GLENCOE MATHEMATICS

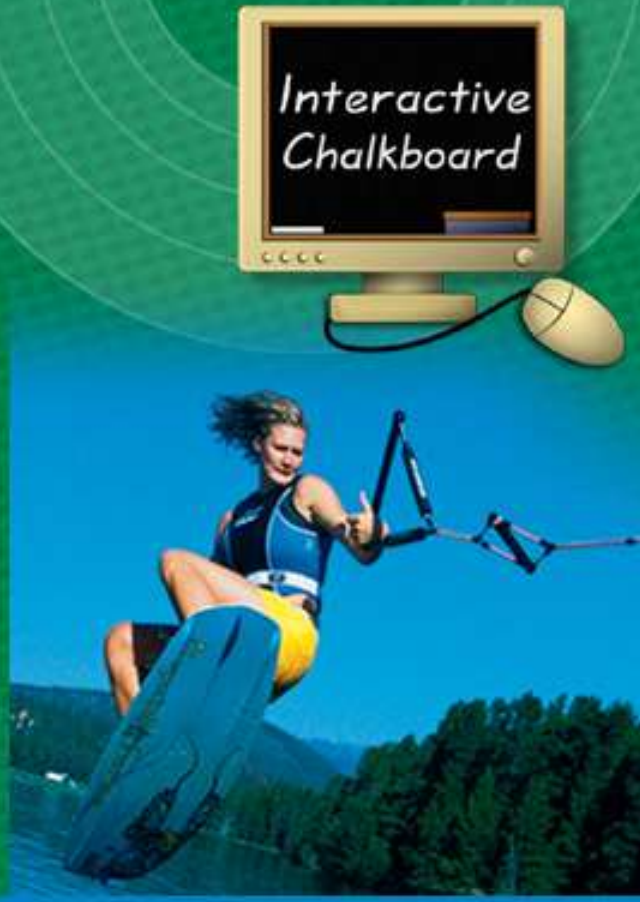
Mathematics

Applications and Concepts

Course 3

CHAPTER 4

Proportions, Algebra, and Geometry



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Lesson 4-1Ratios and Rates
Lesson 4-2Rate of Change
Lesson 4-3Slope
Lesson 4-4Solving Proportions
Lesson 4-5Similar Polygons
Lesson 4-6Scale Drawings and Models
Lesson 4-7Indirect Measurement
Lesson 4-8Dilations

Lesson 4-1 Contents

Example 1Write Ratios in Simplest Form

Example 2Write Ratios in Simplest Form

Example 3Find a Unit Rate

Example 4Compare Unit Rates

Example 1

Express *12 blue marbles out of 18 marbles* in simplest form.

$\frac{12}{18} = \frac{2}{3}$ Divide the numerator and denominator by the greatest common factor, 6.

Answer: The ratio of blue marbles to marbles is $\frac{2}{3}$ or 2 out of 3.

End of slide

Your Turn

Express *5 blue marbles out of 20 marbles* in simplest form.

Answer: $\frac{1}{4}$

End of slide

Example 2

Express *10 inches to 2 feet* in simplest form.

$$\frac{10 \text{ inches}}{2 \text{ feet}} = \frac{10 \text{ inches}}{24 \text{ inches}}$$ Convert 2 feet to 24 inches.

$$= \frac{5 \cancel{\text{ inches}}}{12 \cancel{\text{ inches}}}$$ Divide the numerator and denominator by 2.

Answer: The ratio in simplest form is $\frac{5}{12}$ or 5:12.

End of slide

Your Turn

Express *14 inches to 2 feet* in simplest form.

Answer: $\frac{7}{12}$

Example 3

READING **Yi-Mei reads 141 pages in 3 hours. How many pages does she read per hour?**

Write the rate that expresses the comparison of pages to hours. Then find the unit rate.

$$\frac{141 \text{ pages}}{3 \text{ hours}} = \frac{47 \text{ pages}}{1 \text{ hour}}$$

Divide the numerator and denominator by 3 to get a denominator of 1.

Answer: Yi-Mei reads an average of 47 pages per hour.

End of slide

Your Turn

TRAVEL On a trip from Columbus, Ohio, to Myrtle Beach, South Carolina, Lee drove 864 miles in 14 hours. What was Lee's average speed in miles per hour?

Answer: about 62 miles per hour

End of slide

Example 4

SHOPPING **Alex spends $12.50 for 2 pounds of almonds and $23.85 for 5 pounds of jellybeans. Which item costs less per pound? By how much?**

For each item, write a rate that compares the cost of the item to the number of pounds. Then find the unit rates.

Almonds: $\frac{\$12.50}{2 \text{ pounds}} = \frac{\$6.25}{1 \text{ pound}}$

Jellybeans: $\frac{\$23.85}{5 \text{ pounds}} = \frac{\$4.77}{1 \text{ pound}}$

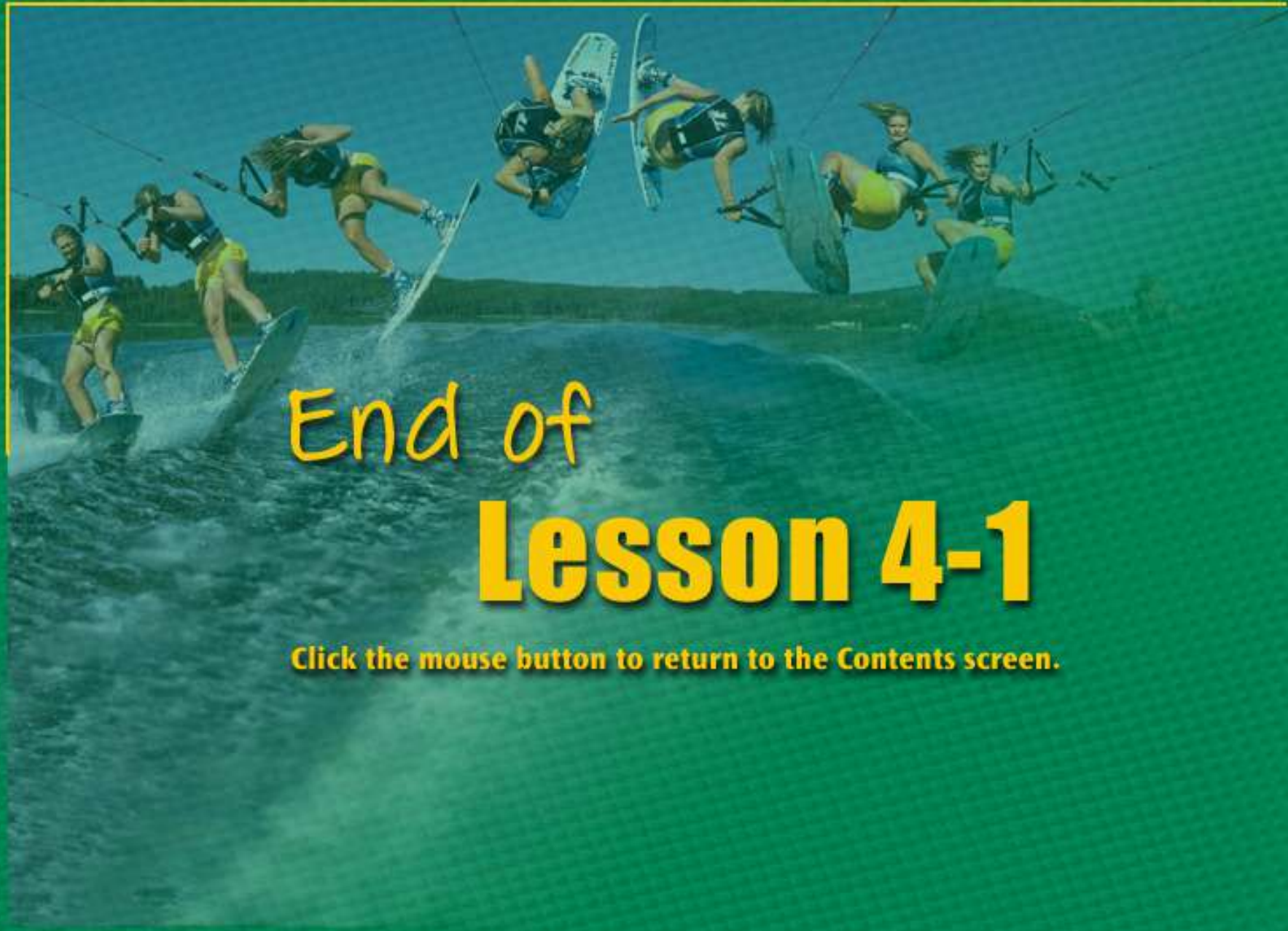
Answer: The almonds cost $6.25 per pound and the jellybeans cost $4.77 per pound. So, the jellybeans cost $6.25 – $4.77 or $1.48 per pound less than the almonds.

