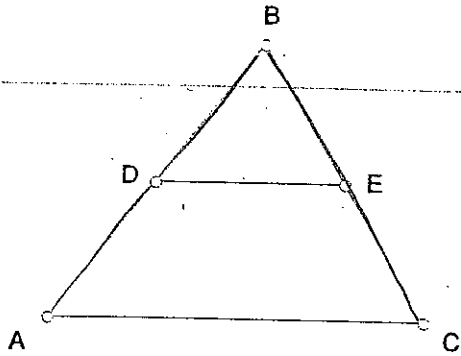


Name: \_\_\_\_\_

# Midpoint Theorem

**If a line segment joins the midpoints of two sides of a triangle, the segment formed is parallel to the third side of a triangle and one half of its length.**



Given  $\triangle ABC$  with sides  $\overline{AB}$ ,  $\overline{BC}$ ,  $\overline{CA}$ .

IF.....

- D is the midpoint of  $\overline{AB}$
- E is the midpoint of  $\overline{BC}$

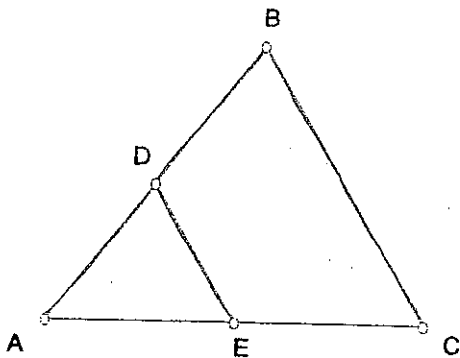
Then.....

$\overline{DE}$  is parallel to \_\_\_\_\_

and

$$\overline{DE} = \frac{1}{2} \text{_____}$$

EX1)



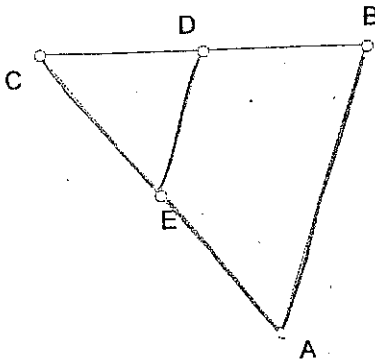
Given  $\triangle ABC$  with sides  $\overline{AB}$ ,  $\overline{BC}$ ,  $\overline{CA}$  and D is the midpoint of  $\overline{AB}$ , E is the midpoint of  $\overline{AC}$ .

If  $\overline{BC} = 7x + 1$ ,  $\overline{DE} = 4x - 2$  and  $m\angle ADE = 70^\circ$

a) Solve for the value of  $x$ .

b) Find the length of  $\overline{BC}$  and  $\overline{DE}$

c) find the  $m\angle ABC$



Given  $\triangle ABC$  with sides  $\overline{AB}$ ,  $\overline{BC}$ ,  $\overline{CA}$  and  $D$  is the midpoint of  $\overline{BC}$ ,  $E$  is the midpoint of  $\overline{AC}$ .

ANSWER THE FOLLOWING QUESTIONS:

1) If  $\overline{DE} = 10$ , find  $\overline{AB}$

5) If  $\overline{AE} = 7$ , find  $\overline{EC}$

2) If  $\overline{DE} = 7$ , find  $\overline{AB}$

6) If  $\overline{CD} = 3$ , find  $\overline{DB}$

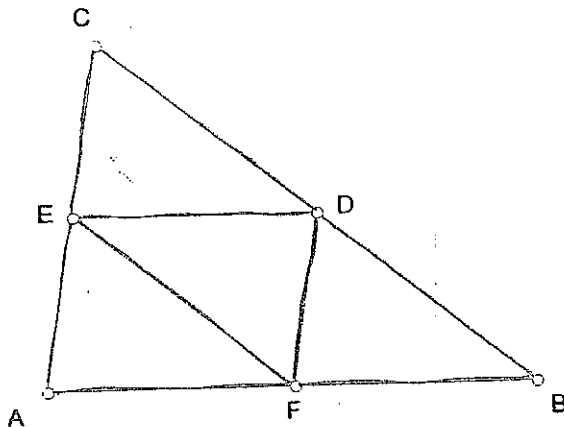
3) If  $\overline{AB} = 12$ , find  $\overline{ED}$

7) If  $\overline{AC} = 24$ , find  $\overline{EC}$

4) If  $\overline{AB} = 25$ , find  $\overline{ED}$

8)  $m\angle BAC = 120^\circ$ , find  $m\angle DEC$

EX 3



Given  $\triangle ABC$  with sides  $\overline{AB}$ ,  $\overline{BC}$ ,  $\overline{CA}$  and  $D$  is the midpoint of  $\overline{BC}$ ,  $E$  is the midpoint of  $\overline{AC}$  and  $F$  is the midpoint of  $\overline{AB}$ .

