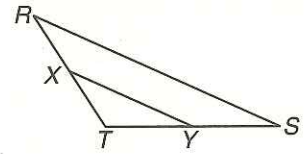


# 6-4 Study Guide and Intervention

## Parallel Lines and Proportional Parts

**Proportional Parts of Triangles** In any triangle, a line parallel to one side of a triangle separates the other two sides proportionally. The converse is also true.



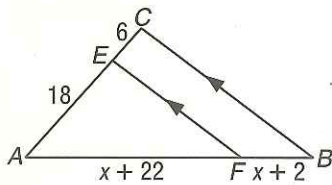
If  $X$  and  $Y$  are the midpoints of  $\overline{RT}$  and  $\overline{TS}$ , then  $\overline{XY}$  is a **midsegment** of the triangle. The Triangle Midsegment Theorem states that a midsegment is parallel to the third side and is half its length.

If  $\overline{XY} \parallel \overline{RS}$ , then  $\frac{RX}{XT} = \frac{SY}{YT}$ .

If  $\frac{RX}{XT} = \frac{SY}{YT}$ , then  $\overline{XY} \parallel \overline{RS}$ .

If  $\overline{XY}$  is a midsegment, then  $\overline{XY} \parallel \overline{RS}$  and  $XY = \frac{1}{2}RS$ .

**Example 1** In  $\triangle ABC$ ,  $\overline{EF} \parallel \overline{CB}$ . Find  $x$ .



Since  $\overline{EF} \parallel \overline{CB}$ ,  $\frac{AF}{FB} = \frac{AE}{EC}$ .

$$\frac{x + 22}{x + 2} = \frac{18}{6}$$

$$6x + 132 = 18x + 36$$

$$96 = 12x$$

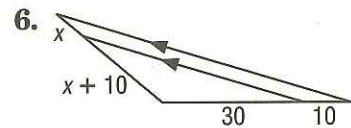
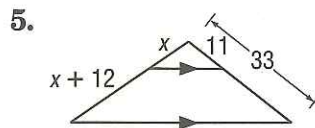
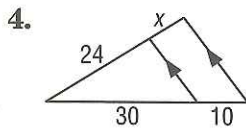
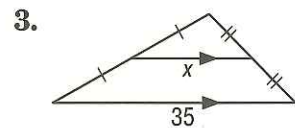
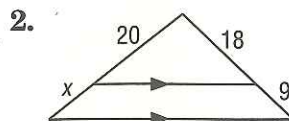
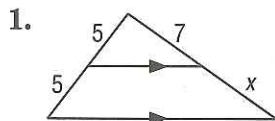
$$8 = x$$

**Example 2** A triangle has vertices  $D(3, 6)$ ,  $E(-3, -2)$ , and  $F(7, -2)$ . Midsegment  $\overline{GH}$  is parallel to  $\overline{EF}$ . Find the length of  $\overline{GH}$ .

$\overline{GH}$  is a midsegment, so its length is one-half that of  $\overline{EF}$ . Points  $E$  and  $F$  have the same  $y$ -coordinate, so  $EF = 7 - (-3) = 10$ . The length of midsegment  $\overline{GH}$  is 5.

### Exercises

Find  $x$ .

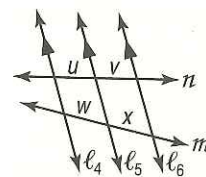
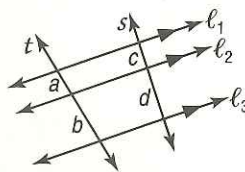


7. In Example 2, find the slope of  $\overline{EF}$  and show that  $\overline{EF} \parallel \overline{GH}$ .

# 6-4 Study Guide and Intervention *(continued)*

## Parallel Lines and Proportional Parts

**Divide Segments Proportionally** When three or more parallel lines cut two transversals, they separate the transversals into proportional parts. If the ratio of the parts is 1, then the parallel lines separate the transversals into congruent parts.



If  $l_1 \parallel l_2 \parallel l_3$ ,  
then  $\frac{a}{b} = \frac{c}{d}$ .

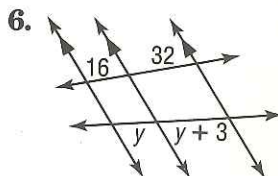
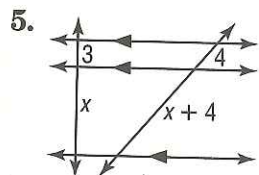
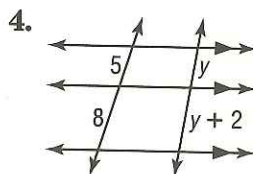
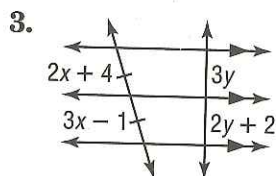
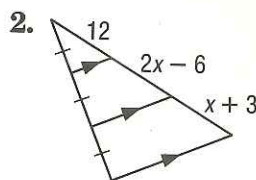
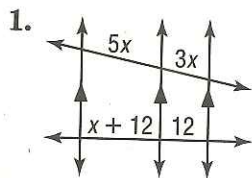
If  $l_4 \parallel l_5 \parallel l_6$  and  
 $\frac{u}{v} = 1$ , then  $\frac{w}{x} = 1$ .

