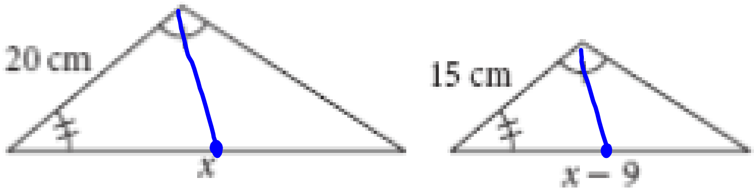
Warm-Up: Find the value of x in the triangles below. Check your answer with another student.



$$\frac{20}{15} = \frac{x}{x-9}$$

$$20x - 180 = 15x$$

$$-180 = -5x$$

$$36 = x$$

LESSON 7.4

Corresponding Parts of Similar Triangles

medians
altitudes
angle bisectors

Objectives

- Discover a relationship between corresponding parts of similar triangles
- Explore the ratio of the parts into which an angle bisector of a triangle divides the angle's opposite side

LESSON 7.4

Corresponding Parts of Similar Triangles

Launch

Construct a triangle and compare the median and angle bisector.

Are they the same line?

What is the difference between a median and an angle bisector?

LESSON 7.4

Corresponding Parts of Similar Triangles

Launch

Construct a triangle and compare the median and angle bisector.

Are they the same line?

Unless the triangle is equilateral or constructed from the vertex angle of an isosceles triangle, the median and angle bisector will be different segments.

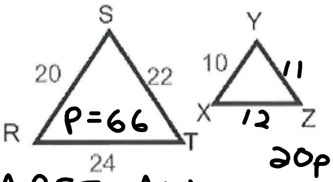
What is the difference between a median and an angle bisector?

The median will divide the opposite side into congruent parts but will not divide the angle into congruent parts as the angle bisector does.

Proportional Perimeters Theorem:

If 2 Triangles are similar, then the perimeters are proportional to the scale factor of the corresponding sides.

1. Δ XYZ



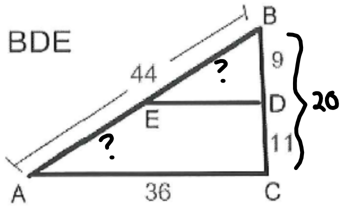
ΔRST~ΔXYZ

$\frac{20}{10} = \frac{66}{p}$

20p = 660

p = 33

2. Δ BDE



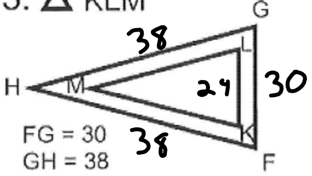
$P_{ABC} = 100$

$\frac{20}{9} = \frac{100}{p}$

20p = 900

p = 45

3. Δ KLM



FG = 30
GH = 38
HF = 38
KL = 24

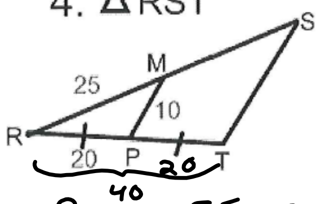
$P_{FGH} = 106$

$\frac{24}{30} = \frac{p}{106}$

30p = 2544

p = 84.8

4. Δ RST



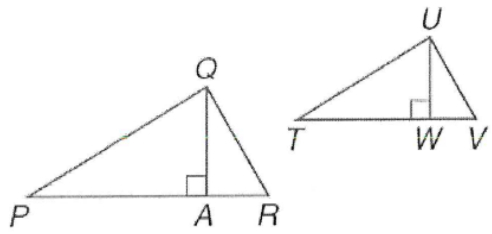
$P_{RPM} = 55$ $P_{RST} = 110$

$\frac{20}{40} = \frac{55}{p}$

Special Segment Theorems

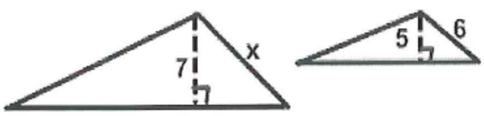
If two triangles are similar, then the measures of the corresponding altitudes are proportional to the measures of the corresponding sides.

