

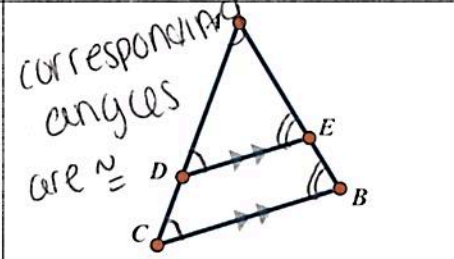
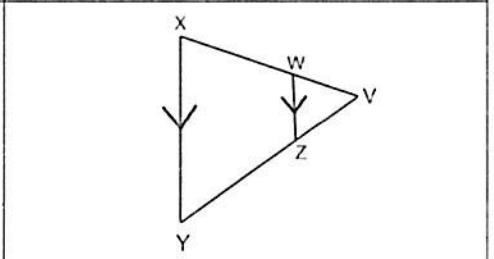
Name: Key

Date: \_\_\_\_\_

UNIT 5

LESSON 3

AIM: WHAT IS THE TRIANGLE SIDE-SPLITTER THEOREM?

TRIANGLE SIDE-SPLITTER THEOREM	DIAGRAM 1	DIAGRAM 2
<p>A line segment splits two sides of a triangle proportionally if and only if it is <u>parallel</u> to the third side.</p>	<p>corresponding angles are <math>\cong</math></p>  <p>Sides <u>AC</u> and <u>AB</u> are split proportionally.</p>	 <p>Sides <u>XV</u> and <u>YV</u> are split proportionally.</p>

Example 2: In  $\triangle ABC$  as shown below, points  $D$  and  $E$  are located on sides  $\overline{AB}$  and  $\overline{AC}$ , respectively. Line segment  $DE$  is drawn such that  $AE = 2.5$ ,  $EC = 7.5$ ,  $AD = 1.25$ , and  $DB = 3.75$ .

Explain why  $\overline{DE}$  is parallel to  $\overline{BC}$ .

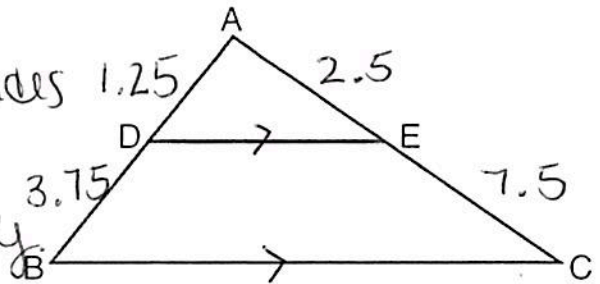
$$\frac{1.25}{3.75} = \frac{2.5}{7.5}$$

$$.33 = .33$$

OR  
CROSS MULT.

$$9.375 = 9.375$$

$\overline{DE} \parallel \overline{BC}$  b/c the sides  $\overline{AB}$  and  $\overline{AC}$  are split proportionally



Example 3: Which of the following segment lengths would justify the claim that  $\overline{PL} \parallel \overline{QM}$

guess + check!

(1)  $LM = 8$ ,  $MN = 12$ ,  $PQ = 10$ , and  $QN = 14$

$$\frac{8}{12} = \frac{10}{14} \quad .67 \neq .71$$

(2)  $LM = 5$ ,  $MN = 10$ ,  $PQ = 8$ , and  $QN = 18$

$$\frac{5}{10} = \frac{8}{18} \quad .5 \neq .4$$

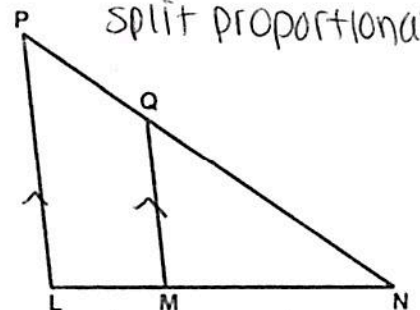
(3)  $LM = 6$ ,  $MN = 10$ ,  $PQ = 9$ , and  $QN = 15$

$$\frac{6}{10} = \frac{9}{15} \quad .6 = .6 \quad \checkmark$$

(4)  $LM = 10$ ,  $MN = 15$ ,  $PQ = 12$ , and  $QN = 20$

$$\frac{10}{15} = \frac{12}{20} \quad .67 \neq .6$$

$\overline{PN}$  and  $\overline{LN}$  are split proportionally

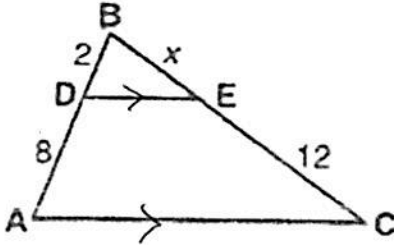


# SOLVING MISSING LENGTHS – 3 PROPORTION CASES

**CASE 1**

$$\frac{\text{upper left}}{\text{lower left (bad)}} = \frac{\text{upper right}}{\text{lower right (bad)}}$$

