JEE Main September 2020

Question Paper With Text Solution

4 September| Shift-2

MATHEMATICS

JEE MAIN SEP 2020 | 4 SEP SHIFT-2

1. The integral

$$\int_{\pi/6}^{\pi/3} \tan^3 x \cdot \sin^2 3x(2\sec^2 x \cdot \sin^2 3x + 3\tan x \cdot \sin 6x)\,dx \text{ is}$$

(1) $-\frac{1}{18}$ (2) $-\frac{1}{9}$ (3) $\frac{7}{18}$ (4) $\frac{9}{2}$

Ans. (1)

Sol. $I = \frac{1}{2}\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \{\left(4\tan^3 x.\sec^2 x\right)\sin^4 3x + \left(4\sin^3 3x.\cos 3x.3\right)\tan^4 x\}dx$

$= \frac{1}{2}\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \{\left(4\tan^3 x.\sec^2 x\right)\sin^4 3x + \left(4\sin^3 3x.\cos 3x.3\right)\tan^4 x\}$

$= \frac{1}{2}\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \sin^4 3x \frac{d}{dx}\left(\tan^4 x\right) + \tan^4 x \frac{d}{dx}(\sin^4 3x)\}dx$

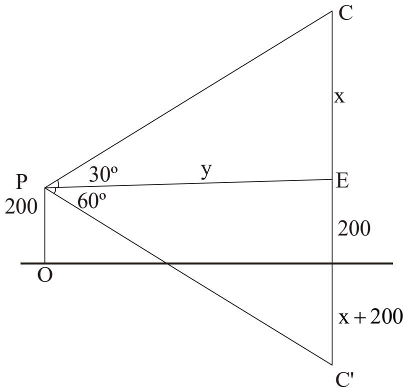
$= \frac{1}{2}\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \left\{\frac{d}{dx}\left(\tan^4 x \sin^4 3x\right)\right\}dx = \frac{1}{2}\left[\tan^4 x.\sin^4 x\right]_{\frac{\pi}{6}}^{\frac{\pi}{3}}$

$= \frac{1}{2}\left[0 - 1\frac{1}{(\sqrt{3})^4}\right] = -\frac{1}{18}$

2. The angle of elevation of a cloud C from a point P, 200 m above a still lake is 30°. If the angle of depression of the image of C in the lake from the point P is 60°, then PC (in m) is equal to :

(1) $400\sqrt{3}$ (2) 400 (3) $200\sqrt{3}$ (4) 100

Ans. (2)

Sol. 

$\tan 30^\circ = \frac{x}{y}$ and

$y = \sqrt{3}x$

$\tan 60^\circ = \frac{x+400}{y}$

$\sqrt{3}y = x + 400$

$3x = x + 400$

$x = 200$

$\sin 30^\circ = \frac{200}{PC} \Rightarrow PC = 400\text{m}$

3. Let $f : (0, \infty) \to (0, \infty)$ be a differentiable function such that $f(1) = e$ and

$\lim\limits_{t\to x} \frac{t^2 f^2(x) - x^2 f^2(t)}{t - x} = 0$. If $f(x) = 1$, then x is equal to :

(1) 2e (2) $\frac{1}{e}$ (3) e (4) $\frac{1}{2e}$

Ans. (2)

Sol. $\lim\limits_{t\to x} \frac{x^2 f^2(t) - t^2 f^2(x)}{t - x} = 0$

using L'H

$\lim\limits_{t\to x} \frac{2x^2 f(t) f'(t) - 2t f^2(x)}{1} = 0$

$2x^2 f(x) f'(x) - 2x f^2(x) = 0$

$2x\, f(x)\,[xf'(x) - f(x)] = 0$

$f(x) \neq 0$ so $xf'(x) = f(x)$

$x\dfrac{dy}{dx} = y$

$\displaystyle\int \frac{dy}{y} = \int \frac{dx}{x}$

Integration $\ln y = \ln x + \ln c$

$y = cx \Rightarrow \quad f(x) = cx$

Now $f(1) = c = e$

So $f(x) = ex$

now $f(x) = 1$

$ex = 1$

$\Rightarrow x = \dfrac{1}{e}$

4. Suppose the vectors x_1, x_2 and x_3 are the solutions of the system of linear equations, $Ax = b$ when the vector b on the right side is equal to b_1, b_2 and b_3 respectively. If

