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Big and Small
Dilating Triangles to Create Similar Triangles

1. Use quadrilateral *ABCD* shown on the grid to complete part (a) through part (c).

    a. On the grid, draw the image of quadrilateral *ABCD* dilated using a scale factor of 3 with the center of dilation at the origin. Label the image *JKLM*.

    b. On the grid, draw the image of quadrilateral *ABCD* dilated using a scale factor of 0.5 with the center of dilation at the origin. Label the image *WXYZ*.
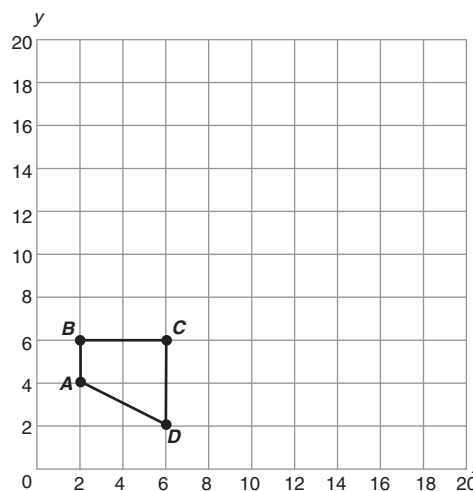

    c. Identify the coordinates of the vertices of quadrilaterals *JKLM* and *WXYZ*.

2. The vertices of triangle *ABC* are *A*(−6, 15), *B*(0, 5), and *C*(3, 10). Without drawing the figure, determine the coordinates of the vertices of the image of triangle *ABC* dilated using a scale factor of $\frac{1}{3}$ with the center of dilation at the origin. Explain your reasoning.

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3. The vertices of trapezoid *WXYZ* are *W*(−1, 2), *X*(−3, −1), *Y*(5, −1), and *Z*(3, 2). Without drawing the figure, determine the coordinates of the vertices of the image of trapezoid *WXYZ* dilated using a scale factor of 5 with the center of dilation at the origin. Explain your reasoning.

4. The vertices of hexagon *PQRSTV* are *P*(−5, 0), *Q*(−5, 5), *R*(0, 7), *S*(5, 2), *T*(5, −2), and *V*(0, −5). Without drawing the figure, determine the coordinates of the vertices of the image of hexagon *PQRSTV* dilated about the origin using a scale factor of 4.2. Explain your reasoning.

5. Triangle *A′B′C′* is a dilation of △*ABC* with the center of dilation at the origin. List the coordinates of the vertices of △*ABC* and △*A′B′C′*. What is the scale factor of the dilation? Explain.

