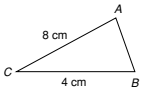
LESSON 2-7

Practice A

Applications of Proportions

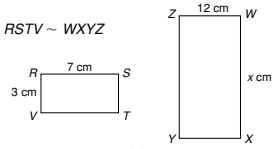
Find the value of *x* in each diagram.

1. $\Delta ABC \sim \Delta DEF$



4

2. $RSTV \sim WXYZ$

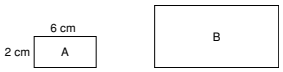


28

3. Sam is 5 feet tall and casts a shadow 4 feet long. At the same time, a nearby tree casts a shadow 12 feet long. Write and solve a proportion to find the height of the tree.

$\frac{5}{x} = \frac{4}{12}$; 15 feet

Every dimension of rectangle A has been multiplied by 2 to form rectangle B.



4. What are the new dimensions of rectangle B?

width = 4 cm; length = 12 cm

5. What is the ratio of the corresponding sides?

$\frac{1}{2}$

6. Complete the table.

	Rectangle A	Rectangle B
Perimeter	16 cm	32 cm^2
Area	12 cm	48 cm^2

7. What is the ratio of the perimeters?

$\frac{1}{2}$

8. How is the ratio of perimeters related to the ratio in problem 5?

They are the same.

9. What is the ratio of the areas?

$\frac{1}{4}$

10. How is the ratio of the areas related to the ratio in problem 5?

The ratio of the areas is the square of the ratio in problem 5.

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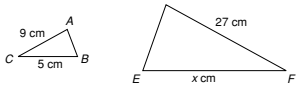
LESSON 2-7

Practice B

Applications of Proportions

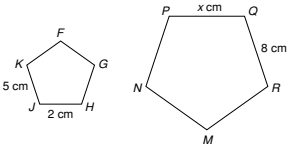
Find the value of *x* in each diagram.

1. $\Delta ABC \sim \Delta DEF$



15

2. $FGHJK \sim MNPQR$



3.2

3. A utility worker is 5.5 feet tall and is casting a shadow 4 feet long. At the same time, a nearby utility pole casts a shadow 20 feet long. Write and solve a proportion to find the height of the utility pole.

$\frac{5.5}{x} = \frac{4}{20}$; 27.5 feet

4. A cylinder has a radius of 3 cm and a length of 10 cm. Every dimension of the cylinder is multiplied by 3 to form a new cylinder. How is the ratio of the volumes related to the ratio of corresponding dimensions?

The ratio of the volumes is the cube of the ratio of the corresponding sides.

5. A rectangle has an area of 48 in^2. Every dimension of the rectangle is multiplied by a scale factor, and the new rectangle has an area of 12 in^2. What was the scale factor?

$\frac{1}{2}$

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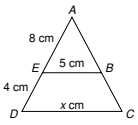
LESSON 2-7

Practice C

Applications of Proportions

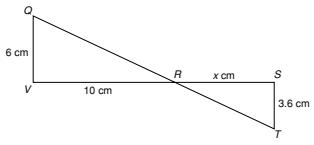
Find the value of *x* in each diagram.

1. $\Delta ACD \sim \Delta ABE$



7.5

2. $\Delta QRV \sim \Delta TRS$



6

3. Keshawn is 5 ft 6 in. tall and casts a shadow that is one-fourth his height. At the same time, a nearby tree casts a shadow that is twice Keshawn's height. Write and solve a proportion to find the height of the tree.

$\frac{5.5}{x} = \frac{1.375}{11}$; 44 feet

4. A triangle has an area of 20 in^2. Every dimension of the triangle is multiplied by a scale factor, and the new triangle has an area of 180 in^2. What was the scale factor?

3

5. A rectangular prism has a volume of 112 cm^3. Every dimension of the rectangular prism is multiplied by a scale factor and the new volume is 1.75 cm^3. What was the scale factor?

$\frac{1}{4}$

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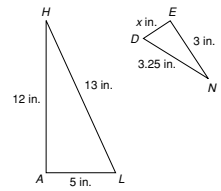
LESSON 2-7

Reteach

Applications of Proportions

To find missing lengths in similar polygons, you must know which sides correspond (match). Making a table can help.

ΔHAL ~ ΔNED. Find the value of x.



Triangle	First two points	Last two points	First and last points
HAL	*HA*	*AL*	*HL*
	12 in.	5 in.	13 in.
NED	*NE*	*ED*	*ND*
	3 in.	*x* in.	3.25 in.

