= e^{\int \tan x\, dx} = e^{\log \sec x} = \sec x$

$\therefore$ Complete solution, $y \cdot (\text{IF}) = \int \cos x \cdot (\text{IF})\, dx + C$

$y \cdot \sec x = \int \cos x \cdot \sec x\, dx + C$

$\Rightarrow y \cdot \sec x = \int 1 dx + C = x + C$

$\Rightarrow y = (x + C)\cos x$

27. Consider the following LPP

Max $f = 5x + 12y$

Subject to constraints

$x + 5y \leq 50,\ 6x + 3y \leq 36,\ x \leq 5, x \geq 0, y \geq 0$

The number of extreme points of the feasible regi are

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

Ans. (b) Given, LPP, Max $f = 5x + 12y$. Subject to constraints

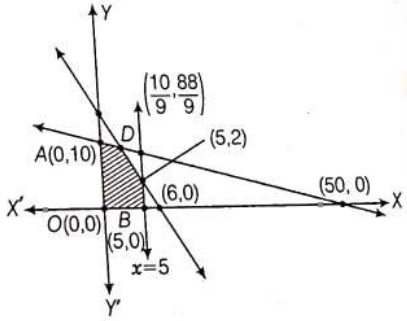
$x + 5y \leq 50,\ 6x + 3y \leq 36, x \leq 5, x \geq 0, y \geq 0$

First we convert all the inequalities into equality

Equation		Points
$x + 5y = 50$	–	(50, 0) and (0, 10)
$6x + 3y = 36$	–	(6, 0) and (0,12)
$x = 5$	–	(5, 0)

Now, plotting these points into the plotting paper.

Let (10 units = 1 sq)



$\therefore$ There are five extreme points $O(0, 0)$, $A(0, 10)$, $B(5, 0)$, C 2) and $D\left(\frac{10}{9}, \frac{88}{9}\right)$

28. Solution of the initi $(2\cos y + 3x)\, dx - x \sin y\, dy$

(a) $x^2 \cos y - y^3 = 1$ (b) x^2

(c) $x^3 \cos y + x^3 = 2$ (d) y

Ans. (c) Given differential equation is

$(2\cos y + 3x)\, dx - x$

$\Rightarrow (2x\cos y + 3x^2)\, dx - x^2 \sin$

$\Rightarrow 2x\cos y\, dx - x^2 \sin y\, dy$

$\Rightarrow \int d(x^2 \cos y) + \int 3x^2\, dx$

$\Rightarrow x^2 \cos y + 3 \cdot \frac{x^3}{3} = C \Rightarrow$

$\because y(1) = 0$

$\therefore (1)^2 \cos 0 + (1)^3 = C$

$\Rightarrow 1 + 1 = C \Rightarrow C = 2$

Now, from Eq. (i), we get x

29. A particular solution

$\frac{d^5y}{dx^5} - 3\frac{d^4y}{dx^4} + 3$

(a) $\frac{1}{3}x^3 e^x$ (b) $\frac{1}{2}x^3 e^x$

Ans. (a) Given differential eq

$\frac{d^5y}{dx^5} - 3$

$\Rightarrow (D^5 -$

Auxiliary equation, m

$\Rightarrow m^2(m^3 - 3$

$\Rightarrow m^2(m-1)($

$\Rightarrow m^2(m-1)$

$\therefore m = 0, 0, 1, 1$

$\therefore \text{PI} = \frac{2e^x}{D^2(D}$

$= 2e^x \frac{1}{D}$

$= 2e^x$

$= 2e^x$

30. The volume $z = 0$, $x = 0$

(a) $\frac{1}{6}$

(c) 1

Ans. (a) Given pl

$\therefore$ Required

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28. Solution of the initial value problem $(2\cos y + 3x)\,dx - x\sin y\,dy = 0,\ y(1) = 0$ is

(a) $x^2\cos y - y^3 = 1$ (b) $x^2\sin y + y^3 = 0$

(c) $x^2\cos y + x^3 = 2$ (d) $y^2\sin x + y^3 = 0$

Ans. (c) Given differential equation is

$$(2\cos y + 3x)\,dx - x\sin y\,dy = 0,\ y(1) = 0$$

$$\Rightarrow\ (2x\cos y + 3x^2)\,dx - x^2\sin y\,dy = 0$$

$$\Rightarrow\ 2x\cos y\,dx - x^2\sin y\,dy + 3x^2\,dx = 0$$

$$\Rightarrow\ \int d(x^2\cos y) + \int 3x^2\,dx = 0 \text{ on integrating}$$

$$\Rightarrow\ x^2\cos y + 3\cdot\frac{x^3}{3} = C \Rightarrow x^2\cos y + x^3 = C \qquad ...(i)$$

$\because\quad y(1) = 0$

$\therefore\quad (1)^2\cos 0 + (1)^3 = C$

$\Rightarrow\ 1 + 1 = C \Rightarrow C = 2$

Now, from Eq. (i), we get $x^2\cos y + x^3 = 2$

29. A particular solution of the differential equation

$$\frac{d^5y}{dx^5} - 3\frac{d^4y}{dx^4} + 3\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} = 2e^x \text{ is}$$

(a) $\frac{1}{3}x^3e^x$ (b) $\frac{1}{2}x^3e^x$ (c) $\frac{1}{6}x^3e^x$ (d) $\frac{2}{3}x^3e^x$

Ans. (a) Given differential equation

$$\frac{d^5y}{dx^5} - 3\frac{d^4y}{dx^4} + 3\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} = 2e^x$$

$$\Rightarrow\quad (D^5 - 3D^4 + 3D^3 - D^2)\,y = 2e^x \quad \left[\because D \equiv \frac{d}{dx}\right]$$

Auxiliary equation, $m^5 - 3m^4 + 3m^3 - m^2 = 0$

$$\Rightarrow\quad m^2(m^3 - 3m^2 + 3m - 1) = 0$$

$$\Rightarrow\quad m^2(m-1)(m^2 - 2m + 1) = 0$$

$$\Rightarrow\quad m^2(m-1)(m-1)^2 = 0$$

$$\therefore\quad m = 0, 0, 1, 1, 1$$

$$\therefore\quad \text{PI} = \frac{2e^x}{D^2(D-1)^3} = \frac{2}{(1)^2}\frac{e^x}{(D-1)^3} = \frac{2}{1}\cdot e^x\,\frac{1}{(D+1-1)^3}\cdot 1$$

$$= 2e^x\,\frac{1}{D^3}\cdot 1 = 2e^x\cdot\iiint 1\,dx\,dx\,dx$$

$$= 2e^x\iint x\,dx\,dx$$

$$= 2e^x\int\frac{x^2}{2}\,dx = 2e^x\cdot\frac{x^3}{6} = \frac{e^x x^3}{3}$$

30. The volume of the tetrahedron bounded by the planes $z = 0$, $x = 0$, $y = 0$ and $y + z - x = 1$ is

(a) $\frac{1}{6}$ (b) 6

(c) 1 (d) $\frac{1}{3}$

Ans. (a) Given planes,

$$z = 0,\ x = 0,\ y = 0 \text{ and } y + z - x = 1$$

$\therefore$ Required volume of the tetrahedron

$$= \int_{x=0}^{-1}\int_{y=0}^{1+x}\int_{z=0}^{1+x-y} dx\,dy\,dz$$

$$= \int_{x=0}^{-1}\int_{y=0}^{1+x}\int_{z=0}^{1+x-y} dz\,dy\,dx$$

$$= \int_{x=0}^{-1}\int_{y=0}^{1+x}(1+x-y)\,dy\,dx$$

$$= \int_{x=0}^{-1}\left[\frac{-(1+x-y)^2}{2}\right]_0^{1+x} dx$$

$$= -\frac{1}{2}\int_{x=0}^{-1}[(1+x-1-x)^2 - (1+x)^2]\,dx$$

$$= \frac{1}{2} = \int_0^{-1}(1+x)^2\,dx = \frac{1}{2}\left[\frac{(1+x)^3}{3}\right]_0^{-1}$$

$$= \frac{1}{6}[(1-1)^3 - (1+0)^3] = \frac{1}{6}(0-1) = -\frac{1}{6}$$

$$= \frac{1}{6} \text{ (neglecting negative sign)}$$

31. The general solution of the non-homogeneous differential equation

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 12y = 150\cos 3x \text{ is}$$

(a) $c_1e^{-3x} + c_2e^{4x} - 7\cos 3x - \sin 3x$

(b) $c_1e^{3x} + c_2e^{-4x} - 7\cos 3x + \sin 3x$

(c) $c_1e^{3x} + c_2e^{-4x} + 7\cos 3x + \sin 3x$

(d) $c_1e^{3x} + c_2e^{-4x} - 7\cos 3x - \sin 3x$

Ans. (b) Given differential equation is

$$\frac{d^2y}{dx^2} + \frac{dy}{dx} - 12y = 150\cos 3x$$

$$\therefore\quad (D^2 + D - 12)\,y = 15\cos 3x$$

Auxiliary equation, $m^2 + m - 12 = 0$

$$\Rightarrow\quad m^2 + 4m - 3m - 12 = 0$$

$$\Rightarrow\quad (m+4)(m-3) = 0$$

$$\Rightarrow\quad m = -4, 3$$

$$\therefore\quad \text{CF} = c_2e^{-4x} + c_1e^{3x}$$

$$\text{Now, PI} = \frac{150\cos 3x}{(D^2 + D - 12)} = \frac{150\cos 3x}{(-9 + D - 12)}$$

$$= \frac{150}{(D-21)} \times \frac{(D+21)}{(D+21)} \times \cos 3x$$

$$= \frac{150(D+21)}{(D^2 - 441)} \times \cos 3x$$

$$= \frac{150\,(D+21)\cos 3x}{(-9-441)} = \frac{150\,(D+21)\cos 3x}{-450}$$

$$= -\frac{1}{3}\{D\cos 3x + 21\cos 3x\}$$

$$= -\frac{1}{3}\{-3\sin 3x + 21\cos 3x\} = \sin 3x - 7\cos 3x$$

$\therefore$ Required solution,

$$y = CF + PI$$

$$y = c_2e^{-4x} + c_1e^{3x} + \sin 3x - 7\cos 3x$$

or $c_1e^{3x} + c_2e^{-4x} - 7\cos 3x + \sin 3x$

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32. What is the probability of getting an even number less than 5, in tossing a fair die?

(a) $\frac{2}{3}$ (b) $\frac{1}{3}$

(c) $\frac{5}{6}$ (d) $\frac{1}{6}$

Ans. (b) Total sample space, $n(S) = 6$

Favourable events = {an even number less than 5} = {2, 4}

$\therefore$ Total favourable events $n(E) = 2$

$\therefore$ Required probability $= \frac{n(E)}{n(S)} = \frac{2}{6} = \frac{1}{3}$

33. For the table

x	0	1	2	3
$f(x)$	1	2	9	28

the divided difference $f[1, 2, 3]$, is

(a) 6 (b) 13

(c) 3 (d) 1

Ans. (a) Given table

x	0	1	2	3
$f(x)$	1	2	9	28

From the table, we observe that, $f(x) = (x^3 + 1)$

$\because$ $f(0) = 1, f(1) = 2, f(2) = 9, f(3) = 27$

We have, $f(a, b) = \frac{f(b) - f(a)}{b - a} = \frac{b^3 + 1 - a^3 - 1}{b - a}$

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

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

Again, $f(a, b, c) = \frac{f(b, c) - f(a, b)}{c - a}$

$= \frac{1}{c - a}[b^2 + bc + c^2 - (a^2 + ab + b^2)]$ [using Eq. (i)]

$= \frac{1}{c - a}[bc + c^2 - a^2 - ab]$

$= \frac{1}{c - a}[(c - a)(c + a) + b(c - a)]$

$= \frac{1}{(c - a)} \cdot (c - a)[a + b + c] = (a + b + c)$

$\therefore$ $f(1, 2, 3) = 1 + 2 + 3 = 6$

34. The Lagrange form of the interpolating polynomial that fits the data

x	0	1	2
$f(x)$	1	2	5

is

(a) $\frac{1}{2}(x - 1)(x - 2) - 2x(x - 2) + \frac{5}{2}x(x - 1)$

(b) $\frac{1}{2}(x - 1)(x - 2) + 2x(x + 2) + \frac{5}{2}x(x - 1)$

(c) $2(x - 1)(x - 2) + \frac{1}{2}x(x + 2) + \frac{2}{5}x(x - 1)$

(d) $2(x - 1)(x - 2) - \frac{1}{2}x(x + 2) + \frac{2}{5}x(x - 1)$

Ans. (a) Given that,

x	0	1	2
$f(x)$	1	2	5

Here, $x_0 = 0, x_1 = 1, x_2 = 2$

By Lagrange's formula, we have

$$f(x) = \frac{(x - x_1)(x - x_2)}{(x_0 - x_1)(x_0 - x_2)} f(x_0) + \frac{(x - x_0)(x - x_2)}{(x_1 - x_0)(x_1 - x_2)} f(x_1) + \frac{(x - x_0)(x - x_1)}{(x_2 - x_0)(x_2 - x_1)} f(x_2)$$

On substituting the values of x_0, x_1, x_2 in this, we get

$$f(x) = \frac{(x - 1)(x - 2)}{(0 - 1)(0 - 2)} \times 1 + \frac{(x - 0)(x - 2)}{(1 - 0)(1 - 2)} \times 2 + \frac{(x - 0)(x - 1)}{(2 - 0)(2 - 1)} \times 5$$

$$= \frac{1}{2}(x - 1)(x - 2) - 2x(x - 2) + \frac{5}{2}(x - 1)x$$

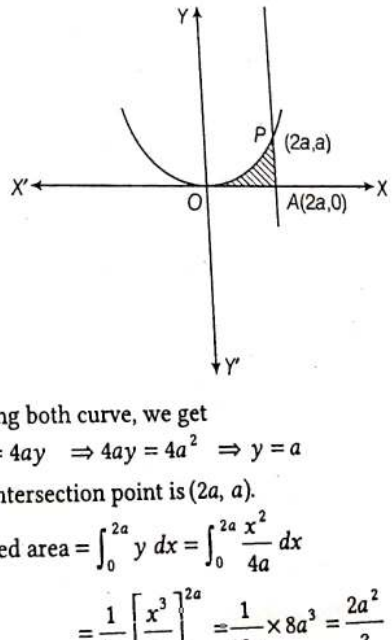
35. The area of the region enclosed by the parabola $x^2 = 4ay$ and the line $x = 2a$ with X-axis is

(a) $\frac{4}{3}a^2$ (b) $\frac{3}{2}a^2$

(c) $\frac{3}{4}a^2$ (d) $\frac{2}{3}a^2$

Ans. (d) Given curves,

$x^2 = 4ay$ and the line $x = 2a$



On solving both curve, we get

$(2a)^2 = 4ay \Rightarrow 4ay = 4a^2 \Rightarrow y = a$

So, the intersection point is $(2a, a)$.

$\therefore$ Required area $= \int_0^{2a} y\,dx = \int_0^{2a} \frac{x^2}{4a}\,dx$

$= \frac{1}{4a}\left[\frac{x^3}{3}\right]_0^{2a} = \frac{1}{12a} \times 8a^3 = \frac{2a^2}{3}$

36. The integral $\int_{-1}^{1} f($

$[-1, 1]$, is approxim

$\int_{-1}^{1} f(x)\,dx$

Suppose the polynomials of

(a) -1

(c) $\frac{1}{\sqrt{2}}$

Ans. (b) Let the polyno

Which is contin

Also given that,

$\int_{-1}^{1} f($

$\Rightarrow \int_{-1}^{1} (ax +$

$\Rightarrow 2\int_{0}^{1}$

$\Rightarrow 0a$

On comparin

and $-\frac{\alpha}{\sqrt{2}}$

$\therefore$

From Eq. (

37. If (2, 1

$f_{yy}(2, 1)$

(a) (2, 1

(b) (2, 1

(c) (2,

(d) fur

na

Ans. (a)

$\Rightarrow f$

$\Rightarrow (2,$

38. If $f($

(a)

(b)

(c)

(d)

Ans. (a)

Fo

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36. The integral $\int_{-1}^{1} f(x)\,dx$, where f is continuous on $[-1, 1]$, is approximated by the formula

$$\int_{-1}^{1} f(x)\,dx \simeq \alpha f\left(-\frac{1}{\sqrt{2}}\right) + \beta f\left(\frac{1}{\sqrt{2}}\right)$$

Suppose the approximation is exact for all polynomials of degree ≤ 1. Then, the value of α is

(a) -1 (b) 1

(c) $\frac{1}{\sqrt{2}}$ (d) $-\frac{1}{\sqrt{2}}$

Ans. (b) Let the polynomial of degree ≤ 1 is

$$f(x) = ax + b \quad \ldots(i)$$

Which is continuous on $[-1, 1]$.