6
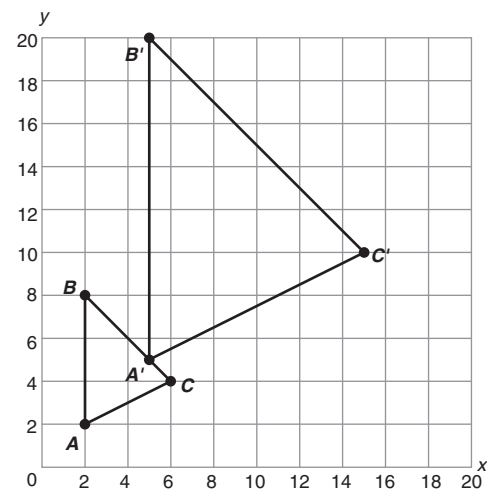
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6. On the grid, draw the image of quadrilateral *QRST* using the dilation $(x, y) \rightarrow (0.75x, 0.75y)$. Label the image $Q'R'S'T'$.
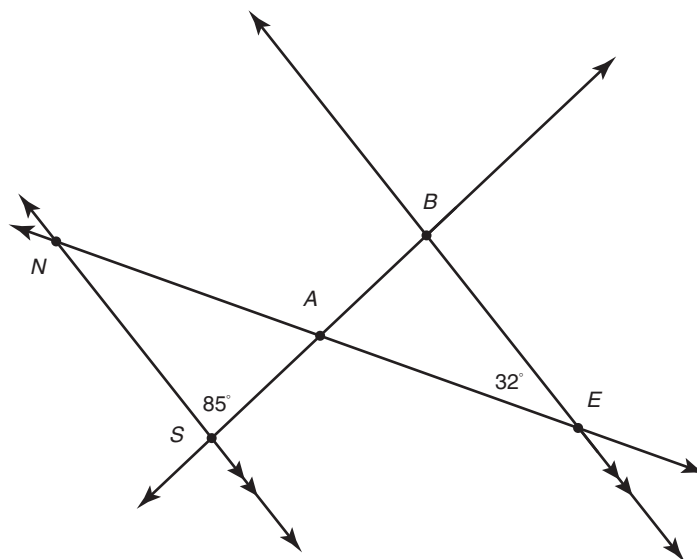
6
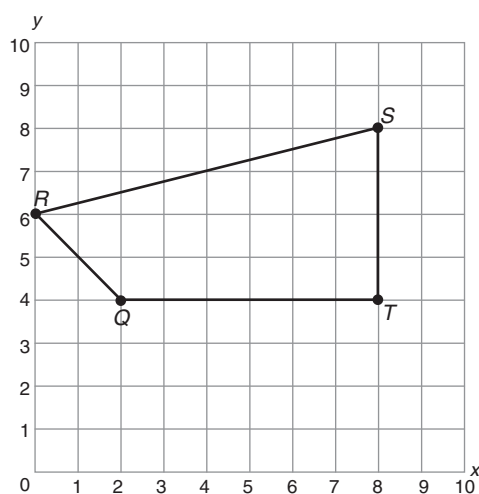
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Similar Triangles or Not?
Similar Triangle Theorems