$x_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, x_2 = \begin{bmatrix} 0 \\ 2 \\ 1 \end{bmatrix}, x_3 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, b_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, b_2 = \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}$ and $b_3 = \begin{bmatrix} 0 \\ 0 \\ 2 \end{bmatrix}$, then the determinant of A is equal to :

(1) $\dfrac{3}{2}$ (2) 2 (3) 4 (4) $\dfrac{1}{2}$

Ans. (2)

Sol. Let $X = [x_1 \;\; x_2 \;\; x_3] = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 2 & 0 \\ 1 & 1 & 1 \end{bmatrix}$

$B = [b_1 \;\; b_2 \;\; b_3] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

$AX = B$

$\Rightarrow |A|\ |X| = |B|$

$\Rightarrow |A| = \frac{|B|}{|X|} = \frac{4}{2} = 2$

5. Let $\lambda \neq 0$ be in R. If α and β are the roots of the equation, $x^2 - x + 2\lambda = 0$ and α and γ are the roots af the equation, $3x^2 - 10x + 27\lambda = 0$, then $\frac{\beta\gamma}{\lambda}$ is equal to :

(1) 27 (2) 9 (3) 36 (4) 18

Ans. (4)

Sol. $\alpha^2 - \alpha + 2\lambda = 0$ ....(i)

$3\alpha^2 - 10\alpha + 27\lambda = 0$ ....(ii)

$$\begin{array}{r} 3\alpha^2 - 10\alpha + 27\lambda = 0 \\ \underset{-}{3\alpha^2} \underset{+}{-} 3\alpha \underset{-}{+} 6\lambda = 0 \\ \hline -7\alpha + 21\lambda = 0 \end{array}$$

$\alpha = 3\lambda$ Put is equation (i)

$9\lambda^2 - 3\lambda + 2\lambda = 0$

$\lambda(9\lambda - 1) = 0$

$\lambda = \frac{1}{9} \rightarrow \alpha = \frac{1}{3}$ $\alpha + \beta = 1$, $\alpha + \gamma = \frac{10}{3}$

$\frac{\beta\gamma}{\lambda} = \frac{\frac{2}{3}3}{\frac{1}{9}} = 18$

6. In a game two players A and B take turns in throwing a pair of fair dice starting with player A and total of scores on the two dice, in each throw is noted. A wins the game if he throws a total of 6 before B throws a total of 7 and B wins the game if he throws a total of 7 before A throws a total of six. The game stops as soon as either of the players wins. The probability of A winning the game is :

(1) $\frac{5}{6}$ (2) $\frac{5}{31}$ (3) $\frac{31}{61}$ (4) $\frac{30}{61}$

Ans. (4)

Sol. A $\rightarrow$ (1, 5), (2, 4), (3, 3), (4,2), (5, 1)

$$P(A)=\frac{5}{36}$$

$$P(\overline{A})=\frac{31}{36}$$

B $\rightarrow$ (1, 6), (2, 5), (3, 4), (4,3), (5, 2) (6, 1)

$$P(\overline{B})=\frac{30}{36},\quad P(B)=\frac{6}{36}$$

$$P(A\text{wins})=\frac{5}{36}+\frac{31}{36}\times\frac{30}{36}\times\frac{5}{36}+\frac{31}{30}\times\frac{30}{36}\times\frac{31}{36}\times\frac{30}{36}\times\frac{5}{36}+.......$$

$$P(A\text{ wins})=\frac{\frac{5}{36}}{1-\frac{31}{36}\times\frac{30}{36}}=\frac{\frac{5}{36}}{1-\frac{31}{36}\times\frac{5}{6}}=\frac{30}{61}$$

7. The solution of the differential equation $\frac{dy}{dx}-\frac{y+3x}{\log_e(y+3x)}+3=0$ is : (where C is a constant of integration.)