Also given that,

$$\int_{-1}^{1} f(x)\,dx = \alpha f\left(-\frac{1}{\sqrt{2}}\right) + \beta f\left(\frac{1}{\sqrt{2}}\right)$$

$$\Rightarrow \int_{-1}^{1} (ax + b)\,dx = \alpha\left\{-\frac{a}{\sqrt{2}} + b\right\} + \beta\left\{\frac{a}{\sqrt{2}} + b\right\}$$

$$\Rightarrow 2\int_{0}^{1} b\,dx = (\alpha + \beta)\,b + \left(\frac{-\alpha}{\sqrt{2}} = \frac{\beta}{\sqrt{2}}\right)a$$

$$\Rightarrow 0a + 2b = (\alpha + \beta)\,b + \left(-\frac{\alpha}{\sqrt{2}} + \frac{\beta}{\sqrt{2}}\right)a$$

On comparing, we get

$$\alpha + \beta = 2 \quad \ldots(ii)$$

and $$-\frac{\alpha}{\sqrt{2}} + \frac{\beta}{\sqrt{2}} = 0$$

$$\therefore \quad \alpha = \beta$$

From Eq. (ii), we get $\alpha = \beta = 1$

37. If (2, 1) is a critical point of $f(x, y)$ and $f_{xx}(2,1)\,f_{yy}(2,1) - [f_{xy}(2,1)]^2 < 0$, then

(a) (2, 1)is a saddle point

(b) (2, 1) is a point of local maximum

(c) (2, 1) is a point of local minimum

(d) further investigation is required to determine the nature of the point

Ans. (a)

Here, $rt - s^2 < 0$

$\Rightarrow$ f has neither maximum nor minimum at (2, 1).

$\Rightarrow$ (2, 1) is a saddle point.

38. If $f(x) = \int_{a}^{x^2} t(t-1)\,dt$, then

(a) f has a local maximum at $x = 0$ and a local minimum at $x = 1$

(b) f has local minima at $x = 0$ and $x = 1$

(c) f has local maximum at $x = 1$ and a local minimum at $x = 0$

(d) f has local maxima at $x = 1$ and $x = 0$

Ans. (a) $f'(x) = x^2(x^2 - 1).\,2x = 2x^3(x^2 - 1)$

For maxima or minima

$$f'(x) = 0 \Rightarrow x = 0, -1, 1$$

$$f''(x) = 10x^4 - 6x^2$$

$$f''(0) = 0,\ f''(1) > 0$$

$\Rightarrow$ $f(x)$ has local minimum at $x = 1$.

$$f'''(x) = 40x^3 - 12x$$

$$f^{iv}(x) = 120x^2 - 12$$

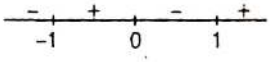
Clearly, $f'''(0) = 0$ and $f^{iv}(0) < 0$

$\therefore$ $x = 0$ is point of maximum of $f(x)$.

Alternate method

$$f'(x) = 2x^3(x^2 - 1)$$

Critical points are $x = -1, 0, 1$



Clearly, $f'(x)$ changes sign from + to − at $x = 0$ and − to + at $x \cong 1$.

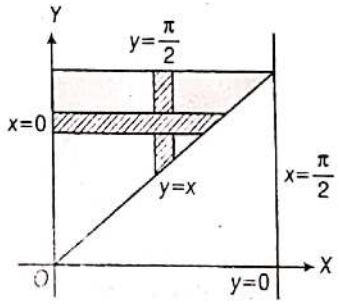
$\Rightarrow$ $f(x)$ has local maximum at $x = 0$ and minimum at $x = 1$.

39. The value of the integral $\int_{0}^{\frac{\pi}{2}} \int_{x}^{\frac{\pi}{2}} \frac{\sin y}{y}\,dy\,dx$, is

(a) 0 (b) $\frac{1}{2}$

(c) 1 (d) 2

Ans. (c) By changing the order of integration, we get



$$\int_{0}^{\pi/2}\int_{x}^{\pi/2} \frac{\sin y}{y}\,dy\,dx = \int_{0}^{\pi/2}\int_{0}^{y} \frac{\sin y}{y}\,dy\,dx$$

$$= \int_{0}^{\pi/2} \frac{\sin y}{y}\,dy \int_{0}^{y} dx = \int_{0}^{\pi/2} \sin y\,dy = (-\cos y)_{0}^{\pi/2}$$

$$= -\left(\cos\frac{\pi}{2} - \cos 0\right) = 1$$

40. The value of the arithmetic expression $-a \cdot \frac{b}{c} + d\%k$ for integers variables $a = 5, b = 3, c = 2, d = 5, k = 3$ is

(a) -5.5 (b) -5

(c) -3 (d) -1

Ans. (b) $\therefore$ $-a * b / c + d\%k$

$$= -5 * \frac{3}{2} + 5\%3 = -\frac{15}{2} + 2$$

$$= -7 + 2 = -5$$

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41. Let $S_1 = \{2\}, S_2 = \{4, 6\}, S_3 = \{8, 10, 12\}$, $S_4 = \{14, 16, 18, 20\}$ and so on. The sum of elements of S_{10} is

(a) 990 (b) 1000
(c) 1010 (d) 1020

Ans. (c) Let $S = 2 + 4 + 8 + 14 + \ldots + t_n$
Also, $S = 2 + 4 + 8 + \ldots + t_{n-1} + t_n$
On subtraction, we get

$$t_n = 2 + 2 + 4 + 6 + \ldots + \text{upto } n \text{ terms}$$
$$= 2 + [2 + 4 + 6 + \ldots + \text{upto } (n-1) \text{ terms}]$$
$$= 2 + 2 \cdot \frac{(n-1)\,n}{2} = 2 + n^2 - n$$

$\therefore \quad t_{10} = 100 - 10 + 2 = 92$
$\Rightarrow \quad S_{10} = \{92, 94, 96, \ldots\ldots \text{upto 10 terms}\}$
$\therefore$ Sum of elements
$$= 92 + 94 + 96 + \ldots\ldots + \text{upto 10 terms}$$
$$= \frac{10}{2}[2 \times 92 + 9 \times 2] = 1010$$

42. The locus of intersection of two lines $\sqrt{3}x - y = 4k\sqrt{3}$ and $k(\sqrt{3}x + y) = 4\sqrt{3}$ for different values of k is a hyperbola. The eccentricity of the hyperbola is

(a) 1.5 (b) $\sqrt{3}$
(c) 2 (d) $\frac{\sqrt{3}}{2}$

Ans. (c) Given, lines are

$$\sqrt{3}x - y = 4k\sqrt{3} \quad \ldots(i)$$

and $k(\sqrt{3}x) + ky = 4\sqrt{3}$

$$\Rightarrow \quad \sqrt{3}x + y = \frac{4\sqrt{3}}{k} \quad \ldots(ii)$$

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

$$3x^2 - y^2 = 48$$
$$\frac{x^2}{16} - \frac{y^2}{48} = 1$$

Which is a hyperbola.

$\therefore \quad a = 4, b = 4\sqrt{3}$

$$e = \sqrt{1 + \frac{b^2}{a^2}} = \sqrt{\frac{16 + 48}{16}} = \sqrt{\frac{64}{16}} = 2$$

43. If $x = 1$ is the directrix of the parabola $y^3 = kx - 8$, then k is

(a) $\frac{1}{8}$ (b) 8 (c) 4 (d) $\frac{1}{4}$

Ans. (c) We have, $y^2 = kx - 8$

$$\Rightarrow \quad y^2 = k\left(x - \frac{8}{k}\right)$$

which is a form of $y^2 = 4AX$

So, $X = x - 8/k, A = k/4$

$\therefore$ Equation of directrix, $X = -A$

$$\Rightarrow \quad x - \frac{8}{k} = -\frac{k}{4}$$
$$\Rightarrow \quad x = \frac{8}{k} - \frac{k}{4}$$
$$\Rightarrow \quad 1 = \frac{8}{k} - \frac{k}{4}$$
$$\Rightarrow \quad 4k = 32 - k^2$$
$$\Rightarrow \quad k^2 + 4k - 32 = 0$$
$$\Rightarrow \quad k^2 + 8k - 4k - 32 = 0$$
$$\Rightarrow \quad (k + 8)(k - 4) = 0$$
$$k = 4, -8$$

44. If the foci of the ellipse $b^2x^2 + 16y^2 = 16b^2$ and the hyperbola $81x^2 - 144y^2 = \frac{81 \times 144}{25}$ coincide, then the value of b is

(a) 1 (b) $\sqrt{5}$ (c) $\sqrt{7}$ (d) 3

Ans. (c) Since, foci coincide,

$$\therefore \quad 16 - b^2 = \frac{144}{25} + \frac{81}{25}$$
$$\Rightarrow \quad 16 - b^2 = \frac{225}{25}$$
$$\Rightarrow \quad b^2 = 16 - \frac{225}{25}$$
$$= \frac{400 - 225}{25} = \frac{175}{25} = 7$$
$$\therefore \quad b = \sqrt{7}$$

45. The condition that the line $lx + my + n = 0$ becomes a tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, is

(a) $a^2l + b^2m + n = 0$ (b) $al^2 + bm^2 = n^2$
(c) $al + bm = n$ (d) $a^2l^2 + b^2m^2 = n^2$

Ans. (d) We have equation of line,

$$lx + my + n = 0$$

and $\quad y = \frac{-l}{m}x + \left(\frac{-n}{m}\right)$

We know that, if the line $y = mx + c$ touches the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

Then, $c^2 = a^2m^2 + b^2$

$$\therefore \quad \frac{n^2}{m^2} = a^2\frac{l^2}{m^2} + b^2$$
$$\Rightarrow \quad n^2 = a^2l^2 + b^2m^2$$

46. The value of $\sin 20° \sin 40° \sin 80°$ is

(a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$
(c) $\frac{\sqrt{3}}{8}$ (d) $\frac{1}{8}$

Ans. (c) We have, $\sin 20° \sin 40° \sin 80°$
$$= \sin 20° \sin (60° - 20°) \sin (60° + 20°)$$

47. Two non-negative
product of the on
number is maxim
(a) 5 and 4
(c) 1 and 8

Ans. (b) Let two number
Given,
and
$\Rightarrow$
$= x(81 +$
$\Rightarrow \quad \frac{dz}{dx} = 3x^2 -$
$\because \quad \frac{dz}{dx} = 0$
$\Rightarrow$
$\Rightarrow$
$\Rightarrow$
$x = 3$
$\therefore$ So, numbers

48. In ΔABC,
are respec
(a) 90°, 30°

Ans. (a) In ΔABC
$\because$ co
$\because$ cos ...(i)
$\Rightarrow$
$\Rightarrow$
Now,
$\Rightarrow$
$\Rightarrow$
$\Rightarrow$
Now

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$$= \sin 20^\circ (\sin^2 60^\circ - \sin^2 20^\circ)$$
$$= \sin 20^\circ \left[\frac{3}{4} - \sin^2 20^\circ\right]$$
$$= \frac{1}{4}[3 \sin 20^\circ - 4 \sin^2 20^\circ]$$
$$= \frac{1}{4} \sin 3 \times 20^\circ = \frac{1}{4} \cdot \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{8}$$

47. Two non-negative numbers whose sum is 9 and the product of the one number and square of the other number is maximum, are
(a) 5 and 4 (b) 3 and 6
(c) 1 and 8 (d) 7 and 2

Ans. (b) Let two numbers be x and y, where $x > 0$, $y > 0$.

Given, $x + y = 9$ ...(i)

and $z = x \cdot y^2$ ...(ii)

$\Rightarrow$ $z = x(9 - x)^2$

$= x(81 + x^2 - 18x) = x^3 - 18x^2 + 81x$

$\Rightarrow$ $\frac{dz}{dx} = 3x^2 - 36x + 81 = 3(x^2 - 12x + 27)$

$\because$ $\frac{dz}{dx} = 0$

$\Rightarrow$ $x^2 - 9x - 3x + 27 = 0$

$\Rightarrow$ $(x - 9)(x - 3) = 0$

$\Rightarrow$ $x = 3, x = 9$

$x = 3$ and $y = 6$ [$\because x = 9$ not possible]

$\therefore$ So, numbers are 3 and 6.

48. In ΔABC, if $a = 2$, $b = 4$ and $\angle C = 60^\circ$, then A and B are respectively equal to
(a) 90°, 30° (b) 45°, 75° (c) 60°, 60° (d) 30°, 90°

Ans. (a) In ΔABC,

$a = 2$, $b = 4$, $\angle C = 60^\circ$

$\because$ $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$

$\because$ $\cos 60^\circ = \frac{4 + 16 - c^2}{2 \times 2 \times 4}$

$\Rightarrow$ $\frac{1}{2} = \frac{20 - c^2}{16}$

$\Rightarrow$ $c^2 = 12$ $\Rightarrow$ $c = 2\sqrt{3}$

Now, $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

$\Rightarrow$ $\frac{\sin A}{a} = \frac{\sin C}{c}$

$\Rightarrow$ $\frac{\sin A}{2} = \frac{\sin 60^\circ}{2\sqrt{3}}$ $\Rightarrow$ $\sin A = \frac{1}{2}$

$\Rightarrow$ $\angle A = 30^\circ$

Now $\angle A + \angle B + \angle C = 180^\circ$

$\Rightarrow$ $30^\circ + \angle B + 60^\circ = 180^\circ$

$\Rightarrow$ $\angle B = 90^\circ$

$\therefore$ $\angle A = 30^\circ$ and $\angle B = 90^\circ$

49. If $\int \frac{xe^x}{\sqrt{1 + e^x}} dx = f(x)\sqrt{1 + e^x} - 2 \log \frac{\sqrt{1 + e^x}}{\sqrt{1 + e^x}} + C$, then $f(x)$ is
(a) $2x - 1$ (b) $2x - 4$ (c) $x + 4$ (d) $x - 4$

Ans. (b) Let $I = \int \frac{xe^x}{\sqrt{1 + e^x}} dx$

Put $1 + e^x = t^2$ $\Rightarrow$ $e^x dx = 2t\, dt$

$x = \log(t^2 - 1)$

$\therefore$ $I = 2\int \log \frac{(t^2 - 1)}{t} t\, dt = 2\int \log(t^2 - 1)\, dt$

$= 2\left[t \log(t^2 - 1) - 2\int \frac{t^2}{t^2 - 1} dt\right]$

$= 2\left[t \log(t^2 - 1) - 2dt \int \left(1 + \frac{1}{t^2 - 1}\right) dt\right]$

$= 2\left[t \log(t^2 - 1) - 2t - \log\left(\frac{t - 1}{t + 1}\right)\right] + C$

$= 2x\sqrt{1 + e^x} - 4\sqrt{1 + e^x} - 2\log\left(\frac{\sqrt{1 + e^x} - 1}{\sqrt{1 + e^x} + 1}\right) + C$

$= (2x - 4)\sqrt{1 + e^x} - 2\log\left(\frac{\sqrt{1 + e^x} - 1}{\sqrt{1 + e^x} + 1}\right) + C$

Hence, $f(x) = 2x - 4$

50. The average marks of boys in a class is 52 and that of girls is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is
(a) 80% (b) 60% (c) 40% (d) 20%

Ans. (a) Given, combined average of class is 50. Let number of boys in class be x and number of girls in class by y.

By combined average formula, $50 = \frac{52 \times x + 42 \times y}{x + y}$

$\Rightarrow$ $50x + 50y = 52x + 42y$

$\Rightarrow$ $8y = 2x$

$\Rightarrow$ $\frac{x}{y} = \frac{4}{1}$

$\Rightarrow$ $\frac{x}{x + y} = \frac{4}{5}$

Hence, ratio of boys to total number of students is $\frac{4}{5}$ and

percentage $= \frac{4}{5} \times 100 = 80\%$

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ENGLISH LANGUAGE AND COMPREHENSION

Directions *(Q. No. 51-52) Answer the following questions based on the given paragraph.*

The fossil remains of the first flying vertebrates, the pterosaurs, have intrigued palaeontologists for more than two centuries. How such large creatures, which weighted in some cases as much as a piloted hang glider and had wingspans from 8 to 12 m, solved the problems of powered flight, and exactly what these creatures were-reptiles or birds are among the questions scientists have puzzled over.