1. In the figure below, $\overleftrightarrow{NS} \parallel \overleftrightarrow{BE}$. Use the information given in the figure to determine the $m\angle SNA$, $m\angle NAS$, $m\angle ABE$, and $m\angle BAE$. Is $\triangle NSA$ similar to $\triangle EBA$? If the triangles are similar, write a similarity statement. Use complete sentences to explain your answers.
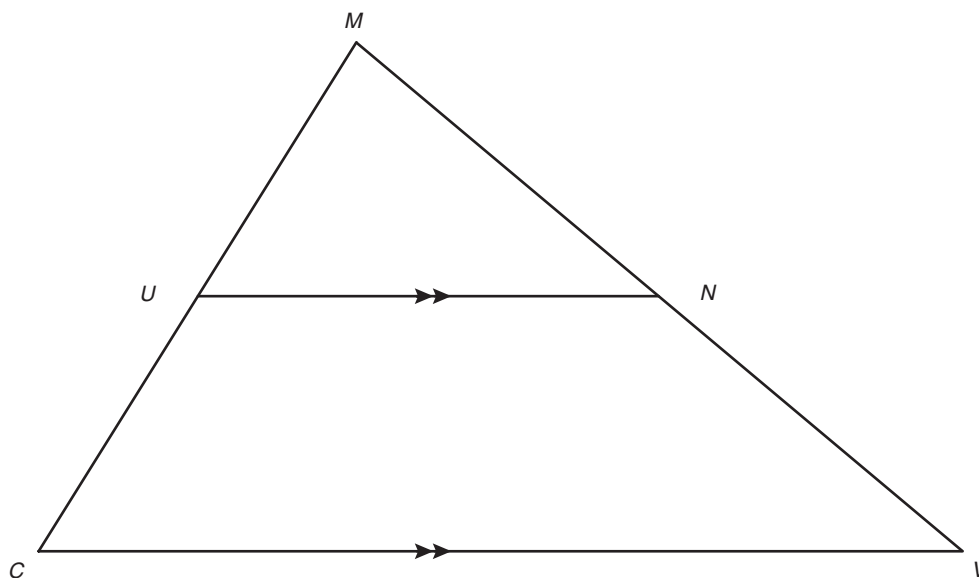
2. Use a ruler to determine whether the triangles shown are similar. Explain your answer.
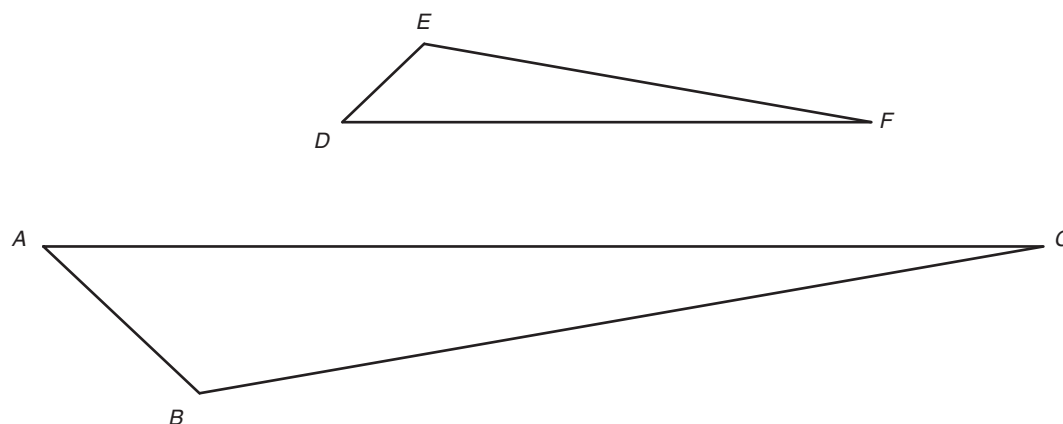
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3. In the figure shown, $\overline{NU} \parallel \overline{CV}$. Use the figure to complete part (a) through part (c).
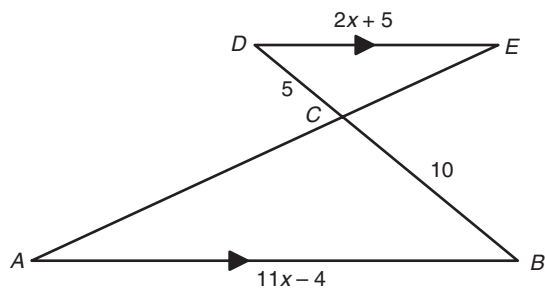

a. Is $\angle MUN \cong \angle MCV$? Explain your answer.

b. Is $\angle MNU \cong \angle MVC$? Explain your answer.

c. Is $\triangle CMV \sim \triangle UMN$? Explain your answer.

6

4. In the figure shown, segments *AB* and *DE* are parallel. The length of segment *BC* is 10 units and the length of segment *CD* is 5 units. Use this information to calculate the value of *x*. Explain how you determined your answer.
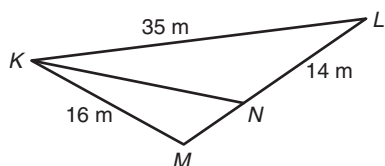
$2x + 5$

D   E

5

C

10

A   B

$11x - 4$

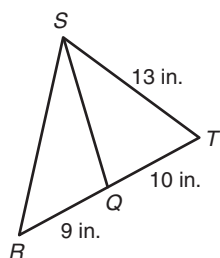Name _____ Date _____

Keep It in Proportion
Theorems About Proportionality

Calculate the indicated length in each figure.

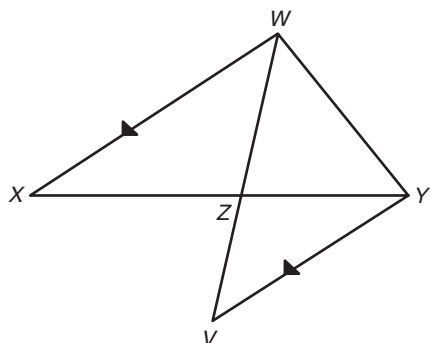**1.** $\overline{KN}$ bisects ∠*K*. Calculate *MN*.

