PART : MATHEMATICS

SECTION – 1

Straight Objective Type (सीधे वस्तुनिष्ठ प्रकार)

This section contains **20 multiple choice questions.** Each question has 4 choices (1), (2), (3) and (4) for its answer, out of which **Only One** is correct.

1. Find the number of solution of $\log_{1/2}|\sin x| = 2 - \log_{1/2}|\cos x|$, $x \in [0,2\pi]$

$x \in [0,2\pi]$ में $\log_{1/2}|\sin x| = 2 - \log_{1/2}|\cos x|$ के हलों की संख्या है–

(1) 2 (2) 4 (3) 6 (4) 8

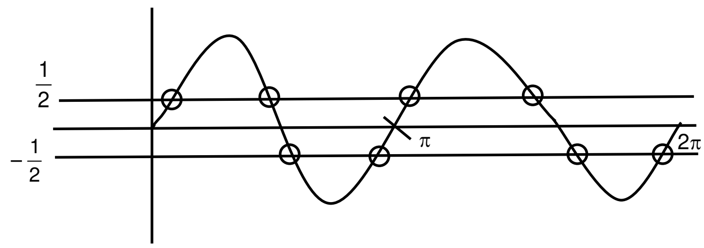
Ans. **(4)**

Sol. $\log_{1/2}|\sin x| = 2 - \log_{1/2}|\cos x|$

$\log_{1/2}|\sin x \cos x| = 2$

$|\sin x \cos x| = \frac{1}{4}$

$\sin 2x = \pm \frac{1}{2}$



Number of solution हलों की संख्या = 8.

2. If e_1 and e_2 are eccentricities of $\frac{x^2}{18} + \frac{y^2}{4} = 1$ and $\frac{x^2}{9} - \frac{y^2}{4} = 1$, respectively and if the point (e_1, e_2) lies on ellipse $15x^2 + 3y^2 = k$. Then find value of k

(1) 14 (2) 15 (3) 16 (4) 17

Ans. **(3)**

Sol. $e_1 = \sqrt{1 - \frac{4}{18}} = \sqrt{\frac{7}{9}} = \frac{\sqrt{7}}{3}$

$e_2 = \sqrt{1 + \frac{4}{9}} = \sqrt{\frac{13}{9}} = \frac{\sqrt{13}}{3}$

$15e_1^2 + 3e_2^2 = k \Rightarrow$ k = $15\left(\frac{7}{}\right) + 3\left(\frac{13}{}\right)$ $\therefore$ k = 16

3. Find integration $\int \frac{\ }{x-3\ ^{6/7}.\ x+4\ ^{8/7}}$

(1) $\left(\frac{x-3}{x+4}\right)^{\frac{1}{7}}+c$ (2) $7\left(\frac{x-3}{x+4}\right)^{\frac{1}{7}}+c$ (3) $7\left(\frac{x-3}{x+4}\right)^{\frac{6}{7}}+c$ (4) $7\left(\frac{x+4}{x-3}\right)^{\frac{6}{7}}+c$

Ans. **(1)**

Sol. $\int\left(\frac{x-3}{x+4}\right)^{\frac{-6}{7}}\frac{1}{(x+4)^2}dx$

Let $\frac{x-3}{x+4}=t^7$,

$\frac{7}{(x+4)^2}dx=7t^6dt$

$\int t^{-6}t^6dt=t+c$

4. If $\left|\frac{z-i}{z+2i}\right|=1$, $|z| = \frac{5}{2}$ then value of $|z + 3i|$ is

(1) $\frac{7}{2}$ (2) $\sqrt{10}$ (3) $\sqrt{5}$ (4) $\sqrt{3}$

Ans. **(1)**

Sol. $x^2 + (y-1)^2 = x^2 + (y+2)^2$

$-2y + 1 = 4y + 4$

$6y = -3 \Rightarrow y = -\frac{1}{2}$

$x^2 + y^2 = \frac{25}{4} \Rightarrow x^2 = \frac{24}{4} = 6$

$\Rightarrow \quad z = \pm\sqrt{6} - \frac{i}{2}$

$|z + 3i| = \sqrt{6+\frac{25}{4}} = \sqrt{\frac{49}{4}}$

$|z + 3i| = \frac{7}{2}$

5. $2^{\frac{1}{4}}\cdot 4^{\frac{1}{16}}8^{\cdot\frac{1}{48}}$ ………….. $\infty =$