Perhaps the least controversial assertion about the pterosaurs is that they were reptiles. Their skulls, pelvises, and hind feet are reptilian. The anatomy of their wings suggests that they did not evolve into the class of birds. In Pterosaurs a greatly elongated fourth finger of each forelimb supported a wing like membrane. The other fingers were short and reptilian, with sharp claws. In birds, the second finger is the principle strut of the wing, which consists primarily of feathers. If the Pterosaur walked or remained stationary, the fourth finger and with it the wing, could only turn upward in an extended inverted V-shape along side of the animal's body.

The pterosaurs resembled both birds and bats in their overall structure and proportions. This is not surprising because the design of any flying vertebrate is subject to aerodynamic constraints. Both the Pterosaurs and the birds have hollow bones a feature that represents a saving in weight. In the birds, however, these bones are reinforced more massively by internal struts.

51. It can be inferred from the passage that the scientists now generally agree that

(a) enormous wingspan of the pterosaurs enable them to fly great distances.
(b) structure of the skeleton of the pterosaurs suggests a close evolutionary relationship to bats.
(c) fossil remains of the pterosaurs reveal how they solved the problem of powered flight.
(d) pterosaur were reptiles.

Ans. (d) Pterosaurs are reptiles is generally agreeable statement.

52. According to the passage, the skeleton of pterosaurs can be distinguished from that of a bird by the

(a) size of its wingspan.
(b) presence of hollow spaces in its bones.
(c) anatomic origin of its wing strut.
(d) presence of hook like projections on its hind feet.

Ans. (c) Anatomic origin of wing strut is the main point to distinguish between bird or non-bird.

53. The following passage consists of six sentences. The first sentence (S_1) is given in the beginning. The final sentence (S_6) is given in the last. The middle four sentences are jumbled up and labelled as P, Q, R and S. You are required to find out the proper sequence of the four sentences and mark accordingly.

S1: Unlike many modern thinkers, Tagore had no blueprint for the world's salvation.
P : His thought will therefore never be out of date.
Q : He merely emphasised certain basic truths which men may ignore only at their peril.
R : He believed in no particularism.
S : He was what Gandhiji rightly termed the great sentinel.
S_6 : As a poet he will always delight, as a singer he will always enchant, as a teacher he will always enlighten.

The proper sequence should be

(a) SRPQ (b) PRQS
(c) RSPQ (d) RQPS

Ans. (d) RQPS is the correct consequence or order of sentences.

Directions *(Q. Nos. 54-55) Each question consists of a word printed in capital letters, followed by four words or phrases. Choose the word or phrase that is most similar in meaning to the word in capital letters.*

54. EXASPERATE

(a) Pacify (b) Mollify
(c) Irritate (d) Placate

Ans. (a) **Exasperate** to make someone extremely annoyed and impatient.

Its similar meaning **Irritate**.

55. INIMICAL

(a) Antagonistic (b) Anonymous
(c) Fanciful (d) Accurate

Ans. (a) **Inimical** unfriendly. Its similar meaning.

Antagonistic disliking someone or behaving in a very unfriendly way.

56. Which of the underlined parts in the sentence given below is a mistake which may need to be deleted or modified?

He can <u>be able to</u> pass the test in <u>flying colours</u> without any <u>difficulties</u> <u>whatsoever</u>.

(a) be able to (b) flying colours
(c) difficulties (d) whatsoever

Ans. (a) Correct sentence: He can pass the test in flying colours without any difficulties whatsoever.

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57. The idiom 'I will be a monkey's uncle' means
(a) to want to keep a monkey
(b) that I have been enlightened
(c) that I have been fooled
(d) to express disbelief

Ans. (c) I will be monkey's uncle mean that I have been fooled.

58. Fill in the blanks.
I could not ..... him to attend the meeting.
(a) prevail over (b) prevail upon
(c) prevail about (d) prevail in

Ans. (b) **Prevail upon** to ask or persuade someone to do something.

Directions *(Q. Nos. 59-60) Each question consists of a word printed in capital letters, followed by four words or phrases. Choose the word or phrase that is most nearly opposite in meaning to the word in capital letters.*

59. OPPROBRIUM
(a) Honour (b) Prudence
(c) Ostentation (d) Umbrage

Ans. (a) **Opprobrium** very strong criticism of something that you do not approve of or dishonour.
Its opposite-**Honour** to respect.

60. INCESSANT
(a) Perpetual
(b) Persistent
(c) Sporadic
(d) Unrelenting

Ans. (c) **Incessant** continuing for a long time without stopping in a way that is annoying.
Its opposite.
Sporadic not regular or frequent.

COMPUTER AWARENESS

61. What one of the following statements is always true?
(a) A compiled program uses more memory than an interpreted program.
(b) A compiler converts a program to a lower level language for execution.
(c) A compiler for a high level language takes less memory than its interpreter.
(d) Compiled programs take more time to execute than interpreted programs.

Ans. (b) A compiler converts a high level program into low level language (Machine language) for execution.

62. The capacity of a memory unit is defined by the number of works multiplied by the number of bits per word. How many separate address and data line are needed for a memory of $4K \times 16$?
(a) 10 address lines and 16 data lines
(b) 12 address lines and 10 data lines
(c) 12 address lines and 16 data lines
(d) 12 address lines and 8 data lines

Ans. (c) $4K \times 16 = 2^{12} \times 16$
$\Rightarrow$ We should have 12 address lines and 16 data lines.

63. The main disadvantage of direct mapping of cache organisation is that
(a) it doesn't allow simultaneous access to the intended data and its tag.
(b) it is more expensive that other type of organisations.
(c) the cache hit ratio is degreaded if two or more blocks used alternatively map into the same block frame in the cache.
(d) the number of blocks required for the cache increases linearly with the size of the main memory.

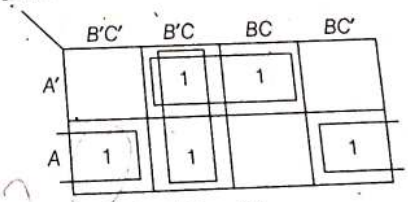
Ans. (d) The number of blocks required for the cache increases linearly with the size of the main memory which is the main disadvantage of direct mapping of cache organisation.

64. The first instruction of bootstrap loader program of an operating system is stored in
(a) RAM (b) BIOS
(c) Hard disk (d) None of these

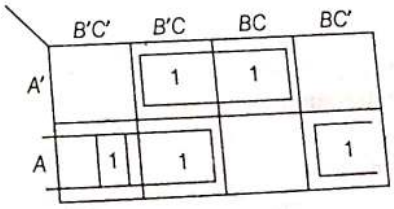
Ans. (b) BIOS = Basic Input Output System which stores first instruction of boots trap loader program.

65. The function $AB'C + A'BC + ABC' + A'B'C$ is equivalent to
(a) $AC' + AB + A'C$
(b) $AB' + AC' + A'C$
(c) $A'B + AC' + AB'$
(d) $A'B + AC + AB'$

Ans. (b) It will be simplified by Karnaugh map as follows. There are three pairs.



$\Rightarrow$ Function is $AC' + B'C + A'C$



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66. The addition of 4 bit, 2's complement binary numbers 1101 and 0100 results in
(a) 0001 and an overflow (b) 1001 and no overflow
(c) 0001 and no overflow (d) 1001 and an overflow

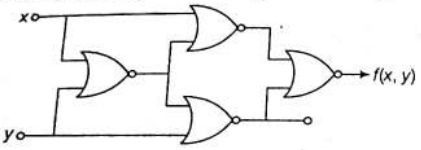
Ans. (c) 1's complement of 1101 = 0010
2's complement of 1101 = 0010 + 1 = 0011
and 1's complement of 0100 = 1011
2's complement of 0100 = 1011 + 1 = 1100

$$\begin{array}{r} 0011 \\ +\ 1100 \\ \hline 1111 \end{array}$$

Addition both 4 bits:

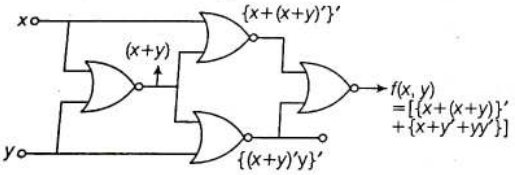
It's one's complement = 0000
and 2's complement = 0000 + 1 = 0001
There is not overflow.

67. Identify the logic function performed by the circuit.



(a) Exclusive OR (b) Exclusive NOR
(c) NAND (d) NOR

Ans. (b)



$f(x, y) = [(x + x' \cdot y')' + \{x' \cdot y' + y\}']'$
(by De-Morgan's law
$= [x' \cdot (x' \cdot y') + (x' \cdot y') \cdot y']'$ (by De-Morgan's law)
$= \{x' \cdot (x + y) + (x + y) \cdot y'\}'$ (by De-Morgan's law)
$= \{x' \cdot (x + y)\}' \cdot \{(x + y) \cdot y\}'$ (by De-Morgan's law)
$= [x + (x + y)'] \cdot [(x + y)' + y]$ (by De-Morgan's law)
$= [x + x' \cdot y'] \cdot [x' \cdot y' + y]$ (by De-Morgan's law)
$= (x + x')(x + y') \cdot (x' + y) \cdot (y' + y)$ (by Distributive law)
$= 1 \cdot (x + y') \cdot (x' + y) \cdot 1$ (by Complement law)
$= (x + y)' \cdot (x' + y)$ (by Identity law)
$= x \cdot x' + xy + y'x' + y'y$ (by Distributive law)
$= 0 + xy + y'x' + 0$ (by Complement law)
$= xy + x'y'$ (by Identify and Commutative law)
which represent exclusive NOR.

68. Which of the following is (are) true about virtual memory systems that uses pages?
I. The virtual address space can be larger than the amount of physical memory.
II. Programs must be resident in main memory throughout their execution.
III. Pages correspond to semantic characteristics of the programs.
(a) I only (b) II only
(c) I and II (d) I and III

Ans. (c) Virtual memory systems uses pages since, the virtual address space can be larger than the amount of physical memory and pages corresponds to semantic characteristics the programs.

69. How many bits are required to store an ASCII character?
(a) 7 (b) 6
(c) 8 (d) None of these

Ans. (a) In ASCII, there are 7 bits required are store.

70. What is the output of a JK flip-flop during next clock cycle, when $J = 1$, $K = 1$? Assume, Q is the output during the current clock cycle.
(a) 1 (b) 0 (c) Q (d) Q'

Ans. (d) $J = 1$, $K = 1$ produces complementary output.
Since, Q is the output during the current clock cycle $\bar{Q}$ (or) will be the output of next clock cycle.

71. What are the values of the variables, **i**, **j** and **k** after execution of the following program segment?
int **i** = 1, **j** = 2, **k** = 3; **i** + = **j** + = **k**;
(a) **i** = 3, **j** = 5, **k** = 6 (b) **i** = 3, **j** = 6, **k** = 5
(c) **i** = 6, **j** = 3, **k** = 5 (d) **i** = 6, **j** = 5, **k** = 3

Ans. (d) int **i** = 1, **j** = 2, **k** = 3, **i** + = **j** + = **k**,
we know that, every expression in 'C' language compiled from right to left.
Step Ist $K = 3$
Step IInd **j** + = **k**
$\Rightarrow$ **j** = **j** + **k** = 2 + 3 = 5 [∵ j =
Step IIIrd **i** + = **j**
$\Rightarrow$ **i** = **i** + **j** = 1 + 5 = 6 [∵ j =

72. Let X and Y be 4 bit registers with initial contents 1011 and 1001, respectively. The following sequence of operations are performed on the two registers
$Y \leftarrow X \oplus Y$
$X \leftarrow X \oplus Y$
$Y \leftarrow X \oplus Y$
Where $\oplus$ denotes XOR operation. The final contents of the two registers are
(a) X = 1001, Y = 1011 (b) X = 101, Y = 1001
(c) X = 1011, Y = 1011 (d) X = 1001, Y = 1001

Ans. (a) $X = 1011$
$Y = 1001$
$Y \leftarrow X \oplus Y \Rightarrow Y = 0010$
$X \leftarrow X \oplus Y$
$\Rightarrow X = 1001 \quad Y \leftarrow X \oplus Y$
$\Rightarrow Y = 1011$
$\Rightarrow X = 1001, Y = 1011$

Solved Paper 2017

73. An I/O processor co... between
(a) cache memory and ...
(b) main memory and ...
(c) two I/O devices

Ans. (b) An I/O processor co... main memory and I/O ...

74. Which of the follo... time in taking t... computer?
(a) Magnetic disk
(c) CD

Ans. (d) Magnetic tape w... of the data from a co...

75. The errors that ...
(a) syntax errors
(c) logical errors

Ans. (a) The errors that ... errors.

76. $(2FAOC)_{16}$ is
(a) (195044)...
(b) (00101111...
(c) Both (a) an...
(d) None of th...

Ans. (c) From option ...
Binary form 0...
Hexadecimal
∴ (2FAOC)...
From option ...
$(195084)_{10} = ($...

77. If the int... maximum...
(a) $2^{16} - 1$...

81. The mis... 3, 6...
(a) 15

Ans. (b) Given ...
Split the ...

3

82. A ma... 10 m... m ar... runs...

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Note: Integer can be swapped without temp. var. But we need atleast 1 temp. variable to swap other types of data

73. An I/O processor controls the flow of information between
(a) cache memory and I/O devices
(b) main memory and I/O devices
(c) two I/O devices (d) cache and main memories

Ans. (b) An I/O processor controls the flow of information between main memory and I/O devices.

74. Which of the following devices will take highest time in taking the backup of the data from a computer?
(a) Magnetic disk (b) Pen drive
(c) CD (d) Magnetic tape

Ans. (d) Magnetic tape will take highest time in taking the backup of the data from a computer.

75. The errors that can be pointed out by compilers are
(a) syntax errors (b) semantic errors
(c) logical errors (d) internal errors

Ans. (a) The errors that can be pointed out by compilers are syntax errors.

76. $(2FAOC)_{16}$ is equivalent to
(a) $(195084)_{10}$
(b) $(00101111101000001100)_2$
(c) Both (a) and (b)
(d) None of the above

Ans. (c) From option (b),
Binary form 0010 1111 1010 0000 1100
Hexadecimal 2 F A Q C
$\therefore \quad (2FAOC)_{16} = (00101111101000001100)_2$
From option (a),
$(195084)_{10} = (00101111101000001100)_2 = (2FAOC)_{16}$

77. If the integer needs two bytes of storage, then maximum value of an unsigned integer is
(a) $2^{16}-1$ (b) $2^{15}-1$ (c) 2^{16} (d) 2^{15}

Ans. (a) If the integer needs two bytes of storage, then maximum value of an unsigned integer is $2^{16}-1$.

78. The minimum number of temporary variables needed to swap the contents of two variables is
(a) 1 (b) 2 (c) 3 (d) 0

Ans. (a) The minimum number of temporary variables needed to swap the contents of two variables is 1.
e.g. int $x=10, y=10, z;$
main ()
{
$z = x;$
$x = y;$
$y = z;$
}

79. Which of the following terms could be used to describe the concurrent processing of computer programs via CRTs, on one computer system?
(a) Time sharing
(b) Online processing
(c) Interactive processing
(d) All of the above

Ans. (c) Interactive processing could be used to describe the concurrent processing of computer programs via CRT's on one computer system.

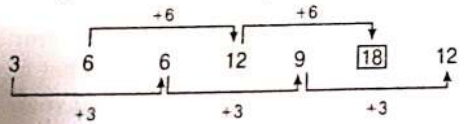
80. Which of the following would most likely not be a symptom of a virus?
(a) Existing program files and icons disappear
(b) The CD-ROM stops functioning
(c) The web browser opens to an unusual home page
(d) Odd messages or images are displayed on the screen

Ans. (b) The CD-ROM stops functioning would most likely not be a system of a virus.