2. $\overline{SQ}$ bisects ∠*S*. Calculate *SR*.

3. Use the figure and the given information to write a paragraph proof of the Angle Bisector/Proportional Side Theorem.
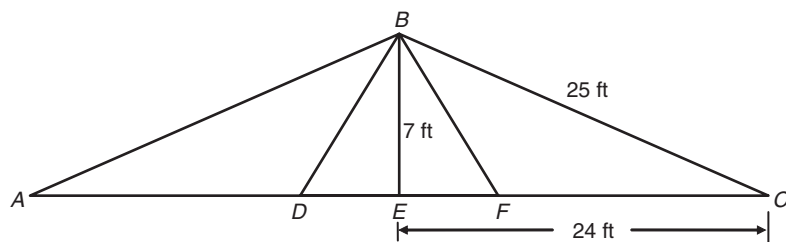

Given: $\overline{WZ}$ bisects $\angle XWY$ and $\overline{XW} \parallel \overline{VY}$
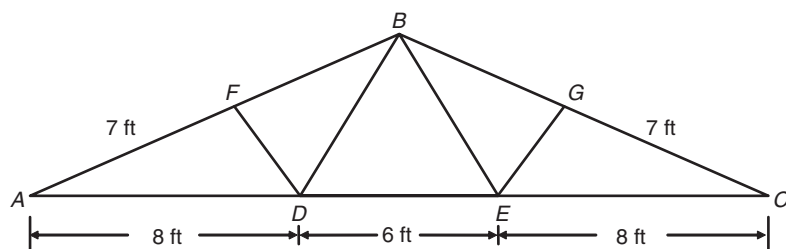
Prove: $\dfrac{WX}{XZ} = \dfrac{WY}{YZ}$

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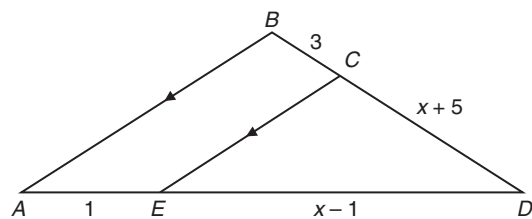**4.** The figure shows a truss on a bridge. Segment *BF* bisects angle *CBE*. Use this information to calculate *EF* and *CF*.

5. The figure shows a truss for a barn roof. Segment *DF* bisects angle *ADB* and segment *EG* bisects angle *CEB*. Triangle *DBE* is an equilateral triangle. Use this information to calculate the perimeter of the truss.
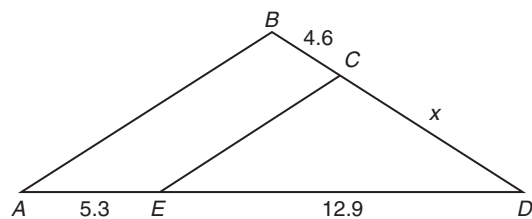
6. Given: $\overline{AB} \parallel \overline{CE}$
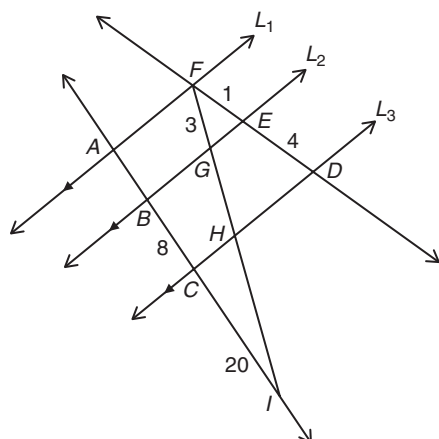
Calculate the value of *x*.