End of slide

Your Turn

SHOPPING Cameron spends $22.50 for 2 pounds of macadamia nuts and $31.05 for 3 pounds of cashews. Which item costs less per pound? By how much?

Answer: cashews by $0.90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Lesson 4-2 Contents

Example 1Find a Rate of Change

Example 2Find a Negative Rate of Change

Example 3Zero Rates of Change

Example 4Zero Rates of Change

Example 1

DOGS The table below shows the weight of a dog in pounds between 4 and 12 months old. Find the rate of change in the dog's weight between 8 and 12 months of age.

Age (mo.)	4	8	12
Weight (lb)	15	28	43

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Example 1

$$\frac{\text{change in weight}}{\text{change in age}} = \frac{(43 - 28) \text{ pounds}}{(12 - 8) \text{ months}}$$

The dog grew from 28 to 43 pounds from ages 8 to 12 months.

$$= \frac{15 \text{ pounds}}{4 \text{ months}}$$

Subtract to find the change in weights and ages.

$$= \frac{3.75 \text{ pounds}}{1 \text{ month}}$$

Express this rate as a unit rate.

Answer: The dog grew an average of 3.75 pounds per month.

End of slide

Your Turn

HEIGHTS The table below shows Julia's height in inches between the ages of 6 and 11. Find the rate of change in her height between ages 6 and 9.

Age (yr)	6	9	11
Height (in.)	52	58	60

Answer: 2 inches per year

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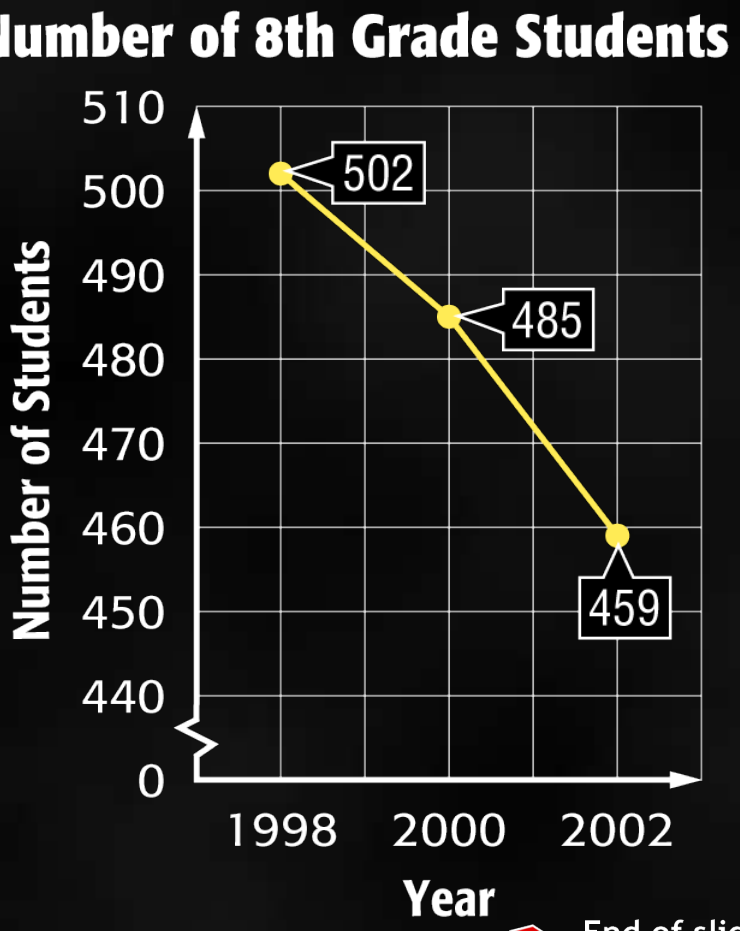
Example 2

SCHOOLS The graph to the right shows the number of students in the 8th grade between 1998 and 2002. Find the rate of change between 2000 and 2002.



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Example 2

Use the formula for the rate of change.

Let $(x_1, y_1) = (2000, 485)$ and $(x_2, y_2) = (2002, 459)$.

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{459 - 485}{2002 - 2000}$$

Write the formula for the rate of change.

$$= \frac{-26}{2}$$

Simplify.

$$= \frac{-13}{1}$$

Express this as a unit rate.

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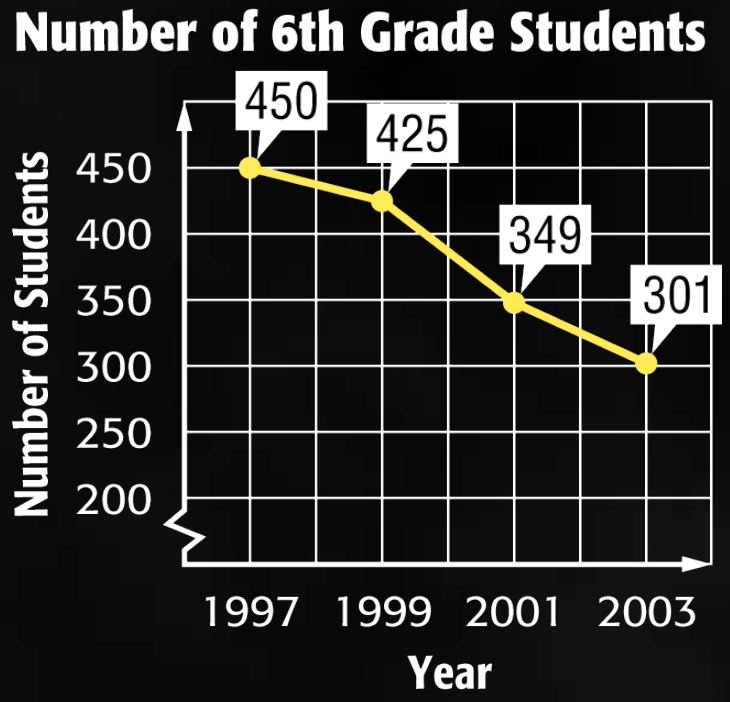
Example 2

Answer: The rate of change is –13 students per year. The rate is negative because between 2000 and 2002, the number of students *decreased.* This is shown on the graph by a line slanting downward from left to right.

Your Turn

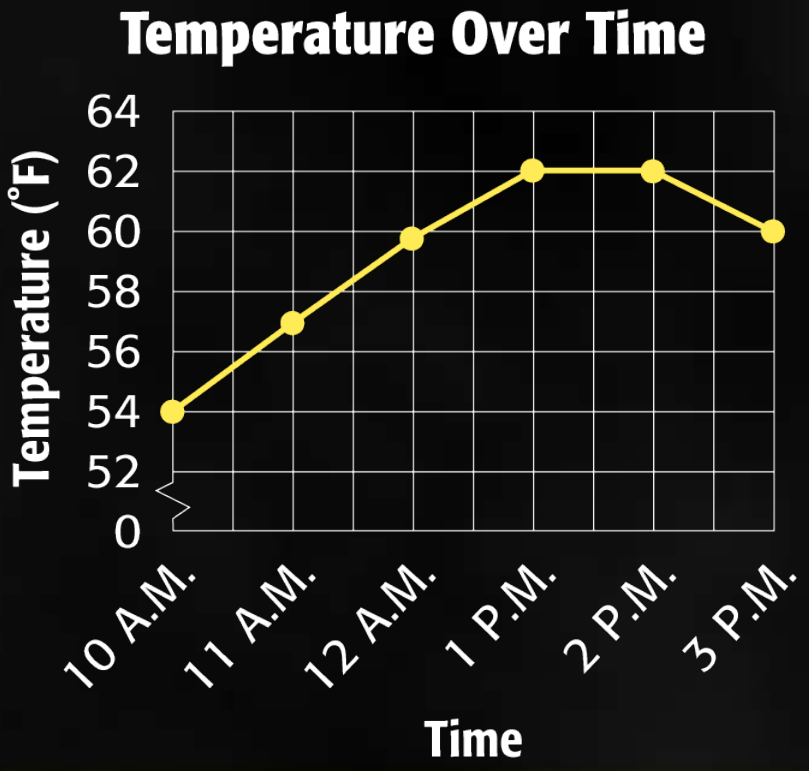
SCHOOLS The graph below shows the number of students in the 6th grade between 1997 and 2003. Find the rate of change between 2001 and 2003.