If  $\overline{AB} = 18$ ,  $\overline{BC} = 8$  and  $\overline{AC} = 12$

Find the perimeter of  $\triangle DEF$

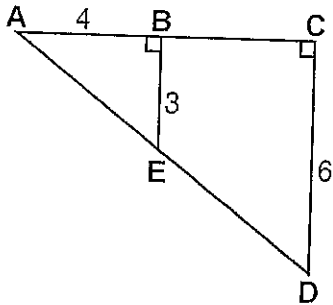




15) If  $AB = 4$ ,  $AE = 3$ , and  $AD = 6$ , find  $AC$ .

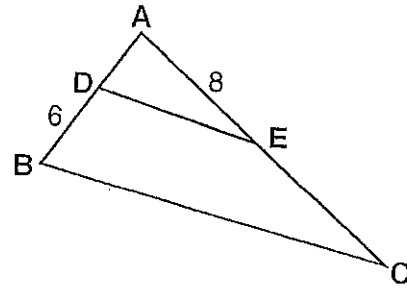
16) If  $AE = 8$ ,  $AD = 16$ , and  $AC = 12$ , find  $AB$ .

17) In the accompanying figure,  $\overline{AB} \perp \overline{BE}$ ,  $\overline{AC} \perp \overline{CD}$ ,  
 $AB = 4$ ,  $BE = 3$ , and  $CD = 6$ .



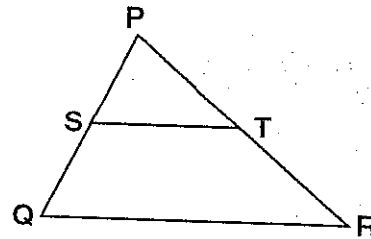
Find the length of  $\overline{AC}$ .

18) In the accompanying diagram,  $\overline{DE} \parallel \overline{BC}$ ,  $DB = 6$ ,  
 and  $AE = 8$ .



If  $EC$  is three times  $AD$ , find  $AD$ .

Questions 19 and 20 refer to the following:



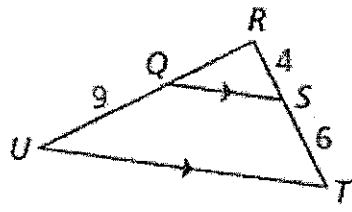
19) If  $\overline{ST} \parallel \overline{QR}$ ,  $PS = 4$ ,  $SQ = 2$ , and  $TR = 3$ , find  $PT$ .

20) If  $\overline{ST} \parallel \overline{QR}$ ,  $PR = 12$ ,  $TR = 4$ , and  $PS = 6$ ,  
 find  $PQ$ .

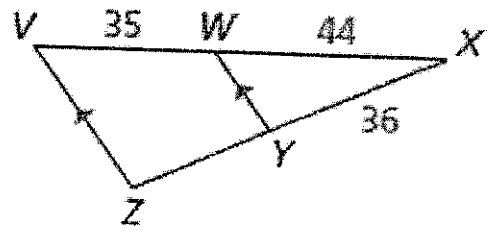


Proportions Involving Line Segments

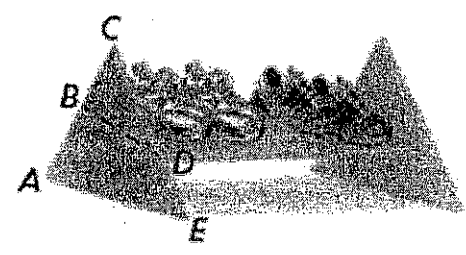
1) In the diagram,  $\overline{QS} \parallel \overline{UT}$ ,  $RS = 4$ ,  $ST = 6$ , and  $QU = 9$ . What is the length of  $\overline{RQ}$ ?



