EXERCISE – V

HINTS & SOLUTIONS

Sol.1 **(i)** Let the equation of plane be

$ax + by + cz + d = 0$ ....(1)

(1) passes through (2,1,0),(5,0,1)&(4,2,1)

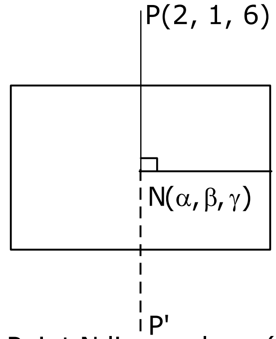
$\Rightarrow a = \frac{-d}{3}; b = -\frac{d}{3}; c = \frac{2}{3}d$

$\Rightarrow x + y - 2z - 3 = 0$ ....(2)

(ii) P (2, 1, 6)

$$\frac{\alpha - 2}{1} = \frac{\beta - 1}{1} = \frac{\gamma - 6}{-2} = \lambda$$

$\alpha = \lambda + 2; \beta = \lambda + 1, \gamma = -2\lambda + 6$



Point N lie on plane (2)

$(\lambda + 2) + (\lambda + 1) - 2(-2\lambda + 6) - 3 = 0$

$\Rightarrow \lambda = 2$

N (4, 3, 2)

$2N = P + P^1 \Rightarrow P^1 = 2N - P$

$= (8, 6, 4) - (2, 1, 6)$

$= (6, 5, -2)$

Sol.2 **B**

$$\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-1}{4} = \lambda \quad ....(1)$$

$$\frac{x-3}{1} = \frac{y-k}{2} = \frac{z}{1} = H \quad ....(2)$$

General point on (1) is $(2\lambda + 1, 3\lambda - 1, 4\lambda + 1)$

and on (2) is $(\mu + 3, 2\mu + k, \mu)$

so $2\lambda + 1 = \mu + 3$

$3\lambda - 1 = 2\mu + k$

$4\lambda + 1 = \mu$

So after solving we get $k = \frac{9}{2}$

Sol.3 Direction of plane $= \vec{L_1} \times \vec{L_2}$

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

$\vec{n} = (1, 1, 1)$

Equation of plane

$x + y + z = d$ passes through (1, 1, 1)

$d = 3$

$x + y + z = 3$

A (3, 0, 0) ; B(0, 3, 0), C (0, 0, 3)

$$\text{Volumeof OABC} = \frac{1}{6}\begin{vmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{vmatrix} = \frac{27}{6} = \frac{9}{2}$$

cubic units.

Sol.4 **D**

(a) Let $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$ be the variable plane

so

$$\left|\frac{1}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2}}}\right| = 1$$

a (a, 0, 0) B(a, b, 0) C(0, 0, c)

Centroid G of ΔABC is G $\left(\frac{a}{c}, \frac{b}{3}, \frac{c}{3}\right)$

$x = \frac{a}{3}; y = \frac{b}{3}, z = \frac{c}{3}$

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

$\Rightarrow \frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = 9$

So k = 9

(b) Reqd. plane $\pi, + \lambda\pi_2 = 0$

$2x - y + z - 3 + \lambda(3x + y + z - 5) = 0$

$(3\lambda + 2)x + (\lambda - 1)y + (\lambda + 1)z$

$- 5\lambda - 3 = 0$ ...(1)

Distance of plane (1) from point

(2, 1, −1) is $\frac{1}{\sqrt{6}}$

$$\Rightarrow \left|\frac{6\lambda + 2 + \lambda - 1 - \lambda - 1 - 5\lambda - 3}{\sqrt{(3\lambda + 2)^2 + (\lambda - 1)^2 + (\lambda + 1)^2}}\right| = \frac{1}{\sqrt{6}}$$

$\Rightarrow 6(\lambda - 1)^2 = 11\lambda^2 + 12\lambda + 6$

$\Rightarrow \lambda = 0, -\dfrac{2y}{5}$

The planes are

$2x - y + z - 3 = 0$

and $62x + 29y + 19z - 109 = 0$

Sol.5 **(a)** $\vec{n}_1 = (2, -2, 1)$ $\vec{n}_2 = (1, -1, 2)$

Normal vector of $\vec{n} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -2 & 1 \\ 1 & -1 & 2 \end{vmatrix}$