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

Sol. $2^{\frac{}{4}+\frac{}{16}+\frac{}{48}+\ldots\ldots\ldots\ldots\infty}$

$= 2^{\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\ldots\ldots\ldots\ldots\infty} = \sqrt{2}$

6. Value of $\cos^3\frac{\pi}{8}\cos\frac{3\pi}{8}+\sin^3\frac{\pi}{8}\sin\frac{3\pi}{8}$ is

$\cos^3\frac{\pi}{8}\cos\frac{3\pi}{8}+\sin^3\frac{\pi}{8}\sin\frac{3\pi}{8}$ का मान है–

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

Ans. **(1)**

Sol. $\cos^3\frac{\pi}{8}\left[4\cos^3\frac{\pi}{8}-3\cos\frac{\pi}{8}\right]+\sin^3\frac{\pi}{8}\left[3\sin\frac{\pi}{8}-4\sin^3\frac{\pi}{8}\right]$

$= 4\cos^6\frac{\pi}{8}-4\sin^6\frac{\pi}{8}-3\cos^4\frac{\pi}{8}+3\sin^4\frac{\pi}{8}$

$= 4\left[\left(\cos^2\frac{\pi}{8}-\sin^2\frac{\pi}{8}\right)\right]\left[\left(\sin^4\frac{\pi}{8}+\cos^4\frac{\pi}{8}+\sin^2\frac{\pi}{8}\cos^2\frac{\pi}{8}\right)\right]-3\left[\left(\cos^2\frac{\pi}{8}-\sin^2\frac{\pi}{8}\right)\right]$

$= \cos\frac{\pi}{4}\left[4\left(1-\sin^2\frac{\pi}{8}\cos^2\frac{\pi}{8}\right)-3\right] = \frac{1}{\sqrt{2}}\left[1-\frac{1}{2}\right] = \frac{1}{2\sqrt{2}}$

7. Find the value of $\int_0^{2\pi}\frac{x\sin^8 x}{\sin^8 x+\cos^8 x}dx$

$\int_0^{2\pi}\frac{x\sin^8 x}{\sin^8 x+\cos^8 x}dx$ का मान है–

(1) π^2 (2) $2\pi^2$ (3) $3\pi^2$ (4) $4\pi^2$

Ans. **(1)**

Sol. $\int_0^{\pi}\frac{x\sin^8 x}{\sin^8 x+\cos^8 x}+\frac{(2\pi-x)\sin^8 x}{\sin^8 x+\cos^8 x}dx$

$= \int_0^{\pi}\frac{2\pi\sin^8 x}{\sin^8 x+\cos^8 x}dx$

$= 2\pi\int_0^{\pi/2}\frac{\sin^8 x}{\sin^8 x+\cos^8 x}+\frac{\cos^8 x}{\sin^8 x+\cos^8 x}dx$

$= 2\pi\int_0^{\pi/2}1\,dx = 2\pi\times\frac{\pi}{2} = \pi^2$

8. If $f(x) = a + bx + cx^2$ where a, b, c $\in$R then $\ _{0} f(x)dx$ is

(1) $\frac{1}{3}\left(f(1)+f(0)+2f\left(\frac{1}{2}\right)\right)$

(2) $\frac{1}{6}\left(f(1)+f(0)+4f\left(\frac{1}{2}\right)\right)$

(3) $\frac{1}{6}\left(f(1)+f(0)-4f\left(\frac{1}{2}\right)\right)$

(4) $\frac{1}{6}\left(f(1)-f(0)-4f\left(\frac{1}{2}\right)\right)$

Ans. (2)

Sol. $\int_0^1 (a+bx+cx^2)dx = ax + \frac{bx^2}{2} + \frac{cx^3}{3}\Big|_0^1 = a + \frac{b}{2} + \frac{c}{3}$

$f(1) = a + b + c$

$f(0) = a$

$f\left(\frac{1}{2}\right) = a + \frac{b}{2} + \frac{C}{4}$

Now $\frac{1}{6}\left(f(1)+f(0)+4f\left(\frac{1}{2}\right)\right)$

$= \frac{1}{6}\left(a+b+c+a+4\left(a+\frac{b}{2}+\frac{c}{4}\right)\right)$

$= \frac{1}{6}(6a+3b+2c) = a + \frac{b}{2} + \frac{c}{3}$

9. If number of 5 digit numbers which can be formed without repeating any digit while tenth place of all of the numbers must be 2 is 336 k find value of k

(1) 8 (2) 7 (3) 6 (4) 5

Ans. **(1)**

Sol.