Answer: –24 students per year

Example 3

TEMPERATURE The graph shows the temperature measured on each hour from 10 A.M. to 3 P.M. Find a time period in which the temperature did not change.



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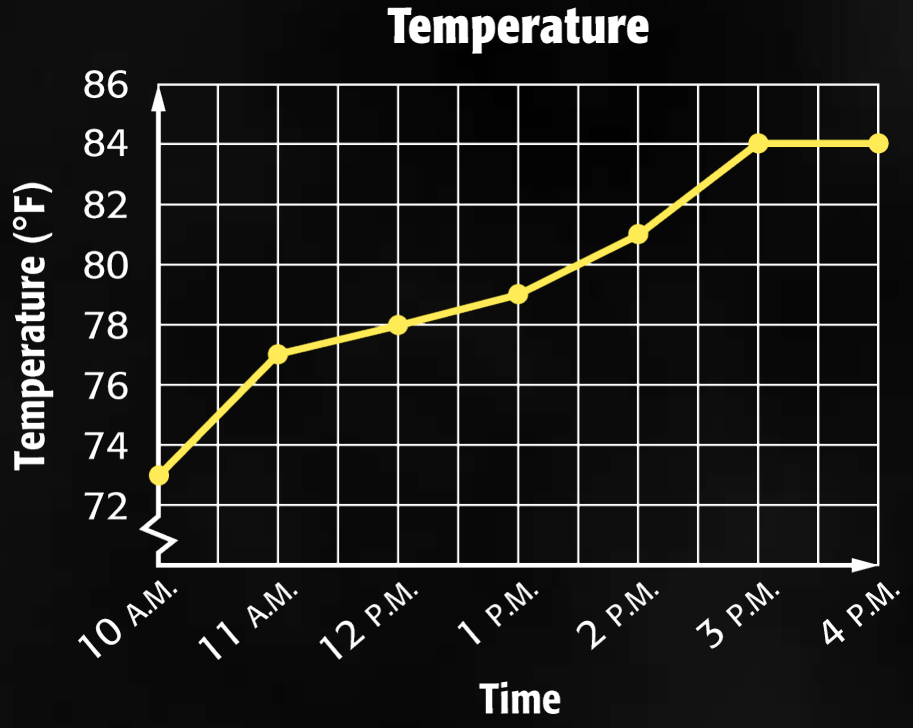
Example 3

Between 1 P.M. and 2 P.M., the temperature did not change. It remained 62°F. This is shown on the graph by a horizontal line segment.

Answer: 1 P.M. and 2 P.M.

Your Turn

TEMPERATURE The graph shows the temperature measured on each hour from 10 A.M. to 4 P.M. Find a time period in which the temperature did not change.



Answer: 3 P.M. to 4 P.M.

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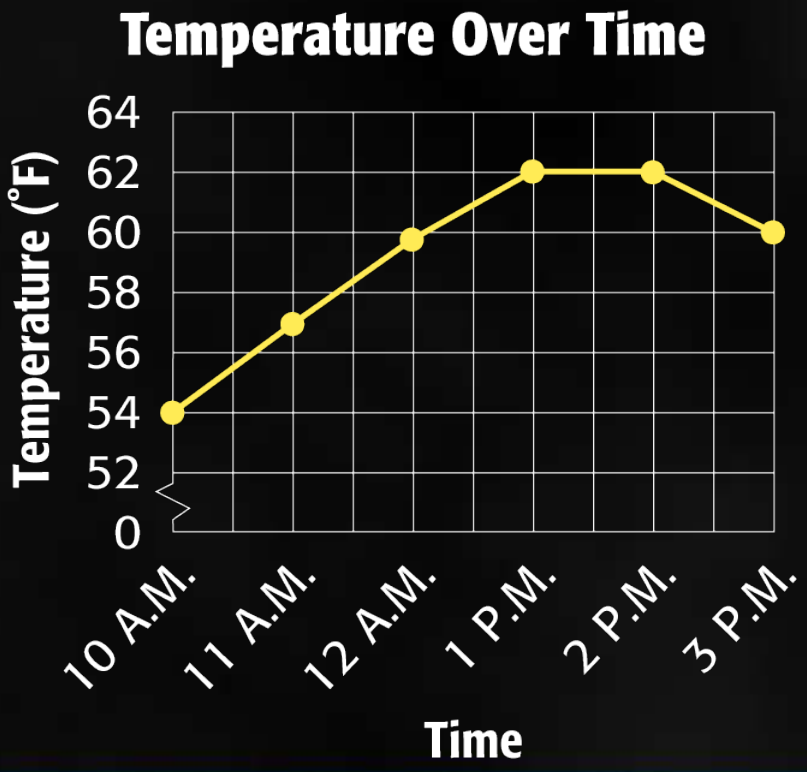
Example 4

TEMPERATURE The graph shows the temperature measured on each hour from 10 A.M. to 3 P.M. Find the rate of change from 1 P.M. to 2 P.M.



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Example 4

Let $(x_1\ y_1) = (1, 62)$ and $(x_2, y_2) = (2, 62)$.

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{62 - 62}{2 - 1}$$

Write the formula for the rate of change.

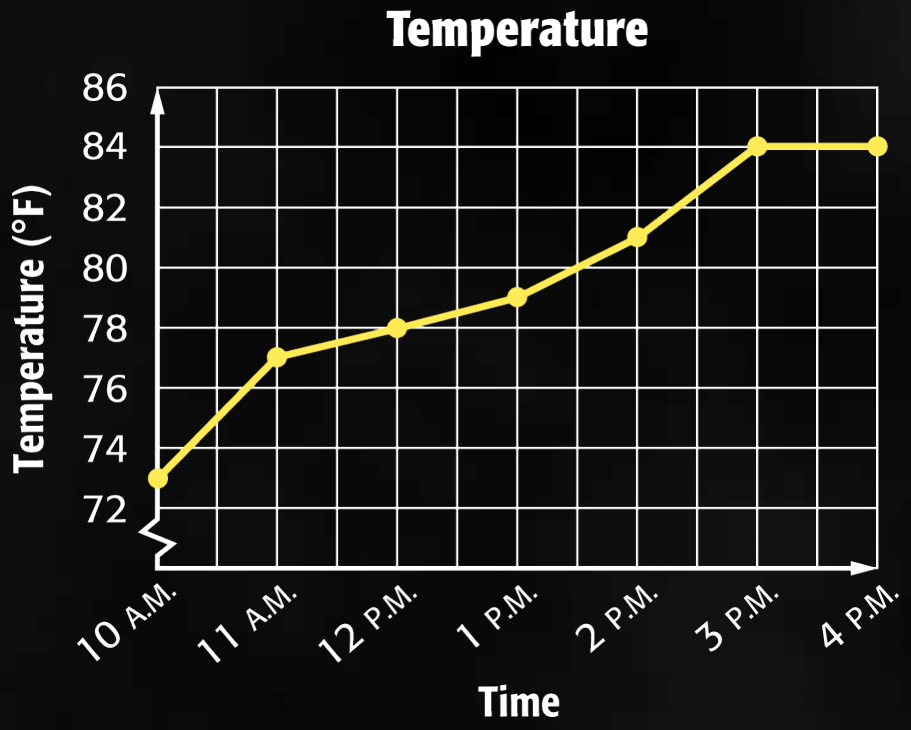
$$= \frac{0}{1} \text{ or } 0$$

Simplify.