Abbreviation: ~ △s *have corr. altitudes proportional to the corr. sides.*



$$\frac{QA}{UW} = \frac{PR}{TV} = \frac{QR}{UV} = \frac{PQ}{TU}$$

5.

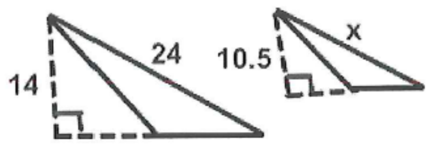


$$\frac{7}{5} = \frac{x}{6}$$

$5x = 42$

$x = 8.4$

6.



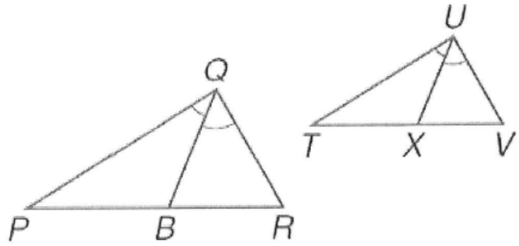
$$\frac{14}{10.5} = \frac{24}{x}$$

$14x = 252$

$x = 18$

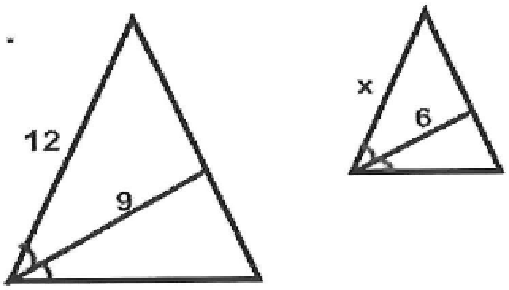
If two triangles are similar, then the measures of the corresponding angle bisectors of the triangles are proportional to the measures of the corresponding sides.

Abbreviation: ~ △s *have corr. ∠ bisectors proportional to the corr. sides.*



$$\frac{QB}{UX} = \frac{PR}{TV} = \frac{QR}{UV} = \frac{PQ}{TU}$$

7.



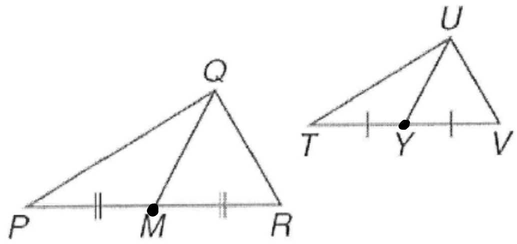
$$\frac{12}{x} = \frac{9}{6}$$

$$9x = 72$$

$$x = 8$$

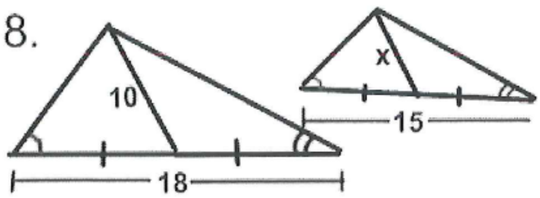
If two triangles are similar, then the measures of the corresponding medians are proportional to the measures of the corresponding sides.

Abbreviation: ~ △s *have corr. medians proportional to the corr. sides.*



$$\frac{QM}{UY} = \frac{PR}{TV} = \frac{QR}{UV} = \frac{PQ}{TU}$$

8.



$$\frac{10}{x} = \frac{18}{15}$$

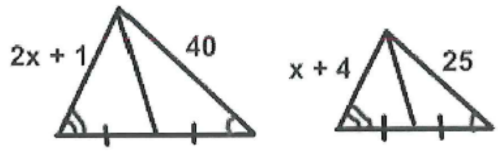
$18x = 150$

$x = 8.\overline{3}$

or $8\frac{1}{3}$

or $\frac{25}{3}$

9.