**Example 3:** In the following diagram  $\overline{DE} \parallel \overline{AC}$ . Find the value of  $x$ .



$$\frac{2}{8} = \frac{x}{12}$$

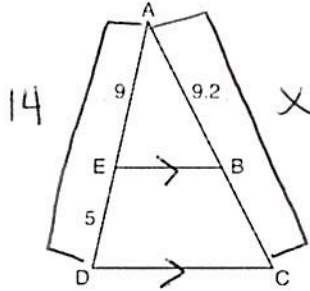
$$\frac{8x}{8} = \frac{24}{8}$$

$$\boxed{x = 3}$$

**CASE 2**

$$\frac{\text{whole left}}{\text{upper left}} = \frac{\text{whole right}}{\text{upper right}}$$

**Example 4:** In the diagram of  $\triangle ADC$  below,  $\overline{EB} \parallel \overline{DC}$ ,  $AE = 9$ ,  $ED = 5$ , and  $AB = 9.2$ . What is the length of  $\overline{AC}$ , to the nearest tenth?



$$\frac{14}{9} = \frac{x}{9.2}$$

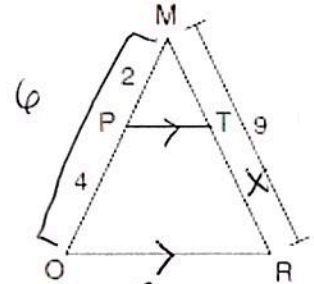
$$9x = 128.8$$

$$\boxed{x = 14.3}$$

**CASE 3**

$$\frac{\text{whole left}}{\text{lower left (bad)}} = \frac{\text{whole right}}{\text{lower right (bad)}}$$

**Example 5:** Given  $\triangle MRO$  shown below, with trapezoid  $PTRO$ ,  $MR = 9$ ,  $MP = 2$ , and  $PO = 4$ . What is the length of  $\overline{TR}$ ?



$$\frac{6}{4} = \frac{9}{x}$$

$$6x = 36$$

$$\boxed{x = 6}$$

## PRACTICE PROBLEMS!

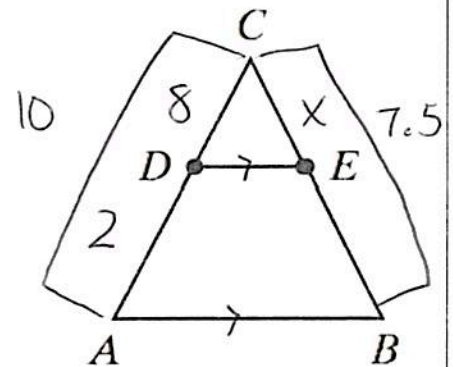
1.  $D$  is a point on  $\overline{AC}$  and  $E$  is a point on  $\overline{BC}$  of  $\triangle ABC$  such that  $\overline{DE} \parallel \overline{AB}$ . If  $CD = 8$ ,  $DA = 2$ , and  $CB = 7.5$ , find  $\underline{CE}$ .

$$\frac{10}{8} = \frac{7.5}{x}$$

$$10x = 60$$

$$x = 6$$

$$\boxed{\overline{CE} = 6}$$



2.  $D$  is a point on  $\overline{AC}$  and  $E$  is a point on  $\overline{BC}$  of  $\triangle ABC$  such that  $\overline{DE} \parallel \overline{AB}$ . If  $CA = 35$ ,  $DA = 10$ , and  $CE = 15$ , find  $EB$ .

OPTION 1

$$\frac{25}{10} = \frac{15}{x}$$

$$150 = 25x$$

$$x = 6$$

OR

OPTION 2

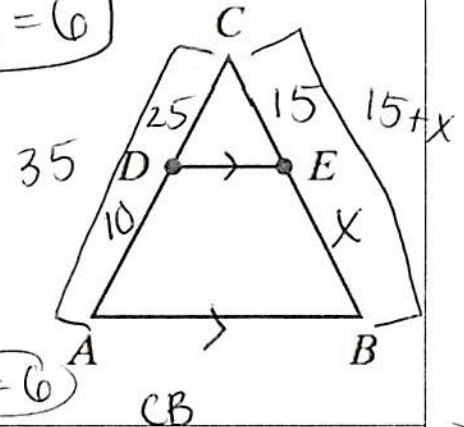
$$\frac{35}{10} = \frac{15+x}{x}$$

$$35x = 10(15+x)$$

$$35x = 150 + 10x$$

$$\begin{array}{r} 35x \\ -10x \\ \hline 25x = 150 \end{array} \rightarrow x = 6$$

