RD Sharma Solutions Class 12 Maths Chapter 29 Ex 29.14

The Plane Ex 29.14 Q1

Consider

$$l_1 : \frac{x-2}{-1} = \frac{y-5}{2} = \frac{z-0}{3}$$

$$l_2 : \frac{x-0}{2} = \frac{y+1}{-1} = \frac{z-1}{2}$$

Clearly line l_1 passes through the point $P(2,5,0)$

The equation of a plane containing line l_2 is

$$a(x-0)+b(y+1)+c(z-1)=0 \qquad \text{...... (1)}$$

Where $2a-b+2c=0$

If it is parallel to line l_1 then

$$-a+2b+3c=0$$

Therefore

$$\frac{a}{-7} = \frac{b}{-8} = \frac{c}{3}$$

Substituting values of a, b, c in the equation (1) we obtain

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

$$-7(x-0)-8(y+1)+3(z-1)=0$$

$$-7x-8y-8+3z-3=0$$

$$7x+8y-3z+11=0 \qquad \text{...... (2)}$$

This is the equation of the plane containing line l_2 and parallel to line l_1

Shortest distance between l_1 and l_2 = Distance between point $P(2,5,0)$ and plane (2)

$$= \left| \frac{14+40+11}{\sqrt{7^2+8^2+(-3)^2}} \right| = \frac{65}{\sqrt{122}}$$

The Plane Ex 29.14 Q2

$$l_1 : \frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$$

$$l_2 : \frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$$

Let the equation of the plane containing l_1 be $a(x+1)+b(y+1)+c(z+1)=0$

Plane is parallel to l_1: $7a-6b+c=0$......(i)

Plane is parallel to l_2: $a-2b+c=0$........(ii)

Solving (i) and (ii),

$$\frac{a}{-6+2} = \frac{b}{1-7} = \frac{c}{-14+6}$$

$$\frac{a}{-4} = \frac{b}{-6} = \frac{c}{-8}$$

$\therefore$ Equation of the plane is $-4(x+1)-6(y+1)-8(z+1)=0$

$4(x+1)+6(y+1)+8(z+1)=0$ is the equation of the plane.

The Plane Ex 29.14 Q3

The equation of a plane containing the line $3x - y - 2z + 4 = 0 = 2x + y + z + 1$ is

$x(2\lambda + 3) + y(\lambda - 1) + z(\lambda - 2) + \lambda + 4 = 0$............(i)

If it is parallel to the line then $\frac{x-1}{2} = \frac{y-3}{4} = \frac{z+2}{1}$ then,

$2(2\lambda + 3) + 4(\lambda - 1) + (\lambda - 2) = 0$

$\Rightarrow \lambda = 0$

Putting $\lambda = 0$ in (i) we get,

$3x - y - 2z + 4 = 0$............(ii)

As this equation of the plane containing the second line and paralle to the first line.

Clearly the line $\frac{x-1}{2} = \frac{y-3}{4} = \frac{z+2}{1}$ passes through the point $(1, 3, -2)$

So, the shortest distance 'd' between the given lines is equal to the length of perpendicular from $(1, 3, -2)$ on the plane (ii).

$$d = \left|\frac{3 - 3 + 4 + 4}{\sqrt{1+9+4}}\right| = \frac{8}{\sqrt{14}}$$