



FINAL JEE-MAIN EXAMINATION - SEPTEMBER, 2020

Held On Thursday, 3 September 2020

TIME : 9: 00 AM to 12 : 00 PM

1. If the surface area of a cube is increasing at a rate of $3.6 \text{ cm}^2/\text{sec}$, retaining its shape; then the rate of change of its volume (in cm^3/sec), when the length of a side of the cube is 10 cm , is :

- (1) 9 (2) 18
(3) 10 (4) 20

Official Ans. by NTA (1)

Sol. $\frac{d}{dt}(6a^2) = 3.6 \Rightarrow 12a \frac{da}{dt} = 3.6$

$$a \frac{da}{dt} = 0.3$$

$$\frac{dv}{dt} = \frac{d}{dt}(a^3) = 3a \left(a \frac{da}{dt} \right)$$

$$= 3 \times 10 \times 0.3 = 9$$

2. If the value of the integral $\int_0^{1/2} \frac{x^2}{(1-x^2)^{3/2}} dx$ is

$\frac{k}{6}$, then k is equal to :

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

Official Ans. by NTA (1)

Sol. $\int_0^{1/2} \frac{(x^2 - 1) + 1}{(1-x^2)^{3/2}} dx$

$$\int_0^{1/2} \frac{dx}{(1-x^2)^{3/2}} - \int_0^{1/2} \frac{dx}{\sqrt{1-x^2}}$$

$$\int_0^{1/2} \frac{x^{-3}}{(x^2-1)^{3/2}} dx - (\sin^{-1} x)_0^{1/2}$$

Let $x^2 - 1 = t^2 \Rightarrow x^{-3} dx = -t dt$

$$\int_{\infty}^{\sqrt{3}} \frac{-t dt}{t^3} - \frac{\pi}{6} = \int_{\sqrt{3}}^{\infty} \frac{dt}{\sqrt{3} t^2} - \frac{\pi}{6} = \frac{1}{\sqrt{3}} - \frac{\pi}{6} = \frac{k}{6}$$

$$k = 2\sqrt{3} - \pi$$

3. Let R_1 and R_2 be two relations defined as follows :

$$R_1 = \{(a, b) \in \mathbb{R}^2 : a^2 + b^2 \in \mathbb{Q}\} \text{ and}$$

$$R_2 = \{(a, b) \in \mathbb{R}^2 : a^2 + b^2 \notin \mathbb{Q}\},$$

where \mathbb{Q} is the set of all rational numbers. Then:

- (1) R_2 is transitive but R_1 is not transitive
(2) R_1 is transitive but R_2 is not transitive
(3) R_1 and R_2 are both transitive
(4) Neither R_1 nor R_2 is transitive

Official Ans. by NTA (4)

Sol. Let $a^2 + b^2 \in \mathbb{Q}$ & $b^2 + c^2 \in \mathbb{Q}$

eg. $a = 2 + \sqrt{3}$ & $b = 2 - \sqrt{3}$

$$a^2 + b^2 = 14 \in \mathbb{Q}$$

Let $c = (1 + 2\sqrt{3})$

$$b^2 + c^2 = 20 \in \mathbb{Q}$$

But $a^2 + c^2 = (2 + \sqrt{3})^2 + (1 + 2\sqrt{3})^2 \notin \mathbb{Q}$

for R_2 Let $a^2 = 1$, $b^2 = \sqrt{3}$ & $c^2 = 2$

$$a^2 + b^2 \notin \mathbb{Q} \text{ & } b^2 + c^2 \notin \mathbb{Q}$$

But $a^2 + c^2 \in \mathbb{Q}$

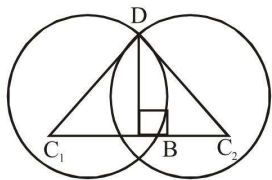
4. Let the latus ractum of the parabola $y^2 = 4x$ be the common chord to the circles C_1 and C_2 each of them having radius $2\sqrt{5}$. Then, the distance between the centres of the circles C_1 and C_2 is:

- (1) 8 (2) $4\sqrt{5}$
(3) 12 (4) $8\sqrt{5}$

Official Ans. by NTA (1)



Sol. Length of latus rectum = 4



$$DB = 2$$

$$C_1B = \sqrt{(C_1D)^2 - (DB)^2} = 4$$

$$C_1C_2 = 8$$

5. If $\int \sin^{-1}\left(\sqrt{\frac{x}{1+x}}\right) dx = A(x)\tan^{-1}(\sqrt{x}) + B(x) + C$,

where C is a constant of integration, then the ordered pair (A(x), B(x)) can be :