(1) $x-2\log_e(y+3x)=C$

(2) $x-\frac{1}{2}(\log_e(y+3x))^2=C$

(3) $x-\log_e(y+3x)=C$

(4) $y+3x-\frac{1}{2}(\log_e x)^2=C$

Ans. (2)

Sol. $$\frac{dy}{dx}-\frac{y-3x}{\ln(y-3x)}=3$$

$$y-3x=t$$

$$\frac{dy}{dx}-3=\frac{dt}{dx}$$

$$\frac{dt}{dx}+3-\frac{t}{\ln(t)}=3$$

$$\int\frac{\ln(t)dx}{t}=\int dx$$

$$\ln(t)=p$$

$\frac{1}{t}dt = dp$

$\int p\,dp = \int dx$

$\frac{p^2}{2} = x + c$

$\frac{\ln^2(t)}{2} = x + c$

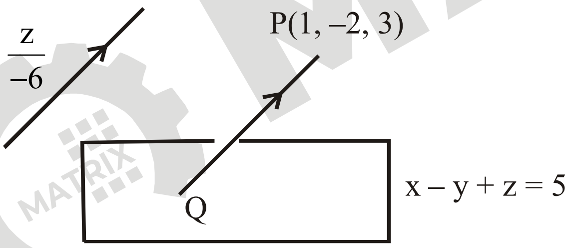
$\frac{\ln^2(y-3x)}{2} = x + c$

8. The distance of the point (1, –2, 3) from the plane $x - y + z = 5$ measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$ is :

(1) $\frac{1}{7}$ (2) $\frac{7}{5}$ (3) 7 (4) 1

Ans. (4)

Sol. $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$



Equation PQ

$\frac{x-1}{2} = \frac{y+2}{3} = \frac{z-3}{-6} = \lambda$

Let $Q \equiv (2\lambda + 1, 3\lambda - 2, -6\lambda + 3)$

point Q lies in plane $x - y + z = 5$

$2\lambda + 1 - 3\lambda + 2 - 6\lambda + 3 = 5$

$-7\lambda = -1$

$\lambda = \frac{1}{7}$

$Q\left(\frac{9}{7},\frac{-11}{7},\frac{15}{7}\right)$

$PQ=\sqrt{\left(1-\frac{9}{7}\right)^2+\left(-2+\frac{11}{7}\right)^2+\left(-3+\frac{15}{7}\right)^2}$

$PQ = 1$

9. The function $f(x)=\begin{cases}\frac{\pi}{4}+\tan^{-1}x, |x|\le 1\\ \frac{1}{2}(|x|-1), |x|>1\end{cases}$ is :

(1) Both continuous and differentiable on $R-\{-1\}$.

(2) Both continuous and differentiable on $R-\{1\}$.

(3) Continuous on $R-\{1\}$ and differentiable on $R-\{-1, 1\}$.

(4) Continuous on $R-\{-1\}$ and differentiable on $R-\{-1, 1\}$.

Ans. (3)

Sol. $\begin{cases}\frac{\pi}{4}+\tan^{-1}x, |x|\le 1\\ \frac{1}{2}(|x|-1), |x|>1\end{cases}$

$f(-1^-)=0=f(-1^+)=f(-1)$

$\Rightarrow$ it is continuous at $x=-1$

$f(1^-)=\frac{\pi}{2}$

$f(1^+)=0$

$\Rightarrow$ discontinous at $x = 1$

$f'(x)=\begin{cases}\frac{1}{1+x^2}, x\le -1\\ -\frac{1}{2}, -1<x<0\end{cases}$

$f'(-1^-) = \frac{1}{2}$

$f'(-1^+) = -\frac{1}{2}$

$\Rightarrow$ Not differentiable at -1

Continuous on R–{1} and differentiable on R–{–1, 1}.