Answer: The rate of change in the temperature between 1 P.M. and 2 P.M. is 0°F per hour.

Your Turn

TEMPERATURE The graph shows the temperature measured on each hour from 10 A.M. to 4 P.M. Find the rate of change from 2 P.M. to 3 P.M.



Answer: 3°F

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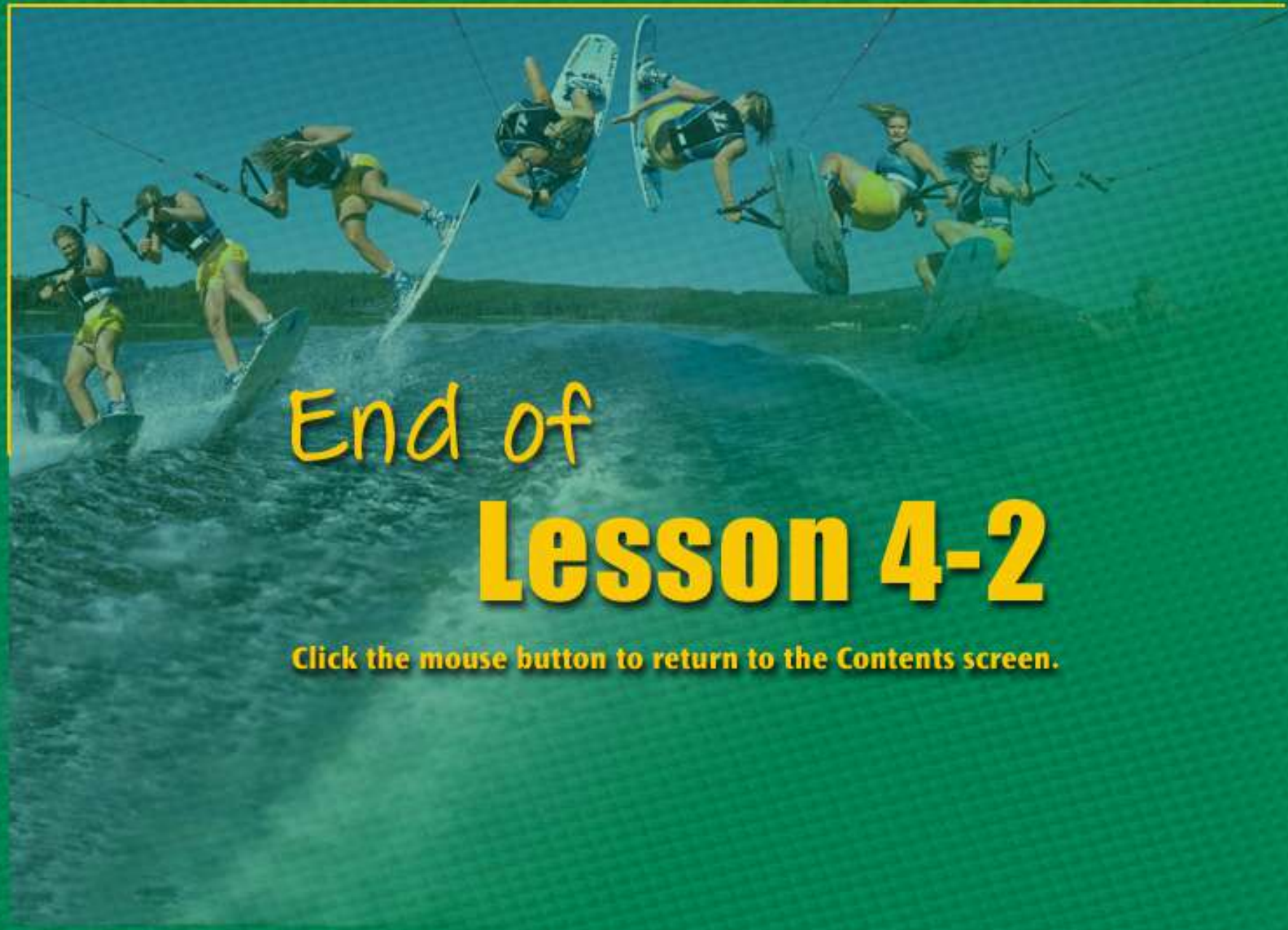
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Lesson 4-3 Contents

Example 1Find Slope Using a Graph

Example 2Find Slope Using a Table

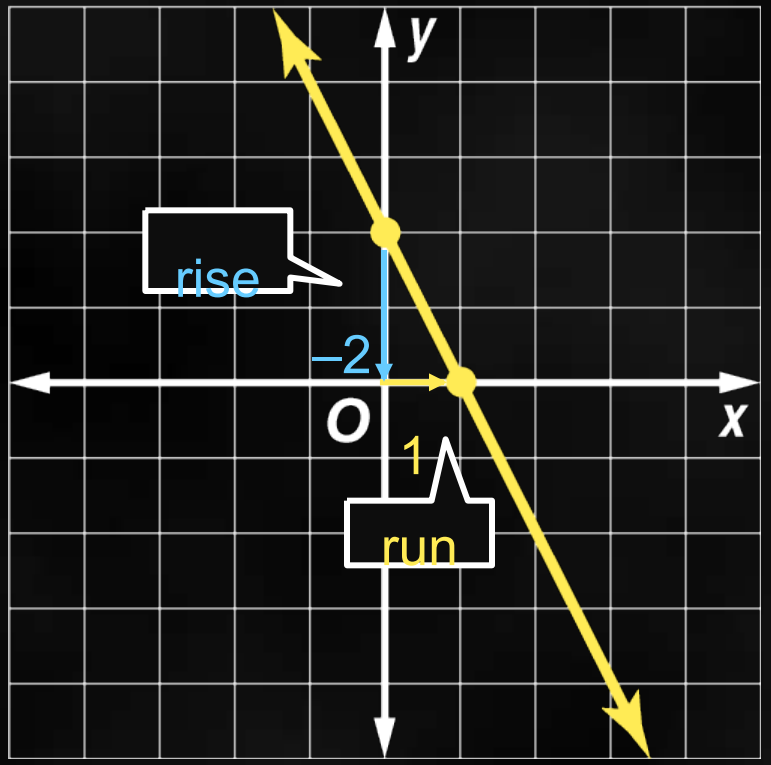
Example 3Use Slope to Solve a Problem

Example 4Use Slope to Solve a Problem

Example 1

Find the slope of the line.

Choose two points on the line.



The vertical change is –2 units while the horizontal change is 1 unit.

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Example 1

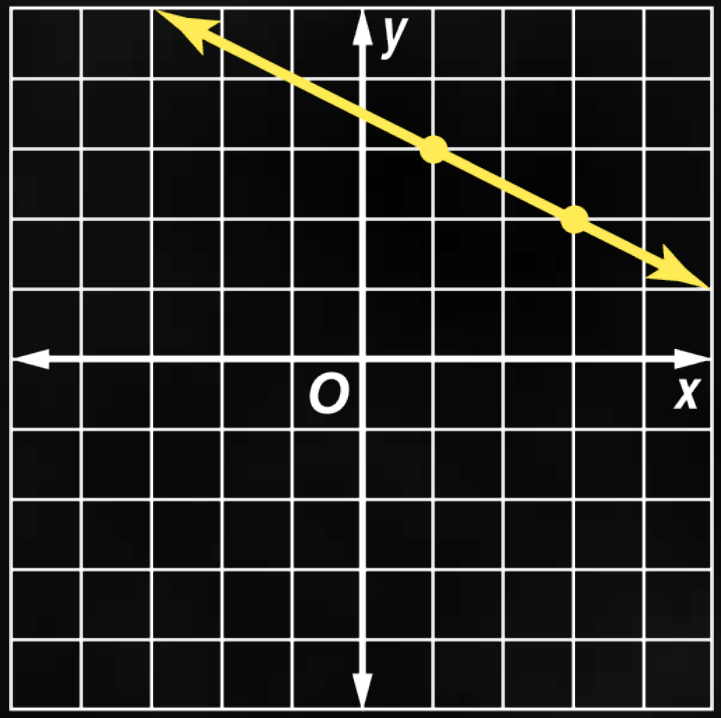
$$\text{slope} = \frac{\text{rise}}{\text{run}}$$ Definition of slope

$$= \frac{-2}{1}$$ rise $= -2$, run $= 1$

Answer: The slope of the line is –2.