7. Calculate a value for *x* such that $\overline{AB} \parallel \overline{CE}$.
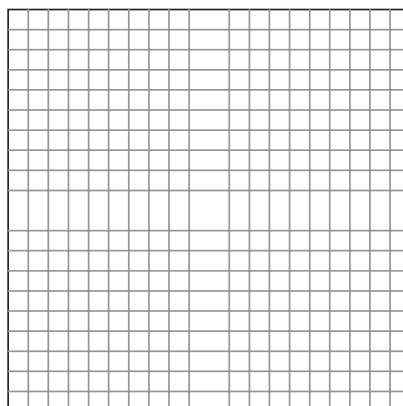
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8. Given: $L_1 \parallel L_2 \parallel L_3$

Calculate *HI*.

9. In △*XYZ*, the midpoint of $\overline{XY}$ is *A*(−3, 0.5), the midpoint of $\overline{XZ}$ is *B*(1, −6), and the midpoint of $\overline{YZ}$ is *C*(3, 0.5). Use the Triangle Midsegment Theorem to determine the coordinates of the vertices of △*XYZ*. Show all of your work and graph triangles *ABC* and *XYZ* on the grid.
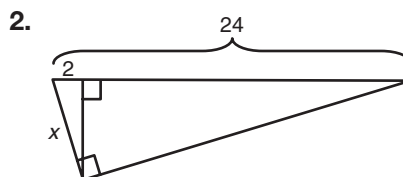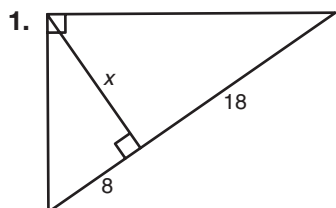
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Geometric Mean
More Similar Triangles

Solve for *x*.

1.

2.

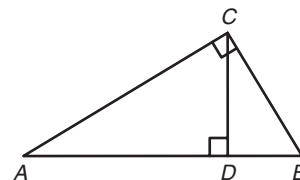**3.** Use the figure and the given information to write a paragraph proof of the Right Triangle/Altitude Similarity Theorem.

Given: Triangle *ABC* is a right triangle with altitude *CD*.

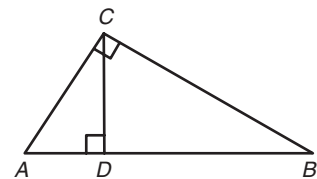Prove: $\triangle ABC \sim \triangle ACD \sim \triangle CBD$

6

4. The geometric mean of two numbers is 20. One of the numbers is 50. What is the other number?

5. The geometric mean of two numbers is $5\sqrt{3}$. One of the numbers is 3. What is the other number?

6. Use the figure and the given information to prove the Right Triangle Altitude Theorem 1.

Given: Triangle *ABC* is a right triangle with altitude *CD*.

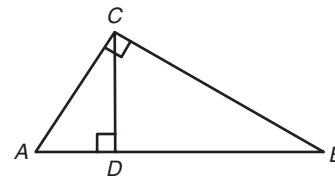Prove: $\dfrac{AD}{CD} = \dfrac{CD}{BD}$

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7. Use the figure and the given information to prove the Right Triangle Altitude/Leg Theorem
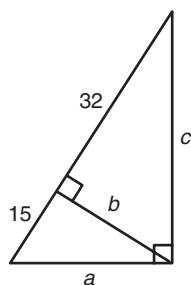
Given: Triangle *ABC* is a right triangle with altitude *CD*.

Prove: $\dfrac{AB}{AC} = \dfrac{AC}{AD}$ and $\dfrac{AB}{BC} = \dfrac{BC}{BD}$
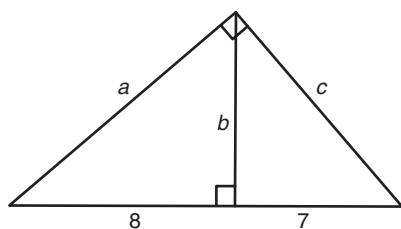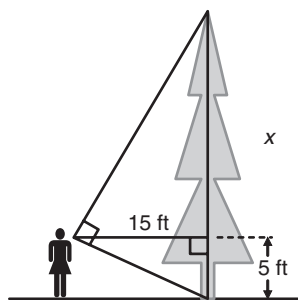

Solve for *a*, *b*, and *c*.