$$\frac{40}{25} = \frac{2x+1}{x+4}$$

$40x + 160 = 50x + 25$

$160 = 10x + 25$

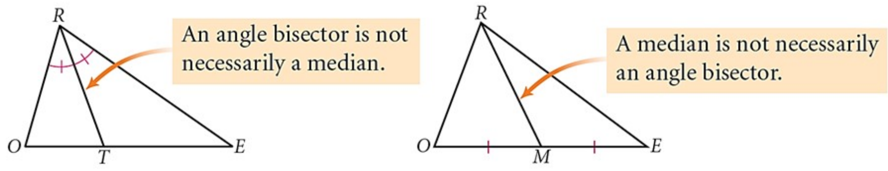
$135 = 10x$

$13.5 = x$

LESSON 7.4

Corresponding Parts of Similar Triangles

Recall when you first saw an angle bisector in a triangle. You may have thought that the bisector of an angle in a triangle divides the opposite side into two equal parts as well. A counterexample shows that this is not necessarily true. In $\triangle ROE$, $\overline{RT}$ bisects $\angle R$, but point T does not bisect $\overline{OE}$.



$OT \neq TE$ $m\angle ORM \neq m\angle MRE$

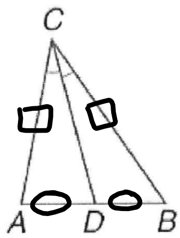
The angle bisector does, however, divide the opposite side in a particular way.

Angle Bisector Theorem An angle bisector in a triangle separates the opposite side into segments that have the same ratio as the other two sides.

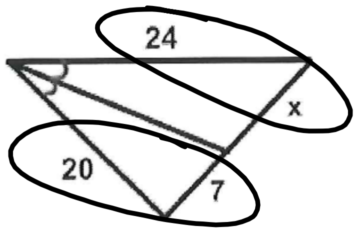
Example: $\frac{AD}{DB} = \frac{AC}{BC}$ ← segments with vertex A ← segments with vertex B

or

$\frac{DB}{AD} = \frac{BC}{AC}$



10.



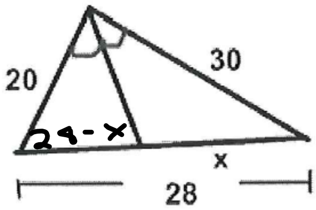
$$\frac{20}{24} = \frac{7}{x}$$

$$\frac{20}{7} = \frac{24}{x}$$

$$20x = 168$$

$$x = 8.4$$

11.



$$\frac{20}{30} = \frac{28-x}{x}$$

$$20x = 840 - 30x$$

$$50x = 840$$

$$x = 16.8$$

or

$$\frac{20}{28-x} = \frac{30}{x}$$

LESSON 7.4

Corresponding Parts of Similar Triangles

Summarize

LESSON 7.4

Corresponding Parts of Similar Triangles

Summarize

- Are ratios of the lengths of all corresponding segments the same as the scale factor? Does the conjecture extend to ratios of perimeters? Diagonals? Diagonals of nontriangular polygons?

- How can you apply the proportional relationships to triangles that are not similar?

LESSON 7.4

Corresponding Parts of Similar Triangles

Summarize

- Are ratios of the lengths of all corresponding segments the same as the scale factor? Does the conjecture extend to ratios of perimeters? Diagonals? Diagonals of nontriangular polygons?
  Yes to all.

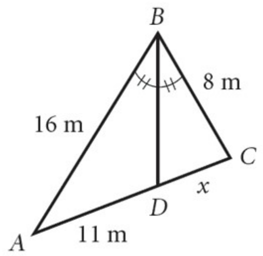
- How can you apply the proportional relationships to triangles that are not similar?
  Add auxiliary lines to create similar triangles, such as dropping perpendiculars to make similar right triangles.

LESSON 7.4

Corresponding Parts of Similar Triangles

Extra Example

Find x.