LOGICAL AND ANALYTICAL REASONING

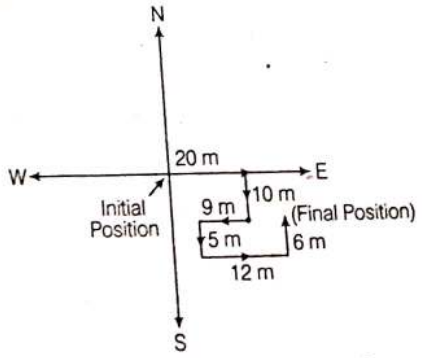
81. The missing number in the given series
3, 6, 6, 12, 9, ..., 12 is
(a) 15 (b) 18 (c) 11 (d) 13

Ans. (b) Given series, 3, 6, 6, 12, 9, ..., 12
Split the given series into two parts



82. A man runs 20 m towards east and turns right, runs 10 m and turns right, runs 9 m and turns left, runs 5 m and turns left, runs 12 m and finally turns left and runs 6 m. Which direction is the man facing?
(a) North (b) South
(c) East (d) West

Ans. (a)



Hence, the man is facing in the North Direction.

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Directions (Q. Nos. 83-85) *Read the following passage carefully and answer the questions.*

Six boys A, B, C, D, E and F are marching in a line. They are arranged according to their heights, the tallest being at the back and the shortest in the front. F is between B and A. E is shorter than D but taller than C who is taller than A. E and F have two boys between them. A is not the shortest among them.

83. Where is E?
(a) Between A and B (b) Between C and A
(c) Between D and C (d) In front of C

84. If we start counting from the shortest, which boy is fourth in the line?
(a) E (b) A (c) D (d) C

85. Who is next to the shortest?
(a) C (b) B
(c) E (d) F

Sol (Q. Nos. 83-85)
According ot the condition,

$$B < F < A < C < E < D$$
(Shortest) (Tallest)

83. (c) E is between D and C

84. (d) C is fourth in the line.

85. (d) F is next to the shortest.

86. The letters P, Q, R, S, T, U and V not necessarily in that order represent seven consecutive integers from 22 to 33 and

1. U is as much less than Q as R is greater than S.
2. V is greater than U and Q.
3. Q is the middle term.
4. P is greater than S.

Then, the sequence of letters from the lowest value to the highest value, is
(a) TVPQRSU (b) TRSQUPV
(c) TUSQRPV (d) TVPQSRU

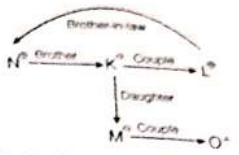
Ans. (c) By given condition, we get the required order (sequence) of letters from the lowest value to the highest value is

$$T < U < S < Q < R < P < V$$

i.e. TUSQRPV

87. Five persons K, L, M, N and O are sitting around a dining table. K is the mother of M, M is actually the wife of O, N is the brother of K and L is the husband of K. How is N related to L?
(a) Son (b) Cousin
(c) Brother (d) Brother-in-law

Ans. (d)



Hence, N is the Brother-in-law of L.

88. If 'ROAST' is coded as 'PQYUR' in a certain language, then 'SLOPPY' is coded in that language as
(a) MRNAQN (b) NRMNQA
(c) QNMRNA (d) RANNMQ

Ans. (c)

$R \xrightarrow{-2} P$ $S \xrightarrow{-2} Q$
$O \xrightarrow{+2} Q$ $L \xrightarrow{+2} N$
$A \xrightarrow{-2} Y$ $O \xrightarrow{-2} M$
$S \xrightarrow{+2} U$ $P \xrightarrow{+2} R$
$T \xrightarrow{-2} R$ $P \xrightarrow{-2} N$
$Y \xrightarrow{+2} A$

89. If 'leli broon' means 'yellow hat', 'pleka froti' means 'flower garden' and 'froti mix' means 'garden salad' then which word could mean 'yellow flower'?
(a) leli froti (b) leli pleka
(c) plekafroti (d) froti broon

Ans. (b)

leli broon ⟶ yellow hat
pleka froti ⟶ flower garden
froti mix ⟶ garden salad
∴ flower ⟶ pleka
yellow ⟶ leli or broon

By option,
yellow flower ⟶ lelil pleka

90. If + is *, − is +, * is/and/is −, then $6 - 9 + 8 * \frac{3}{20}$ equal to
(a) −2 (b) 6 (c) 10 (d) 12

Ans. (c) $E = 6 - 9 + 8 * \frac{3}{20}$

By given condition,

$$E = 6 + 9 * \frac{8}{3} - 20$$
$$E = 6 + 3 * 8 - 20$$
$$E = 6 + 24 - 20$$
$$E = 10$$

91. In a certain year, there were exactly four Fridays and four Mondays in January. On what day of the week did the 20th of January fall that year?
(a) Saturday (b) Sunday
(c) Thursday (d) Tuesday

Ans. (b) Let in a month of January.

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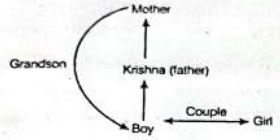
(4 times) Friday ⟶ 25, 18, 11, 4 (dates)
(4 times) Monday ⟶ 28, 21, 14, 7 (dates)
Then, required dates of Sunday,
Sunday ⟶ 27, 20, 13, 6
So, 20th January fell on Sunday.

92. Krishna said, "This girls is the wife of grandson of my mother." How is Krishna related to girl?
(a) Father
(b) Father-in-law
(c) Husband
(d) Grandfather

Ans. (b)



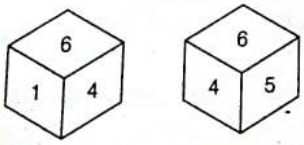
Krishna is "father-in-law" of that girl.

93. A study of native born residents in a area of Adivasis found that two-third of the children developed considerable levels of nearsightedness after starting school, while their illiterate parents and grandparents, who had no opportunity for formal schooling, showed no signs of this disability.

If the above statements are true, which of the following conclusions is most strongly supported by them?
(a) Only people who have the opportunity for formal schooling develop nearsightedness
(b) People who are illiterate do not suffer from nearsightedness
(c) The nearsightedness in the children is caused by the visual stress required by reading and other class work
(d) Only literate people are nearsighted

Ans. (c) From the statements, we clearly say that the reason behind the nearsightedness of the children is caused by the visual stress required by reading and other class work.

94. Two positions of a dice are shown below. When number 1 is on the top, what number will be at the bottom?



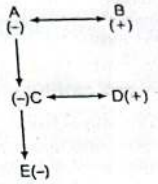
(a) 2 (b) 3
(c) 5
(d) Cannot be determined

Ans. (c) After observation of given two dice, we get the number 5 is at the bottom of the dice, when number 1 is on the top

95. There is a family party consisting of two fathers, two mothers, two sons, one father-in-law, one mother-in-law, one daughter-in-law, one grandfather, one grandmother and one grandson.

What is the minimum number of persons required, so that this is possible?
(a) 5 (b) 6
(c) 7 (d) 8

Ans. (a) Let '–' means 'male' and '+' means 'female'.



Two fathers (A, C) Two mothers (B, D)
Two sons (C, E) One father-in-law (A)
One mother-in-law (B) One daughter-in-law (D)
One grandfather (A) One grandmother (B)
Hence, there are 5 minimum number of persons. One Grandson (E).

96. Each word in parenthesis below is formed in a method. This method is used in all four examples.
SNIP (NICE) PACE
TEAR (EAST) FAST
TRAY (RARE) FIRE
POUT (OURS) CARS
Based on this method, the word in the parenthesis of CANE (?) BATS is
(a) NEAT (b) CATS (c) ANTS (d) NETS

Ans. (c) SNIP (NICE) PACE
TEAR (EAST) FAST
POUT (OURS) CARS
∴ CANE (AN + TS) BATS
Hence, ? = ANTS

97. 'College' is related to 'student' in the same way as Hospital is related to
(a) Doctor
(b) Nurse
(c) Medicine
(d) Patient

Ans. (d) In the college education is given to students, in the same way treatment is given to the 'Patient' in 'Hospital'.

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Directions (Q. Nos. 98-100) *Read the following passage carefully and answer the questions.*

Five houses lettered A, B, C, D and E are built in a row next to each other. The houses are lined up in the order A, B, C, D and E. Each of the five houses have coloured roofs and chimneys. The roof and chimney of each house must be painted as follows.

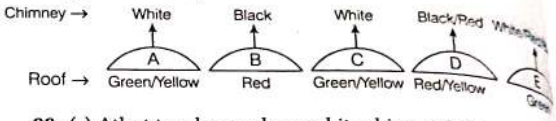
1. The roof must be painted either green, red or yellow.
2. The chimney must be painted either white, black or red.
3. No house may have the same colour chimney as the colour of roof.
4. No house may use any of the same colours that adjacent house uses.
5. House E has a green roof.
6. House B has a red roof and a black chimney.

98. Which of the following is true?
(a) Atleast two houses have black chimney
(b) Atleast two houses have red roofs
(c) Atleast two houses have white chimneys.
(d) Atleast two houses have green roofs

99. If house C has a yellow roof, then which of following must be true?
(a) House E has a white chimney
(b) House E has a black chimney
(c) House E has a red chimney
(d) House D has a red chimney

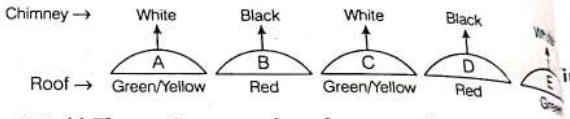
100. What is the maximum number of green roofs?
(a) 1 (b) 2 (c) 3 (d) 4

Sol (Q. Nos. 98-100)



98. (c) Atlest two houses have white chimney is true.

99. (a)



100. (c) The maximum number of green roofs are 3.

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1. All questions in this so
2. There is a total of 100 q
3. (Q. Nos. 1-50) consist
4. (Q. Nos. 51-60) consis
5. (Q. Nos. 61-80) consis
6. (Q. Nos. 81-100) cons

1. The value of t

$$2\left(1+\frac{1}{\omega}\right)\left(1+\frac{}{}\right.$$

(a) $\left[\frac{n(n+1)}{2}\right.$

(c) $\left[\frac{n(n+1)}{2}\right.$

Sol. *(c)* $2\left(1+\right.$

$= (1+\omega)(1$

$= \sum_{r=1}^{n}(r+$

$= \sum_{r=1}^{n}(r$

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Jamia Millia Islamia

Master of Computer Application (MCA)

Entrance Examination

Solved Paper 2016*

Time Allowed : 180 min **Max. Marks : 100**

Instructions for Candidates

Read the following instructions carefully.

1. All questions in this solved paper are of objective type.
2. There is a total of 100 questions.
3. (Q. Nos. 1-50) consist of Mathematics.
4. (Q. Nos. 51-60) consist of English Language and Comprehension.
5. (Q. Nos. 61-80) consist of Computer Awareness.
6. (Q. Nos. 81-100) consist of Logical and Analytical Ability.

MATHEMATICS

1. The value of the expression

$$2\left(1+\frac{1}{\omega}\right)\left(1+\frac{1}{\omega^2}\right)+3\left(2+\frac{1}{\omega}\right)\left(2+\frac{1}{\omega^2}\right)+\ldots+(n+1)\left(n+\frac{1}{\omega}\right)\left(n+\frac{1}{\omega^2}\right) \text{ is}$$

(a) $\left[\frac{n(n+1)}{2}\right]^2$ (b) $\left[\frac{n(n+1)}{2}\right]^2 - n$

(c) $\left[\frac{n(n+1)}{2}\right]^2 + n$ (d) None of these

Sol. *(c)* $2\left(1+\frac{1}{\omega}\right)\left(1+\frac{1}{\omega^2}\right)+3\left(2+\frac{1}{\omega}\right)\left(2+\frac{1}{\omega^2}\right)+\ldots+(n+1)\left(n+\frac{1}{\omega}\right)\left(n+\frac{1}{\omega^2}\right)$

$=(1+\omega)(1+\omega^2)+3(2+\omega)(2+\omega^2)+\ldots+(n+1)(n+\omega)(n+\omega^2)$

$$=\sum_{r=1}^{n}(r+1)(r+\omega)(r+\omega^2)=\sum_{r=1}^{n}(r+1)[r^2+(\omega+\omega^2)r+\omega^3]$$

$$=\sum_{r=1}^{n}(r+1)(r^2-r+1)=\sum_{r=1}^{n}(r^3+1)=\left[\frac{n(n+1)}{2}\right]^2+n$$

2. All chords of the curve $3x^2 - y^2 - 2x + 4y = 0$ which subtend a right angle at the origin pass through the fix point.

(a) (1, 2) (b) (1, – 2) (c) (– 1, 2) (d) (– 1, – 2)

Sol. *(b)* Given equation of the curve is

$$3x^2 - y^2 - 2x + 4y = 0 \quad \ldots(i)$$

Let the equation of one of the chord be

$$y = mx + c$$

$$\Rightarrow \quad \frac{y - mx}{c} = 1 \quad \ldots(ii)$$

On making Eq. (i) homogeneous, we get

$$3x^2 - y^2 + (-2x + 4y)\left(\frac{y - mx}{c}\right) = 0$$

$$\Rightarrow \quad x^2(3c + 2m) + y^2(-c + 4) - 2xy - 4mxy = 0$$

which represent a pair of straight lines passing through origin.

Since, the angle subtended is a right angle

$$\therefore \quad 3c + 2m - c + 4 = 0$$

$$c = -m + 2$$

Substituting the value of c in $y = mx + c$, we have

$$y = mx - m - 2$$

$$\Rightarrow \quad y + 2 = m(x - 1)$$

$\Rightarrow$ All such chord pass through a fixed point (1, – 2).

* Memory based

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3. The equation $4x^2 - 24xy + 11y^2 = 0$ represents

(a) two parallel lines
(b) two perpendicular lines
(c) two lines through the origin
(d) a circle

Sol. *(c)* Here, $a = 4$, $b = 11$ and $h = -12$

$\because h^2 - ab = (-12)^2 - 4 \times 11 = 100$

$\therefore$ The two lines represented by given equation will be real and distinct which represent a pair of straight line passing through the origin.

4. The value of the integral $\int \frac{\log(x+1) - \log x}{x(x+1)}\,dx$ is

(a) $-\frac{1}{2}[\log(x+1)]^2 - \frac{1}{2}(\log x)^2 + \log(x+1)\log x + C$

(b) $-[\{\log(x+1)\}^2 - (\log x)^2] + \log(x+1)\log x + C$

(c) $\left[\log\left(1+\frac{1}{x}\right)\right]^2 + C$

(d) None of the above

Sol. *(a)* Let $I = \int \frac{\log(x+1) - \log x}{x(x+1)}\,dx$

$$= \int \frac{\log\left(1+\frac{1}{x}\right)}{x(x+1)}\,dx = \int \frac{\log\left(1+\frac{1}{x}\right)}{x^2\left(1+\frac{1}{x}\right)}\,dx$$

Put $1 + \frac{1}{x} = t$

$\Rightarrow \quad -\frac{1}{x^2}dx = dt$

$\therefore \quad I = -\int \frac{\log t}{t}\,dt = -\frac{1}{2}(\log t)^2 + C$

$$= -\frac{1}{2}\left[\log\left(1+\frac{1}{x}\right)\right]^2 + C$$

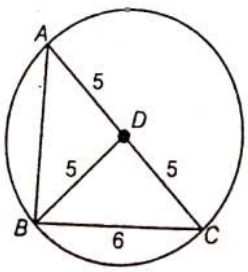
$$= -\frac{1}{2}[\log(x+1) - \log x]^2 + C$$

$$= -\frac{1}{2}\{\log(x+1)\}^2 - \frac{1}{2}(\log x)^2 + \log(x+1)\log x + C$$

5. ABC is a right angled triangle with $\angle B = 90°$, $a = 6$ cm. If the radius of the circumcircle is 5 cm. Then, the area of ΔABC is

(a) 25 cm^2
(b) 30 cm^2
(c) 36 cm^2
(d) 24 cm^2

Sol. *(d)* Let D be the centre of circumcircle $BD = 5$ cm



In ΔABC

$$AC^2 = AB^2 + BC^2$$

$\Rightarrow \quad 100 = AB^2 + 36$

$\Rightarrow \quad AB^2 = 64$

$\Rightarrow \quad AB = 8$

$\therefore$ Area of $\Delta ABC = \frac{1}{2} \times AB \times BC = \frac{1}{2} \times 8 \times 6 = 24$ cm^2

6. The value of the determinant

$$\begin{vmatrix} 1 & \cos(\alpha-\beta) & \cos\alpha \\ \cos(\alpha-\beta) & 1 & \cos\beta \\ \cos\alpha & \cos\beta & 1 \end{vmatrix}$$ is