			2	

Number of numbers संख्याओं की संख्या $= 8 \times 8 \times 7 \times 6 = 2688 = 336k \Rightarrow k = 8$

10. A (3,–1), B(1,3), C(2,4) are vertices of ΔABC if D is centroid of ΔABC and P is point of intersection of lines $x + 3y - 1 = 0$ and $3x - y + 1 = 0$ then which of the following points lies on line joining D and P

त्रिभुज ABC के शीर्ष A (3,–1), B(1,3), C(2,4) है यदि D त्रिभुज ABC का केन्द्रक है तथा P रेखाओं $x + 3y - 1 = 0$ तथा $3x - y + 1 = 0$ का प्रतिच्छेद बिन्दु है तो निम्न में से कौनसा बिन्दु D तथा P को जोड़ने वाली रेखा पर स्थित है–

(1) (–9,–7) (2*) (–9,–6) (3) (9,6) (4) (9,–6)

Ans. **(2)**

Sol. D (2,2)

Point of intersection P $\left(-\frac{1}{5}, \frac{2}{5}\right)$

equation of line DP

$8x - 11y + 6 = 0$

Sol. D (2,2)

$8x - 11y + 6 = 0$

11. If f(x) is twice differentiable and continuous function in $x \in [a,b]$ also $f'(x) > 0$ and $f''(x) < 0$ and $c \in (a,b)$ then $\frac{f(c)-f(a)}{-}$ is greater than

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

Ans. **(4)**

Sol. Lets use LMVT for $x \in [a,c]$

$$\frac{f(c)-f(a)}{c-a} = f'(\alpha), \alpha \in (a,c)$$

also use LMVT for $x \in [c,b]$

$$\frac{f(b)-f(c)}{b-c} = f'(\beta), \beta \in (c,b)$$

$\because f''(x) < 0 \Rightarrow f'(x)$ is decreasing

$f'(\alpha) > f'(\beta)$

$$\frac{f(c)-f(a)}{c-a} > \frac{f(b)-f(c)}{b-c}$$

$$\frac{f(c)-f(a)}{f(b)-f(c)} > \frac{c-a}{b-c} \quad (\because f(x) \text{ is increasing})$$

H_

$$\frac{f(c)-f(a)}{c-a} = f'(\alpha) \text{ , } \alpha \in (a,c)$$

$f'(\alpha) > f'(\beta)$

$$\frac{f(c)-f(a)}{c-a} > \frac{f(b)-f(c)}{b-c}$$

$$\frac{f(c)-f(a)}{f(b)-f(c)} > \frac{c-a}{b-c}$$ ($\because$ f(x) वर्धमान है)

12. If plane

$x + 4y - 2z = 1$

$x + 7y - 5z = \beta$

$x + 5y + \alpha z = 5$

intersects in a line (R × R × R) then $\alpha + \beta$ is equal to

यदि समतल

$x + 4y - 2z = 1$

$x + 7y - 5z = \beta$

$x + 5y + \alpha z = 5$

एक रेखा में (R × R × R) तो $\alpha + \beta$ बराबर है–

(1) 0 (2) 10 (3) – 10 (4) 2

Ans. **(2)**

Sol. $$\Delta = 0 \Rightarrow \begin{vmatrix} 1 & 4 & -2 \\ 1 & 7 & -5 \\ 1 & 5 & \alpha \end{vmatrix} = 0$$

$(7\alpha + 25) - (4\alpha + 10) + (-20 + 14) = 0$

$3\alpha + 9 = 0 \Rightarrow \alpha = -3$

Also तथा $$D_z = 0 \Rightarrow \begin{vmatrix} 1 & 4 & 1 \\ 1 & 7 & \beta \\ 1 & 5 & 5 \end{vmatrix} = 0$$

$1(35 - 5\beta) - (15) + 1\,(4\beta - 7) = 0$

$\beta = 13$

13. For observations x_i given $\sum_{i=1}^{10}(x_i-5)=10$ and $\sum_{i=1}^{10}(x_i-5)^2=40$. If mean and variance of observations $(x_1-3), (x_2-3)$ ………$(x_{10}-3)$ is λ & μ respectively then ordered pair (λ, μ) is

