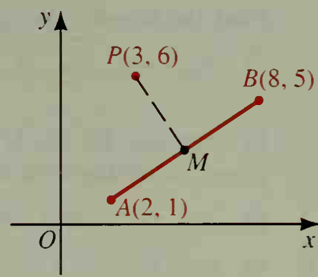
Example 2 Given points $A(2, 1)$ and $B(8, 5)$, show that $P(3, 6)$ is on the perpendicular bisector of $\overline{AB}$.



Solution 1 Join P to M, the midpoint of $\overline{AB}$ and show that $\overline{PM} \perp \overline{AB}$.

Step 1 $M = \left(\frac{2+8}{2}, \frac{1+5}{2}\right) = (5, 3)$

Step 2 Slope of $\overline{AB} = \frac{5-1}{8-2} = \frac{4}{6} = \frac{2}{3}$

Slope of $\overline{PM} = \frac{3-6}{5-3} = \frac{-3}{2}$

Step 3 Since the product of the slopes of $\overline{AB}$ and $\overline{PM}$ is -1, $\overline{PM} \perp \overline{AB}$.

Solution 2 Show that P is equidistant from A and B and apply Theorem 4-6, page 153.

Step 1 $PA = \sqrt{(3-2)^2 + (6-1)^2} = \sqrt{26}$

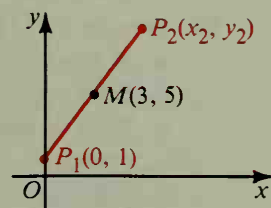
$PB = \sqrt{(3-8)^2 + (6-5)^2} = \sqrt{26}$

Step 2 Since $PA = PB$, P is on the perpendicular bisector of $\overline{AB}$.

Classroom Exercises

Find the coordinates of the midpoint of the segment that joins the given points.

1. $(3, 5)$ and $(7, 5)$
2. $(0, 4)$ and $(4, 3)$
3. $(-2, 2)$ and $(6, 4)$
4. $(-3, 7)$ and $(-7, -5)$
5. $(-1, -3)$ and $(-3, 6)$
6. $(2b, 3)$ and $(4, -5)$
7. $(t, 2)$ and $(t + 4, -4)$
8. (a, n) and (d, p)



9. $M(3, 5)$ is the midpoint of $\overline{P_1P_2}$, where P_1 has coordinates $(0, 1)$. Find the coordinates of P_2.
10. Point $(1, -1)$ is the midpoint of $\overline{AB}$, where A has coordinates $(-1, 3)$. Find the coordinates of B.

Written Exercises

Find the coordinates of the midpoint of the segment that joins the given points.

A

1. $(0, 2)$ and $(6, 4)$
2. $(-2, 6)$ and $(4, 3)$
3. $(6, -7)$ and $(-6, 3)$
4. $(a, 4)$ and $(a + 2, 0)$
5. $(2.3, 3.7)$ and $(1.5, -2.9)$
6. (a, b) and (c, d)