Your Turn

Find the slope of the line.



Answer: $-\frac{1}{2}$

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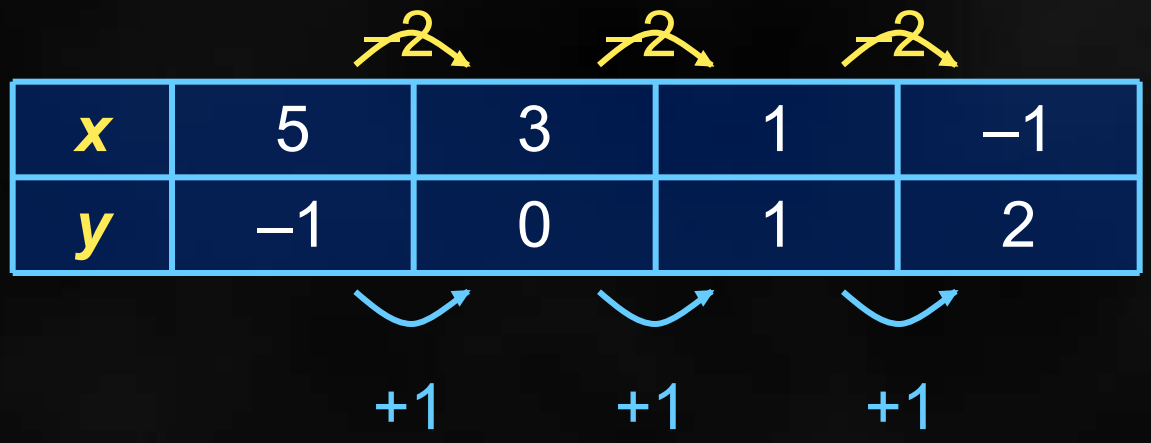
Example 2

The points given in the table lie on a line. Find the slope of the line. Then graph the line.



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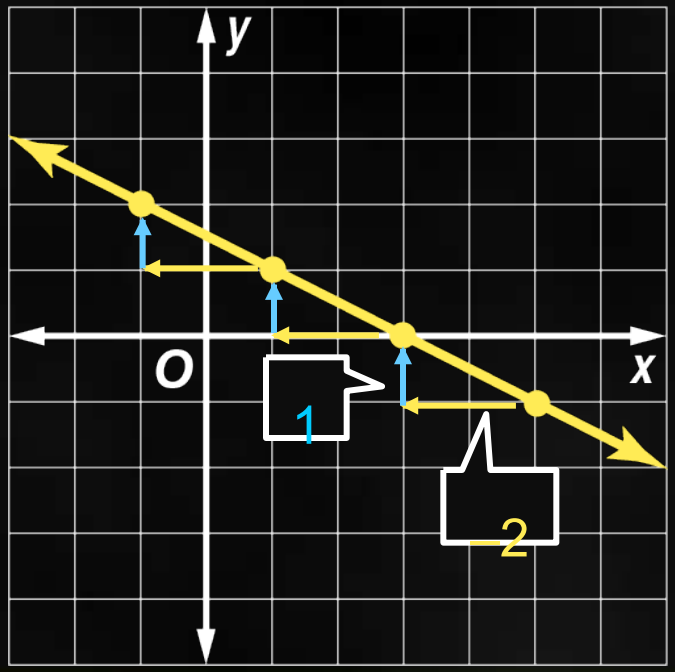
Example 2

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

← change in y

← change in x

$$= \frac{1}{-2} \text{ or } -\frac{1}{2}$$



Answer: $-\frac{1}{2}$

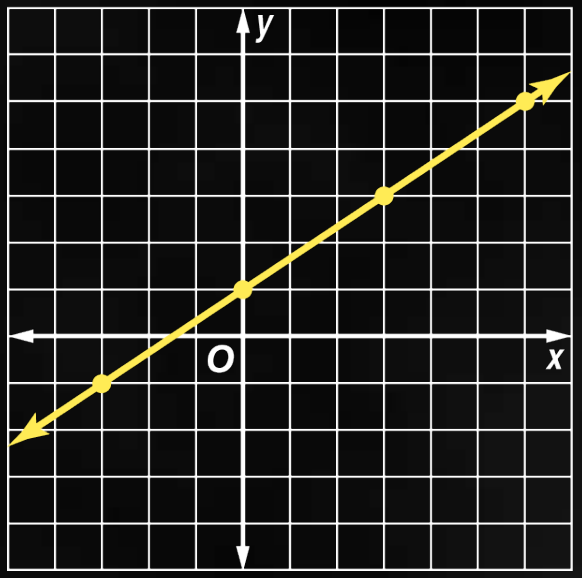
STOP! End of slide

Your Turn

The points given in the table lie on a line. Find the slope of the line. Then graph the line.

x	–3	0	3	6
y	–1	1	3	5

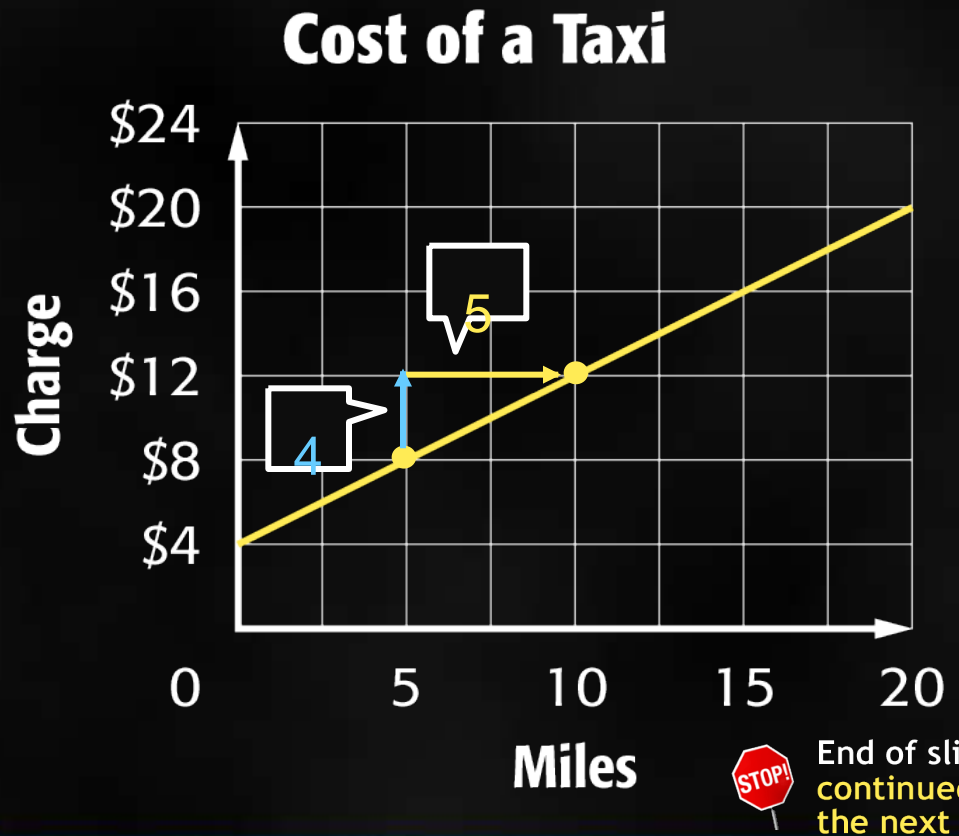
Answer: $\frac{2}{3}$



Example 3

TAXIS The graph shows the cost of a taxi ride for the number of miles driven. Find the slope of the line.

Count the units of vertical and horizontal change between any two points on the line.