आंकड़ों x_i के लिये दिया है कि $\sum_{i=1}^{10}(x_i-5)=10$ तथा $\sum_{i=1}^{10}(x_i-5)^2=40$ यदि आंकड़ों $(x_1-3), (x_2-3)$ ………$(x_{10}-3)$ का माध्य λ तथा चरिता μ है तो क्रमित युग्म (λ, μ) है–

(1) (3, 3) (2) (1, 3) (3) (3, 1) (4) (1, 1)

Ans. **(1)**

Sol. Mean माध्य $(x_i-5) = \frac{\Sigma(x_i-5)}{10}=1$

$\therefore$ λ = {Mean माध्य (x_i-5)} + 2 = 3

μ = var चरिता (x_i-5) = $\frac{\Sigma(x_i-5)^2}{10}-\frac{\Sigma(x_i-5)}{10}=3$

14. In a bag there are 20 cards 10 names A and another 10 names B. Cards are drawn randomly one by one with replacement then find probability that second A comes before third B.

(1) $\frac{13}{16}$ (2) $\frac{11}{16}$ (3) $\frac{7}{16}$ (4) $\frac{9}{16}$

Ans. **(2)**

Sol. AA + ABA + BAA + ABBA + BBAA + BABA

$= \frac{1}{4}+\frac{1}{8}+\frac{1}{8}+\frac{1}{16}+\frac{1}{16}+\frac{1}{16}=\frac{11}{16}$

15. The negation of '$\sqrt{5}$ is an integer or 5 is an irrational number' is

(1) $\sqrt{5}$ is an integer and 5 is not an irrational Number

(2) $\sqrt{5}$ is not an integer and 5 is an irrational Number

(3) $\sqrt{5}$ is not an integer or 5 is not an irrational Number

(4) $\sqrt{5}$ is not an integer and 5 is not an irrational Number

Ans. **(4)**

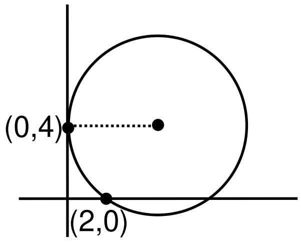
Sol. $\sqrt{5}$ is not an integer and 5 is not an irrational Number $\sim(p\vee q)$ = $\sim p \wedge \sim q$

16. If a circle touches y-axis at (0, 4) and passes through (2, 0) then which of the following can not be the

(1) $3x + 4y - 6 = 0$ (2) $3x + 4y - 24 = 0$ (3) $4x - 3y - 17 = 0$ (4) $4x + 3y - 6 = 0$

Ans. **(1)**

Sol.



equation of family of circle

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

$\Rightarrow$ passes गुजरता है (2, 0)

$4 + 16 + 2\lambda = 0 \Rightarrow \lambda = -10$

$x^2 + y^2 - 10x - 8y + 16 = 0$

centre केन्द्र (5, 4). $R = \sqrt{25+16-16} = 5$

17. If $f'(x) = \tan^{-1}(\sec x + \tan x)$, $x \in \left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$ and $f(0) = 0$ then the value of $f(1)$ is

(1) $\frac{\pi+1}{4}$ (2) $\frac{\pi-1}{4}$ (3) $\frac{\pi+1}{2}$ (4) 0

Ans. **(1)**

Sol. $f'(x) = \tan^{-1}(\sec x + \tan x) = \tan^{-1}\left(\frac{1+\sin x}{\cos x}\right) = \tan^{-1}\left(\frac{1-\cos\left(\frac{\pi}{2}+x\right)}{\sin\left(\frac{\pi}{2}+x\right)}\right) = \tan^{-1}\left(\frac{2\sin^2\left(\frac{\pi}{4}+\frac{x}{2}\right)}{2\sin\left(\frac{\pi}{4}+\frac{x}{2}\right)\cos\left(\frac{\pi}{4}+\frac{x}{2}\right)}\right)$

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

$(f'(x))dx = \frac{\pi}{4}+\frac{x}{2}dx$

$f(x) = \frac{\pi}{4}x + \frac{x^2}{4} + c$

$f(0) = c = 0 \Rightarrow \quad f(x) = \frac{\pi}{4}x + \frac{x^2}{4}$

18. A sphere of 10cm radius has a uniform thickness of ice around it. Ice is melting at rate 50cm^3/min when thickness is 5cm then rate of change of thickness

(1) $\frac{1}{36\pi}$ (2) $\frac{1}{18\pi}$ (3) $\frac{1}{9\pi}$ (4) $\frac{1}{12\pi}$