8.

9.

10. You are standing 15 feet from a tree. Your line of sight to the top of the tree and to the bottom of the tree forms a 90-degree angle as shown in the diagram. The distance between your line of sight and the ground is 5 feet. Estimate the height of the tree.
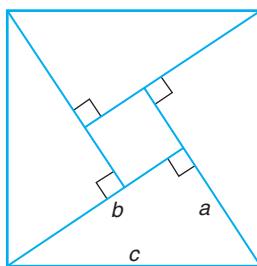
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Proving the Pythagorean Theorem
Proving the Pythagorean Theorem and the Converse
of the Pythagorean Theorem

1. Use this figure to prove the Pythagorean Theorem. Given that the bottom triangle is a right triangle, this figure is constructed by making three copies of the bottom triangle, as shown.

a. Determine the area of the large square.

b. Determine the area of the small square.

c. Determine the total area of the four triangles.

d. Show that the area of the large square is equal to the sum of the area of the four triangles and the small square.

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2. In order to prove the Pythagorean Theorem using this figure, show that the sum of the three triangles is equal to the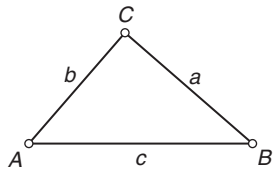 area of the trapezoid. (Note: $A_{trapezoid} = h\left(\dfrac{b_1 + b_2}{2}\right)$ where h is the height and b is the base.)
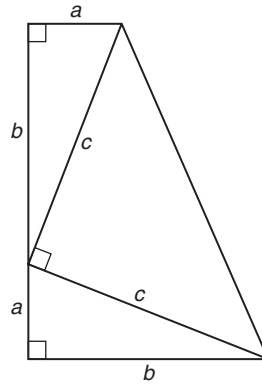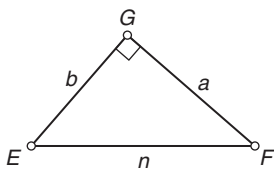
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3. Consider the figure where $a^2 + b^2 = c^2$.

In order to prove the Converse of the Pythagorean Theorem, Peter constructs a new triangle with the same leg lengths of *a* and *b*, and makes angle *G* a right angle.

Complete the statements in the two column proof to prove the Converse of the Pythagorean Theorem, that traingle *ABC* is a right triangle.

Reason	Statement
$a^2 + b^2 = n^2$	
$a^2 + b^2 = c^2$	
	Transitive Property
$\triangle ABC \cong \triangle EFG$	
$\angle c = 90°$	
$\triangle ABC$ is a right triangle	

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Indirect Measurement
Application of Similar Triangles

1. You want to measure the height of a tree at the community park. You stand in the tree's shadow so that the tip of your shadow meets the tip of the tree's shadow on the ground, 2 meters from where you are standing. The distance from the tree to the tip of the tree's shadow is 5.4 meters. You are 1.25 meters tall. Draw a diagram to represent the situation. Then, calculate the height of the tree.

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2. You and a friend are on the 10th floor of apartment buildings that are directly across the street from each other, and have balconies. The two of you are making a banner to hang between the apartment buildings. The banner must cross the street. To hang the banner, you and your friend need to attach it to hooks on the wall of each balcony. The wall of your balcony is 6 feet away from the street and the wall of your friend's balcony is 4 feet away from the street. You also know that your friend's balcony is 10 feet away from the end of his building and your balcony is 100 feet away from the edge of your building. How wide is the street between you and your friend's apartment buildings? How long does the banner need to be? Show all your work and use complete sentences in your answer.