10. The minimum value of $2^{\sin x} + 2^{\cos x}$ is :

(1) $2^{-1+\frac{1}{\sqrt{2}}}$ (2) $2^{1-\sqrt{2}}$ (3) $2^{1-\frac{1}{\sqrt{2}}}$ (4) $2^{-1+\sqrt{2}}$

Ans. (3)

Sol. A.M $\geq$ G.M

$$\frac{2^{\sin x} + 2^{\cos x}}{2} \geq \left(2^{\sin x}.2^{\cos x}\right)^{\frac{1}{2}} \qquad \sin x + \cos x \in \left[-\sqrt{2}\sqrt{2}\right]$$

$$\frac{2^{\sin x} + 2^{\cos x}}{2} \geq \left(2^{\frac{\sin x + \cos x}{2}}\right)^{\frac{1}{2}} \qquad ....(i)$$

$$2^{\sin x} + 2^{\cos x} \geq 2.2^{\frac{\sin x + \cos x}{2}}$$

$$2.2^{\frac{-\sqrt{2}}{2}} \Rightarrow 2^{1-\frac{1}{\sqrt{2}}}$$

11. Let x = 4 be a directrix to an ellipse whose centre is at the origin and its eccentricity is $\frac{1}{2}$. If $P(1, \beta)$, $\beta > 0$ is a point on this ellipse, then the equation of the normal to it at P is :

(1) 4x – 3y = 2 (2) 7x –4y = 1 (3) 8x –2y = 5 (4) 4x – 2y = 1

Ans. (4)

Sol. $x = \frac{a}{e} = 4 \Rightarrow a = 4e$

$a = 2$

$b^2 = a^2(1 - e^2) = 3$

$= 4\left(1 - \frac{1}{4}\right) = 3$

$$\frac{x^2}{4}+\frac{y^2}{3}=1$$

$$\frac{1}{4}+\frac{\beta^2}{3}=1$$

$$\frac{\beta^2}{3}=\frac{3}{4}$$

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

Equation of normal

$$\frac{a^2x}{x_1}-\frac{b^2y}{y_1}=a^2-b^2$$

$4x - 2y = 1$

12. Contrapositive of the statement : 'If a function f is differentiable at a, then it is also continuous at a' , is :

(1) If a function f is not continuous at a , then it is differentiable at a.

(2) If a function f is continuous at a, then it is differentiable at a.

(3) If a function f is continuous at a, then it is not differentiable at a.

(4) If a function f is not continuous at a, then it is not differentiable at a.

Ans. (4)

Sol. $(p \rightarrow q)$ Contrapositive = $\sim q \rightarrow \sim p$

13. Let $a_1, a_2, ..., a_n$ be a given A.P. whose common difference is an integer and $S_n = a_1 + a_2 + ... + a_n$. If $a_1 = 1$, $a_n = 300$ and $15 \leq n \leq 50$, then the ordered pair (S_{n-4}, a_{n-4}) is equal to :

(1) (2490, 248) (2) (2480, 248) (3) (2480, 249) (4) (2490, 249)

Ans. (1)

Sol. $a_1 = 1, a_n = 300$,

$$\Rightarrow d=\frac{299}{(n-1)}=\frac{13\times 23}{(n-1)}=\text{integer}$$

So $n - 1 = \pm 13, \pm 23, \pm 299, \pm 1$

$\Rightarrow n = 0, 2, -298, 300, -22, 24, -12, 14$

But $n \in [15, 50] \quad \Rightarrow n = 24 \quad \Rightarrow d = 13$

Hence, $S_{20} = \frac{20}{2}[2(1) + 19 \times 13] = 10[2 + 247] = 2490$

$a_{n-4} = a_{20} = a_1 + 19d$

$= 1 + 19 \times 13$

$= 1 + 247$

$= 248$

14. The circle passing through the intersection of the circles, $x^2 + y^2 - 6x = 0$ and $x^2 + y^2 - 4y = 0$, having its centre on the line, $2x - 3y + 12 = 0$, also passes through the point :