Ans. (2)

Sol. Let thickness माना मोटाई = x cm

Total volume कुल आयतन $v = \frac{4}{3}\pi(10 + x)^3$

$\frac{dv}{dt} = 4\pi\ (10 + x)^2\ \frac{dx}{dt}$ ………..(i)

Given दिया है $\frac{dv}{dt} = 50cm^3/min$

At x = 5cm

$50 = 4\pi\ (10 + 5)^2\ \frac{dx}{dt}$

$\frac{dx}{dt} = \frac{1}{18\pi}$ cm/min

19. Find number of real roots of equation $e^{4x} + e^{3x} - 4e^{2x} + e^x + 1 = 0$ is

(1) 1 (2) 2 (3) 3 (4) 4

Ans. (1)

Sol. Let $e^x = t \in (0, \infty)$

Given equation

$t^4 + t^3 - 4t^2 + t + 1 = 0$

$t^2 + t - 4 + \frac{1}{t} + \frac{1}{t^2} = 0$

$\left(t^2 + \frac{1}{t^2}\right) + \left(t + \frac{1}{t}\right) - 4 = 0$

Let $t + \frac{1}{t} = \alpha$

$(\alpha^2 - 2) + \alpha - 4 = 0$

$\alpha^2 + \alpha - 6 = 0$

$\alpha^2 + \alpha - 6 = 0$

$\alpha = -3, 2 \quad \Rightarrow \quad \alpha = 2 \quad \Rightarrow \quad e^x + e^{-x} = 2$

x = 0 only solution

20. If A = $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 3 & 4 \\ 1 & -1 & 3 \end{bmatrix}$, B = adj(A) and C = 3A then $\frac{|adjB|}{|C|}$ is

यदि A = $\begin{bmatrix} 1 & 1 & 2 \\ 1 & 3 & 4 \\ 1 & -1 & 3 \end{bmatrix}$, B = adj(A) तथा C = 3A तब $\frac{|adjB|}{|C|}$ बराबर है–

(1) 8 (2) 4 (3) 2 (4) 16

Ans. **(1)**

Sol. |A| = $\begin{vmatrix} 1 & 1 & 2 \\ 1 & 3 & 4 \\ 1 & -1 & 3 \end{vmatrix}$ = ((9+4) – 1(3–4) + 2(–1–3))

= 13 + 1 – 8 = 6

| adjB | = | adjadjA | = $|A|^{(n-1)^2}$ = $|A|^4$ = $(36)^2$

|C| = |BA| = $3^3 \times 6$

$\frac{|adjB|}{|C|} = \frac{36 \times 36}{3^3 \times 6} = 8$

SECTION – 2

- This section contains **FIVE (05)** questions. The answer to each question is **NUMERICAL VALUE** with two digit integer and decimal upto one digit.
- If the numerical value has more than two decimal places **truncate/round-off** the value upto **TWO** decimal places.
  - Full Marks : **+4** If ONLY the correct option is chosen.
  - Zero Marks : **0** In all other cases

21. (1+x) $\frac{dy}{dx} = \left((1+x)^2 + (y-3)\right)$, If y(2) = 0 then y(3) =?

(1+x) $\frac{dy}{dx} = \left((1+x)^2 + (y-3)\right)$, यदि y(2) = 0 तो y(3) =?

Ans. **3**

Sol. $\frac{dy}{dx} = (1+x) + \left(\frac{y-3}{1+x}\right)$

$\frac{dy}{dx} - \frac{1}{(1+x)}y = (1+x) - \frac{3}{(1+x)}$

I.F. = $e^{-\overline{(1+x)}}$ $= \frac{\quad}{(1+x)}$

$\therefore \frac{d}{dx}\left(\frac{y}{1+x}\right) = 1 - \frac{3}{(1+x)^2}$

$\frac{y}{1+x} = x + 3(1+x)^{-1} + c$

y = (1+x) $\left[x + \frac{3}{(1+x)} + c\right]$

$\therefore$ at x = 2, y = 0

$\therefore$ 0 = 3 (2+1+c) $\Rightarrow$ c = –3

$\therefore$ at x = 3 , y = 3

22. f(x) = $\begin{cases} \frac{\sin(a+2)x + \sin x}{x}; & x < 0 \\ b; & x = 0 \\ \frac{(x+3x^2)^{\frac{1}{3}} - x^{\frac{1}{3}}}{x^{\frac{4}{3}}}; & x > 0 \end{cases}$