(a) 0
(b) 1
(c) $\alpha^2 - \beta^2$
(d) $\alpha^2 + \beta^2$

Sol. *(a)* Given, $\begin{vmatrix} 1 & \cos(\alpha-\beta) & \cos\alpha \\ \cos(\alpha-\beta) & 1 & \cos\beta \\ \cos\alpha & \cos\beta & 1 \end{vmatrix}$

is symmetric determinant

$\therefore$ Its value is

$1 + 2\cos(\alpha-\beta)\cos\alpha\cos\beta - \cos^2\alpha - \cos^2\beta - \cos^2(\alpha-$

$= 1 - \cos^2\alpha - \cos^2\beta - \cos(\alpha-\beta)$

$[\cos(\alpha-\beta) - 2\cos\alpha\cos$

$= 1 - \cos^2\alpha - \cos^2\beta - \cos(\alpha-\beta)$

$[\cos(\alpha-\beta) - \cos(\alpha+\beta) - \cos(\alpha-$

$= 1 - \cos^2\alpha - \cos^2\beta + \cos(\alpha-\beta)\cos(\alpha+\beta)$

$= 1 - \cos^2\alpha - \cos^2\beta + \cos^2\alpha\cos^2\beta - \sin^2\alpha\sin^2\beta$

$= 1 - \cos^2\alpha - \cos^2\beta(1 - \cos^2\alpha) - \sin^2\alpha\sin^2\beta$

$= (1 - \cos^2\alpha)(1 - \cos^2\beta) - \sin^2\alpha\sin^2\beta$

$= \sin^2\alpha\sin^2\beta - \sin^2\alpha\sin^2\beta = 0$

7. The angle between the straight lines

$\mathbf{r} = (2-3t)\hat{\mathbf{i}} + (1+2t)\hat{\mathbf{j}} + (2+6t)\hat{\mathbf{k}}$ and

$\mathbf{r} = (1+4s)\hat{\mathbf{i}} + (2-s)\hat{\mathbf{j}} + (8s-1)\hat{\mathbf{k}}$ is

(a) $\cos^{-1}\left(\frac{\sqrt{41}}{34}\right)$
(b) $\cos^{-1}\left(\frac{21}{34}\right)$
(c) $\cos^{-1}\left(\frac{34}{63}\right)$
(d) $\cos^{-1}\left(\frac{5\sqrt{23}}{41}\right)$

Sol. *(c)* Given, lines can be rewritten as

$\mathbf{r} = 2\hat{\mathbf{i}} + \hat{\mathbf{j}} + 2\hat{\mathbf{k}} + t(-3\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 6\hat{\mathbf{k}})$ and

$\mathbf{r} = \hat{\mathbf{i}} + 2\hat{\mathbf{j}} - \hat{\mathbf{k}} + s(4\hat{\mathbf{i}} - \hat{\mathbf{j}} + 8\hat{\mathbf{k}})$

Here, $a_1 = -3, b_1 = 2, c_1 = 6$

$a_2 = 4, b_2 = -1, c_2 = 8$

$$\therefore \quad \cos\theta = \frac{a_1a_2 + b_1b_2 + c_1c_2}{\sqrt{a_1^2 + b_1^2 + c_1^2}\sqrt{a_2^2 + b_2^2 + c_2^2}}$$

$$\Rightarrow \quad \cos\theta = \frac{-3\times4 + 2\times(-1) + 6\times8}{\sqrt{9+4+36}\sqrt{16+1+64}} = \frac{34}{7\times9}$$

$$\Rightarrow \quad \theta = \cos^{-1}\left(\frac{34}{63}\right)$$

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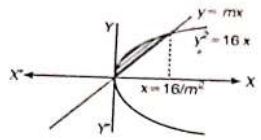
8. Area bounded by the curve $y^2 = 16x$ and line $y = mx$ is $\frac{2}{3}$, then m is equal to

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

Sol. *(b)* Area $= \int_0^{16/m^2} (\sqrt{16x} - mx)\, dx = \frac{2}{3}$



$$\Rightarrow \left[4 \cdot \frac{2}{3} x^{3/2} - \frac{mx^2}{2}\right]_0^{16/m^2} = \frac{2}{3}$$

$$\Rightarrow \frac{1}{m^3}\left[\frac{512}{3} - \frac{256}{2}\right] = \frac{2}{3}$$

$$\Rightarrow m^3 = \frac{128}{3} \times \frac{3}{2} = 64$$

$$\therefore m = 4$$

9. The quadratic equation in x such that the arithmetic mean of its roots is 5 and geometric mean of the roots is 4, is given by

(a) $x^2 + 20x + 16 = 0$ (b) $x^2 + 10x + 16 = 0$
(c) $x^2 - 10x + 16 = 0$ (d) $x^2 - 10x - 16 = 0$

Sol. *(c)* Let α and β be the roots of given equation, then

$$\alpha + \beta = 10, \quad \alpha\beta = 16$$

$\therefore$ Required equation is,

$$x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

$$\Rightarrow x^2 - 10x + 16 = 0$$

10. The solution set of the equation

$$\left[4\left(1 - \frac{1}{3} + \frac{1}{9} - \frac{1}{27} + \ldots\right)\right]^{\log_2 x} = \left[54\left(1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \ldots\right)\right]^{\log_x 2}$$ is

(a) $\left\{4, \frac{1}{4}\right\}$ (b) $\left\{2, \frac{1}{2}\right\}$ (c) $\{1, 2\}$ (d) $\left\{8, \frac{1}{8}\right\}$

Sol. *(a)* $\left[4\left(1 - \frac{1}{3} + \frac{1}{9} - \frac{1}{27} + \ldots\right)\right]^{\log_2 x} = \left[54\left(1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \ldots\right)\right]^{\log_x 2}$

$$\Rightarrow \left[4\left(\frac{1}{1 + 1/3}\right)\right]^{\log_2 x} = \left[54\left(\frac{1}{1 - 1/3}\right)\right]^{\log_x 2}$$

$$\Rightarrow \left[4\left(\frac{3}{4}\right)\right]^{\log_2 x} = \left[54 \times \frac{3}{2}\right]^{\log_x 2}$$

$$\Rightarrow 3^{\log_2 x} = 3^{4 \log_x 2}$$

$$\Rightarrow \log_2 x = 4 \log_x 2 = \frac{4}{\log_2 x}$$

$$\Rightarrow (\log_2 x)^2 = 4$$

$$\Rightarrow \log_2 x = \pm 2$$

If $\log_2 x = 2$

$$\Rightarrow x = 2^2 = 4$$ and if $\log_2 x = -2$

$$\Rightarrow x = 2^{-2} = \frac{1}{4}$$

$\therefore$ Solution set of the equation is $\left\{4, \frac{1}{4}\right\}$

11. The tangent at (1, 7) to the curve $x^2 = y - 6$ touches the circle $x^2 + y^2 + 16x + 12y + c = 0$ at

(a) (6, 7) (b) (– 6, 7) (c) (6, – 7) (d) (– 6, – 7)

Sol. *(d)* The tangent at (1, 7) to the parabola $x^2 = y - 6$ is

$x(1) = \frac{1}{2}(y + 7) - 6$ [replacing $x^2 \to xx_1$ and $2y \to y + y_1$]

$$\Rightarrow 2x = y + 7 - 12$$

$$\Rightarrow y = 2x + 5$$

which is also tangent to the circle

$$\Rightarrow x^2 + y^2 + 16x + 12y + c = 0$$

$$\Rightarrow x^2 + (2x + 5)^2 + 16x + 12(2x + 5) + c = 0$$

$$\Rightarrow 5x^2 + 60x + 85 + c = 0$$

must have equal roots $\alpha = \beta$ for above equation i.e.

$$\alpha + \beta = \frac{-60}{5}$$

$\therefore$ on $\alpha = -6$ [as $\alpha = \beta$]

$\therefore$ $x = -6$

and $y = 2x + 5 = -7$

Point of contact is $(-6, -7)$.

12. $\frac{\frac{1}{2}\cdot\frac{2}{2}}{1^3} + \frac{\frac{2}{2}\cdot\frac{3}{2}}{1^3 + 2^3} + \frac{\frac{3}{2}\cdot\frac{4}{2}}{1^3 + 2^3 + 3^3} + \ldots + n$ terms equals

(a) $\left(\frac{n}{n+1}\right)^2$ (b) $\left(\frac{n}{n+1}\right)^3$
(c) $\left(\frac{n}{n+1}\right)$ (d) $\left(\frac{1}{n+1}\right)$

Sol. *(c)* $T_n = \frac{\frac{n(n+1)}{2 \cdot 2}}{1^3 + 2^3 + 3^3 + \ldots + n^3}$

$$= \frac{\frac{n(n+1)}{4}}{\left(\frac{n(n+1)}{2}\right)^2} = \frac{1}{n(n+1)} = \frac{1}{n} - \frac{1}{n+1}$$

$$\therefore T_n = \Sigma\left(\frac{1}{n} - \frac{1}{n+1}\right) = \left(1 - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) + \ldots + \left(\frac{1}{n} - \frac{1}{n+1}\right)$$

$$= 1 - \frac{1}{n+1} = \frac{n}{n+1}$$

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13. The domain of the real valued function $f(x) = \sqrt{1-2x} + 2\sin^{-1}\left(\frac{3x-1}{2}\right)$ is

(a) $\left[-\frac{1}{3}, 1\right]$ (b) $\left[\frac{1}{2}, 1\right]$ (c) $\left[-\frac{1}{2}, \frac{1}{3}\right]$ (d) $\left[-\frac{1}{3}, \frac{1}{2}\right]$

Sol. *(d)* The given function is

$$f(x) = \sqrt{1-2x} + 2\sin^{-1}\left(\frac{3x-1}{2}\right)$$

For domain of $f(x)$, $1-2x \geq 0$ and $-1 \leq \frac{3x-1}{2} \leq 1$

$$\Rightarrow \quad x \leq \frac{1}{2} \text{ and } -2 \leq 3x-1 \leq 2$$

$$\Rightarrow \quad x \leq \frac{1}{2} \text{ and } -\frac{1}{3} \leq x \leq 1$$

$\therefore$ Domain of $f(x) = \left[-\frac{1}{3}, \frac{1}{2}\right]$

14. If the vector $\mathbf{a} + \lambda\mathbf{b} + 3\mathbf{c}$, $-2\mathbf{a} + 3\mathbf{b} - 4\mathbf{c}$ and $\mathbf{a} - 3\mathbf{b} + 5\mathbf{c}$ are coplanar, then the value of λ is

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

Sol. *(d)* Since, given vectors are coplanar so it can be written as

$$\mathbf{a} + \lambda\mathbf{b} + 3\mathbf{c} = x(-2\mathbf{a} + 3\mathbf{b} - 4\mathbf{c}) + y(\mathbf{a} - 3\mathbf{b} + 5\mathbf{c})$$

On comparing the coefficient of $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ on both sides, we get $-2x + y = 1$, $3x - 3y = \lambda$ and $-4x + 5y = 3$

On solving above equations, we get

$$x = -\frac{1}{3}, y = \frac{1}{3}, \lambda = -2$$

15. The centroid of the triangle formed by the pair of straight line $12x^2 - 20xy + 7y^2 = 0$ and the line $2x - 3y + 4 = 0$ is

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

Sol. *(c)* The separate equation of pair of straight lines of $12x^2 - 20xy + 7y^2 = 0$ are $6x - 7y = 0$ and $2x - y = 0$

Thus, equation of sides of triangle are

$$6x - 7y = 0 \quad \ldots(i)$$

$$2x - y = 0 \quad \ldots(ii)$$

and $$2x - 3y + 4 = 0 \quad \ldots(iii)$$

On solving these equations, we get the vertices of a triangle $A(0, 0)$, $B(1, 2)$ and $C(7, 6)$

$\therefore$ Centroid of triangle is

$$\left(\frac{0+1+7}{3}, \frac{0+2+6}{3}\right) = \left(\frac{8}{3}, \frac{8}{3}\right)$$

16. If $f : R \to R$ is defined by $f(x) = x^2 - 6x - 14$, then $f^{-1}(2)$ equal to

(a) $\{2, 8\}$ (b) $\{-2, 8\}$
(c) $\{-2, -8\}$ (d) $\{2, -8\}$

Sol. *(b)* Let $y = x^2 - 6x - 14$

$$\Rightarrow \quad y = (x-3)^2 - 23$$

$$\Rightarrow \quad x = \pm\sqrt{y+23} + 3$$

$$\Rightarrow \quad f^{-1}(x) = \pm\sqrt{x+23} + 3$$

$$\therefore \quad f^{-1}(2) = \pm\sqrt{25} + 3 = -2, 8$$

17. If $2A + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix}$ and $A + 2B = \begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix}$, then B is

(a) $\begin{bmatrix} 8 & -1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 8 & 1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$
(c) $\begin{bmatrix} 8 & 1 & -2 \\ -1 & 10 & -1 \end{bmatrix}$ (d) $\begin{bmatrix} 8 & 1 & 2 \\ 1 & 10 & 1 \end{bmatrix}$

Sol. *(b)* We have,

$$2A + 3B = \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix}$$

and $$A + 2B = \begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix}$$

On solving Eqs. (i) and (ii), we get

$$B = 2\begin{bmatrix} 5 & 0 & 3 \\ 1 & 6 & 2 \end{bmatrix} - \begin{bmatrix} 2 & -1 & 4 \\ 3 & 2 & 5 \end{bmatrix} = \begin{bmatrix} 8 & 1 & 2 \\ -1 & 10 & -1 \end{bmatrix}$$

18. If in the expansion of $\left(3x - \frac{2}{x^2}\right)^{15}$, rth term independent of x, then value of r is

(a) 6 (b) 10
(c) 9 (d) 12

Sol. *(a)* rth term in the expansion of $\left(3x - \frac{2}{x^2}\right)^{15}$ is

$$T_r = {}^{15}C_{r-1}(3x)^{15-r+1}\left(\frac{-2}{x^2}\right)^{r-1}$$

$$= {}^{15}C_{r-1}(3)^{15-r+1}(-2)^{r-1}(x)^{15-3r+1}$$

For the term independent of x, put

$$15 - 3r + 3 = 0 \Rightarrow r = 6$$

19. The value of $\lim_{x \to 0}\left(\frac{\int_0^{x^2} \sec^2 t\, dt}{x \sin x}\right)$ is

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

Sol. *(c)* $\lim_{x \to 0}\left(\frac{\int_0^{x^2} \sec^2 t\, dt}{x \sin x}\right) = \lim_{x \to 0} \frac{\sec^2 x^2 \, 2x}{\sin x + x\cos x}$

$$= \lim_{x \to 0} \frac{2x \cdot \sec^2 x^2}{x\left(\frac{\sin x}{x} + \cos x\right)}$$

$$= \frac{2 \times 1}{1+1} = 1 \qquad \left[\because \lim_{x \to 0} \frac{\sin x}{x}\right.$$

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20. Form of the differential equation of all family of lines $y = mx + \frac{4}{m}$ by eliminating the arbitrary constant m is

(a) $\frac{d^2y}{dx^2} = 0$ (b) $x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} + 4 = 0$

(c) $x\left(\frac{dy}{dx}\right)^2 + y\left(\frac{dy}{dx}\right) + 4 = 0$ (d) $\frac{dy}{dx} = 0$

Sol. *(b)* $y = mx + \frac{4}{m}$ ...(i)

$\therefore \quad \frac{dy}{dx} = m$

From Eq. (i), we get $y = x\left(\frac{dy}{dx}\right) + \frac{4}{\left(\frac{dy}{dx}\right)}$

$\Rightarrow \quad y\left(\frac{dy}{dx}\right) = x\left(\frac{dy}{dx}\right)^2 + 4$

$\Rightarrow \quad x\left(\frac{dy}{dx}\right)^2 - y\frac{dy}{dx} + 4 = 0$

which is the required differential equation.