- (1) $(x-1, \sqrt{x})$ (2) $(x+1, \sqrt{x})$
 (3) $(x+1, -\sqrt{x})$ (4) $(x-1, -\sqrt{x})$

Official Ans. by NTA (3)

Sol. Put $x = \tan^2 \theta \Rightarrow dx = 2 \tan \theta \sec^2 \theta d\theta$

$$\int \theta \cdot (2 \tan \theta \cdot \sec^2 \theta) d\theta$$

↓ ↓

I II (By parts)

$$= \theta \cdot \tan^2 \theta - \int \tan^2 \theta d\theta$$

$$= \theta \cdot \tan^2 \theta - \int (\sec^2 \theta - 1) d\theta$$

$$= \theta(1 + \tan^2 \theta) - \tan \theta + C$$

$$= \tan^{-1}(\sqrt{x})(1+x) - \sqrt{x} + C$$

6. The probability that a randomly chosen 5-digit number is made from exactly two digits is :

- (1) $\frac{121}{10^4}$ (2) $\frac{150}{10^4}$
 (3) $\frac{135}{10^4}$ (4) $\frac{134}{10^4}$

Official Ans. by NTA (3)

Sol. First Case: Choose two non-zero digits 9C_2

Now, number of 5-digit numbers containing both digits = $2^5 - 2$

Second Case: Choose one non-zero & one zero as digit 9C_1 .

Number of 5-digit numbers containing one non zero and one zero both = $(2^4 - 1)$

Required prob.

$$= \frac{{}^9C_2 \times (2^5 - 2) + {}^9C_1 \times (2^4 - 1)}{9 \times 10^4}$$

$$= \frac{36 \times (32 - 2) + 9 \times (16 - 1)}{9 \times 10^4}$$

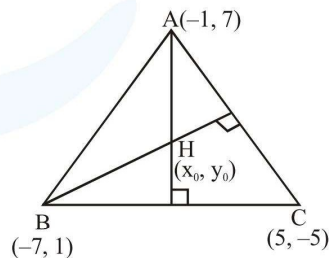
$$= \frac{4 \times 30 + 15}{10^4} = \frac{135}{10^4}$$

7. If a ΔABC has vertices $A(-1, 7)$, $B(-7, 1)$ and $C(5, -5)$, then its orthocentre has coordinates:

- (1) $(3, -3)$ (2) $\left(-\frac{3}{5}, \frac{3}{5}\right)$
 (3) $(-3, 3)$ (4) $\left(\frac{3}{5}, -\frac{3}{5}\right)$

Official Ans. by NTA (3)

Sol. Let orthocentre is $H(x_0, y_0)$



$$m_{AH} \cdot m_{BC} = -1$$

$$\Rightarrow \left(\frac{y_0 - 7}{x_0 + 1}\right) \left(\frac{1 + 5}{-7 - 5}\right) = -1$$

$$\Rightarrow 2x_0 - y_0 + 9 = 0 \dots\dots\dots (1)$$

and $m_{BH} \cdot m_{AC} = -1$



$$\Rightarrow \left(\frac{y_0 - 1}{x_0 + 7} \right) \left(\frac{7 - (-5)}{-1 - 5} \right) = -1$$

$$\Rightarrow x_0 - 2y_0 + 9 = 0 \dots\dots (2)$$

Solving equation (1) and (2) we get

$$(x_0, y_0) \equiv (-3, 3)$$

8. If z_1, z_2 are complex numbers such that $\text{Re}(z_1) = |z_1 - 1|$, $\text{Re}(z_2) = |z_2 - 1|$ and $\arg(z_1 - z_2) = \frac{\pi}{6}$, then $\text{Im}(z_1 + z_2)$ is equal to:

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

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

Official Ans. by NTA (4)

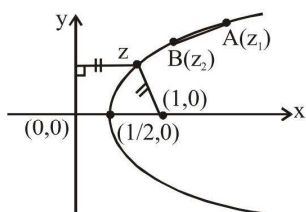
Sol. $\text{Re}(z) = |z - 1|$

$$\Rightarrow x = \sqrt{(x-1)^2 + (y-0)^2} \quad (x > 0)$$

$$\Rightarrow y^2 = 2x - 1 = 4 \cdot \frac{1}{2} \left(x - \frac{1}{2} \right)$$

\Rightarrow a parabola with focus $(1, 0)$ & directrix as imaginary axis.