(1) (–3, 1) (2) (–1, 3) (3) (1, –3) (4) (–3, 6)

Ans. (4)

Sol. $S_1 + \lambda S_2 = 0$

$S : (x^2 + y^2 - 6x) + \lambda(x^2 + y^2 - 4y) = 0$

$x^2 + y^2 - \left(\frac{6}{\lambda+1}\right)x - \left(\frac{4\lambda}{\lambda+1}\right)y = 0$

Center $\left(\frac{3}{\lambda + 1}, \frac{4\lambda}{\lambda + 1}\right)$

$2x - 3y + 12 = 0$

$2\left(\frac{3}{\lambda+1}\right) - 3\frac{6\lambda}{\lambda+1} + 12 = 0$

$6 - 6\lambda + 12\lambda + 12 = 0$

$6\lambda = -18$

$\lambda = -3$

$S : x^2 + y^2 + 3x - 6y = 0$

15. If a and b are real numbers such that $(2 + \alpha)^4 = a + b\alpha$, where $\alpha = \frac{-1 + i\sqrt{3}}{2}$, then a + b is equal to :

(1) 33 (2) 9 (3) 57 (4) 24

Ans. (2)

Sol. $\alpha = \omega$

$(2 + \omega)^4 = a + b\omega$

$1 + \omega + \omega^2 = 0$

$(2 + \omega)^4 = (1 - \omega^2)^4$

$= 1 - 4\omega^2 + 6\omega^4 - 4\omega^6 + \omega^8$

$= 9\omega.$

So, a + b = 9

16. If the system of equations

$x + y + z = 2$

$2x + 4y - z = 6$

$3x + 2y + \lambda z = \mu$

has infinitely many solutions, then :

(1) $2\lambda - \mu$ (2) $\lambda - 2\mu = -5$ (3) $2\lambda + \mu = 14$ (4) $\lambda + 2\mu = 14$

Ans. (3)

Sol. For infinitely many solutions,

$\Delta = 0 = \Delta_1 = \Delta_2 = \Delta_3$

$$\Delta = 0 \Rightarrow \begin{vmatrix} 1 & 1 & 1 \\ 2 & 4 & -1 \\ 3 & 2 & \lambda \end{vmatrix} = 0$$

$$\Rightarrow \lambda = \frac{9}{2}$$

$$\Delta_3 = 0 \Rightarrow \begin{vmatrix} 1 & 1 & 2 \\ 2 & 4 & 6 \\ 3 & 2 & \mu \end{vmatrix} = 0$$

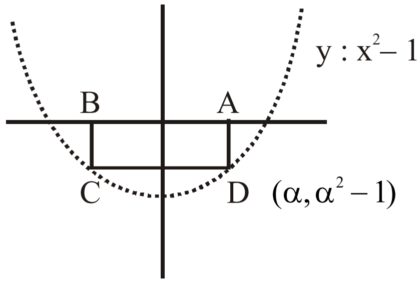
$2\lambda + \mu = 14$

17. The area (in sq. units) of the largest rectangle ABCD whose vertices A and B lie on the x-axis and vertices C and D lie on the parabola, $y = x^2 - 1$ below the x-axis, is :

(1) $\frac{4}{3\sqrt{3}}$ (2) $\frac{1}{3\sqrt{3}}$ (3) $\frac{2}{3\sqrt{3}}$ (4) $\frac{4}{3}$

Ans. (1)

Sol.