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Example 3

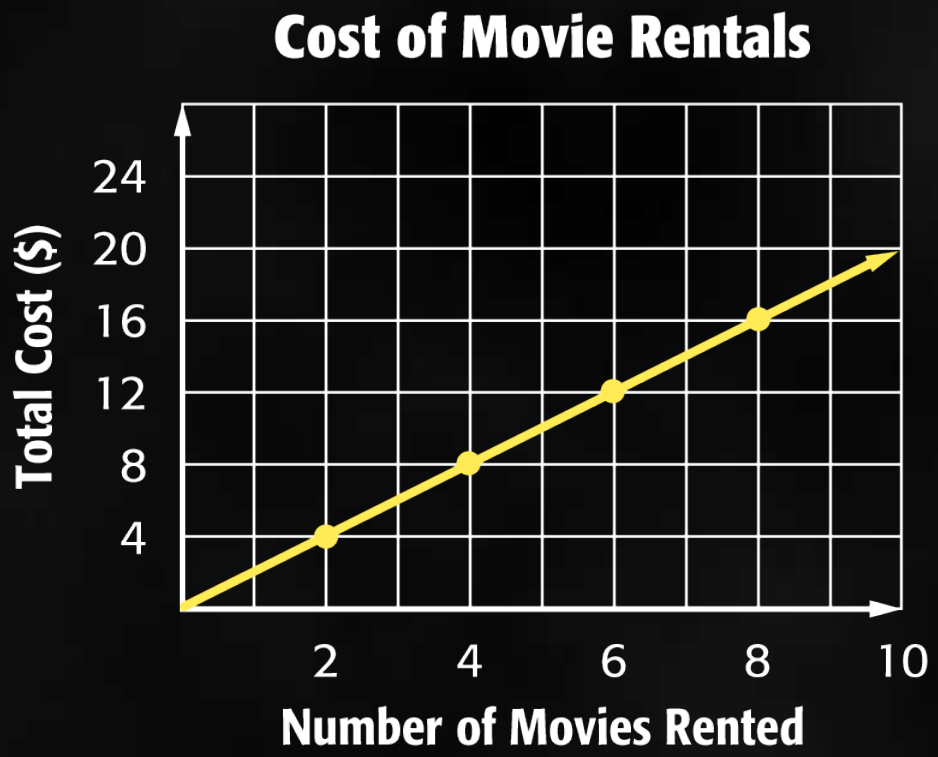
$$\text{slope} = \frac{\text{rise}}{\text{run}}$$ Definition of slope

$$= \frac{4}{5}$$ rise = 4, run = 5

Answer: The slope of the line is $\frac{4}{5}$.

Your Turn

MOVIES The graph shows the cost of movie rentals at Videos Plus. Find the slope of the line.



Answer: 2

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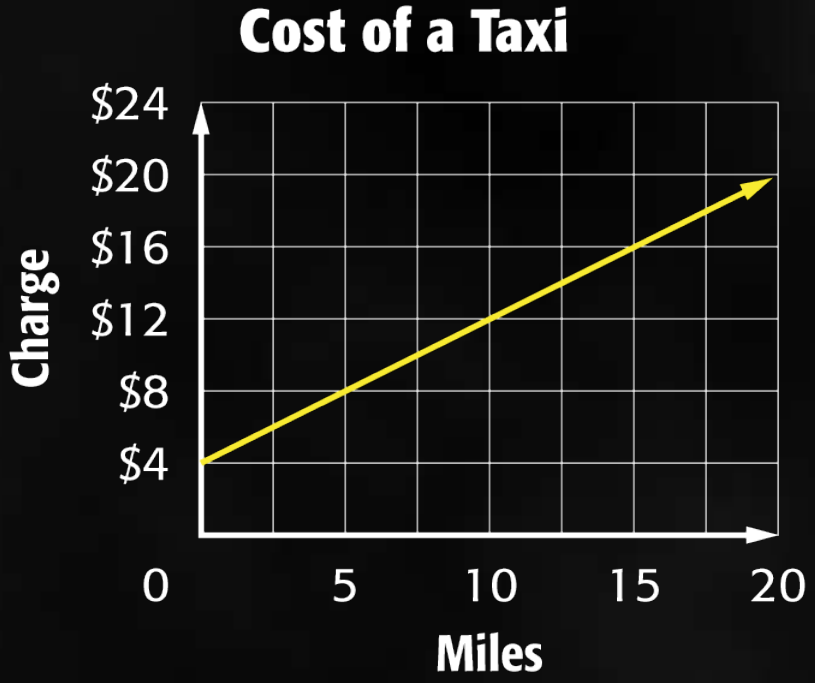
Example 4

The graph shows the cost of a taxi ride for the number of miles driven. Interpret the meaning of the slope as a rate of change.



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Example 4

Answer: For this graph, a slope of $\frac{4}{5}$ means that the cost of a taxi ride increases \$4 for every 5 miles driven. Written as a unit rate, $\frac{\$4}{5 \text{ miles}}$ is $\frac{\$0.80}{1 \text{ mile}}$. The charge is \$0.80 per mile.

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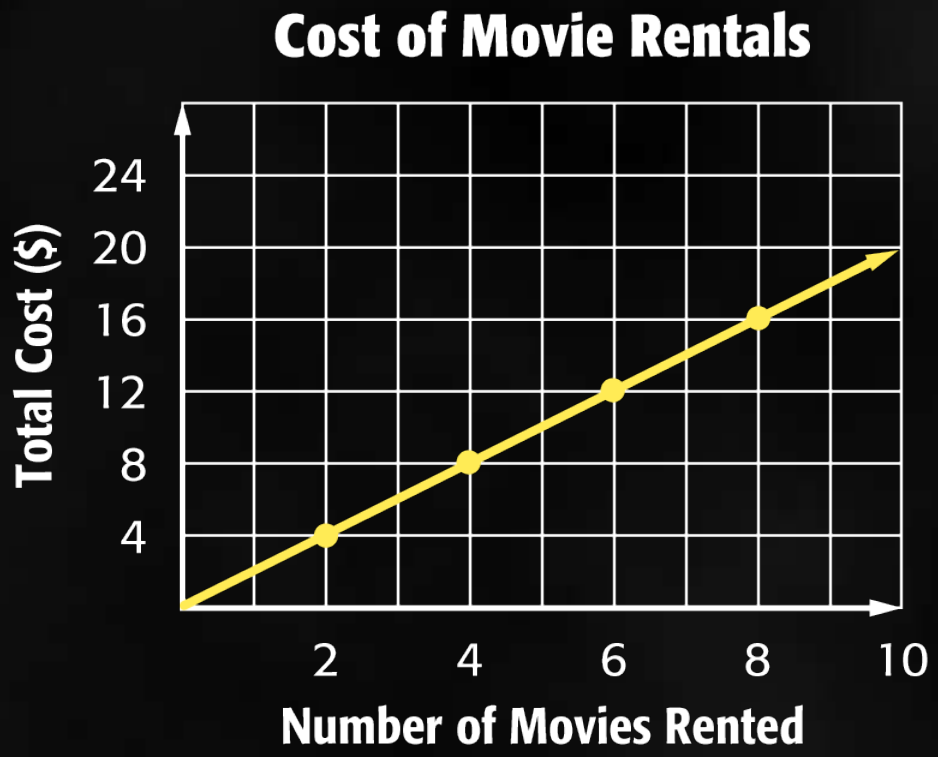
Your Turn

The graph shows the cost of movie rentals at Videos Plus. Interpret the meaning of the slope as a rate of change.



