Method 2 *Show that both pairs of opposite sides are parallel.*

$$\text{Slope of } \overline{AB} = \frac{4-1}{6-2} = \frac{3}{4};$$

$$\text{slope of } \overline{DC} = \frac{7-4}{3-(-1)} = \frac{3}{4}.$$

$$\text{Slope of } \overline{AD} = \frac{4-1}{-1-2} = \frac{3}{-3} = -1;$$

$$\text{slope of } \overline{BC} = \frac{7-4}{3-6} = \frac{3}{-3} = -1.$$

Method 3 *Show that the diagonals bisect each other.*

$$\text{Midpoint of } \overline{AC} = \left(\frac{3+2}{2}, \frac{1+7}{2}\right) = \left(\frac{5}{2}, 4\right);$$

$$\text{midpoint of } \overline{BD} = \left(\frac{-1+6}{2}, \frac{4+4}{2}\right) = \left(\frac{5}{2}, 4\right).$$

Since the diagonals have the same midpoint, they bisect each other.

You could also use the work in Methods 1 and 2 to show that one pair of opposite sides is both congruent and parallel.

Exercises

The coordinates of the vertices of quadrilateral *ABCD* are given. Show that *ABCD* is a parallelogram by using each of the three methods shown in the example.

1. $A(5, 7)$, $B(0, 3)$, $C(1, -3)$, $D(6, 1)$

2. $A(-2, 6)$, $B(-3, 2)$, $C(2, -4)$, $D(3, 0)$

Decide whether quadrilateral *DEFG* is a parallelogram.

3. $D(3, 5)$, $E(5, 7)$, $F(3, 4)$, $G(0, 1)$

4. $D(3, -2)$, $E(-2, 5)$, $F(5, 6)$, $G(10, -1)$

The coordinates of three vertices of $\square PQRS$ are given. Find the coordinates of the missing vertex.

5. $P(0, 0)$, $Q(5, 2)$, $R(8, 4)$

6. $P(-2, 0)$, $Q(2, 1)$, $S(0, 5)$

7. **a.** Draw the triangle with vertices $O(0, 0)$, $I(4, 2)$, and $J(2, 6)$.

b. Find the coordinates of M and N, the midpoints of $\overline{OJ}$ and $\overline{IJ}$, respectively.

c. Find the slopes of $\overline{MN}$ and $\overline{OI}$. What do your results tell you about $\overline{MN}$ and $\overline{OI}$? What kind of quadrilateral is *OMNI*?

8. Repeat Exercise 7 for the general triangle with vertices $O(0, 0)$, $I(a, 0)$, and $J(b, c)$.

9. Given the quadrilateral *ABCD* with vertices $A(-4, 5)$, $B(4, -1)$, $C(7, 3)$, and $D(-1, 9)$.

a. Use slopes to show that opposite sides are parallel and adjacent sides are perpendicular.

b. What kind of quadrilateral is *ABCD*?