$$\therefore \text{Vertex} = \left(\frac{1}{2}, 0 \right)$$



$A(z_1)$ & $B(z_2)$ are two points on it such that

$$\text{slope of } AB = \tan \frac{\pi}{6} = \frac{1}{\sqrt{3}}$$

$$(\arg(z_1 - z_2) = \frac{\pi}{6})$$

for $y^2 = 4ax$

Let $A(at_1^2, 2at_1)$ & $B(at_2^2, 2at_2)$

$$m_{AB} = \frac{2}{t_1 + t_2} = \frac{4a}{y_1 + y_2} = \frac{1}{\sqrt{3}}$$

$$\left(\text{Here } a = \frac{1}{2} \right)$$

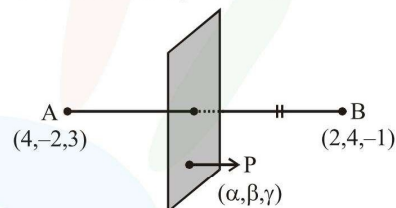
$$\Rightarrow y_1 + y_2 = 4a\sqrt{3} = 2\sqrt{3}$$

9. The plane which bisects the line joining the points $(4, -2, 3)$ and $(2, 4, -1)$ at right angles also passes through the point :

- (1) $(4, 0, -1)$ (2) $(4, 0, 1)$
 (3) $(0, 1, -1)$ (4) $(0, -1, 1)$

Official Ans. by NTA (1)

Sol.



$$PA = PB$$

$$\Rightarrow PA^2 = PB^2$$

$$\Rightarrow (\alpha - 4)^2 + (\beta + 2)^2 + (\gamma - 3)^2 = (\alpha - 2)^2 + (\beta - 4)^2 + (\gamma + 1)^2$$

$$\Rightarrow -4\alpha + 12\beta - 8\gamma = -8$$

$$\Rightarrow 2x - 6y + 4z = 4$$

10. $\lim_{x \rightarrow a} \frac{(a + 2x)^{\frac{1}{3}} - (3x)^{\frac{1}{3}}}{(3a + x)^{\frac{1}{3}} - (4x)^{\frac{1}{3}}}$ ($a \neq 0$) is equal to :

(1) $\left(\frac{2}{3}\right)\left(\frac{2}{9}\right)^{\frac{1}{3}}$ (2) $\left(\frac{2}{3}\right)^{\frac{4}{3}}$

(3) $\left(\frac{2}{9}\right)^{\frac{4}{3}}$ (4) $\left(\frac{2}{9}\right)\left(\frac{2}{3}\right)^{\frac{1}{3}}$

Official Ans. by NTA (1)



Sol. Required limit

$$\begin{aligned}
 L &= \lim_{h \rightarrow 0} \frac{(a+2(a+h))^{1/3} - (3(a+h))^{1/3}}{(3a+a+h)^{1/3} - (4(a+h))^{1/3}} \\
 &= \lim_{h \rightarrow 0} \frac{(3a)^{1/3} \left(1 + \frac{2h}{3a}\right)^{1/3} - (3a)^{1/3} \left(1 + \frac{h}{a}\right)^{1/3}}{(4a)^{1/3} \left(1 + \frac{h}{4a}\right)^{1/3} - (4a)^{1/3} \left(1 + \frac{h}{a}\right)^{1/3}} \\
 &= \lim_{h \rightarrow 0} \left(\frac{3^{1/3}}{4^{1/3}}\right) \left[\frac{\left(1 + \frac{2h}{9a}\right) - \left(1 + \frac{h}{3a}\right)}{\left(1 + \frac{h}{12a}\right) - \left(1 + \frac{h}{3a}\right)} \right] \\
 &= \left(\frac{3}{4}\right)^{1/3} \frac{\left(\frac{2}{9} - \frac{1}{3}\right)}{\left(\frac{1}{12} - \frac{1}{3}\right)} = \left(\frac{3}{4}\right)^{1/3} \frac{(8-12)}{(3-12)} \\
 &= \left(\frac{3}{4}\right)^{1/3} \frac{(-4)}{(-9)} = \frac{4^{1-\frac{1}{3}}}{3^{2-\frac{1}{3}}} = \frac{4^{2/3}}{3^{5/3}} \\
 &= \frac{(8 \times 2)^{1/3}}{(27 \times 9)^{1/3}} = \frac{2}{3} \left(\frac{2}{9}\right)^{1/3}
 \end{aligned}$$

