ASSIGNMENT-1

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Question: Calculate the ratio in which the line joining $\mathbf{A}=\begin{pmatrix}-4\\2\end{pmatrix}$ and $\mathbf{B}=\begin{pmatrix}3\\6\end{pmatrix}$ is divided by the point $\mathbf{P}=\begin{pmatrix}z\\3\end{pmatrix}$. Also find

1) z
2) Length of $\overrightarrow{\mathbf{AP}}$

Solution: Lets take the ratio in which the line is divided by the point to be 1:k. Now lets use the section formula for the point $\mathbf{P}$,

$$\mathbf{P} = \begin{pmatrix}z\\3\end{pmatrix} \tag{1}$$

$$\mathbf{P} = \left[\frac{(1\times\mathbf{B})+(k\times\mathbf{A})}{1+3}\right] \tag{2}$$

$$= \left[\frac{\left[1\times\begin{pmatrix}3\\6\end{pmatrix}\right]+\left[k\times\begin{pmatrix}-4\\2\end{pmatrix}\right]}{1+3}\right] \tag{3}$$

$$= \left[\frac{(1\times3)+[k\times(-4)]}{1+3}, \frac{(1\times6)+(k\times2)}{1+3}\right] \tag{4}$$

$$= \begin{pmatrix}\frac{3-4k}{4}\\ \frac{6+2k}{4}\end{pmatrix} \tag{5}$$

Equating the y-coordinates from (1) and (5) get,

$$\implies 3 = \frac{6+2k}{4} \tag{6}$$

$$\implies 6 = 2k \tag{7}$$

$$\implies k = 3 \tag{8}$$

$\therefore$ the ratio in which the line $\overrightarrow{\mathbf{AP}}$ is divided by $\mathbf{P}$ is 1:3.

1) Taking equation (5) and substituting (8) we get,

$$\mathbf{P} = \begin{pmatrix}\frac{3-4k}{4}\\ \frac{6+2k}{4}\end{pmatrix} \tag{9}$$

$$= \begin{pmatrix}\frac{3-(4\times3)}{4}\\ \frac{6+(2\times3)}{4}\end{pmatrix} \tag{10}$$

$$= \begin{pmatrix}\frac{-9}{4}\\ \frac{12}{4}\end{pmatrix} \tag{11}$$

$$\therefore \text{ the point } \mathbf{P} = \begin{pmatrix}-2.25\\3\end{pmatrix} \tag{12}$$

2) Length of the line $\overrightarrow{\mathbf{AP}}$

$$= \|\overrightarrow{\mathbf{AP}}\|_2 \tag{13}$$

$$= \|\mathbf{P}-\mathbf{A}\|_2 \tag{14}$$

$$= \left\|\begin{pmatrix}-2.25\\3\end{pmatrix}-\begin{pmatrix}-4\\2\end{pmatrix}\right\|_2 \tag{15}$$

$$= \left\|\begin{pmatrix}1.75\\1\end{pmatrix}\right\|_2 \tag{16}$$

$$= \sqrt[2]{(1.75)^2+(1)^2} \tag{17}$$

$$= 2.015 \tag{18}$$

The length of the line $\overrightarrow{\mathbf{AP}}$ = 2.015(Approx).

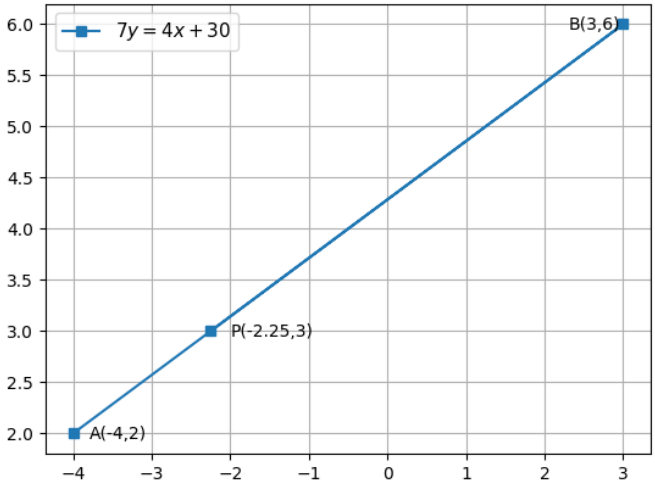

Fig. 1. Graph showing the line $7y = 4x + 30$.