A $(\alpha, 0)$, $B(-\alpha, 0)$

$\Rightarrow D(\alpha, \alpha^2 - 1)$

Area of rectangle (ABCD) = (AB) (AD)

$S = (2\alpha)(1 - \alpha^2)$

$S = 2\alpha - 2\alpha^3$

$\frac{ds}{d\alpha} = 2 - 6\alpha^2 = 0$

$\alpha = \frac{1}{\sqrt{3}}, \ \alpha = \frac{-1}{\sqrt{3}}$

Area $= 2\alpha - 2\alpha^3 = \frac{2}{\sqrt{3}} - \frac{2}{3\sqrt{3}} = \frac{4}{3\sqrt{3}}$

18. If for some positive integer n, the coefficients of three consecutive terms in the binomial expansion of $(1+x)^{n+5}$ are in the ratio 5 : 10 : 14, then the largest coefficient in this expansion is :

(1) 462 (2) 792 (3) 330 (4) 252

Ans. (1)

Sol. $(1 + x)^{n+5}$

T_r, T_{r+1}, T_{r+2}

$\frac{T_r}{T_{r+1}} = 2$ $\frac{T_{r+2}}{T_{r+1}} = \frac{7}{5}$

$\frac{^{n+5}C_r}{^{n+5}C_{r-1}} = 2$ $\frac{^{n+5}C_{r+1}}{^{n+5}C_0} = \frac{7}{5}$

$\frac{(n+5)-(r)+1}{r} = 2$ $\frac{(n+5)-(r+1)+1}{r+1} = \frac{7}{5}$

$n - r + 6 = 2r$ $5n + 75 - 5r = 7r + 7$

$n - 3r + 6 = 0$ $5n - 12r + 18 = 0$

$$\begin{array}{r} 5n - 12r + 18 = 0 \\ \underset{-}{5n} \underset{+}{-} 15r \underset{-}{+} 30 = 0 \\ \hline 3r - 12 = 0 \end{array}$$

$n = 4$ $n = 6$ $^{11}C_5 = 462$

19. If the perpendicular bisector of the line segment joining the pints P(1, 4) and Q(k,3) has y-intercept equal to –4, then a value of k is :

(1) $\sqrt{15}$ (2) –2 (3) –4 (4) $\sqrt{14}$

Ans. (3)

Sol. Equation of parpendicular Bisector will be :

PA = PB

$\Rightarrow (x-1)^2 + (y-4)^2 = (x-k)^2 + (y-3)^2$

$\Rightarrow (2k-2)\,x - 2y + 3 - k^2 = 0$

y – intercept is – 4

$\Rightarrow x = 0, y = -4$

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

$\Rightarrow k^2 = 16$

$\Rightarrow k = \pm 4$

Out of which R = – 4 is in the options.

20. Let $\bigcup_{i=1}^{50} X_i = \bigcup_{i=1}^{n} Y_i$ = T, where each X_i contains 10 elements and each Y_i contains 5 elements. If each element of the set T is an element of exactly 20 of sets X_i's and exactly 6 of sets Y_i's, then n is equal to :

(1) 30 (2) 50 (3) 15 (4) 45

Ans. (1)

Sol. Number of elements in T = $\frac{50\times10}{20} = \frac{n\times5}{6}$

$\Rightarrow n = 30$

21. Let {x} and [x] denote the fractional part of x and the greatest integer $\leq$ x respectively of a real number x. If $\int_0^n \{x\}\,dx, \int_0^n [x]\,dx$ and $10(n^2 - n)$, ($n \in N, n > 1$) are three consecutive terms of a G.P., then n is equal to ______.