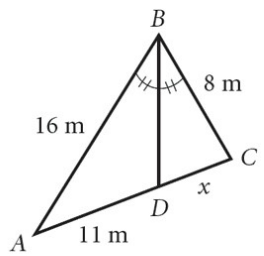
LESSON 7.4

Corresponding Parts of Similar Triangles

Extra Example

ANSWER

$x = 5.5$ m.



LESSON 7.4

Corresponding Parts of Similar Triangles

Closing Question

Holly was visiting Chicago. When she saw the Willis Tower, she wanted to measure the height of it. She decided to use a 12-foot light pole and measure its shadow at 1 P.M. The length of the shadow was 2 feet. Then she measured the length of Willis Tower's shadow and it was 242 feet at the same time. What is the height of the Willis Tower?

LESSON 7.4

Corresponding Parts of Similar Triangles

Closing Question

ANSWER

Holly was visiting Chicago. When she saw the Willis Tower, she wanted to measure the height of it. She decided to use a 12-foot light pole and measure its shadow at 1 P.M. The length of the shadow was 2 feet. Then she measured the length of Willis Tower's shadow and it was 242 feet at the same time. What is the height of the Willis Tower?

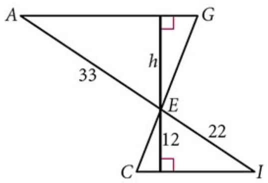
According to Holly's method, the Willis Tower is 1452 ft.
(actual height of Willis Tower is 1450 feet)

Homework: Pg. 394 1-11

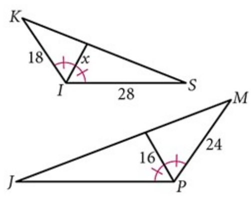
7.4 Exercises
pages 394 – 395

For Exercises 1–13, use your new conjectures. All measurements are in centimeters.

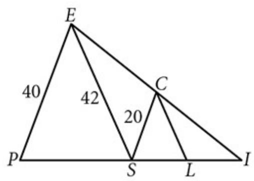
1. $\triangle ICE \sim \triangle AGE$
$h =$?



2. $\triangle SKI \sim \triangle JMP$
$x =$?

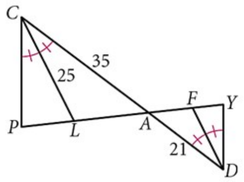


3. $\triangle PIE \sim \triangle SIC$
Point S is the midpoint of $\overline{PI}$. Point L is the midpoint of $\overline{SI}$. $CL =$? ⓗ

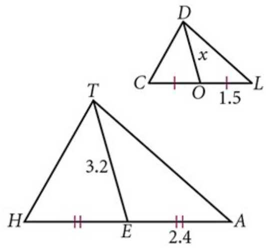


7.4 Exercises
pages 394 – 395

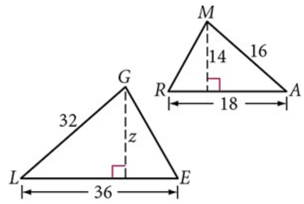
4. $\triangle CAP \sim \triangle DAY$
$FD = \underline{?}$



5. $\triangle HAT \sim \triangle CLD$
$x = \underline{?}$

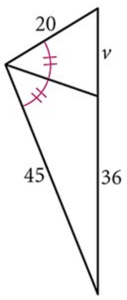


6. $\triangle ARM \sim \triangle ???$
$z = \underline{?}$

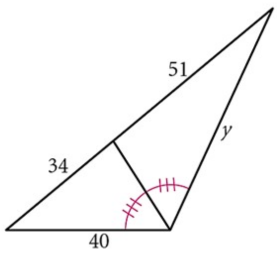


7.4 Exercises
pages 394 – 395

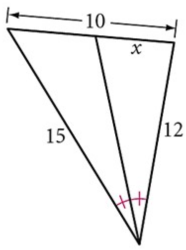
7. $v = \underline{?}$



8. $y = \underline{?}$



9. $x = \underline{?}$ ⓗ



Discovering Geometry
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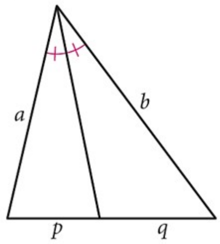
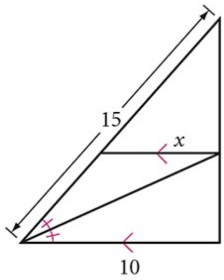
Lesson 7.4: Corresponding Parts of Similar Triangles