$= -3\hat{i} - 3\hat{j} - 0\hat{k}$

$\vec{n} = (-3, -3, 0)$

So plane will be

$-3x - 3y = k$

passes through $(1, -2, 1)$ $\Rightarrow k = 3$

$-3x - 3y = 3$

$x + y + 1 = 0$

$d = \left|\dfrac{1+2+1}{\sqrt{2}}\right| = \dfrac{4}{\sqrt{2}} = 2\sqrt{2}$

(b) **(A)** Solving the two equations

$x = \dfrac{|a|+1}{a+1} > 0$ and $y = \dfrac{|a|-1}{a+1} > 0$

when $a + 1 > 0$ we get $a > 1$

$\Rightarrow a_0 = 1$ (S)

(B) $\vec{a} = (\alpha, \beta, \gamma) \Rightarrow \vec{a}\cdot\hat{k} = \gamma$

$\hat{k} \times (\hat{k} \times \vec{a}) = (\hat{k}\cdot\vec{a})\hat{k} - (\hat{k} - \hat{k})\vec{a}$

$= \gamma\hat{k} - (\alpha\hat{i} + \beta\hat{j} + \gamma\hat{k})$

$\Rightarrow \alpha\hat{i} + \beta\hat{j} = \overline{O} \Rightarrow \alpha = 0, \beta = 0$

$\alpha + \beta + \gamma = 2 \Rightarrow \gamma = 2$ (P)

(C) $\left|\int_0^1 (1-y^2)dy\right| + \left|\int_0^1 (y^2-1)dy\right|$

$= 2\int_0^1 (1-y^2)dy = \left|\dfrac{4}{3}\right|$

$\left|\int_0^1 \sqrt{1-x}\,dx\right| + \left|\int_{-1}^0 \sqrt{1-x}\,dx\right| = 2\int_0^1 \sqrt{1-x}\,dx$

$= 2\int_0^1 \sqrt{x}\,dx = \dfrac{4}{3}$ (Q)

(D) $\sin A \sin B \sin C + \cos A \cos B$

$\le \sin A \sin B + \cos A \cos B$

$\le \cos(A - B)$

$\cos(A - B) \ge 1$

$\Rightarrow \cos(A - B) = 1 \Rightarrow \sin C = 1$

(C) **(A)** $t = \sum_{i=1}^{\infty} \tan^{-1}\left(\dfrac{1}{2i^2}\right)$

$= \sum_{i=1}^{\infty} \tan^{-1}\left(\dfrac{2}{4i^2 - 1 + 1}\right)$

$= \sum_{i=1}^{\infty} [\tan^{-1}(2i+1) - \tan^{-1}(2i-1)]$

$=[(\tan^{-1}3 - \tan^{-1}1) + (\tan^{-1}5 - \tan^{-1}3) + \ldots\ldots$

$\ldots\ldots + \tan^{-1}(2n+1) - \tan^{-1}(2n-1) \ldots\ldots \infty]$

$t = \tan^{-1}(2n+1) - \tan^{-1} 1$

$t = \lim_{n\to\infty} \tan^{-1} \dfrac{2n}{1 + (2n+1)}$

$\tan t = \lim_{n\to\infty} \dfrac{n}{n+1} = 1$ (Q)

(B) We have

$\cos\theta_1 = \dfrac{1 - \tan^2\frac{\theta_1}{2}}{1 + \tan^2\frac{\theta_1}{2}} = \dfrac{a}{b+c}$

$\Rightarrow \tan^2\dfrac{\theta_1}{2} = \dfrac{b+c-a}{b+c+a}$

Also $\cos\theta_3 = \dfrac{1 - \tan^2\frac{\theta_3}{2}}{1 + \tan^2\frac{\theta_3}{2}} = \dfrac{c}{a+b}$