21. A dictionary is printed consisting of 7 letters words only that can be made with a letters of the word CRICKET. If the words are printed at the alphabetical order as in an ordinary dictionary, then the number of words before the word CRICKET is

(a) 530 (b) 480 (c) 531 (d) 487

Sol. *(a)* Given word is CRICKET

Total number of letters are 7 out of which two letters 'C' are count as one

$\therefore$ Required number of ways of words before the word CRICKET

$= 5! \times 4 + 2 \times 4! + 2! = 480 + 48 + 2 = 530$

22. If a system of the equations

$(\alpha+1)^3 x + (\alpha+2)^3 y - (\alpha+3)^3 = 0,$

$(\alpha+1)x + (\alpha+2)y - (\alpha+3) = 0$ and $x + y - 1 = 0$ is consistent, then the value of α is

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

Sol. *(d)* Given equations are

$(\alpha+1)^3 x + (\alpha+2)^3 y - (\alpha+3)^3 = 0$

$(\alpha+1)x + (\alpha+2)y - (\alpha+3) = 0$

and $x + y - 1 = 0$

Since, this system of equation is consistent

$\therefore \begin{vmatrix} (\alpha+1)^3 & (\alpha+2)^3 & -(\alpha+3)^3 \\ (\alpha+1) & (\alpha+2) & -(\alpha+3) \\ 1 & 1 & -1 \end{vmatrix} = 0$

Applying $C_2 \to C_2 - C_1$ and $C_3 \to C_3 + C_1$, we get

$\begin{vmatrix} (\alpha+1)^3 & (\alpha+2)^3 - (\alpha+1)^3 & (\alpha+1)^3 - (\alpha+3)^3 \\ (\alpha+1) & (\alpha+2) - (\alpha+1) & -(\alpha+3) + (\alpha+1) \\ 1 & 0 & 0 \end{vmatrix} = 0$

$\Rightarrow \quad \begin{vmatrix} (\alpha+1)^3 & 3\alpha^2 + 9\alpha + 7 & -6\alpha^2 - 24\alpha - 26 \\ \alpha+1 & 1 & -2 \\ 1 & 0 & 0 \end{vmatrix} = 0$

$\Rightarrow \quad -2(3\alpha^2 + 9\alpha + 7) + 6\alpha^2 + 24\alpha + 26 = 0$

$\Rightarrow \quad 6\alpha + 12 = 0 \Rightarrow \alpha = -2$

23. If a, b and c be in arithmetic progression than the value of $(a + 2b - c)(2b + c - a)(a + 2b - c)$ is

(a) $16abc$ (b) $4abc$ (c) $8abc$ (d) $3abc$

Sol. *(a)* $2b = a + c$

Now, $(a + 2b - c)(2b + c - a)(a + 2b + c)$

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

$= 2a \cdot 2c \cdot 4b = 16abc$

24. $f(x) = x^3 - 6x^2 - 36x + 2$ is decreasing function, then $x \in$ is equal to

(a) $(6, \infty)$ (b) $(-\infty, -2)$

(c) $(-2, 6)$ (d) None of these

Sol. *(c)* Given, $f(x) = x^3 - 6x^2 - 36x + 2$

$f'(x) = 3x^2 - 12x - 36$

For decreasing $f'(x) < 0$

$\Rightarrow \quad 3(x^2 - 4x - 12) < 0$

$\Rightarrow \quad (x - 6)(x + 2) < 0$

$\Rightarrow \quad -2 < x < 6$

$\Rightarrow \quad x \in (-2, 6)$

25. Sum of n terms of the series $\frac{1}{2} + \frac{3}{4} + \frac{7}{8} + \frac{15}{8} + \ldots$ is

(a) $2^n - 1$ (b) $2^{-n}(n-1)$

(c) $2^n(n-1) + 1$ (d) $2^{-n} + n - 1$

Sol. *(a)* Let $S = 1 + 3 + 7 + 15 + \ldots + T_n$

$\Rightarrow \quad \frac{S}{0} = \frac{1 + 3 + 7 + \ldots + T_{n-1} + T_n}{1 + 2 + 4 + 8 + \ldots - T_n}$

$\Rightarrow \quad T_n = 1 + 2 + 4 + \ldots n \text{ terms} = \frac{(2^n - 1)}{2 - 1} = 2^n - 1$

26. $\int_0^1 \log\left\{\sin\left(\frac{\pi x}{2}\right)\right\} dx$ is equal to

(a) $-\frac{\pi}{2}\log 2$ (b) $-\log 2$

(c) $\frac{-2}{\pi}\log 2$ (d) $\frac{\pi}{2}\log 2$

Sol. *(b)* Let $I = \int_0^1 \log\left\{\sin\left(\frac{\pi x}{2}\right)\right\} dx$

Put $\frac{\pi x}{2} = \theta$

$\Rightarrow \quad dx = \frac{2}{\pi} d\theta$

$\therefore \quad I = \frac{2}{\pi}\int_0^{\pi/2} \log\sin\theta \, d\theta$

$= \frac{2}{\pi}\left(-\frac{\pi}{2}\log 2\right) = -\log 2$

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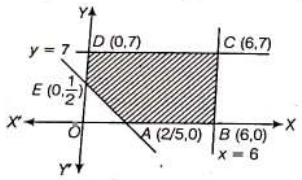
27. The average marks of boys in a class is 52 and that of girls is 42. The average marks of boys and girls combined is 50. The percentage of boys in the class is
(a) 40% (b) 20% (c) 80% (d) 60%

Sol. *(c)* Let the number of boys and girls be x and y.
Then, the total marks obtain by all boys and girls $= 52x + 42y$
$\therefore \quad 52x + 42y = 50(x + y)$
$\Rightarrow \quad 2x = 8y$
$\Rightarrow \quad x = 4y$
$\because$ Total number of students in the class $= x + y = 5y$
$\therefore$ Required percentage of boys $= \frac{4y}{5y} \times 100 = 80\%$

28. If given constraints are $5x - 14y \geq 2$, $x \leq 6$, $y \leq 7$, then the maximum value of the function
(a) 13 (b) 14 (c) 15 (d) 20

Sol. *(d)* Feasible region is $ABCDEA$ and $z = x + 2y$



At point $A\left(\frac{2}{5}, 0\right)$, $z = \frac{2}{5} + 0 = \frac{2}{5}$
At point $B(6, 0)$, $z = 6 + 0 = 6$
At point $C(6, 7)$, $z = 6 + 14 = 20$
At point $D(0, 7)$, $z = 0 + 2(7) = 14$
At point $E\left(0, \frac{1}{2}\right)$, $z = 0 + 2 \times \frac{1}{2} = 1$
So, the maximum value of z is 20.

29. In a ΔABC, $\cos\left(\frac{B + 2C + 3A}{2}\right) + \cos\left(\frac{A - B}{2}\right)$ is equal to
(a) -1 (b) 0 (c) 1 (d) 2

Sol. *(b)* In a ΔABC

$$A + B + C = \pi$$
$$\therefore \cos\left(\frac{B + 2C + 3A}{2}\right) + \cos\left(\frac{A - B}{2}\right)$$
$$= 2\cos\left(\frac{2C + 4A}{4}\right)\cos\left(\frac{2A + 2B + 2C}{4}\right)$$
$$= 2\cos\left(\frac{C + 2A}{2}\right)\cos\left(\frac{\pi}{2}\right) = 0$$

30. If $\mathbf{a} = \hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$ and $\mathbf{b} = \hat{\mathbf{i}} \times (\mathbf{a} \times \hat{\mathbf{i}}) + \hat{\mathbf{j}} \times (\mathbf{a} \times \hat{\mathbf{j}}) + \hat{\mathbf{k}} \times (\mathbf{a} \times \hat{\mathbf{k}})$, then length of $\mathbf{b}$ is equal to
(a) $\sqrt{12}$ (b) $2\sqrt{12}$ (c) $3\sqrt{14}$ (d) $2\sqrt{14}$

Sol. *(d)* We have, $\mathbf{a} = \hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$
$\therefore \quad \mathbf{b} = \hat{\mathbf{i}} \times (\mathbf{a} \times \hat{\mathbf{i}}) + \hat{\mathbf{j}} \times (\mathbf{a} \times \hat{\mathbf{j}}) + \hat{\mathbf{k}} \times (\mathbf{a} \times \hat{\mathbf{k}})$
Now, $\hat{\mathbf{i}} \times (\mathbf{a} \times \hat{\mathbf{i}}) = (\hat{\mathbf{i}} \cdot \hat{\mathbf{i}})\mathbf{a} - (\hat{\mathbf{i}} \cdot \mathbf{a})\hat{\mathbf{i}}$
$= 1(\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}) - 0\hat{\mathbf{k}} = 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}$
Similarly $\hat{\mathbf{j}} \times (\mathbf{a} \times \hat{\mathbf{j}}) = \hat{\mathbf{j}} + 3\hat{\mathbf{k}}$
and $\hat{\mathbf{k}} \times (\mathbf{a} \times \hat{\mathbf{k}}) = \hat{\mathbf{i}} + 2\hat{\mathbf{j}}$
From Eq. (i), we get
$\mathbf{b} = 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}} + \hat{\mathbf{i}} + 3\hat{\mathbf{k}} + \hat{\mathbf{i}} + 2\hat{\mathbf{j}} = 2\hat{\mathbf{i}} + 4\hat{\mathbf{j}} + 6\hat{\mathbf{k}}$
$\Rightarrow \quad |\mathbf{b}| = \sqrt{4 + 16 + 36} = 2\sqrt{14}$

31. If x satisfies the inequations $2x - 7 < 11, 3x + 4 <$ then x lies in the interval
(a) $(-\infty, 3)$ (b) $(-\infty, 2)$ (c) $(-\infty, -3)$ (d) $(-\infty,$

Sol. *(c)* Given, $2x - 7 < 11, 3x + 4 < -5$
$\Rightarrow \quad x < 9,$
$\quad x < -8$
$\Rightarrow \quad x < -3$
So, x lies in the interval $(-\infty, -3)$

32. In a class of 30 pupils 12 take needles works, 16 Physics and 18 take History. If all the 30 stude take atleast one subject and no one takes all th then the number of pupils taking 2 subjects is
(a) 16 (b) 6
(c) 8 (d) 20

Sol. *(a)* Given, $n(N) = 12, n(P) = 16, n(H) = 18$
$n(N \cup P \cup H) = 30$
and $n(N \cap P \cap H) = 0$
Now, $n(N \cup P \cup H) = n(N) + n(P) + n(H)$
$- n(N \cap P) - n(P \cap H) - n(H \cap N) + n(N \cap P$
$\Rightarrow \quad n(N \cap P) + n(P \cap H) + n(H \cap N)$
$= (12 + 16 + 18) - 30 = 46 - 30 = 16$

33. If $\sec^{-1}\sqrt{1 + x^2} + \text{cosec}^{-1}\frac{\sqrt{1 + y^2}}{y} + \cot^{-1}\frac{1}{z} = \pi,$ $x + y + z$ is equal to
(a) xyz (b) 2xyz
(c) xyz^2 (d) x^2yz

Sol. *(a)* Given, $\sec^{-1}\sqrt{1 + x^2} + \text{cosec}^{-1}\frac{\sqrt{1 + y^2}}{y} + \cot^{-1}\frac{1}{z} = \pi$
$\therefore \quad \tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \pi$
$\Rightarrow \quad \tan^{-1}\left(\frac{x + y + z - xyz}{1 - xy - yz - zx}\right) = \pi$
$\Rightarrow \quad x + y + z = \pi$

34. The general value of θ satisfying the equa $2\sin^2\theta - 3\sin\theta - 2 = 0$ is
(a) $n\pi + (-1)^{n+1}\frac{\pi}{6}$ (b) $n\pi + (-1)^n\frac{\pi}{2}$
(c) $n\pi + (-1)^n\frac{5\pi}{6}$ (d) $n\pi + (-1)^n\frac{7\pi}{6}$

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Sol. *(a)* $2\sin^2\theta - 3\sin\theta - 2 = 0$

$\Rightarrow \quad (2\sin\theta + 1)(\sin\theta - 2) = 0$

$\Rightarrow \quad \sin\theta = -\frac{1}{2} \quad [\because \sin\theta \neq 2]$

$\Rightarrow \quad \sin\theta = \sin\left(-\frac{\pi}{6}\right)$

$\Rightarrow \quad \theta = n\pi + (-1)^n\left(-\frac{\pi}{6}\right)$

$\Rightarrow \quad \theta = n\pi + (-1)^{n+1}\frac{\pi}{6}$

35. The distance between the planes $2x - 2y + z + 3 = 0$ and $4x - 4y + 2z + 5 = 0$ is

(a) 3 (b) 6 (c) $\frac{1}{6}$ (d) $\frac{1}{3}$

Sol. *(c)* Since, the planes $2x - 2y + z + 3 = 0$ and $2x - 2y + z + \frac{5}{2} = 0$ are parallel to each other,

$\therefore$ Distance between them

$$= \frac{|d_2 - d_1|}{\sqrt{a_1^2 + b_1^2 + c_1^2}} = \frac{\left|\frac{5}{2} - 3\right|}{\sqrt{4+4+1}} = \frac{1}{6}$$

36. For any complex number z, the minimum value of $|z| + |z - 1|$ is

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

Sol. *(b)* $\because \quad |-z| = |z|$ and $|z_1 + z_2| \leq |z_1| + |z_2|$

Now, $|z| + |z - 1| = |z| + |1 - z|$

$\geq |z + (1 - z)| = 1$

37. The solution of the differential equation $(1 + y^2) + (x - e^{\tan^{-1} y})\frac{dy}{dx} = 0$ is

(a) $2xe^{\tan^{-1} y} = e^{2\tan^{-1} y} + C$ (b) $xe^{\tan^{-1} y} = \tan^{-1} y + C$

(c) $xe^{2\tan^{-1} y} = e^{\tan^{-1} y} + C$ (d) $(x - 2) = Ce^{-\tan^{-1} y}$

Sol. *(a)* Given, differential equation is

$$(1 + y^2) + (x - e^{\tan^{-1} y})\frac{dy}{dx} = 0$$

$$\Rightarrow \quad (1 + y^2)\frac{dx}{dy} = -x + e^{\tan^{-1} y}$$

$$\Rightarrow \quad \frac{dx}{dy} + \frac{x}{1 + y^2} = \frac{e^{\tan^{-1} y}}{1 + y^2}$$

which is a linear differential equation

Here, $P = \frac{1}{1 + y^2}, Q = \frac{e^{\tan^{-1} y}}{1 + y^2}$

$$\Rightarrow \quad \text{IF} = e^{\int P\,dy} = e^{\int \frac{1}{1+y^2}dy} = e^{\tan^{-1} y}$$

$\therefore$ Solution will be $x \cdot \text{IF} = \int Q \cdot \text{IF}\,dy + C$

$$\Rightarrow \quad xe^{\tan^{-1} y} = \int \frac{e^{\tan^{-1} y}}{1 + y^2} \cdot e^{\tan^{-1} y} + \frac{C}{2}$$

$$\Rightarrow \quad xe^{\tan^{-1} y} = \frac{e^{2\tan^{-1} y}}{2} + \frac{C}{2}$$

$$\therefore \quad 2xe^{\tan^{-1} y} = e^{2\tan^{-1} y} + C$$

38. The angle between the vectors $\mathbf{a} + \mathbf{b}$ and $\mathbf{a} - \mathbf{b}$ when $\mathbf{a} = (1, 1, 4)$ and $\mathbf{b} = (1, -1, 4)$ is

(a) 45° (b) 90° (c) 15° (d) 30°

Sol. *(b)* Here, $|\mathbf{a}| = \sqrt{1 + 1 + (4)^2} = 3\sqrt{2}$

and $|\mathbf{b}| = \sqrt{1 + (-1)^2 + (4)^2} = 3\sqrt{2}$

$\therefore \quad |\mathbf{a}| = |\mathbf{b}|$

Now, $(\mathbf{a} + \mathbf{b}) \cdot (\mathbf{a} - \mathbf{b}) = |\mathbf{a}|^2 - |\mathbf{b}|^2 = 0$

Hence, angle between them is 90°.