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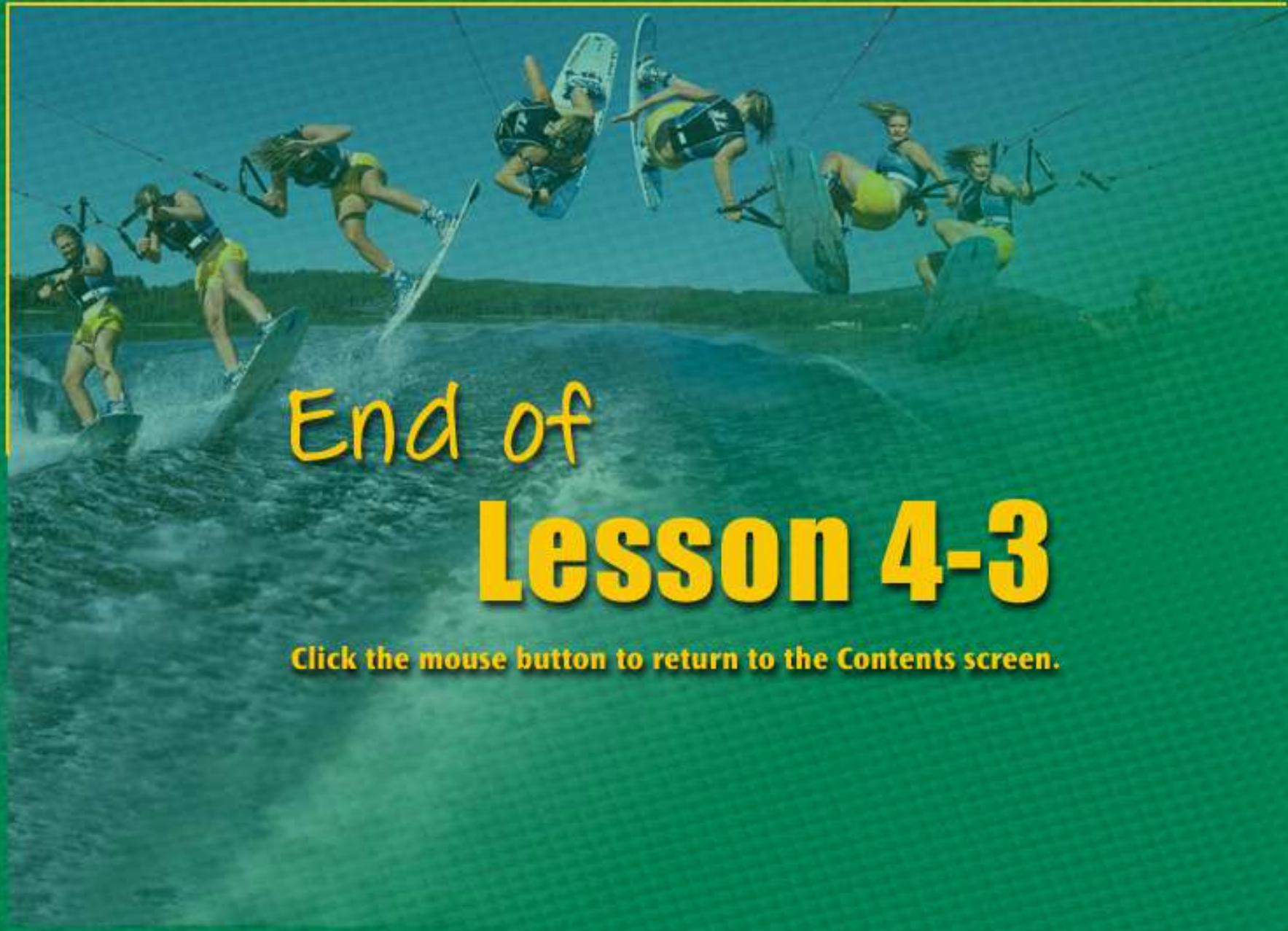
Your Turn

Answer: For this graph, a slope of 2 means that the cost of a movie rental increases $2 for each movie rented.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Lesson 4-3
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Lesson 4-4 Contents

Example 1Identify a Proportion

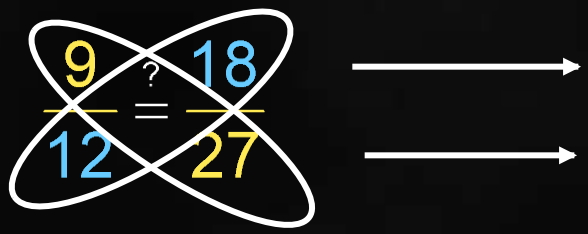
Example 2Solve a Proportion

Example 3Use a Proportion to Solve a Problem

Example 1

Determine whether the ratios $\frac{9}{12}$ and $\frac{18}{27}$ form a proportion.

Find the cross products.



$12 \cdot 18 = 216$

$9 \cdot 27 = 243$

Answer: Since the cross products are not equal, the ratios do not form a proportion.

Your Turn

Determine whether the ratios $\frac{7}{21}$ and $\frac{8}{24}$ form a proportion.

Answer: yes

End of slide

Example 2

Solve $\frac{x}{4} = \frac{7}{20}$.

$\frac{x}{4} = \frac{7}{20}$ Write the equation.

$x \cdot 20 = 4 \cdot 7$ Find the cross products.

$20x = 28$ Multiply.

$\frac{20x}{20} = \frac{28}{20}$ Divide each side by 20.

$x = 1.4$ Simplify.

Answer: The solution is 1.4.

End of slide

Your Turn

Solve $\frac{x}{5} = \frac{11}{20}$.

Answer: 2.75

End of slide

Example 3

COOKING **A recipe serves 10 people and calls for 3 cups of flour. If you want to make the recipe for 15 people, how many cups of flour should you use?**

cups of flour → $\frac{3}{10} = \frac{n}{15}$ ← cups of flour

total people served → $\frac{3}{10} = \frac{n}{15}$ ← total people served

$3 \cdot 15 = 10 \cdot n$ Find the cross products.

$45 = 10n$ Multiply.

$\frac{45}{10} = \frac{10n}{10}$ Divide each side by 10.

$4.5 = n$ Simplify.

Answer: You will need 4.5 cups of flour to make the recipe for 15 people.

End of slide

Your Turn

COOKING A recipe serves 12 people and calls for 5 cups of sugar. If you want to make the recipe for 18 people, how many cups of sugar should you use?

Answer: 7.5 cups

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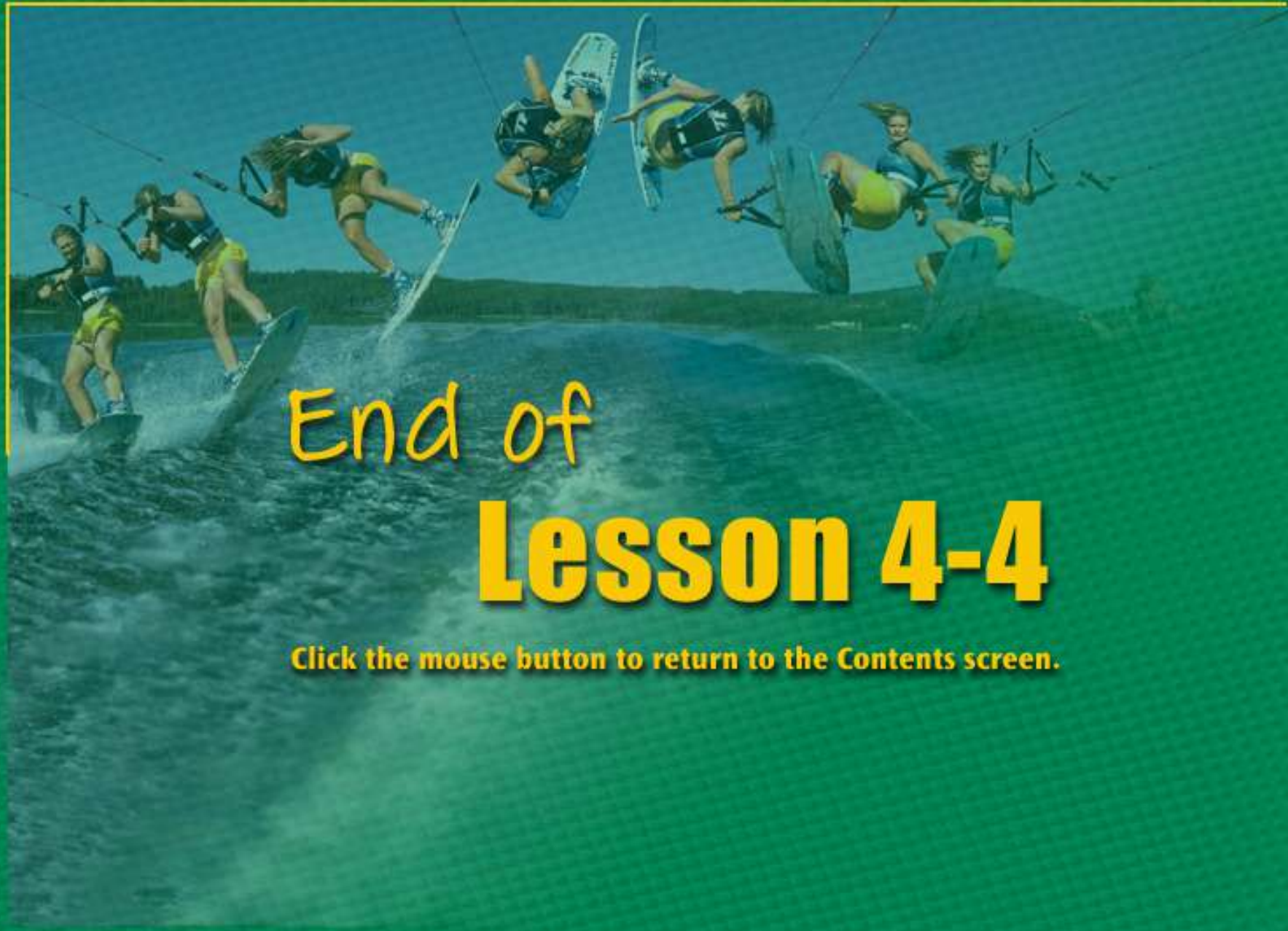
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Lesson 4-5 Contents