$\Rightarrow \tan^2\dfrac{\theta_3}{2} = \dfrac{a+b-c}{a+b+c}$

$\tan^2\dfrac{\theta_1}{2} + \tan^2\dfrac{\theta_3}{2} = \dfrac{2b}{3b} = \dfrac{2}{3}$ (S)

(C) Line through (0, 1, 0) and $\perp^n$ to plane $x + 2y + 2z = 0$

is $\frac{x-0}{1} = \frac{y-1}{2} = \frac{z-0}{2} = \lambda$

Let $P(\lambda, 2\lambda + 1, 2\lambda)$ be the foot of $\perp^n$ on the straight line then

$\lambda.1 + (2\lambda + 1)\,2 + 2(2\lambda) = 0$

$\Rightarrow\ k = -\frac{2}{9}$

$P\left(-\frac{2}{9}, \frac{5}{9}, \frac{-4}{9}\right)$

$\perp^n$ distance $= \sqrt{\frac{4+25+16}{81}} = \frac{\sqrt{5}}{3}$ unit.

(R)

Sol.6 **(a)** $3x - 6y - 2z = 15$ & $2x + y - 2z = 5$

for z= 0 we get x = 3, y = −1

Direction vector of planes are

(3, −6, −2) & (2, 1, −2)

then the D.R.'s of line of intersection of plane is (14, 2, 15)

$\frac{x-3}{14} = \frac{y+1}{2} = \frac{z-0}{15} = \lambda$

statement-2 is correct.

(b) $D = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = -\frac{1}{2}(a + b + c)$

$[(a-b)^2 + (b-c)^2 + (c-a)^2]$

(A) If $a + b + c \neq 0$ and $\Sigma a^2 = \Sigma ab$

$\Rightarrow$ D = 0 and a = b = c

$\Rightarrow$ Equation represents identical planes

(B) D = 0 $\Rightarrow$ Equation will have infinite many solution

$ax + by = (a + b)z$

$bx + cy = (b + c)z$

$(b^2 - ac)y = (b^2 - ac)z$

$y = z$

$\Rightarrow\ ax + by + cy = 0$

$\Rightarrow\ ax = ay \Rightarrow x = y \Rightarrow x = y = z$

(C) $D \neq 0$

$\Rightarrow$ Planes meeting at only one point

(D) $a + b + c = 0$

$\Sigma a^2 = \Sigma ab$

$\Rightarrow\ a = b = c = 0$

Sol.7 **(a)** **D**

Given equations are

$x - y + z = 1$

$x + y - z = -1$

$x - 3y + 3z = 2$

The system of equations can be put in matrix from as

$Ax = B$

$$\begin{bmatrix} 1 & -1 & 1 \\ 1 & 1 & -1 \\ 1 & -3 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -2 \\ 0 & -2 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix} \begin{matrix} R_2 \to R_2 - R_1 \\ R_3 \to R_3 - R_1 \end{matrix}$$

$$\sim \begin{bmatrix} 1 & -1 & 1 \\ 0 & 2 & -2 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -2 \\ -1 \end{bmatrix} R_3 \to R_3 + R_2$$

Which is inconsistent as $\rho(A : B) \neq \rho(A)$

$\Rightarrow$ The three planes do not have a common point.

$\Rightarrow$ Statement-2 is true.

Since, planes P_1, P_2, P_3 are pairmise intersection, then their lines of intersection are parallel.

Statement-1 is false.

(b) (i) $\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 3 & 1 & 2 \\ 1 & 2 & 3 \end{vmatrix} = -\hat{i} - 7\hat{j} + 5\hat{k}$

Hence unit vector will be $= \frac{-\hat{i} - 7\hat{j} + 5\hat{k}}{5\sqrt{3}}$

(ii) Shortest distance

$= \frac{(1+2)(-1) + (2-2)(-7) + C(1+3)5}{5\sqrt{3}}$

$= \frac{17}{5\sqrt{3}}$

(iii) Plane is given by

$-(x+1) - 7(y + 2) + 5(z + 1) = 0$

$\Rightarrow x + 7y - 5z + 10 = 0$

distance $= \left|\frac{1 + 7 - 5 + 10}{\sqrt{75}}\right| = \frac{13}{\sqrt{75}}$