$\frac{HA}{NE} = \frac{AL}{ED}$ *Choose any two columns from the table to set up a proportion.*

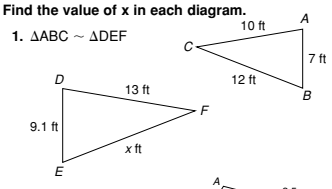
$\frac{12}{3} = \frac{5}{x}$ *Substitute.*

$12x = 15$ *Use cross products.*

$x = 1.25$ *Divide both sides by 12.*

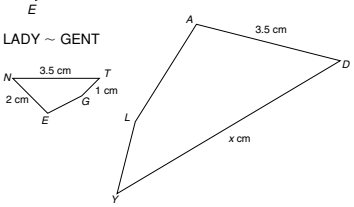
Find the value of x in each diagram.

1. ΔABC ~ ΔDEF



x = 15.6 ft

2. LADY ~ GENT



x = 6.125 cm

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LESSON 2-7

Reteach

Applications of Proportions continued

When you multiply every dimension of a figure by a scale factor *k*, you create similar figures. You can determine the ratios of perimeters, areas, and volumes between those figures by thinking about the units that are used to measure perimeter, area, and volume.

Measurement	Measurement Units	Ratio Between
Perimeter	*single* units (in., ft, cm, m)	*single* ratio (k)
Area	*square* units (in^2, ft^2, cm^2, m^2)	*square* ratio (k^2)
Volume	*cubic* units (in^3, ft^3, cm^3, m^3)	*cubic* ratio (k^3)

The dimensions of a rectangular cake measure 12 in. by 18 in. by 4 in. Every dimension is multiplied by $\frac{1}{2}$ to create a smaller, similar cake. How is the ratio of the volumes related to the ratio of corresponding dimensions? What is the ratio of the volumes?

Think: Volume is measured in *cubic* units. So the ratio of the volumes is the *cube* of the ratio of the corresponding dimensions: $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$.

Complete the table by filling in the missing ratios.

	Scale Factor	Ratio of Perimeters	Ratio of Areas	Ratio of Volumes
3.	5	5	$(5)^2 = 25$	$(5)^3 = 125$
4.	$\frac{2}{3}$	$\frac{2}{3}$	$\left(\frac{2}{3}\right)^2 = \frac{4}{9}$	$\left(\frac{2}{3}\right)^3 = \frac{8}{27}$
5.	$\frac{10}{7}$	$\frac{10}{7}$	$\left(\frac{10}{7}\right)^2 = \frac{100}{49}$	$\left(\frac{10}{7}\right)^3 = \frac{1000}{343}$

6. A stop sign has the shape of an octagon with each side measuring 0.5 ft. To make a scale model of the sign, every dimension is multiplied by $\frac{1}{20}$. How is the ratio of the areas related to the ratio of the corresponding dimensions? What is the ratio of the areas?

The ratio of the areas is the square of the ratio of corresponding dimensions: $\left(\frac{1}{20}\right)^2 = \frac{1}{400}$.

7. A circular plate has radius 15 cm. Every dimension is multiplied by 4 to create a larger, similar plate. How is the ratio of the circumferences related to the ratio of the corresponding dimensions? What is the ratio of the circumferences? (*Hint*: Think of circumference as perimeter of a circle.)

The ratio of the circumferences is equal to the ratio of corresponding dimensions: 4.

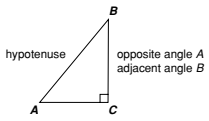
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LESSON 2-7

Challenge

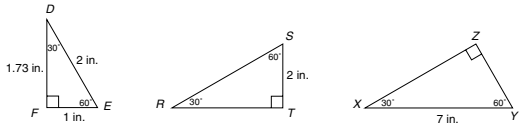
Trigonometric Ratios

Trigonometry is the study of angle and side relationships in triangles. Right triangles are especially important in trigonometry. In a right triangle, the side opposite the right angle is always called the **hypotenuse**, and the remaining sides are called the **legs**. Each leg can be described as **opposite** or **adjacent** to a given acute angle.



adjacent angle *A*
opposite angle *B*

Use these similar right triangles to fill in the table.