Ans. 21

Sol. $\int_0^n \{x\}dx = n\int_0^1 xdx = n\left(\frac{x^2}{2}\right)_0^1 = \frac{n}{2}$

$\int_0^n \{x\}dx = \int_0^n (x - \{x\}dx = \int_0^n xdx - \int_0^n \{x\}dx = \frac{n^2}{2} - \frac{n}{2}$

now $\frac{n}{2}, \frac{n^2-n}{2}$ and $10(n^2 - n)$.... G.P

$\left(\frac{n^2-n}{2}\right)^2 = \frac{n}{2}\times10(n^2-n)$

$\Rightarrow n - 20 = 20$

$\Rightarrow n = 21$

22. If $\vec{a} = 2\hat{i} + \hat{j} + 2\hat{k}$, then the value of $\left|\hat{i}\times(\vec{a}\times\hat{i})\right|^2 + \left|\hat{j}\times(\vec{a}\times\hat{j})\right|^2 + \left|\hat{k}\times(\vec{a}\times\hat{k})\right|^2$ is equal to ______.

Ans. 18

Sol. Let $\vec{a} = x\hat{i} + y\hat{i} + z\hat{k}$

$\hat{i}\times(\vec{a}\times\hat{i}) = (\hat{i}.\hat{i})\,\vec{a} - (\vec{a}.\hat{i})\,\hat{i}$

$= x\hat{i} + y\hat{j} + z\hat{k} - x\hat{i}$

$= y\hat{j} + z\hat{k}$ ....(i)

similarly $\hat{j} \times (\vec{a} \times \hat{j}) = x\hat{i} + z\hat{k}$ ....(ii)

and $\hat{k} \times (\vec{a} \times \hat{k}) = x\hat{i} + y\hat{k}$ ....(iii)

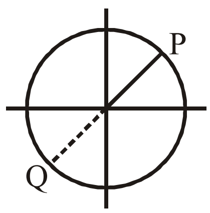
$|y\hat{j} + z\hat{k}|^2 + |x\hat{i} + z\hat{k}|^2 + |x\hat{i} + y\hat{i}|^2$

$2(x^2 + y^2 + z^2) = 2|\vec{a}|^2 = 18$

23. Let PQ be a diameter of the circle $x^2 + y^2 = 9$. If α and β are the lengths of the perpendiculars from P and Q on the straight line, $x + y = 2$ respectively, then the maximum value of $\alpha\beta$ is ______ .

Ans. 7

Sol.



P(3cosθ, 3sinθ)

Q(–3cosθ, –3sinθ)

$$\alpha = \left|\frac{3\cos\theta + 3\sin\theta - 2}{\sqrt{2}}\right|$$

$$\Rightarrow \alpha\beta_{max} = \left|\frac{9 \times 2 - 4}{2}\right| = 7$$

$$\alpha\beta = \left|\frac{9(\cos\theta + \sin\theta)^2 - 4}{2}\right|$$

$$(\cos\theta + \sin\theta)^2_{max} = 2$$

$$\Rightarrow \alpha\beta_{max} = \left|\frac{9 \times 2 - 4}{2}\right| = 7$$

24. If the variance of the following frequency distribution :

Class	:	10 – 20	20 – 30	30 – 40
Frequencey	:	2	x	2

is 50, then x is equal to _____.

Ans. 4

Sol.

x_i	5	15	25
f_i	2	x	2

$$\vec{x} = \frac{\sum f_i x_i}{\sum f_i} = \frac{10 + 15x + 50}{4 + x}$$

$$= \frac{15(4 + x)}{4 + x} = 15$$

$$\sigma^2 = 50 = \frac{\sum f_i {x_i}^2}{\sum f_i} - \left(\overline{x}\right)^2 = 50$$

$$\frac{50 + 225x + 1250}{4 + x} - (15)^2 = 50$$

$$x = 4$$

25. The test consists of 6 multiple choice questions, each having 4 alternative answers of which only one is correct. The number of ways, in which a candidate answers all six questions such that exactly four of the answers are correct, is _____ .

Ans. 135

Sol. Required no. of ways $= {}^6C_4 (1)^4 \times (3)^2$

$$= {}^6C_4 (1)^4 \times 3^2 = 135$$