# 1.9.17

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**Question:**
Write the coordinates of a point **P** on the $x$-axis which is equidistant from points $\mathbf{A}(-2, 0)$ and $\mathbf{B}(6, 0)$.

**Solution:** Let

$$\mathbf{A} = \begin{pmatrix} a \\ 0 \end{pmatrix}, \quad \mathbf{B} = \begin{pmatrix} b \\ 0 \end{pmatrix}, \quad \mathbf{P} = \begin{pmatrix} x \\ 0 \end{pmatrix} \tag{1}$$

Since **P** is equidistant from **A** and **B**, their distances satisfy:

$$\|\mathbf{P} - \mathbf{A}\| = \|\mathbf{P} - \mathbf{B}\| \tag{2}$$

Square both sides:

$$\|\mathbf{P} - \mathbf{A}\|^2 = \|\mathbf{P} - \mathbf{B}\|^2 \tag{3}$$

Using the norm squared definition:

$$(\mathbf{P} - \mathbf{A}) \cdot (\mathbf{P} - \mathbf{A}) = (\mathbf{P} - \mathbf{B}) \cdot (\mathbf{P} - \mathbf{B}) \tag{4}$$

Substitute vectors:

$$(x - a)^2 + 0^2 = (x - b)^2 + 0^2 \tag{5}$$

Simplify:

$$(x - a)^2 = (x - b)^2 \tag{6}$$

Rewrite as difference of squares:

$$(x - a)^2 - (x - b)^2 = 0 \tag{7}$$

Factorize:

$$[(x - a) - (x - b)] \cdot [(x - a) + (x - b)] = 0 \tag{8}$$

Simplify:

$$(b - a) \cdot (2x - (a + b)) = 0 \tag{9}$$

Since $b \neq a$:

$$2x - (a + b) = 0 \tag{10}$$

Solve for $x$:

$$x = \frac{a + b}{2} \tag{11}$$

Now substitute $a = -2$, $b = 6$:

$$x = \frac{-2 + 6}{2} = \frac{4}{2} = 2 \tag{12}$$

Hence, the coordinates of **P** are

$$\boxed{\mathbf{P} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}} \tag{13}$$

**Graphical Representation:**

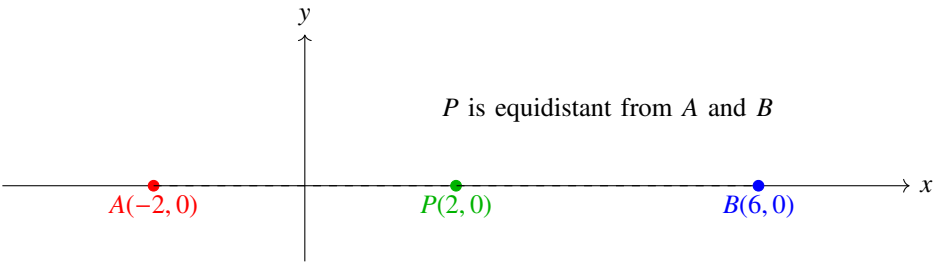


**Fig. 0**