Function is continuous at x = 0, find a + 2b.

f(x) = $\begin{cases} \frac{\sin(a+2)x + \sin x}{x}; & x < 0 \\ b; & x = 0 \\ \frac{(x+3x^2)^{\frac{1}{3}} - x^{\frac{1}{3}}}{x^{\frac{4}{3}}}; & x > 0 \end{cases}$

Ans. 0

Sol. LHL = a + 3

f(0) = b

RHL = $\lim_{h \to 0}\left(\frac{(1+3h)^{\frac{1}{3}} - 1}{h}\right) = 1$

$\therefore$ a = –2

b = 1

$\therefore$ a + 2b = 0

23. Find the coefficient of x^4 in $(1 + x + x^2)^{10}$

Ans. 615

Sol. General term $\frac{}{\alpha!\beta!\gamma!}\ x^{\beta+2\gamma}$

for coefficient of x^4 $\Rightarrow \beta + 2\gamma = 4$

$\gamma = 0, \beta = 4, \alpha = 6 \quad \Rightarrow \quad \frac{10!}{6!4!0!} = 210$

$\gamma = 1, \beta = 2, \alpha = 7 \quad \Rightarrow \quad \frac{10!}{7!2!1!} = 360$

$\gamma = 2, \beta = 0, \alpha = 8 \quad \Rightarrow \quad \frac{10!}{8!0!2!} = 45$

Total कुल= 615

24. If $\vec{P} = (a+1)\hat{i} + a\hat{j} + a\hat{k}$

$\vec{Q} = a\hat{i} + (a+1)\hat{j} + a\hat{k}$

$\vec{R} = a\hat{i} + a\hat{j} + (a+1)\hat{k}$

and $\vec{P}, \vec{Q}, \vec{R}$ are coplanar vectors and $3(\vec{P}.\vec{Q})^2 - \lambda\left|\vec{R}\times\vec{Q}\right|^2 = 0$ then value of λ is

$\vec{P} = (a+1)\hat{i} + a\hat{j} + a\hat{k}$

$\vec{Q} = a\hat{i} + (a+1)\hat{j} + a\hat{k}$

$\vec{R} = a\hat{i} + a\hat{j} + (a+1)\hat{k}$

Ans. **1**

Sol. $\begin{vmatrix} a+1 & a & a \\ a & a+1 & a \\ a & a & a+1 \end{vmatrix} = 0 \Rightarrow a + 1 + a + a = 0 \quad \Rightarrow a = -\frac{1}{3}$

$\vec{P} = \frac{2}{3}\hat{i} - \frac{1}{3}\hat{j} - \frac{1}{3}\hat{k}$

$\vec{Q} = \frac{1}{3}(-\hat{i} + 2\hat{j} - \hat{k})$

$\vec{R} = \frac{1}{3}(-\hat{i} - \hat{j} + 2\hat{k})$

$\vec{P}.\vec{Q} = \frac{1}{9}(-2 - 2 + 1) = -\frac{1}{3}$

$\vec{R} \times \vec{Q} = \frac{1}{9}\begin{vmatrix} i & j & k \\ -1 & 2 & -1 \\ -1 & -1 & 2 \end{vmatrix} = \frac{1}{9}(i(4-1) - j(-2-1) + k(1+2))$

$= \frac{1}{9}(3i + 3j + 3k) = \frac{i+j+k}{3}$

$\left|\vec{R}\times\vec{Q}\right| = \frac{1}{3}\sqrt{3} \Rightarrow \left|\vec{R}\times\vec{Q}\right|^2 = \frac{1}{3}$

$3(\vec{P}.\vec{Q})^2 - \lambda\left|\vec{R}\times\vec{Q}\right|^2 = 0$

$3.\frac{1}{9} - \lambda.\frac{1}{3} = 0 \Rightarrow \lambda = 1$

25. If points A (2, 4, 0), B(3, 1, 8), C(3, 1, –3), D(7, –3, 4) are four points then projection of line segment AB on line CD.

Sol. $\overrightarrow{AB} = (\hat{i}) - (3\hat{j}) + 8\hat{k}$

$\overrightarrow{CD} = 4\hat{i} - 4\hat{j} + 7\hat{k}$

$(\overrightarrow{AB}\cdot\overrightarrow{CD}) = \frac{4+12+56}{\sqrt{16+16+49}} = \frac{72}{9} = 8$