

# 1.4.6

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**Question:** If the point  $\mathbf{P}(2 \ 1)$  lies on the line segment joining points  $\mathbf{A}(4 \ 2)$  and  $\mathbf{B}(8 \ 4)$ , then

**Solution:**

Variable	Description
$\mathbf{P}(2 \ 1)$	Point on the line segment joining $\mathbf{A}$ and $\mathbf{B}$
$\mathbf{A}(4 \ 2)$	one end of the line segment $AB$
$\mathbf{B}(8 \ 4)$	another end of the line segment $AB$

TABLE 0: Variables Used

$$\|A - B\| = \sqrt{(A - B)^\top (A - B)}$$

$$\mathbf{A} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} \mathbf{B} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$$

$$(A - B) = \begin{pmatrix} -4 \\ -2 \end{pmatrix}$$

$$(A - B)^\top = (-4 - 2)$$

$$\begin{aligned} AB &= \sqrt{(-4 - 2) \begin{pmatrix} -4 \\ -2 \end{pmatrix}} \\ &= 2\sqrt{5} \end{aligned}$$

Similarly,

$$\begin{aligned}
 AP &= \sqrt{(-2-1)\begin{pmatrix} -2 \\ -1 \end{pmatrix}} \\
 &= \sqrt{5} \\
 PB &= \sqrt{(-6-3)\begin{pmatrix} -6 \\ -3 \end{pmatrix}} \\
 &= 3\sqrt{5}
 \end{aligned}$$

Therefore,

$$AP = \frac{1}{2}AB$$

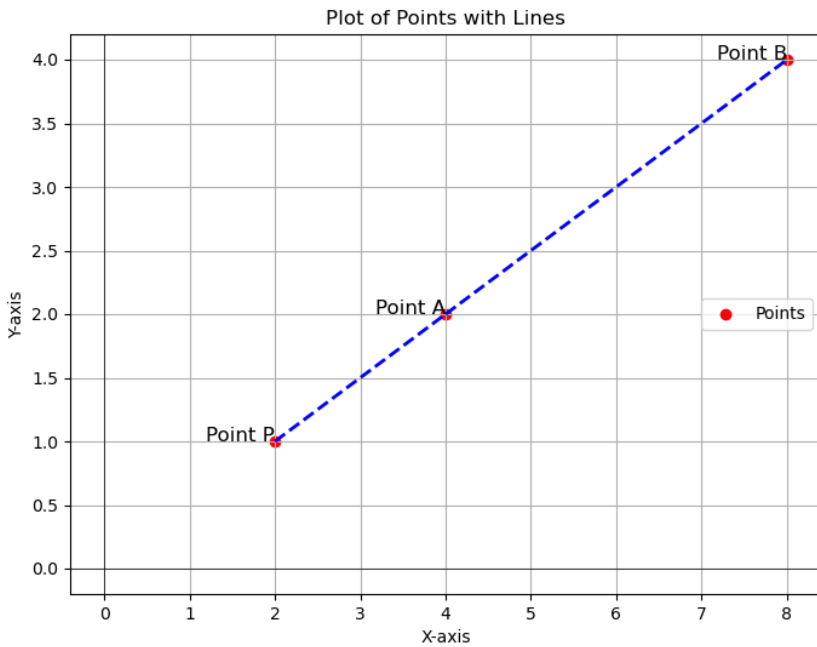


Fig. 0.1: Plot of Points A, B and P