11. Let A be a 3×3 matrix such that

$$\text{adj } A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 0 & 2 \\ 1 & -2 & -1 \end{bmatrix} \text{ and}$$

$$B = \text{adj}(\text{adj } A).$$

If $|A| = \lambda$ and $|(B^{-1})^T| = \mu$, then the ordered pair, $(|\lambda|, \mu)$ is equal to :

- (1) $\left(9, \frac{1}{9}\right)$ (2) $\left(9, \frac{1}{81}\right)$
 (3) $\left(3, \frac{1}{81}\right)$ (4) $(3, 81)$

Official Ans. by NTA (3)

$$\text{Sol. } C = \text{adj } A = \begin{vmatrix} +2 & -1 & 1 \\ -1 & 0 & 2 \\ 1 & -2 & -1 \end{vmatrix}$$

$$|C| = |\text{adj } A| = +2(0+4) + 1(1-2) + 1(2, 4)$$

$$= +8 - 1 + 2$$

$$|\text{adj } A| = |A|^2 = 9 = 9$$

$$\lambda = |A| = \pm 3$$

$$|\lambda| = 3$$

$$B = \text{adj } C$$

$$|B| = |\text{adj } C| = |C|^2 = 81$$

$$|(B^{-1})^T| = |B|^{-1} = \frac{1}{81}$$

$$(|\lambda|, \mu) = \left(3, \frac{1}{81}\right)$$

12. Suppose $f(x)$ is a polynomial of degree four, having critical points at $-1, 0, 1$. If $T = \{x \in \mathbb{R} \mid f(x) = f(0)\}$, then the sum of squares of all the elements of T is :

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

Official Ans. by NTA (3)

$$\text{Sol. } f'(x) = x(x+1)(x-1) = x^3 - x$$

$$\int df(x) = \int x^3 - x \, dx$$

$$f(x) = \frac{x^4}{4} - \frac{x^2}{2} + C$$

$$f(x) = f(0)$$

$$\frac{x^4}{4} - \frac{x^2}{2} = 0$$

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

$$x = 0, 0, \sqrt{2}, -\sqrt{2}$$

$$x_1^2 + x_2^2 + x_3^2 = 0 + 2 + 2 = 4$$



Sol. $x^3 dy + xy dx = x^2 dy + 2y dx$
 $\Rightarrow dy(x^3 - x^2) = dx(2y - xy)$
 $\Rightarrow -\int \frac{1}{y} dy = \int \frac{x-2}{x^2(x-1)} dx$
 $\Rightarrow -\ln y = \int \left(\frac{A}{x} + \frac{B}{x^2} + \frac{C}{(x-1)} \right) dx$

Where $A = 1, B = +2, C = -1$

$\Rightarrow -\ln y = \ln x - \frac{2}{x} - \ln(x-1) + \lambda$
 $\Rightarrow y(2) = e$
 $\Rightarrow -1 = \ln 2 - 1 - 0 + \lambda$
 $\therefore \lambda = -\ln 2$
 $\Rightarrow \ln y = -\ln x + \frac{2}{x} + \ln(x-1) + \ln 2$
 Now put $x = 4$ in equation
 $\Rightarrow \ln y = -\ln 4 + \frac{1}{2} + \ln 3 + \ln 2$
 $\Rightarrow \ln y = \ln\left(\frac{3}{2}\right) + \frac{1}{2} \ln e$
 $\Rightarrow y = \frac{3}{2} \sqrt{e}$

17. Let e_1 and e_2 be the eccentricities of the ellipse,

$\frac{x^2}{25} + \frac{y^2}{b^2} = 1 (b < 5)$ and the hyperbola,

$\frac{x^2}{16} - \frac{y^2}{b^2} = 1$ respectively satisfying $e_1 e_2 = 1$. If

α and β are the distances between the foci of the ellipse and the foci of the hyperbola respectively, then the ordered pair (α, β) is equal to :

- (1) (8, 10) (2) (8, 12)
 (3) $\left(\frac{20}{3}, 12\right)$ (4) $\left(\frac{24}{5}, 10\right)$

Official Ans. by NTA (1)

Sol. For ellipse $\frac{x^2}{25} + \frac{y^2}{b^2} = 1$ ($b < 5$)

Let e_1 is eccentricity of ellipse

$\therefore b^2 = 25(1 - e_1^2)$ (1)

Again for hyperbola

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

Let e_2 is eccentricity of hyperbola.