Sol.8 (a) A

Any point Q on the line

$Q \equiv \{(1 - 34), (\mu - 1), (5\mu + 2)\}$

$\overrightarrow{PQ} = \{-3\mu - 2, \mu - 3, 5\mu - 4\}$

Now $1(-3\mu - 2) - 4(\mu - 3) + 3(5\mu - 4) = 0$

$\Rightarrow \mu = \frac{1}{4}$

(b) C

D.C. of the line are $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$

Equation of line

$\vec{r} = (2, -1, 2) + \lambda\left(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$

where λ is the distance.

variable point on lie is

$$\left(2 + \frac{\lambda}{\sqrt{3}}, \frac{-1+\lambda}{\sqrt{3}}, \frac{2+\lambda}{\sqrt{3}}\right)$$

Which lies on the plane $2x + y + z = 9$

$\Rightarrow \lambda = \sqrt{3}$ **[C]**

(C) $\left.\begin{array}{l} 3x - y - z = 0 \\ -3x + z = 0 \end{array}\right\rangle \begin{array}{l} y = 0 \\ \text{and } z = 3x \end{array}$

$-3x + 2y + z = 0$

$\Rightarrow x^2 + y^2 + z^2 = x^2 + z^2$

$= 9x^2 + x^2 \; 10x^2 \le 100$

$\Rightarrow x^2 \le 10 \quad \Rightarrow x = 0, \pm 1, \pm 2, \pm 3$ **[7]**

Sol.9 C

Plane 1 : $ax + by + cz = 0$

containing line $\frac{x}{2} = \frac{y}{3} = \frac{z}{4}$

$2a + 3b + 4c = 0$ ....(i)

Plane 2 : $a^1x + b^1y + c^1z = 0$ is $\perp^n$ to plane containg lines

$\frac{x}{3} = \frac{y}{4} = \frac{z}{2}$ and $\frac{x}{4} = \frac{y}{2} = \frac{z}{3}$

$3a' + 4b' + 2c' = 0$

and $4a' + 2b' + 3c' = 0$

$\frac{a'}{12-4} = \frac{b'}{8-9} = \frac{c'}{6-16}$

$\Rightarrow 8a - b - 10c = 0$ ....(ii)

Equation of plane 1 : $x - 2y + z = 0$ **[C]**

Sol.10 $2\ell + 3m + 4n = 0$

$3\ell + 4m + 5n = 0$

$\frac{\ell}{-1} = \frac{m}{2} = \frac{n}{-1}$

Equation of plane will be

$a(x - 1) + b(y - 2) + c(z - 3) = 0$

$-1(x - 1) + 2(y - 2) - 1(z - 3) = 0$

$-x + 2y - z = 0$

$x - 2y + z = 0$

$\frac{|d|}{\sqrt{6}} = \sqrt{6} \qquad \Rightarrow |d| = 6$

Sol.11 A

Distance of point $P(1, -2, 1)$ from plane $x + 2y - 2z = d$ is $5 \Rightarrow \alpha = 10$

Equation of PQ $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-1}{-2} = t$

$Q \equiv (t + 1, 2t - 2, -2t + 1)$

$PQ = 5 \Rightarrow t = \frac{5+\alpha}{9} = \frac{5}{3}$

$\Rightarrow Q \equiv \left(\frac{8}{3}, \frac{4}{3}, \frac{-7}{3}\right)$

Sol.12 (A) Let the line

$\frac{x}{a} = \frac{y}{b} = \frac{z}{c}$ intersect the lines

$\Rightarrow a + 3b + 5c = 0$

and $3a + b - 5c = 0$

$\Rightarrow a : b : c :: 5t : -5t : 2t$

on solving with given lines we get points of intersection $P \equiv (5, -5, 2)$ and