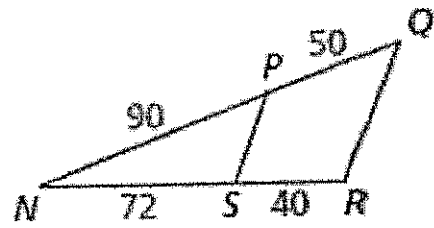
2. Find the length of  $\overline{YZ}$ .



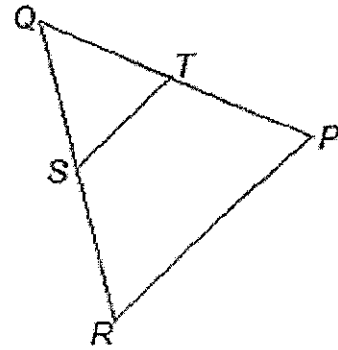
3) On the shoe rack shown,  $BA = 33$  centimeters,  $CB = 27$  centimeters,  $CD = 44$  centimeters, and  $DE = 25$  centimeters. Explain why the shelf is not parallel to the floor.



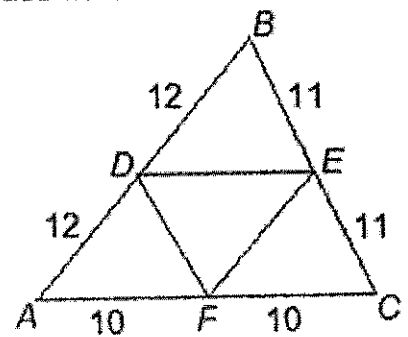
4. Determine whether  $\overline{PS} \parallel \overline{QR}$ .



5) In  $\triangle PQR$ ,  $S$  is the midpoint of  $\overline{RQ}$  and  $T$  is the midpoint of  $\overline{PQ}$ .  
 $RP = 7x + 5$ ,  $ST = 4x - 2$ ,  $SR = 2x + 1$ , and  $PQ = 9x + 1$ .  
 Find  $ST$ ,  $RP$ ,  $SR$ ,  $RQ$ ,  $PQ$ , and  $TQ$ .

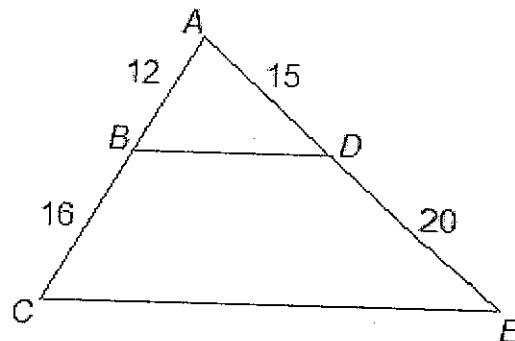


6) In  $\triangle ABC$ , points  $D$ ,  $E$ , and  $F$  are the midpoints of the sides with the measures shown. Find the measure of the perimeter of  $\triangle DEF$ .



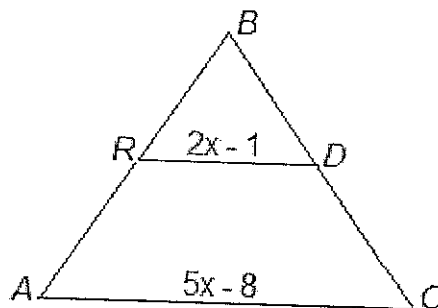


7) In  $\triangle AEC$ , if  $AB = 12$ ,  $BC = 16$ ,  $AD = 15$ , and  $DE = 20$ , is  $\overline{BD} \parallel \overline{CE}$ ?



8) In  $\triangle ABC$ ,  $R$  is the midpoint of  $\overline{AB}$ , and  $D$  is the midpoint of  $\overline{BC}$ .

If  $AC = 5x - 8$ ,  $RD = 2x - 1$ ,  $DC = 3x + 2$ , and  $AB = 10x - 1$ , find the lengths of  $AB$ ,  $AC$ ,  $DC$ , and  $RD$ .