7.4 Exercises
pages 394 – 395

10. $\frac{a}{b} = \underline{?}, \frac{a}{p} = \underline{?}$



11. $x = \underline{?}$ ⓗ

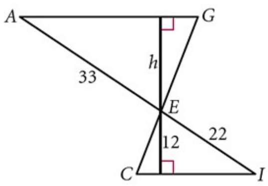


ANSWERS

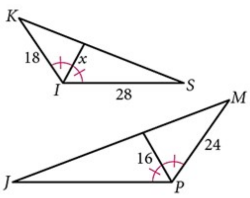
7.4 Exercises

For Exercises 1–13, use your new conjectures. All measurements are in centimeters.

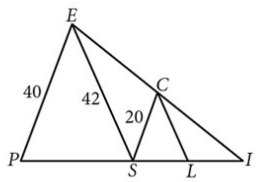
1. $\triangle ICE \sim \triangle AGE$
$h = \underline{?}$ 18 cm



2. $\triangle SKI \sim \triangle JMP$
$x = \underline{?}$ 12 cm



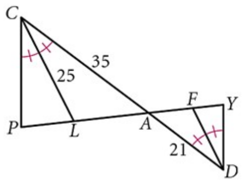
3. $\triangle PIE \sim \triangle SIC$
Point S is the midpoint of $\overline{PI}$.
Point L is the midpoint of $\overline{SI}$. $CL = \underline{?}$ ⓗ 21 cm



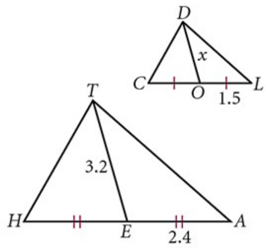
ANSWERS

7.4 Exercises

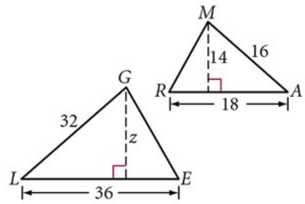
4. $\triangle CAP \sim \triangle DAY$
$FD = \underline{?}$ 15 cm



5. $\triangle HAT \sim \triangle CLD$
$x = \underline{?}$ 2.0 cm



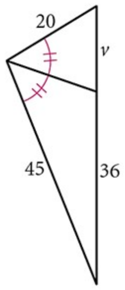
6. $\triangle ARM \sim \triangle ???$ $\triangle LEG$
$z = \underline{?}$ 28



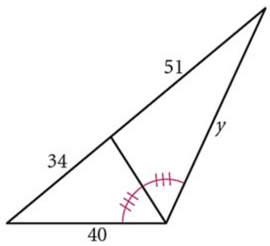
ANSWERS

7.4 Exercises

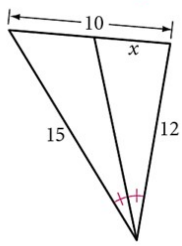
7. $v = \underline{?}$ 16 cm



8. $y = \underline{?}$ 60 cm



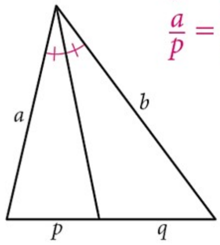
9. $x = \underline{?}$ (h) $4\frac{4}{9}$ cm



ANSWERS

7.4 Exercises

10. $\frac{a}{b} = \underline{?}$, $\frac{a}{p} = \underline{?}$ $\frac{a}{b} = \frac{p}{q}$, $\frac{a}{p} = \frac{b}{q}$



11. $x = \underline{?}$ ⓗ 6 cm