$Q \equiv \left(\frac{10}{3}, \frac{-10}{3}, \frac{8}{3}\right)$

$PQ^2 = d^2 = 6$

(B) $\tan^{-1}(x + 3) - \tan^{-1}(x - 3) = \sin^{-1}\left(\frac{3}{5}\right)$

$\tan^{-1}\left[\frac{(x+3)-(x-3)}{1+(x^2-9)}\right] = \tan^{-1}\frac{3}{4}$

$\Rightarrow \frac{6}{x^2-8} = \frac{3}{4} \qquad \Rightarrow x = \pm 4$

(C) $\vec{a} = \mu\vec{b} + 4\vec{c} \Rightarrow m(|\vec{b}|)^2 = -4\vec{b}.\vec{c}$

and $|\vec{b}|^2 + \vec{b}.\vec{c} - \vec{a}.\vec{c} = 0$

Again as $2|\vec{b} + \vec{c}| = |\vec{b} - \vec{a}|$

Solving and eliminating $\vec{b}.\vec{c}$ and

eliminating $|\vec{a}|^2$

We get $(2\mu^2 - 10\mu)\,|b|^2 = 0 \Rightarrow \mu = 0, 5$

(D) $I = \dfrac{2}{\pi^5}\displaystyle\int_{-\pi}^{\pi} f(x)\,dx = \dfrac{\pi}{2}\int_{-\pi}^{\pi}\dfrac{\sin 9(x/2)}{\sin(x/2)}\,dx$

$= \dfrac{2}{\pi} \times 2\displaystyle\int_{0}^{\pi}\dfrac{\sin 9(x/2)}{\sin(x/2)}\,dx$

Let $\dfrac{x}{2} = \theta \qquad \Rightarrow dx = 2d\theta$

$I = \dfrac{8}{\pi}\displaystyle\int_{0}^{\pi/2}\dfrac{\sin 9\theta}{\sin\theta}\,d\theta$

$I = \dfrac{8}{\pi}\displaystyle\int_{0}^{\pi/2}\dfrac{(\sin 9\theta - \sin 7\theta)}{\sin\theta}$

$+ \dfrac{(\sin 7\theta - \sin 5\theta)}{\sin\theta} + \left(\dfrac{\sin 5\theta - \sin\theta}{\sin\theta}\right)$

$+ \dfrac{\sin\theta d\theta}{\sin\theta}$

$= \dfrac{16}{\pi}\displaystyle\int_{\pi}^{\pi/2}(\cos 9\theta + \cos 6\theta + \cos 4\theta + \cos 2\theta)\,d\theta$

$+ \dfrac{8}{\pi}\displaystyle\int_{0}^{\pi/2} d\theta$

$= \dfrac{16}{\pi}\left[\dfrac{\sin 8\theta}{8} + \dfrac{\sin 6\theta}{6} + \dfrac{\sin 4\theta}{4} + \dfrac{\sin 2\theta}{2}\right]_0^{\pi/2} + \dfrac{8}{\pi}[\theta]_0^{\pi/2}$

$= 0 + \dfrac{8}{\pi} \times \dfrac{\pi}{2} = 4$

Sol.13 A

Line $\dfrac{x-2}{1} = \dfrac{y-3}{4} = \dfrac{z-5}{1} = \lambda$ (Let)

dso $(\lambda + 2, 4\lambda + 3, \lambda + 5)$

Line on plane $5x - 4y - z = 1$

$5\lambda + 10 - 16\lambda - 12 - \lambda - 5 = 1$

$-12\lambda = 8$

$\lambda = -2/3$ so $P\left(\dfrac{4}{3}, \dfrac{1}{3}, \dfrac{13}{3}\right)$

for foot of perpendiuclar of T(2, 1, 4)

