LESSON 5.4

NAME ______________________________ DATE __________

Reteaching with Practice

For use with pages 287–293

GOAL **Identify the midsegments of a triangle and use properties of midsegments of a triangle**

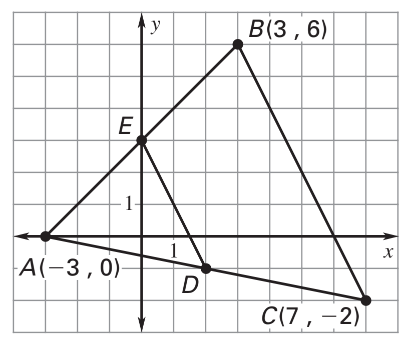
VOCABULARY

A **midsegment of a triangle** is a segment that connects the midpoints of two sides of a triangle.

Theorem 5.9 Midsegment Theorem
The segment connecting the midpoints of two sides of a triangle is parallel to the third side and is half as long.

EXAMPLE 1 *Using the Midsegment Theorem*

Show that the midsegment $\overline{ED}$ is parallel to side $\overline{BC}$ and is half as long.



SOLUTION

Use the Midpoint Formula to find the coordinates of D and E.

$$D = \left(\frac{-3 + 7}{2}, \frac{0 + (-2)}{2}\right) = (2, -1)$$

$$E = \left(\frac{-3 + 3}{2}, \frac{0 + 6}{2}\right) = (0, 3)$$

Next, find the slopes of $\overline{BC}$ and $\overline{ED}$.

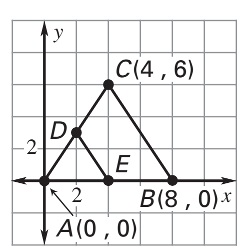
$$\text{Slope of } \overline{BC} = \frac{6 - (-2)}{3 - 7} = -\frac{8}{4} = -2 \qquad \text{Slope of } \overline{ED} = \frac{3 - (-1)}{0 - 2} = -\frac{4}{2} = -2$$

Because their slopes are equal, $\overline{BC}$ and $\overline{ED}$ are parallel. You can use the Distance Formula to show that $ED = \sqrt{20} = 2\sqrt{5}$ and $BC = \sqrt{80} = 4\sqrt{5}$. So $\overline{ED}$ is half as long as $\overline{BC}$.

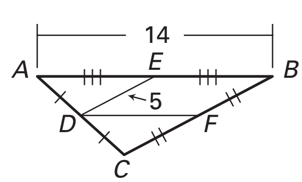
Exercises for Example 1

Use the Midsegment Theorem.

1. Show that the midsegment $\overline{ED}$ is parallel to side $\overline{BC}$ and is half as long.



2. $\overline{ED}$ and $\overline{DF}$ are midsegments in $\triangle ABC$. Find DF and CB.



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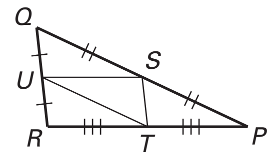
3. Given $PQ = 14$, $SU = 6$, and $QU = 3$, find the perimeter of $\triangle STU$.



EXAMPLE 2 *Using Midpoints to Draw a Triangle*

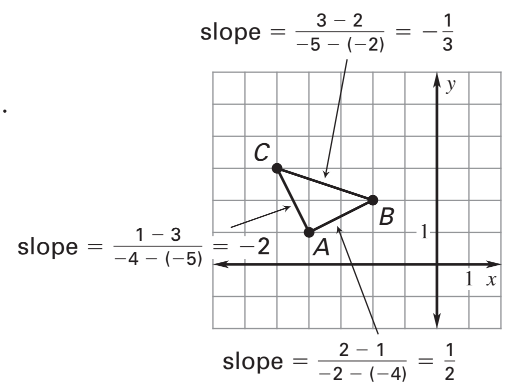
The midpoints of the sides of a triangle are $A(-4, 1)$, $B(-2, 2)$, and $C(-5, 3)$. What are the coordinates of the vertices of the triangle?

SOLUTION

Plot the midpoints in a coordinate plane.

Connect these midpoints to form the midsegments $\overline{AB}$, $\overline{BC}$, and $\overline{CA}$.

Find the slopes of these midsegments. Use the slope formula as shown.



Each midsegment contains two of the unknown triangle's midpoints and is parallel to the side that contains the third midpoint (by the Midsegment Theorem). So, you know a point on each side of the unknown triangle and the slope of each side (because parallel lines have equal slopes).

Draw the lines that contain the three sides.

The lines intersect at $D(-7, 2)$, $E(-3, 4)$, and $F(-1, 0)$, which are the vertices of the triangle.

Exercises for Example 2

You are given the midpoints of the sides of a triangle. Find the coordinates of the vertices of the triangle.

4. $L(0, 3)$, $M(2, -3)$, $N(-4, 5)$

5. $L(-7, 5)$, $M(-1, -1)$, $N(3, 1)$

6. $L(1, 3)$, $M(4, -2)$, $N(7, 1)$

7. $L(6, 3)$, $M(1, 0)$, $N(-2, 4)$