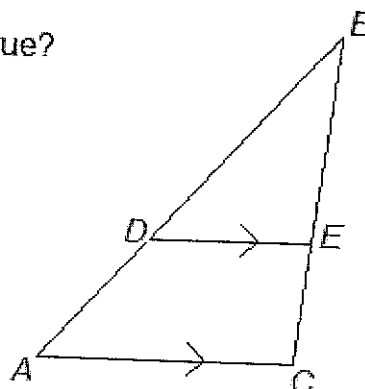
9) In  $\triangle ABC$ , if  $\overline{DE} \parallel \overline{AC}$ , which of the following are not true?

(a)  $\frac{BD}{BA} = \frac{BE}{BC}$

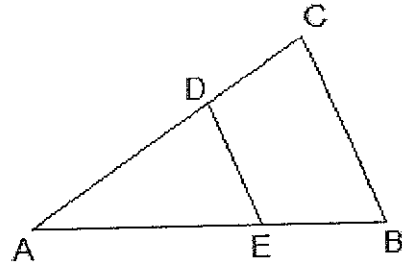
(c)  $\frac{BD}{DE} = \frac{DA}{AC}$

(b)  $\frac{BD}{DA} = \frac{BE}{EC}$

(d)  $\frac{BD}{BA} = \frac{DE}{AC}$



For 10 and 11, use  $\triangle ABC$  with  $D$  a point on  $\overline{AC}$  and  $E$  a point on  $\overline{AB}$  such that  $\overline{DE} \parallel \overline{BC}$ . In each instance, write an algebraic equation to find the indicated lengths.

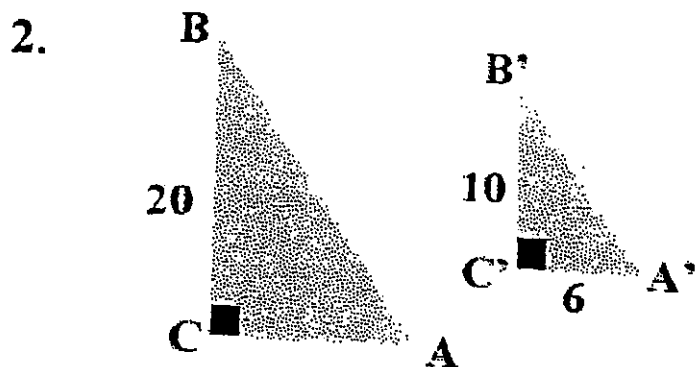


10) If  $AD = 1$ ,  $DC = x$ ,  $AE = x$  and  $EB = x + 2$ , find  $DC$ .

11) If  $ED = x$ ,  $DA = 6$ ,  $CB = 6$ , and  $CD = x - 1$ , find  $ED$ .

# SIMILARITY ~ SIMILARITY

1. In triangle ABC, angle A =  $90^\circ$  and angle B =  $35^\circ$ . In triangle DEF, angle E =  $35^\circ$  and angle F =  $55^\circ$ . Are the triangles similar? Explain your answer.



Given angle A and angle A' are  $59^\circ$ .

a.) Are the triangles similar? Why or why not?

b.) What is the ratio of similitude?

c.) Find AC.

3. Rectangle ABCD is similar to rectangle A'B'C'D'. If  $AB = 4$ ,  $BC = 8$ ,  $B'C'$  is 6 units longer than  $A'B'$ , find  $B'C'$ .

4. A vertical flagpole casts a shadow 12 feet long at the same time that a nearby vertical post 8 feet casts a shadow 3 feet long. Find the height of the flagpole. Explain your answer.

5. The corresponding sides of two similar hexagons are 32 and 8. What is the ratio of similitude for these hexagons?

6. Two triangles are similar. The sides of the first triangle are 7, 9, and 11. The smallest side of the second triangle is 21. Find the perimeter of the second triangle.

Choose:

- 27
- 33
- 63
- 81

7. Two triangular roofs are similar. The ratio of the corresponding sides of these roofs is 2:3. If the altitude of the smaller roof is 6 feet, find the corresponding altitude of the larger roof.

Choose:

- 6
- 9
- 36
- 81

8. Two polygons are similar. If the ratio of the perimeters is 7:4, find the ratio of the corresponding sides.

Choose:

7 : 4

49 : 16

9. The ratio of the perimeters of two similar triangles is 3:7. Find the ratio of the areas. Choose:

3 : 7

9 : 49

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10. The areas of two similar polygons are in the ratio 25:81. Find the ratio of the corresponding sides.

Choose:

5 : 9

25 : 81

625 : 6561

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