SATPREP **Name** _____

Assignment : Equation of plane and applications **Date** _____

1. Find a vector that is normal to the plane containing the lines L_1, and L_2, whose equations are:

$$L_1: \boldsymbol{r} = \boldsymbol{i} + \boldsymbol{k} + \lambda\,(2\boldsymbol{i} + \boldsymbol{j} - 2\boldsymbol{k})$$
$$L_2: \boldsymbol{r} = 3\boldsymbol{i} + 2\boldsymbol{j} + 2\boldsymbol{k} + \mu\,(\boldsymbol{j} + 3\boldsymbol{k})$$

2. Consider the points A(1, 2, –4), B(l, 5, 0) and C(6, 5, –12). Find the area of ΔABC.

3. Consider the four points A(1, 4, –1), B(2, 5, –2), C(5, 6, 3) and D(8, 8, 4). Find the point of intersection of the lines (AB) and (CD).

4. The line $\boldsymbol{r} = \boldsymbol{i} + \boldsymbol{k} + \mu(\boldsymbol{i} - \boldsymbol{j} + 2\boldsymbol{k})$ and the plane $2x - y + z + 2 = 0$ intersect at the point P. Find the coordinates of P.

5. Given that $\boldsymbol{a} = 2\boldsymbol{i} - \boldsymbol{j} - \boldsymbol{k}$, $\boldsymbol{b} = 2\boldsymbol{i} + \boldsymbol{j} - 2\boldsymbol{k}$ and $\boldsymbol{c} = -\boldsymbol{i} + \boldsymbol{j} - \boldsymbol{k}$ are the position vectors of the points A, B and C respectively, calculate the area of triangle ABC.

6. Find the coordinates of the point of intersection of the line L with the plane P where:

$$L: \frac{x+3}{2} = \frac{y-1}{-1} = \frac{z-1}{2}$$
$$P: 2x + 3y - z = -5$$

7. The point A is the foot of the perpendicular from the point (1, 1, 9) to the plane $2x + y - z = 6$. Find the coordinates of A.

8. Find the equation of the line of intersection of the two planes $-4x + y + z = -2$ and $3x - y + 2z = -1$.

9. Find an equation for the line of intersection of the following two planes.

$$x + 2y - 3z = 2$$
$$2x + 3y - 5z = 3$$

10. The vector equations of the lines L_1 and L_2 are given by

$$L_1: \boldsymbol{r} = \boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k} + \lambda(\boldsymbol{i} + 2\boldsymbol{j} + 3\boldsymbol{k});$$

$$L_2: \boldsymbol{r} = \boldsymbol{i} + 4\boldsymbol{j} + 5\boldsymbol{k} + \mu(2\boldsymbol{i} + \boldsymbol{j} + 2\boldsymbol{k}).$$

The two lines intersect at the point P. Find the position vector of P.

Answers of Assignment Equation of plane and applications

1. $5\boldsymbol{i} - 6\boldsymbol{j} + 2\boldsymbol{k}$

2. 21. 9

3. (–1, 2, 1)

4. (0, 1, –1)

5. $\frac{7}{2}$

6. (–1, 0, 3)

7. (5, 3, 7)

8. $x = \frac{3y+3}{11} = 3z + 3$ (or equivalent)

OR

$\boldsymbol{r} = \begin{pmatrix} 0 \\ -1 \\ -1 \end{pmatrix} + \lambda \begin{pmatrix} 3 \\ 11 \\ 1 \end{pmatrix}$ (or equivalent)

9. $-\boldsymbol{i} - \boldsymbol{j} - \boldsymbol{k}$, $\boldsymbol{r} = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} + t \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$

10. $3\boldsymbol{i} + 5\boldsymbol{j} + 7\boldsymbol{k}$.