$\therefore b^2 = 16(e_2^2 - 1)$ (2)

by (1) & (2)

$25(1 - e_1^2) = 16(e_2^2 - 1)$

Now $e_1 \cdot e_2 = 1$ (given)

$\therefore 25(1 - e_1^2) = 16\left(\frac{1 - e_1^2}{e_1^2}\right)$

or $e_1 = \frac{4}{5} \therefore e_2 = \frac{5}{4}$

Now distance between foci is $2ae$

\therefore distance for ellipse = $2 \times 5 \times \frac{4}{5} = 8 = \alpha$

distance for hyperbola = $2 \times 4 \times \frac{5}{4} = 10 = \beta$

$\therefore (\alpha, \beta) \equiv (8, 10)$

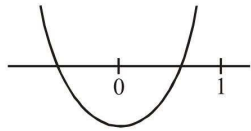
18. The set of all real values of λ for which the quadratic equations,

$(\lambda^2 + 1)x^2 - 4\lambda x + 2 = 0$ always have exactly one root in the interval $(0, 1)$ is :

- (1) $(-3, -1)$ (2) $(1, 3]$
 (3) $(0, 2)$ (4) $(2, 4]$

Official Ans. by NTA (2)

Sol. If exactly one root in $(0, 1)$ then



$$\Rightarrow f(0).f(1) < 0$$

$$\Rightarrow 2(\lambda^2 - 4\lambda + 3) < 0$$

$$\Rightarrow 1 < \lambda < 3$$

Now for $\lambda = 1, 2x^2 - 4x + 2 = 0$

$$(x - 1)^2 = 0, x = 1, 1$$

So both roots doesn't lie between (0, 1)

$$\therefore \lambda \neq 1$$

Again for $\lambda = 3$

$$10x^2 - 12x + 2 = 0$$

$$\Rightarrow x = 1, \frac{1}{5}$$

so if one root is 1 then second root lie between (0, 1)

so $\lambda = 3$ is correct.

$$\therefore \lambda \in (1, 3].$$

19. If the term independent of x in the expansion of

$\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$ is k, then 18 k is equal to :

(1) 9 (2) 11

(3) 5 (4) 7

Official Ans. by NTA (4)

Sol. $T_{r+1} = {}^9C_r \left(\frac{3}{2}x^2\right)^{9-r} \left(-\frac{1}{3x}\right)^r$

$$T_{r+1} = {}^9C_r \left(\frac{3}{2}\right)^{9-r} \left(-\frac{1}{3}\right)^r x^{18-3r}$$

For independent of x

$$18 - 3r = 0, r = 6$$

$$\therefore T_7 = {}^9C_6 \left(\frac{3}{2}\right)^3 \left(-\frac{1}{3}\right)^6 = \frac{21}{54} = k$$

$$\therefore 18k = \frac{21}{54} \times 18 = 7$$

20. Let p, q, r be three statements such that the truth value of $(p \wedge q) \rightarrow (\sim q \vee r)$ is F. Then the truth values of p, q, r are respectively :

(1) T, F, T (2) F, T, F

(3) T, T, F (4) T, T, T

Official Ans. by NTA (3)

Sol. $(p \wedge q) \rightarrow (\sim q \vee r) = \text{false}$

when $(p \wedge q) = T$

and $(\sim q \vee r) = F$

So $(p \wedge q) = T$ is possible when $p = q = \text{true}$

$$\therefore \sim q = \text{False} (q = \text{true})$$

So $(\sim q \vee r) = \text{False}$ is possible if r is false

$$\therefore p = T, q = T, r = F$$

21. If m arithmetic means (A.Ms) and three geometric means (G.Ms) are inserted between 3 and 243 such that 4th A.M. is equal to 2nd G.M., then m is equal to _____.

Official Ans. by NTA (39)

Sol. 3, A₁, A₂ A_m, 243

$$d = \frac{243 - 3}{m + 1} = \frac{240}{m + 1}$$

Now 3, G₁, G₂, G₃, 243

$$r = \left(\frac{243}{3}\right)^{\frac{1}{3+1}} = 3$$

$$\therefore A_4 = G_2$$

$$\Rightarrow a + 4d = ar^2$$

$$3 + 4 \left(\frac{240}{m + 1}\right) = 3(3)^2$$

$$m = 39$$



22. If the tangent of the curve, $y = e^x$ at a point (c, e^c) and the normal to the parabola, $y^2 = 4x$ at the point $(1, 2)$ intersect at the same point on the x-axis, then the value of c is _____.