39. If $\sin^{-1}\left(\frac{x}{5}\right) + \text{cosec}^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then the value of x is

(a) 1 (b) 3 (c) 4 (d) 5

Sol. *(b)* Given, $\sin^{-1}\left(\frac{x}{5}\right) + \text{cosec}^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$

$$\Rightarrow \quad \sin^{-1}\left(\frac{x}{5}\right) + \sin^{-1}\left(\frac{4}{5}\right) = \frac{\pi}{2}$$

$$\Rightarrow \quad \sin^{-1}\left(\frac{x}{5}\right) = \cos^{-1}\left(\frac{4}{5}\right)$$

$$\Rightarrow \quad \sin^{-1}\left(\frac{x}{5}\right) = \sin^{-1}\left(\frac{3}{5}\right)$$

$$\Rightarrow \quad x = 3$$

40. If $f : R \to R$ is defined by

$$f(x) = \begin{cases} \frac{2\sin x - \sin 2x}{2x\cos x}, & \text{if } x \neq 0 \\ a, & \text{if } x = 0 \end{cases}$$

then the value of a, so that f is continuous at 0, is

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

Sol. *(d)* Given,

$$f(x) = \begin{cases} \frac{2\sin x - \sin 2x}{2x\cos x}, & \text{if } x \neq 0 \\ a, & \text{if } x = 0 \end{cases}$$

Now, $\lim_{x \to 0} f(x) = \lim_{x \to 0} \frac{2\sin x - \sin 2x}{2x\cos x}$ $\left[\frac{0}{0} \text{ form}\right]$

$$= \lim_{x \to 0} \frac{2\cos x - 2\cos 2x}{2(\cos x - x\sin x)}$$

$$= \lim_{x \to 0} \frac{2 - 2}{2(1 - 0)} = 0$$

Since, $f(x)$ is continuous at $x = 0$

$\therefore \quad f(0) = \lim_{x \to 0} f(x)$

$\Rightarrow \quad a = 0$

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41. Let R be the relation on the set R of all real numbers defined by aRb if $|a-b| \le 1$, then R is

(a) reflexive and symmetric (b) symmetric only
(c) transitive only (d) anti-symmetric only

Sol. *(a)* aRa if $|a-b| = 0 < 1$, which is true

$\therefore$ It is reflexive.

Now, aRb, $|a-b| \le 1$

$\Rightarrow$ $|b-a| \le 1 \Rightarrow aRb \Rightarrow bRa$

$\therefore$ It is symmetric.

42. The rate of change of the surface area of the sphere of radius r when the radius is increasing at the rate of 2 cm/s is proportional to

(a) $\frac{1}{r^2}$ (b) $\frac{1}{r}$ (c) r^2 (d) r

Sol. *(c)* Let surface area of sphere, $S = \frac{4}{3}\pi r^3$

$$\Rightarrow \quad \frac{dS}{dt} = 4\pi r^2 \frac{dr}{dt} \Rightarrow \frac{dS}{dt} = 4\pi r^2(2) = 8\pi r^2$$

$$\therefore \quad \frac{dS}{dt} \propto r^2$$

43. $\int \frac{\sqrt{\tan x}}{\sin x \cdot \cos x}\, dx$ is equal to

(a) $2\sqrt{\cot x} + C$ (b) $\sqrt{\cot x} + C$
(c) $\sqrt{\tan x} + C$ (d) $2\sqrt{\tan x} + C$

Sol. *(d)* Divide numerator and denominator by $\cos^2 x$, we get

$$I = \int \frac{\sec^2 x\, dx}{\sqrt{\tan x}}$$

Put $\tan x = t$

$$\Rightarrow \quad \sec^2 x\, dx = dt$$

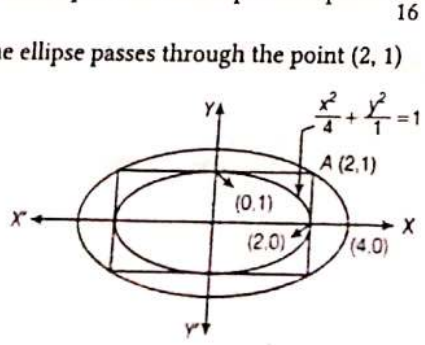
$$\therefore \quad I = \int \frac{1}{\sqrt{t}}\, dt = 2\sqrt{t} = 2\sqrt{\tan x} + C$$

44. The ellipse $x^2 + 4y^2 = 4$ is inscribed in a rectangle aligned with the coordinate axes, which is turn in inscribed in another ellipse that passes through the point (4, 0). Then, the equation of the ellipse is

(a) $x^2 + 12y^2 = 16$ (b) $4x^2 + 48y^2 = 48$
(c) $4x^2 + 64y^2 = 48$ (d) $x^2 + 16y^2 = 16$

Sol. *(a)* Let the equation of the required ellipse be $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$

But the ellipse passes through the point (2, 1)



$$\Rightarrow \quad \frac{1}{4} + \frac{1}{b^2} = 1$$

$$\Rightarrow \quad \frac{1}{b^2} = \frac{3}{4}$$

$$\Rightarrow \quad b^2 = \frac{4}{3}$$

Hence, equation is $\frac{x^2}{16} + \frac{3y^2}{4} = 1$

$$\Rightarrow \quad x^2 + 12y^2 = 16$$

45. $\int \frac{dx}{\cos x + \sqrt{3}\sin x}$ is equal to

(a) $\frac{1}{2}\log \tan\left(\frac{x}{2} + \frac{\pi}{12}\right) + C$ (b) $\frac{1}{2}\log \tan\left(\frac{x}{2} - \frac{\pi}{12}\right) + C$
(c) $\log \tan\left(\frac{x}{2} + \frac{\pi}{12}\right) + C$ (d) $\log \tan\left(\frac{x}{2} - \frac{\pi}{12}\right) + C$

Sol. *(a)* Let $I = \int \frac{dx}{2\left(\frac{1}{2}\cos x + \frac{\sqrt{3}}{2}\sin x\right)}$

$$= \frac{1}{2}\int \sec\left(x - \frac{\pi}{3}\right) dx = \frac{1}{2}\log \tan\left(\frac{x}{2} - \frac{\pi}{6} + \frac{\pi}{4}\right) + C$$

$$= \frac{1}{2}\log \tan\left(\frac{x}{2} + \frac{\pi}{12}\right) + C$$

46. Equation of the circle which of the $x^2 + y^2 - 2x = 0$ in the line $x + y = 2$

(a) $x^2 + y^2 - 2x + 4y + 3 = 0$
(b) $2(x^2 + y^2) + x + y + 1 = 0$
(c) $x^2 + y^2 - 4x - 2y + 4 = 0$
(d) None of the above

Sol. *(c)* Centre and radius of the given circle are (1, 0) a respectively.

Let the centre of the image circle be (x_1, y_1).

Hence, (x_1, y_1) be the image of the point (1, 0) w.r.t. the $x + y = 2$, then

$$\frac{x_1 - 1}{1} = \frac{y_1 - 0}{1} = \frac{-2[1(1) + 1(0) - 2]}{(1)^2 + (1)^2}$$

$$\Rightarrow \quad \frac{x_1 - 1}{1} = \frac{y_1}{1} = 1$$

$$\Rightarrow \quad x_1 = 2,\ y_1 = 1$$

$\therefore$ Equation of image circle is $(x-2)^2 + (y-1)^2 = 1^2$

$$\Rightarrow \quad x^2 + y^2 - 4x - 2y + 4 = 0$$

47. If $2\sec 2\alpha = \tan\beta + \cot\beta$, then one of the value $\alpha + \beta$ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$
(c) π (d) $n\pi - \frac{\pi}{4}, n \in I$

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Sol. *(a)* Given, $2\sec 2\alpha$

$\Rightarrow$ $2\sec 2\alpha$

$\therefore$ $\sec 2\alpha$

Taking +ve sign,

$\Rightarrow$

For $n = 0, \alpha +$

48. For any two is logically
(a) p

Sol. *(b)*

49. The so
$xdy - yd$
(a) $y - \sqrt{x}$
(c) $y + \sqrt{}$

Sol. *(b)* Given
Put

Directions
It is a equipn produc techno econo negle which than labou
A ch chan colla

51. W
(a)
(b)
(c)
(d)

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Sol. *(a)* Given, $2\sec 2\alpha = \tan\beta + \cot\beta$

$$\Rightarrow \quad 2\sec 2\alpha = \frac{1+\tan^2\beta}{\tan\beta} = \frac{\sec^2\beta}{\tan\beta}$$

$$= \frac{2}{2\cos\beta\sin\beta} = 2\operatorname{cosec} 2\beta$$

$$\therefore \quad \sec 2\alpha = \sec\left(\frac{\pi}{2} - 2\beta\right) \Rightarrow 2\alpha = 2n\pi \pm \left(\frac{\pi}{2} - 2\beta\right)$$

Taking +ve sign, we have

$$2(\alpha+\beta) = 2n\pi + \frac{\pi}{2}$$

$$\Rightarrow \quad \alpha + \beta = n\pi + \frac{\pi}{4}, n \in I$$

For $n = 0, \alpha + \beta = \frac{\pi}{4}$

48. For any two statements p and q, $\sim(p \vee q) \vee (\sim p \wedge q)$ is logically equivalent to

(a) p (b) $\sim p$ (c) q (d) $\sim q$

Sol. *(b)*

$$\sim(p \vee q) \vee (\sim p \wedge q)$$
$$\equiv (\sim p \wedge \sim q) \vee (\sim p \wedge q)$$
$$\equiv \sim p \wedge (\sim q \vee q) = \sim p$$

49. The solution of the differential equation $xdy - ydx - \sqrt{x^2+y^2}\,dx = 0$ is

(a) $y - \sqrt{x^2+y^2} = cx^2$ (b) $y + \sqrt{x^2+y^2} = cx^2$

(c) $y + \sqrt{x^2+y^2} = cy^2$ (d) $x - \sqrt{x^2+y^2} = cy^2$

Sol. *(b)* Given, $\frac{dy}{dx} = \frac{\sqrt{x^2+y^2}+y}{x}$

Put $y = vx$

$$\Rightarrow \quad \frac{dy}{dx} = v + x\frac{dv}{dx}$$

$$\therefore \quad v + x\frac{dv}{dx} = \frac{\sqrt{x^2+v^2x^2}+vx}{x}$$

$$\Rightarrow \quad \frac{dv}{\sqrt{1+v^2}} = \frac{dx}{x}$$

$$\Rightarrow \quad \log(v + \sqrt{1+v^2}) = \log x + \log c \qquad \text{[integrating]}$$

$$\Rightarrow \quad \log\left(\frac{y}{x} + \sqrt{1+\frac{y^2}{x^2}}\right) = \log cx$$

$$\Rightarrow \quad y + \sqrt{x^2+y^2} = cx^2$$

50. If A and B are independent events of a random experiment such that $P(A \cap B) = \frac{1}{6}$ and $P(\bar{A} \cap \bar{B}) = \frac{1}{3}$, then $P(A)$ is equal to

(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{5}{7}$ (d) $\frac{2}{3}$

Sol. *(b)* Since, A and B are independent events.

$$\therefore \quad P(A)P(B) = \frac{1}{6} \text{ and } P(\bar{A})P(\bar{B}) = \frac{1}{3}$$

$$\Rightarrow \quad [1 - P(A)][1 - P(B)] = \frac{1}{3}$$

$$\Rightarrow \quad 1 - [P(A) + P(B)] + P(A)P(B) = \frac{1}{3}$$

$$\Rightarrow \quad 1 + \frac{1}{6} - \frac{1}{3} = P(A) + P(B)$$

$$\Rightarrow \quad P(A) + P(B) = \frac{5}{6}$$

$$\Rightarrow \quad P(A) = \frac{1}{2}, P(B) = \frac{1}{3} \text{ or } P(A) = \frac{1}{3}, P(B) = \frac{1}{2}$$

ENGLISH LANGUAGE AND COMPREHENSION

Directions (Q. Nos. 51-54) *Read the given passage carefully and answer the questions given below.*

It is a commonly held belief that quality and productivity are a function of technology or a set of new equipment. No doubt these are essential, but they alone are not sufficient for bringing about improvements in productivity or quality. It is the men and women behind the machines and the people who manage the technology who are critical in bringing about these improvements. It has been a strange paradox of India's economic development that even though people are our most abundant resource, they have so far either been neglected or treated as liabilities rather than as assets. Part of the reason for this has been outdated labour laws which have been a deterrent for industrialists and employers, leading them to establish capital-intensive rather than labour-intensive operations. The other reason has been a confrontationist attitude, both on the part of labour as well as managements.

A change must come about in both these factors, outside representation and leadership of unions etc need to change. At the same time, the attitude of confrontation must change to one of cooperation and active collaboration.

51. Which of the following arguments has been emphasised in the paragraph?

(a) Only technology or a new set of equipment can improve quality and productivity

(b) Only management behind any type of machines can improve quality and productivity

(c) By managing the new technology, labour can bring about improvements in quality and productivity

(d) Indian labour and management is neither quality nor productivity conscious

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Sol. *(c)* If we are able to teach the labour new technology, improvement in quality and productivity can be brought about.

52. India's strange contradiction of development is
(a) people are resourceful but new equipment is not given to them
(b) people are resourceful but they are neglected
(c) labour is not earnest and therefore it is no longer a liability
(d) labour is inefficient but still it is pampered

Sol. *(b)* It is an irony that people of India are very resourceful but they are most often neglected.

53. Capital-intensive operations can lead to
(a) strict labour laws (b) new labour laws
(c) too many labour laws (d) irrelevant labour laws

Sol. *(d)* Irrelevant labour laws. A company's capital expenses are generally judged in relation to its labour expenses, which can lead to irregular labour laws.

54. Which of the following statements on confrontation between labour and management is false?
(a) Too much government interference between labour and management
(b) Conflicting attitude of labour and management
(c) Establishment of capital-intensive industries
(d) Neglect of labour-intensive operations

Sol. *(a)* Too much governmental interference between labour and management.

Directions (Q. Nos. 55-56) *Find out whether there is any grammatical error in the sentences given below. If there is no error, mark the option (d) as your answer.*

55. The flock of lions (a)/roamed about (b)/ fearlessly in the jungle. (c)/No error (d)

Sol. Part (a) has error of use of correct noun, remove flock and write herd.
E.g. For a group of lions we always say **herd** not flock.

56. My brother in laws (a)/who live in Pune (b)/have come to stay with us. (c)/No error (d)

Sol. Part (a) has error of use of plural. We will put plural in 'brothers' not in 'law'.

Directions (Q. Nos. 57-58) *Choose the correct synonym of the given word, out of the four alternatives given.*

57. Pacified
(a) Threatened (b) Pleased
(c) Reprimanded (d) Quietened

Sol. *(d)* is correct synonym as other options do not fit here. All words mean silenced or satisfied.
E. g. The bottle of milk **pacified** the crying baby.

58. Redundant
(a) Unwilling (b) Surplus
(c) Wrong (d) Mislabel

Sol. *(b)* Surplus is synonym of redundant.
E. g. Eight permanent staff were made **redundant**.

59. Choose the correct meaning of the idiom
To take with a grain of salt
(a) to take with some reservation
(b) to take with total disbelief
(c) to take whole-heartedly
(d) to take seriously

Sol. *(a)* is correct
E. g. I've seen the article which I take **with a grain of salt**.

60. In the following question, a paragraph consists of six sentences, in which first and last sentences S_1 and S_6 are fixed. The middle four sentences are jumbled and labelled P, Q, R, S. Choose the correct sequence of these four sentences.

S_1: The department has initiated steps
P. from the corporate sector
Q. to evolve appropriate schemes
R. and financial institutions for
S. for mobilising investment
S_6 the development of waste lands
(a) PRSQ (b) QPSR
(c) QSPR (d) RPSQ

Sol. *(c)* QSPR
The full sentence will be
The department has initiated steps to evolve appropriate schemes for mobilising investment from the corporate sector and financial institutions for the development of wastelands.

61. The software that i... managing direct... programming and a...
(a) Graphic Software
(c) Application Softwa...

Sol. *(c)* Application softwa... that is used for file m... subdirectories, progra...

62. Which was the firs...
(a) 3080
(c) 8080

Sol. *(b)* The 4004 was th... processor.
The 4004 microproc... chip set which incl... shift register.

63. Which of the fo... layer?
(a) Provide servic... the network.
(b) Maintaining a... between two ...
(c) Provide facili... meaningful f...
(d) Responsible ... two nodes.

Sol. *(c)* The presen... message data ... communicating ...

64. Which of the ... how many b... acknowledge...
(a) TCP heade...
(b) Window si...
(c) Acknowle...
(d) Urgent po...

Sol. *(b)* The windo... starting at the ...

65. The Artifi... designing ... intelligent ...
(a) function...
(c) human b...

Sol. *(b)* The Art... intelligent c... more expres...

66. Which wa... was it intr...
(a) PDP-1,
(c) PDP-II

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COMPUTER AWARENESS

61. The software that is used for file manipulations, managing directories and subdirectories, programming and accounts setups is known as
(a) Graphic Software (b) Operating System
(c) Application Software (d) Programming Language

Sol. *(c)* Application software is a program or group of programs that is used for file manipulations, managing directories and subdirectories, programming and accounts setups.

62. Which was the first Intel processor introduced?
(a) 3080 (b) 4004
(c) 8080 (d) 8086

Sol. *(b)* The 4004 was the first commercially available computer processor.
The 4004 microprocessor is one of 4 chips constituting MCS-4 chip set which includes the 4001 ROM, 4002 RAM and 4003 shift register.