$$\overline{EB} = 6$$



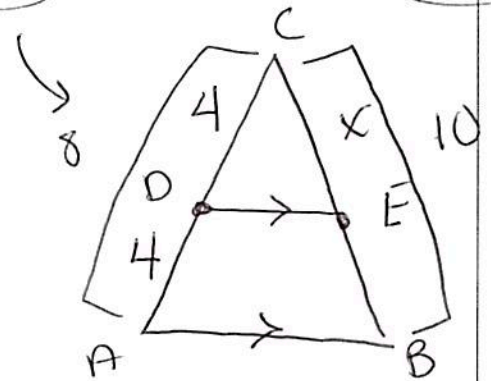
3.  $D$  is a point on  $\overline{AC}$  and  $E$  is a point on  $\overline{BC}$  of  $\triangle ABC$  such that  $\overline{DE} \parallel \overline{AB}$ . If  $CA = 8$ ,  $DA = 4$ , and  $CE = 10$ , find  $EB$ .

$$\frac{8}{4} = \frac{10}{x}$$

$$40 = 8x$$

$$x = 5$$

$$\overline{CE} = 5$$



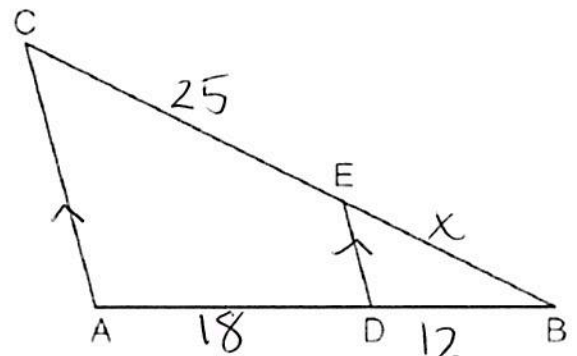
4. In the diagram below of  $\triangle ABC$ ,  $D$  is a point on  $\overline{AC}$  and  $E$  is a point on  $\overline{BC}$ ,  $\overline{AC} \parallel \overline{DE}$ ,  $CE = 25$  inches,  $AD = 18$  inches, and  $DB = 12$  inches. Find, to the nearest tenth of an inch, the length of  $EB$ .

$$\frac{x}{25} = \frac{12}{18}$$

$$18x = 300$$

$$x = 16.7 \text{ in}$$

$$\overline{EB} = 16.7 \text{ in}$$



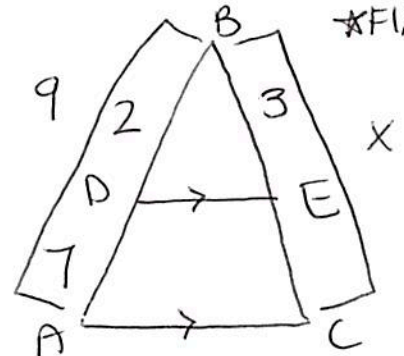
5. In  $\triangle ABC$ , point  $D$  is a point on  $\overline{AB}$  and  $E$  is a point on  $\overline{BC}$  such that  $\overline{DE} \parallel \overline{AC}$ . If  $DB = 2$ ,  $DA = 7$ , and  $BE = 3$ , what is the length of  $EC$ ?

$$\frac{9}{2} = \frac{x}{3}$$

$$2x = 27$$

$$x = 13.5$$

$$\overline{BC} = 13.5$$





HOMEWORK

1. In the diagram below of  $\triangle ADE$ ,  $B$  is a point on  $\overline{AE}$  and  $C$  is a point on  $\overline{AD}$  such that  $\overline{BC} \parallel \overline{ED}$ ,  $AC = x - 3$ ,  $BE = 20$ ,  $AB = 16$ , and  $AD = 2x + 2$ . Find the length  $\overline{AC}$ .