### Example

Refer to lines  $l_1$ ,  $l_2$ , and  $l_3$  above. If  $a = 3$ ,  $b = 8$ , and  $c = 5$ , find  $d$ .  
 $l_1 \parallel l_2 \parallel l_3$  so  $\frac{3}{8} = \frac{5}{d}$ . Then  $3d = 40$  and  $d = 13\frac{1}{3}$ .

### Exercises

Find  $x$  and  $y$ .



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## 6-4 Study Guide and Intervention (continued)

### Parallel Lines and Proportional Parts

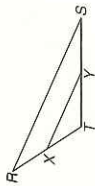
**Proportional Parts of Triangles** In any triangle, a line parallel to one side of a triangle separates the other two sides proportionally. The converse is also true.

If  $X$  and  $Y$  are the midpoints of  $\overline{RT}$  and  $\overline{ST}$ , then  $\overline{XY}$  is a midsegment of the triangle. The Triangle Midsegment Theorem states that a midsegment is parallel to the third side and is half its length.

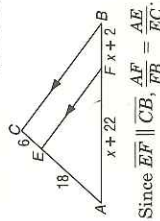
$$\text{If } \overline{XY} \parallel \overline{RS}, \text{ then } \frac{RX}{XT} = \frac{SY}{YT}.$$

$$\text{If } \frac{RX}{XT} = \frac{SY}{YT}, \text{ then } \overline{XY} \parallel \overline{RS}.$$

If  $\overline{XY}$  is a midsegment, then  $\overline{XY} \parallel \overline{RS}$  and  $XY = \frac{1}{2}RS$ .



**Example 1** In  $\triangle ABC$ ,  $\overline{EF} \parallel \overline{CB}$ . Find  $x$ .

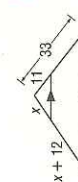
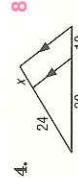
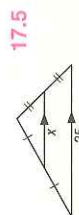
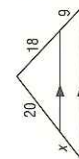


$$\text{Since } \overline{EF} \parallel \overline{CB}, \frac{AF}{FB} = \frac{AE}{EC}.$$

$$\begin{aligned} \frac{x + 22}{x + 2} &= \frac{18}{6} \\ 6x + 132 &= 18x + 36 \\ 96 &= 12x \\ 8 &= x \end{aligned}$$

**Exercises**

Find  $x$ .



7. In Example 2, find the slope of  $\overline{EF}$  and show that  $\overline{EF} \parallel \overline{GH}$ .

The endpoints of  $\overline{GH}$  are at  $(0, 2)$  and  $(5, 2)$ . The slope of  $\overline{GH}$  is 0 and the slope of  $\overline{EF}$  is 0.  $\overline{GH}$  and  $\overline{EF}$  are parallel.

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## 6-4 Study Guide and Intervention (continued)

### Parallel Lines and Proportional Parts

**Divide Segments Proportionally** When three or more parallel lines cut two transversals, they separate the transversals into proportional parts. If the ratio of the parts is 1, then the parallel lines separate the transversals into congruent parts.



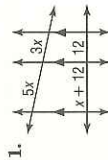
$$\text{If } l_1 \parallel l_2 \parallel l_3, \text{ then } \frac{a}{b} = \frac{c}{d}.$$

$$\text{If } l_4 \parallel l_5 \parallel l_6 \text{ and } \frac{u}{v} = 1, \text{ then } \frac{w}{x} = 1.$$

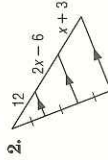
**Example** Refer to lines  $l_1, l_2$ , and  $l_3$  above. If  $a = 3, b = 8$ , and  $c = 5$ , find  $d$ .  
 $l_1 \parallel l_2 \parallel l_3$  so  $\frac{3}{8} = \frac{5}{d}$ . Then  $3d = 40$  and  $d = 13\frac{1}{3}$ .

**Exercises**

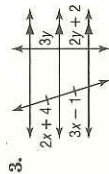
Find  $x$  and  $y$ .



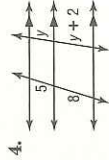
$x = 8$



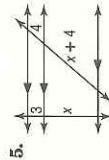
$x = 9$



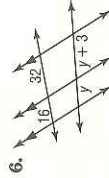
$x = 5; y = 2$



$y = 3\frac{1}{3}$



$x = 12$



$y = 3$