63. Which of the following is true about presentation layer?
(a) Provide service that directly support the end users of the network.
(b) Maintaining and terminating a dialogue or a session between two end users.
(c) Provide facility to convert message data into a meaningful form.
(d) Responsible for transmitting raw bit streams between two nodes.

Sol. *(c)* The presentation layer provides facilities to convert message data into a form which is meaningful to the communicating application layer entities.

64. Which of the following field of the TCP header tells how many bytes may be sent starting at the byte acknowledged?
(a) TCP header length
(b) Window size
(c) Acknowledgement number
(d) Urgent pointer

Sol. *(b)* The window size field tells how many bytes may be sent starting at the byte acknowledged.

65. The Artificial Intelligence is concerned with designing intelligent computer systems that exhibit intelligent characteristics expressed by
(a) functional behaviour (b) human behaviour
(c) human brain (d) statistical analysis

Sol. *(b)* The Artificial Intelligence is concerned with designing intelligent computer system and this type of computers are more expressed by human behaviour.

66. Which was the world's first mini computer and when was it introduced?
(a) PDP-1, 1958 (b) IBM system/36, 1960
(c) PDP-II, 1961 (d) VAX-11/780, 1962

Sol. *(a)* The PDP-1 was the first computer in digital equipment corporation's PDP series. It was also the original hardware for playing history's first game on a mini computer.

67. Cloud computing is an abstraction based on the notion of pooling physical resources and presenting them as a ..... resource.
(a) real (b) virtual
(c) cloud (d) None of these

Sol. *(b)* Cloud computing is a new model for virtual resources, for staging applications, and for platform independent user access to services.

68. Term that is used for stationary or mobile wireless station and also have optional central base station is called
(a) point-to-point (b) multi point
(c) network point (d) access point

Sol. *(d)* In mobile networking, a Wireless Access Point (WAP) is a networking hardware device that allows a Wi-Fi compliant device to connect to a wired network.

69. Which of the following machine was not invented by Charles Babbage?
(a) Tabulating Machine (b) Analytical Engine
(c) Difference Engine (d) Both (c) and (d)

Sol. *(a)* Charles Babbage, credited deservedly as father of computer, the world renowned inventor of Difference Engine and Analytical Engine.

70. In which topology, if there are n devices in a network, each device has $n-1$ ports for cables?
(a) Mesh (b) Star
(c) Bus (d) Ring

Sol. *(a)* A mesh topology is a network topology in which each node relays data for the network.

71. A program that secretly takes over another Internet attached computer and then uses that computer to launch attacks.
(a) Worm (b) Zombie
(c) Virus (d) Trap doors

Sol. *(b)* A zombie is a computer connected to the Internet that has been comprised by a hacker, computer virus or trojan horse.

72. Consider the In-order and Post-order traversals of a tree as given below:

In-order : j e n k o p b f a c l g m d h i

Post-order : j n o p k e f b c l m g h i d a

The pre-order traversal of the tree shall be
(a) a b f e j k n o p c d g l m h i
(b) a b c d e f j k n o p g l m h i
(c) a b e j k n o p f c d g l m h i
(d) j e n o p k f b c l m g h i d a

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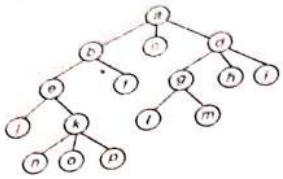
Sol. (c)



73. Network layer at source is responsible for creating a packet from data that coming from another
(a) data (b) link (c) IP (d) protocol

Sol. (d) The network layer is responsible for routing, which is moving packet/creating a packet from data that coming from another protocol.

74. What is the name for information sent from robot sensors to robot controllers?
(a) Temperature (b) Pressure
(c) Feedback (d) Signal

Sol. (c) Feedback sensors are used to detect the actuator's output, so that the control system can correct for external factor.

75. A subset of data in a data warehouse in the form of summary data, related to a particular department or business function
(a) meta data (b) archive data
(c) data mart (d) operational data store

Sol. (c) A data mart is a subset of the data warehouse that is usually oriented to specific business line or team.

76. What property of the files prevents sharing of files and directories?
(a) Tree structure (b) One level structure
(c) Two level structure (d) Length

Sol. (a) Tree structure is one of the property of the file which prevents sharing of files and directories.

77. Devices that provide the connectivity to a W network are known as
(a) subscriber stations (b) base stations
(c) gateway (d) None of these

Sol. (a) WiMAX is a family of wireless communications st After network entry is allowed, the subscriber st allocated an access slot by the base station.

78. Consider the following statements in $a = 4$, b $c = 0$; $c = ++a---b+a++---b+b+$ What will be the value of a, b and c after statement?
(a) 7, 2, 8 (b) 5, 2, 10
(c) 6, 2, 9 (d) 4, 2, 8

Sol. (c) 6, 2, 9

79. Determine the wrong statement about ma function in C.
(a) It used to allocate space in memory during the execution of the program.
(b) It does not initialise the memory allocated during execution.
(c) It initialises the allocated memory to zero.
(d) None of the above

Sol. (c) Malloc() couldn't able to allocate requested amou memory.

80. A combinational circuit that converts bi information from n input lines of a maximum unique output lines
(a) subtractor (b) decoder
(c) adder (d) multiplexer

Sol. (b) A decoder is a circuit that changes a code into a signals. It converts binary information from n input lines maximum of 2^n unique output lines.

LOGICAL AND ANALYTICAL ABILITY

Directions (Q. Nos. 81-82) *Each question given below consists of a statement, followed by two arguments numbered* I *and* II. *You have to decide which of the arguments is a strong argument and which is a weak argument?*

Give answer
(a) if only argument I is strong
(b) if only argument II is strong
(c) if neither I nor II is strong
(d) if both I and II are strong

81. Statement Should young entrepreneurs be encouraged?

Arguments
I. Yes, they will help in the industrial develop of the country.
II. Yes, they will reduce the burden on employment market.

Sol. (d) It is very clear that encouragement to the y entrepreneurs will open up the fields for setting up of industries. Therefore, it will help in industrial develop Consequently, more job opportunities will be created. both the arguments are strong.

82. Statement Shou
Arguments
I. Yes, these criminals
II. No, afflue stay.

Sol. (b) The luxury h place for staying strong one Argu hotels is not a

83. In a certain 'BSVDDUH the same co
(a) BFUTFM
(c) BFUTLH

Sol. (a) As, C U R A T I V E

Directions (Q. given figures int

84.

(a) (1,
(c) (1,

Sol. (d) 1, conta which their desig

85.

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82. **Statement** Should luxury hotels be banned in India?

Arguments

I. Yes, these are places from where international criminals operate.

II. No, affluent foreign tourists will have no place to stay.

Sol. ***(b)*** The luxury hotels are symbols of country's development and a place for staying the affluent foreign tourists. So, Argument II is a strong one Argument I is a week argument because ban on luxury hotels is not a way to end the international criminals.

83. In a certain code language, 'CURATIVE' is written as 'BSVDDUHS'. How 'STEAMING' is to be written in the same code language?

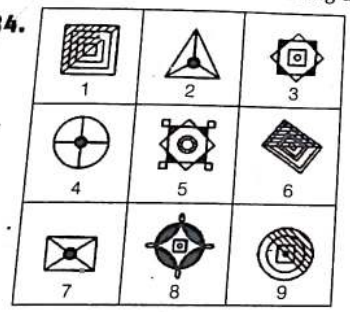
(a) BFUTFMHL (b) TUFBFMHL
(c) BFUTLHMF (d) BFUTHOJN

Sol. ***(a)*** As, C U R A T I V E → B S V D D U H S (+1, −1)

Similarly, S T E A M I N G → B F U T F M H L (+1, −1)

Directions (Q. Nos. 84-85) *In the following questions, group the given figures into three classes using a figure only once.*

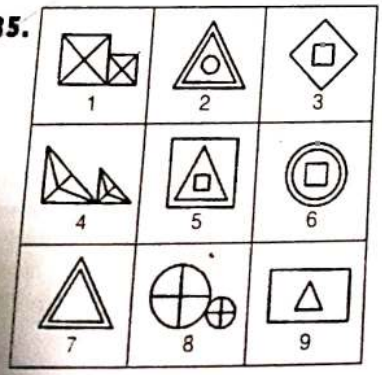
84.



(a) (1, 6, 9), (2, 5, 7), (4, 8, 3) (b) (1, 6, 9), (2, 4, 8), (3, 5, 7)
(c) (1, 3, 5), (2, 6, 7), (4, 8, 9) (d) (1, 6, 9), (2, 4, 7), (3, 5, 8)

Sol. ***(d)*** 1, 6 and 9 form a group of figures in which hall of the figure contains parallel straight lines. 2, 4 and 7 form a group of figures which are divided into equal parts and a dark circle is present at their centre. 3, 5 and 8 form a group of figures in which similar design pattern is followed.

85.



(a) (1, 3, 7), (2, 4, 6), (5, 8, 9)
(b) (1, 4, 6), (2, 5, 7), (3, 8, 9)
(c) (1, 4, 8), (2, 5, 6), (3, 7, 9)
(d) (1, 4, 8), (2, 7, 9), (3, 5, 6)

Sol. ***(c)*** 1, 4 and 8 contain similar figures both divided into four parts and attached to each other

2, 5 and 6 contain three figures (two of which are similar) placed one inside the other.

3, 7 and 9 contain one figure inside the other which may or may not be similar.

Directions (Q. Nos. 86-87) *In each of the following questions, arrange the words in a meaningful, logical order then select the appropriate sequence from the alternatives given below each of the groups of words.*

86. 1. Trillion 2. Thousand
3. Billion 4. Hundred
5. Million

(a) 1, 2, 4, 3, 5 (b) 1, 5, 3, 2, 4
(c) 4, 2, 3, 5, 1 (d) 4, 2, 5, 3, 1

Sol. ***(d)*** All the words represent the counting numbers and their increasing order is given as below

Hundred → Thousand → Million → Billion → Trillion

This order is given in option (d), i.e. 4, 2, 5, 3, 1.

87. 1. Country 2. Furniture
3. Forest 4. Wood
5. Trees

(a) 1, 3, 5, 4, 2 (b) 1, 4, 3, 2, 5
(c) 2, 4, 3, 1, 5 (d) 5, 2, 3, 1, 4

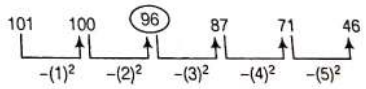
Sol. ***(a)*** From the above words, it is deduced that a country contains forests, a forest has trees, trees give wood that is used to make furniture. Hence, the correct sequence is (a).

Directions (Q. Nos. 88-90) *Complete the series by choosing the correct option.*

88. 101, 100, ? 87, 71, 46

(a) 92 (b) 88
(c) 89 (d) 96

Sol. ***(d)*** The pattern is as follows

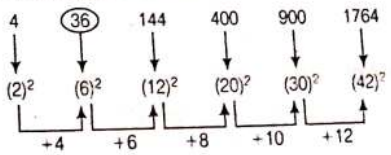


Missing number $= 100 - (2)^2 = 100 - 4 = 96$

89. 4, ?, 144, 400, 900, 1764

(a) 25 (b) 36
(c) 49 (d) 100

Sol. ***(b)*** The pattern is as follows



$\therefore ? = 36$

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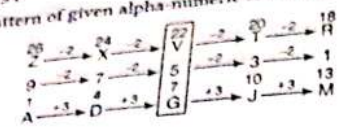
90. Z9A, X7D, ?, T3J, R1M
(a) W6F (b) S3H
(c) G9V (d) V5G

Sol. *(d)* Pattern of given alpha-numeric series is as follows



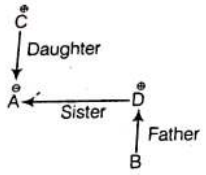
$\therefore ? = V5G$

Directions (Q. Nos. 91-92) *Read the following information carefully and answer the questions that follow*

I. $P + Q$ means P is the father of Q.
II. $P - Q$ means P is the wife of Q.
III. $P \times Q$ means P is the brother of Q.
IV. $P + Q$ means P is the daughter of Q.

91. If $A + C + D + B$, then which of the following statement is true?
(a) A is the daughter of B (b) B is the aunt of A
(c) A is the aunt of B (d) A is the mother of B

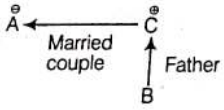
Sol. *(c)* From the given information following family diagram can be drawn



So, it is clear that A is the aunt of B.

92. If $A - C + B$, then which of the following statements is true?
(a) A is the daughter of B (b) B is the aunt of A
(c) A is the mother of B (d) A is the aunt of B

Sol. *(c)* From the given information, following family diagram can be drawn



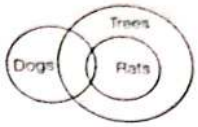
Now, it is clear that A is the mother of B.

Directions (Q. Nos. 93-94) *In each of the questions below are given three statements followed by four conclusions numbered I, II, III and IV. You have to take the given statements to be true even, if they seem to be at variance from commonly known facts. Read all the conclusions and then decide which of the given conclusion(s) logically follow(s) from the given statements disregarding commonly known facts.*

93. Statements Some dogs are rats.
All rats are trees.
Some trees are not dogs.

Conclusions
I. Some trees are dogs.
II. All dogs are trees.
III. All rats are dogs.
IV. No tree is dog.
(a) None follows (b) Only I follows
(c) I and II follow (d) II and III follow

Sol. *(b)*

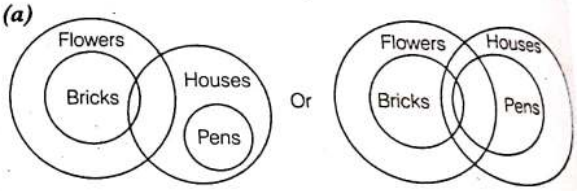


Conclusions
I. Some trees are dogs.
II. All dogs are trees.
III. All rats are dogs.
IV. No tree is dog.

94. Statements All bricks are flowers.
Some houses are flowers.
All pens are houses.

Conclusions
I. Some houses are bricks.
II. Some pens are flowers.
III. Some flowers are bricks.
IV. No pen is flower.
(a) Either I or II and III follow
(b) Either II or IV and I follow
(c) Either I or III and IV follow
(d) None follows

Sol. *(a)*



Conclusions
I. Some houses are bricks.
II. Some pens are flowers.
III. Some flowers are bricks.
IV. No pen is flower.

Directions (Q. Nos. 95-98) *Examine the information given in the following paragraph and answer the items that follow.*

Guest lectures on five subjects viz. Economics, History, Statistics, English and Mathematics have to be arranged in a week from Monday to Friday. Only one lecture can be arranged on each day. Economics cannot be scheduled on Tuesday. Guest faculty for History is available only on Tuesday. Mathematics lecture has to be scheduled immediately after the day of Economics lecture. English lecture has to be scheduled immediately before the day of Economics lecture.

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95. Which lecture is scheduled on Monday?
(a) History (b) Economics
(c) Mathematics (d) Statistics

96. Which lecture is scheduled between Statistics and English?
(a) Economics (b) History
(c) Mathematics (d) No lecture

97. Which lecture is the last one in the week?
(a) History (b) English
(c) Mathematics (d) Economics

98. Which lecture is scheduled on Wednesday?
(a) Statistics
(b) Economics
(c) English
(d) History

Sol. (Q. Nos. 95-98) *Information given in the passage can be arranged in the tabular form like this*

Days	Monday	Tuesday	Wednesday	Thursday	Friday
Subject	Statistics	History	English	Economics	Maths

95. *(d)* Statistics lecture is scheduled on Monday.

96. *(b)* From the above table History is scheduled between Statistics and English.

97. *(c)* Mathematics lecture is scheduled on the last day of the week.

98. *(c)* English lecture is scheduled on Wednesday.

Directions (Q. Nos. 99-100) *In each of the following questions, a related pair of words is followed by four pairs of words or phrases. Select the pair that best expresses a relationship similar to the one expressed in the question pair.*

99. Dubious: Certain
(a) Hot : Angry (b) Cold : Warm
(c) Long : Elongated (d) Short : Dawarfish

Sol. *(b)* Dubious is the antonym of Certain, similarly Cold is the antonym of Warm.

100. Indolence : Beaver
(a) Elegence : Peacock (b) Ferocity : Lomb
(c) Passivity : Cow (d) Joviality : Hyena

Sol. *(a)* Beaver is known for its Indolence, similarly Peacock is known for its beauty or 'Elegence'.

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