Official Ans. by NTA (4)

Sol. $y = e^x \Rightarrow \frac{dy}{dx} = e^x$

$$m = \left(\frac{dy}{dx} \right)_{(c, e^c)} = e^c$$

\Rightarrow Tangent at (c, e^c)

$$y - e^c = e^c (x - c)$$

it intersect x-axis

Put $y = 0 \Rightarrow x = c - 1$ (1)

Now $y^2 = 4x \Rightarrow \frac{dy}{dx} = \frac{2}{y} \Rightarrow \left(\frac{dy}{dx} \right)_{(1, 2)} = 1$

\Rightarrow Slope of normal = -1

Equation of normal $y - 2 = -1(x - 1)$

$$x + y = 3 \text{ it intersect x-axis}$$

Put $y = 0 \Rightarrow x = 3$ (2)

Points are same

$\Rightarrow x = c - 1 = 3$

$\Rightarrow c = 4$

23. Let a plane P contain two lines

$$\vec{r} = \hat{i} + \lambda(\hat{i} + \hat{j}), \lambda \in \mathbb{R} \text{ and}$$

$$\vec{r} = -\hat{j} + \mu(\hat{j} - \hat{k}), \mu \in \mathbb{R}$$

If $Q(\alpha, \beta, \gamma)$ is the foot of the perpendicular drawn from the point $M(1, 0, 1)$ to P, then $3(\alpha + \beta + \gamma)$ equals _____.

Official Ans. by NTA (5)

Sol. Dr's normal to plane

$$= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 1 & 0 \\ 0 & 1 & -1 \end{vmatrix} = -\hat{i} + \hat{j} + \hat{k}$$

Equation of plane

$$-1(x - 1) + 1(y - 0) + 1(z - 0) = 0$$

$$x - y - z - 1 = 0 \quad \dots\dots(1)$$

Now $\frac{\alpha - 1}{1} = \frac{\beta - 0}{-1} = \frac{\gamma - 0}{-1} = -\frac{(1 - 0 - 1 - 1)}{3}$

$$\frac{\alpha - 1}{1} = \frac{\beta}{-1} = \frac{\gamma - 1}{-1} = \frac{1}{3}$$

$$\alpha = \frac{4}{3}, \beta = -\frac{1}{3}, \gamma = \frac{2}{3}$$

$$3(\alpha + \beta + \gamma) = 3\left(\frac{4}{3} - \frac{1}{3} + \frac{2}{3}\right) = 5$$

24. Let S be the set of all integer solutions, (x, y, z) , of the system of equations

$$x - 2y + 5z = 0$$

$$-2x + 4y + z = 0$$

$$-7x + 14y + 9z = 0$$

such that $15 \leq x^2 + y^2 + z^2 \leq 150$. Then, the number of elements in the set S is equal to _____.

Official Ans. by NTA (8)



Sol. $\Delta = \begin{vmatrix} 1 & -2 & 5 \\ -2 & 4 & 1 \\ -7 & 14 & 9 \end{vmatrix} = 0$

Let $x = k$

\Rightarrow Put in (1) & (2)

$$k - 2y + 5z = 0$$

$$-2k + 4y + z = 0$$

$$z = 0, y = \frac{k}{2}$$

\therefore x, y, z are integer

\Rightarrow k is even integer

Now $x = k, y = \frac{k}{2}, z = 0$ put in condition

$$15 \leq k^2 + \left(\frac{k}{2}\right)^2 + 0 \leq 150$$

$$12 \leq k^2 \leq 120$$

$\Rightarrow k = \pm 4, \pm 6, \pm 8, \pm 10$

\Rightarrow Number of element in $S = 8$.

25. The total number of 3-digit numbers, whose sum of digits is 10, is _____.

Official Ans. by NTA (54)

Sol. Let three digit number is xyz

$$x + y + z = 10 ; x \geq 1, y \geq 0, z \geq 0 \dots (1)$$

$$\text{Let } T = x - 1 \Rightarrow x = T + 1 \text{ where } T \geq 0$$

Put in (1)

$$T + y + z = 9 ; 0 \leq T \leq 8, 0 \leq y, z \leq 9$$

No. of non negative integral solution

$$= {}^{9+3-1}C_{3-1} - 1 \text{ (when } T = 9)$$

$$= 55 - 1 = 54$$