$(\lambda\ 4\lambda + 2, \lambda + 1) . (1, 4, 1) = 0$

$\lambda + 16\lambda + 8 + \lambda + 1 = 0$

$\lambda = -9/18 \qquad \Rightarrow \lambda = -1/2$

So R(3/2, 1, 9/2), distance $a = 1/\sqrt{2}$

Sol.14 A

$(x + 2y + 3z - 2) + \lambda(x - y + z - 3) = 0$

$(1 + \lambda)x + (2 - \lambda)y + (\lambda + 3)z - (2 + 3\lambda) = 0$

$\Rightarrow \dfrac{|(1+\lambda).3 + (2-\lambda)1 - (\lambda+3) - (2+3\lambda)|}{\sqrt{(1+\lambda)^2 + (2-\lambda)^2 + (\lambda+3)^2}} = \dfrac{2}{\sqrt{3}}$

$\Rightarrow \sqrt{3\lambda^2 + 4\lambda + 14} = \dfrac{2}{\sqrt{3}}$

$\Rightarrow \dfrac{|-2\lambda|}{\sqrt{3\lambda^2 + 4\lambda + 14}} = \dfrac{2}{\sqrt{3}}$

$= 3\lambda^2 + 4\lambda + 14$

$\lambda = -7/2$

$(x + 2y + 3z - z) - 7/2\,(x - y + z - 3) = 0$

$-5x + 11y - z + 17 = 0$

$5x - 11y + z = 17$

Sol.15 B, C

$\begin{vmatrix} 2 & 0 & 0 \\ 2 & k & 2 \\ 5 & 2 & k \end{vmatrix} = 0 \Rightarrow k = \pm 2$

use the value of k for finding the equation of planes

Answer Ex–I SINGLE CORRECT (OBJECTIVE QUESTIONS)

1. B	**2.** C	**3.** B	**4.** A	**5.** D	**6.** A	**7.** A
8. A	**9.** B	**10.** A	**11.** D	**12.** A	**13.** D	**14.** A
15. B	**16.** B	**17.** A	**18.** A	**19.** B	**20.** D	**21.** A
22. D	**23.** A	**24.** B	**25.** A	**26.** D	**27.** A	**28.** A
29. A	**30.** D	**31.** B	**32.** D	**33.** C	**34.** C	**35.** B
36. D	**37.** A	**38.** C	**39.** C	**40.** D	**41.** C	**42.** C
43. A	**44.** B	**45.** A	**46.** C	**47.** D	**48.** B	**49.** C
50. C	**51.** B	**52.** B	**53.** C	**54.** A	**55.** A	**56.** A
57. C	**58.** B					

Answer Ex–II MULTIPLE CORRECT (OBJECTIVE QUESTIONS)

1. AB	**2.** ABC	**3.** BD	**4.** AC	**5.** AD	**6.** ABC	**7.** BC
8. BD	**9.** ABCD	**10.** AB	**11.** BC	**12.** BC		

Answer Ex–III SUBJECTIVE QUESTIONS

2. (1/2, 1/2, 1/2) **3.** (a/2, b/2, c/2) **4.** 3 : 2 ; (0, 13/5, 1) **5.** (2/3, –2/3, –1/3)

6. 60° **8.** $2 - 2\sqrt{2}$ **9.** $x + y \pm \sqrt{2}\, z = 1$ **10.** $\pi/2$

11. $11x - y - 3z = 35$ **12.** $\frac{x-4}{9} = \frac{y+1}{-1} = \frac{z-7}{-3}$ **13.** $\sqrt{26}$

14. $x^2 + y^2 + z^2 - y - 2z - 14 = 0,\ \frac{317\pi}{24}$ **15.** $7x + 13y + 4z - 9 = 0$; $\left(\frac{12}{117} - \frac{-78}{117}, \frac{57}{117}\right)$

16. $\frac{x-2}{-1} = \frac{y+1}{13} = \frac{z+1}{9}$ **17.** $\alpha = -1,\ \frac{80}{63}$ **19.** $\frac{x}{1} = \frac{y}{2} = \frac{z}{-1}; \frac{x}{-1} = \frac{y}{1} = \frac{z}{-2}$

20. $\frac{x+1}{11} = \frac{y-1}{9} = \frac{z-1}{-15}$ **21.** $\cos^{-1}\frac{4}{9}$ **22.** $\sin^{-1}\frac{4}{\sqrt{30}}$