$$\frac{36}{16} = \frac{2x+2}{x-3}$$

$$36(x-3) = 16(2x+2)$$

$$36x - 108 = 32x + 32$$

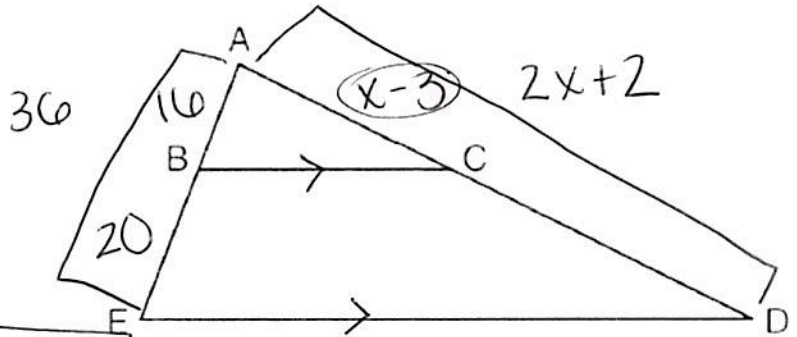
$$-32x + 108 \quad -32x + 108$$


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$$4x = 140$$

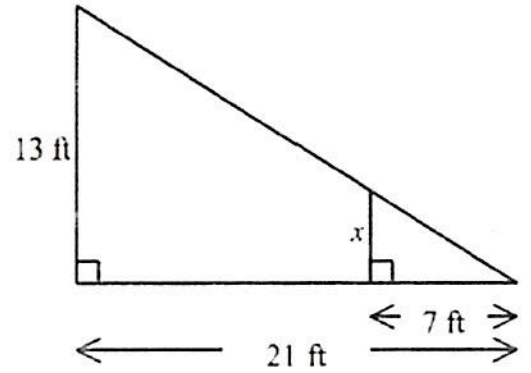
$$x = 35$$

$$\boxed{AC = 35 - 3 = 32}$$



2. Solve for  $x$  to the nearest tenth.

Take out

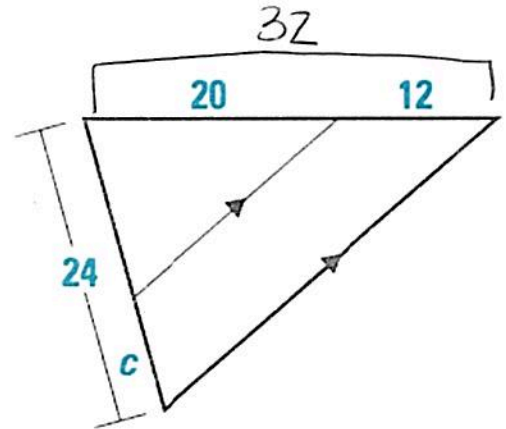


3. Solve for  $c$ .

$$\frac{24}{c} = \frac{32}{12}$$

$$288 = 32c$$

$$\boxed{c = 9}$$



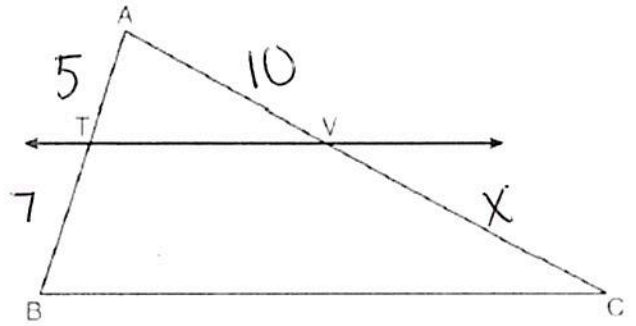
4. In the diagram below of  $\triangle ABC$ ,  $\overline{TV} \parallel \overline{BC}$ ,  $AT = 5$ ,  $TB = 7$ , and  $AV = 10$ . What is the length of  $\overline{VC}$ ?

$$\frac{5}{7} = \frac{10}{x}$$

$$5x = 70$$

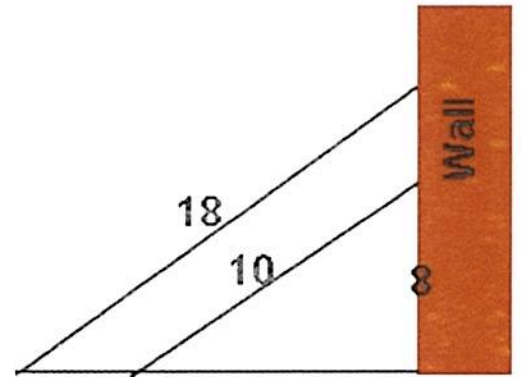
$$x = 14$$

$$\boxed{VC = 14}$$



5. Two ladders are leaned up against a wall such that they make the same angle with the ground. The 10 foot ladder reaches 8 feet up the wall. How much further up the wall does the 18 foot ladder reach?

TAKE OUT



6. The map at the right shows the walking paths at a local park. The garden walkway is parallel to the walkway between the monument and the pond. How long is the path from the pond to the playground?

$$\frac{60}{24} = \frac{2x + 10}{x}$$

$$60x = 24(2x + 10)$$

$$60x = 48x + 240$$

$$\begin{array}{r} 60x = 48x + 240 \\ -48x \quad -48x \\ \hline 12x = 240 \end{array}$$

$$12x = 240$$

$$x = 20$$