	ΔDEF	ΔRST	ΔXYZ
1. Name the side opposite the 30° angle in each triangle.	$\overline{EF}$	$\overline{ST}$	$\overline{YZ}$
2. What is the length of the side opposite the 30° angle?	1 in.	2 in.	3.5 in.
3. Name the hypotenuse.	$\overline{DE}$	$\overline{RS}$	$\overline{XY}$
4. What is the length of the hypotenuse?	2 in.	4 in.	7 in.
5. Calculate $\frac{\text{length of side opposite } 30°}{\text{length of hypotenuse}}$.	$\frac{1}{2} = 0.5$	$\frac{2}{4} = \frac{1}{2} = 0.5$	$\frac{3.5}{7} = \frac{1}{2} = 0.5$

6. The ratio in problem 5 is called the **sine** of the angle. Based on your results, what is the sine of a 30° angle in any right triangle? $\frac{1}{2}$ or 0.5

7. Use the triangles above to determine the sine of a 60° angle. 0.865

8. The ratio $\frac{\text{length of adjacent side}}{\text{length of hypotenuse}}$ is called the **cosine** of the angle.

a. Use the triangles above to determine the cosine of a 30° angle. 0.865

b. Use the triangles above to determine the cosine of a 60° angle. $\frac{1}{2}$ or 0.5

9. Explain how the sines of 30° and 60° are related to the cosines of 30° and 60°.

The sine of a 30° angle equals the cosine of a 60° angle.

The sine of a 60° angle equals the cosine of a 30° angle.

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LESSON 2-7

Problem Solving

Applications of Proportions

Write the correct answer.

1. A 4 by 5 inch photo is enlarged by multiplying every dimension by 2 to form a similar 8 by 10 inch photo. What is the ratio of the perimeter of the smaller rectangle to that of the larger? What is the ratio of the two areas?

1:2; 1:4

2. Pamela wants to buy a suitcase whose dimensions are $1\frac{1}{2}$ times those of her $28 \times 16 \times 8$ inch suitcase. How is the ratio of the volumes related to the ratio of corresponding dimensions? What is the ratio of the volumes?

The ratio of the volumes is the cube of the ratio of the corresponding dimensions; 8:27

3. The Taylor's plan to expand their 80 square foot garage by tripling the dimensions. What will be the area of the new garage?

720 sq. ft.

4. A tent has a volume of 26.25 in^3. Every dimension is multiplied by a scale factor so that the new tent has a volume of 1680 in^3. What was the scale factor?

4

Complete the table below and use it to answer questions 5–8. Select the best answer. Assume the shadow lengths were measured at the same time of day.

Object	Length of Shadow (ft)	Height (ft)
Flagpole	8	20
Oak tree	12	
Goal post	18	
Telephone pole		17.5
Fence		6.5

5. The flagpole casts an 8 foot shadow, as shown in the table. At the same time, the oak tree casts a 12 foot shadow. How tall is the oak tree?

A 4.8 ft **C** 30 ft
B 24 ft **D** 32 ft

6. How tall is the goal post?

F 7.2 ft **H** 38 ft
G 30 ft **J** 45 ft

7. What is the length of the telephone pole's shadow?

A 5.5 ft **C** 25.5 ft
B 7 ft **D** 43.8 ft

8. What is the length of the fence's shadow?

F 1.5 ft **H** 16.25 ft
G 2.6 ft **J** 21.5 ft

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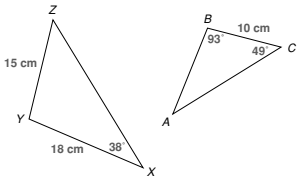
LESSON 2-7

Reading Strategies

Understanding Symbols

Use the table below to help you understand the symbols commonly used in geometry.

Symbols	Words
$\overline{XY}$	segment *XY*
$\angle X$	angle *X*
ΔXYZ	triangle *XYZ*
XY	the length of segment *XY*
$m\angle X$	the measure of angle *X*
$\sim$	is similar to



Answer each question.

1. Write "triangle *ABC*" in symbols. ΔABC

2. Write $m\angle B = 93°$ in words. The measure of angle B is 93 degrees.

3. Write $\Delta XYZ \sim \Delta ABC$ in words.

Triangle XYZ is similar to triangle ABC.

4. Use the information given in symbols below to label the diagram shown above.

$m\angle X = 38°$ $m\angle B = 93°$ $m\angle C = 49°$
$XY = 18$ cm $YZ = 15$ cm $BC = 10$ cm

Corresponding angles of similar triangles have the same measure.

5. What is $m\angle Z$ 49°

6. What is $m\angle A$ 38°

7. Write a proportion relating *AB*, *BC*, *XY*, and *YZ*. Possible answer: $\frac{AB}{BC} = \frac{XY}{YZ}$

8. Substitute the known values into the proportion from problem 7, and then solve it find *AB*.

$\frac{X}{10} = \frac{18}{15}$; 12 cm

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