

Sangam S. K. M College - Nadi

Year 13

Mathematics

Worksheet 2: Solution

1. Find $\begin{pmatrix} 7 \\ 5 \\ -4 \end{pmatrix} + 2 \begin{pmatrix} -5 \\ 0 \\ 3 \end{pmatrix} = \begin{pmatrix} -3 \\ 5 \\ 2 \end{pmatrix}$

2. Point $P_1 = (-1, 0, -2)$ and $P_2 = (-5, -2, 4)$. Find the vector $\overrightarrow{P_1P_2}$ in terms of the unit vectors i, j and k .

$$\begin{aligned} \overrightarrow{P_1P_2} &= \begin{pmatrix} -5 \\ -2 \\ 4 \end{pmatrix} - \begin{pmatrix} -1 \\ 0 \\ -2 \end{pmatrix} = \begin{pmatrix} -4 \\ -2 \\ 6 \end{pmatrix} \\ &= -4i - 2j + 6k \end{aligned}$$

3. Two vectors \underline{a} and \underline{b} are defined as $\underline{a} = \begin{pmatrix} 2 \\ -4 \\ -4 \end{pmatrix}$ and $\underline{b} = \begin{pmatrix} 2 \\ -1 \\ -2 \end{pmatrix}$

a) Find $|\underline{a}|$

$$|\underline{a}| = \sqrt{2^2 + (-4)^2 + (-4)^2} = 6$$

b) Find $|\underline{b}|$

$$|\underline{b}| = \sqrt{2^2 + (-1)^2 + (-2)^2} = 3$$

- c) Determine the dot product of \underline{a} and \underline{b} .

$$\begin{aligned} \underline{a} \cdot \underline{b} &= (2)(2) + (-4)(-1) + (-4)(-2) \\ &= 16 \end{aligned}$$

- d) Hence, calculate the angle between \underline{a} and \underline{b} .

$$\theta = \cos^{-1} \frac{16}{(6)(3)}$$

$$\theta = 27.27^\circ$$

4. The symmetric equation of a line is given as

$$\frac{3-x}{-2} = y + 2 = \frac{4z-8}{-4}$$

Write the **parametric equation** of this line.

$$\frac{x-3}{2} = \frac{y+2}{1} = \frac{z-2}{-1}$$

$$x = 3 + 2t, \quad y = -2 + t, \quad z = 2 - t$$

5. If P is any point on a line segment AB which divides it in the ratio $m : n$,

$$\text{then } P = \frac{na + mb}{m+n}$$

Let point A = (7, 7, 8) and point B = (-2, 1, -1). Determine the **coordinates** of point P on the line AB given that AP: PB = 1: 2

$$P = \frac{na + mb}{m+n}$$

$$P = \frac{2 \begin{pmatrix} 7 \\ 7 \\ 8 \end{pmatrix} + 1 \begin{pmatrix} -2 \\ 1 \\ -1 \end{pmatrix}}{1+2}$$

$$P = (4, 5, 5)$$