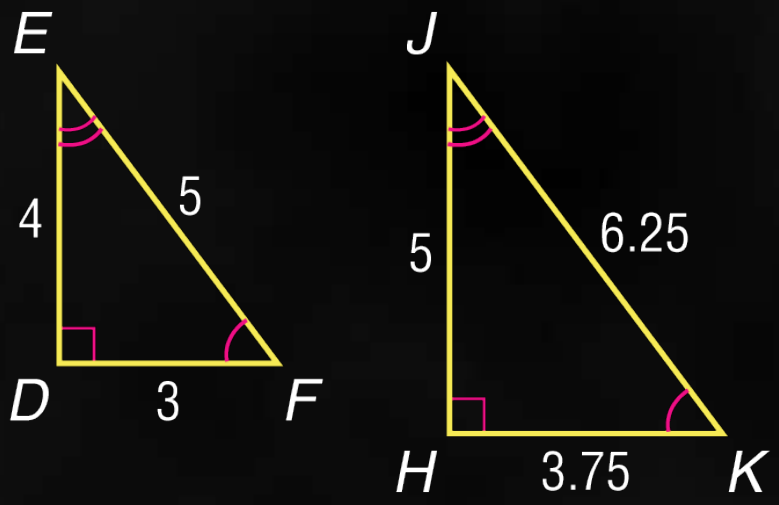
Example 1Identify Similar Polygons

Example 2Find Missing Measures

Example 3Scale Factor and Perimeter

Example 1

Determine whether triangle *DEF* is similar to triangle *HJK*. Explain your reasoning.



First, check to see if corresponding angles are congruent.

$\angle D \cong \angle H$, $\angle E \cong \angle J$, and $\angle F \cong \angle K$.

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Example 1

Next, check to see if corresponding sides are proportional.

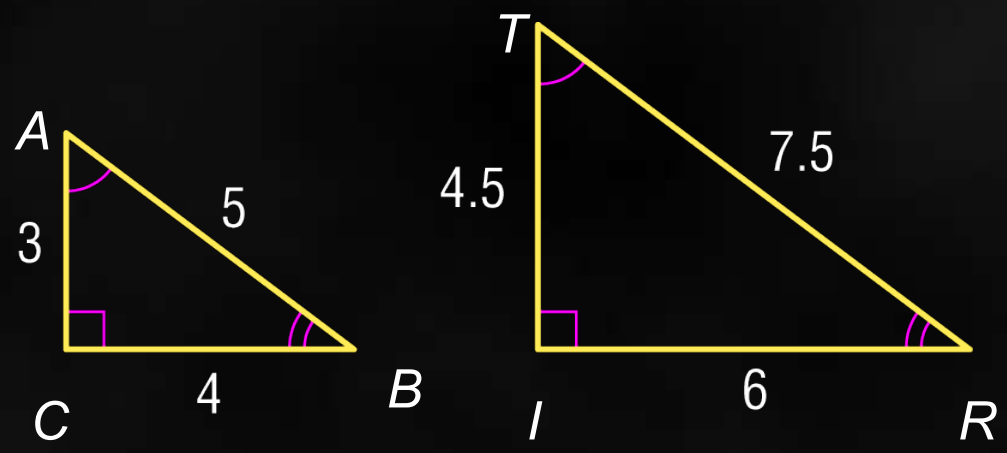
$$\frac{DE}{HJ} = \frac{4}{5} = 0.8 \qquad \frac{EF}{JK} = \frac{5}{6.25} = 0.8 \qquad \frac{DF}{HK} = \frac{3}{3.75} = 0.8$$

Answer: Since the corresponding angles are congruent and $\frac{4}{5} = \frac{5}{6.25} = \frac{3}{3.75}$, triangle *DEF* is similar to triangle *HJK*.

End of slide

Your Turn

Determine whether triangle *ABC* is similar to triangle *TRI*. Explain your reasoning.



Answer: Yes; corresponding angles are congruent and $\frac{3}{4.5} = \frac{5}{7.5} = \frac{4}{6}$.

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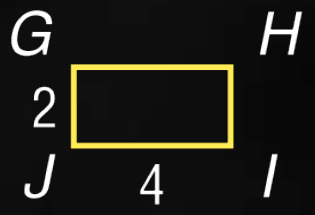
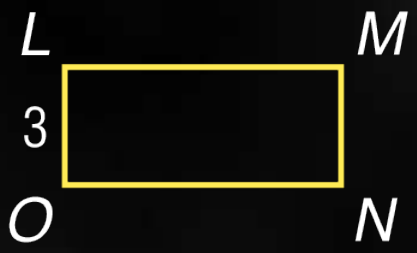
Example 2

Given that rectangle *GHIJ* ~ rectangle *LMNO*, write a proportion to find the measure of $\overline{NO}$. Then solve.





The scale factor from rectangle *GHIJ* to rectangle *LMNO* is $\frac{GJ}{LO}$, which is $\frac{2}{3}$. Write a proportion with this scale factor. Let n represent the measure of $\overline{NO}$.

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Example 2

$\frac{IJ}{NO} = \frac{2}{3}$ $\overline{IJ}$ corresponds to $\overline{NO}$. The scale factor is $\frac{2}{3}$.

$\frac{4}{n} = \frac{2}{3}$ $IJ = 4$ and $NO = n$

$4 \cdot 3 = n \cdot 2$ Find the cross products.

$\frac{12}{2} = \frac{2n}{2}$ Multiply. Then divide each side by 2.

$6 = n$ Simplify.

Answer: 6

End of slide

Your Turn

Given that rectangle *ABCD* ~ rectangle *WXYZ*, write a proportion to find the measure of $\overline{ZY}$. Then solve.

Answer: 15

End of slide

Example 3

MULTIPLE-CHOICE TEST ITEM **A polygon has sides 2.5 times as long as a similar polygon. The smaller polygon has a perimeter of 42 inches. What is the perimeter of the larger polygon?**

A 16.8 in. **B** 45 in. **C** 84 in. **D** 105 in.

Read the Test Item

Since each side of the larger polygon is 2.5 times longer than the corresponding sides of the smaller polygon, the scale factor from the smaller polygon to the larger polygon is $2\frac{1}{2}$ or $\frac{5}{2}$.

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Example 3

Solve the Test Item

Let x represent the perimeter of the larger polygon. The ratio of the perimeters is equal to the ratio of the sides.

ratio of perimeters → $\left\{\frac{x}{42} = \frac{5}{2}\right\}$ ← ratio of sides

$42(5) = x \cdot 2$ Find the cross products.

$\frac{210}{2} = \frac{2x}{2}$ Multiply. Then divide each side by 2.

$105 = x$ Simplify.

Answer: D

End of slide

Your Turn

MULTIPLE-CHOICE TEST ITEM A polygon has sides 3.5 times as long as a similar polygon. The larger polygon has a perimeter of 77 inches. What is the perimeter of the smaller polygon?

A 22 in. **B** 34 in. **C** 72 in. **D** 269.5 in.

Answer: A

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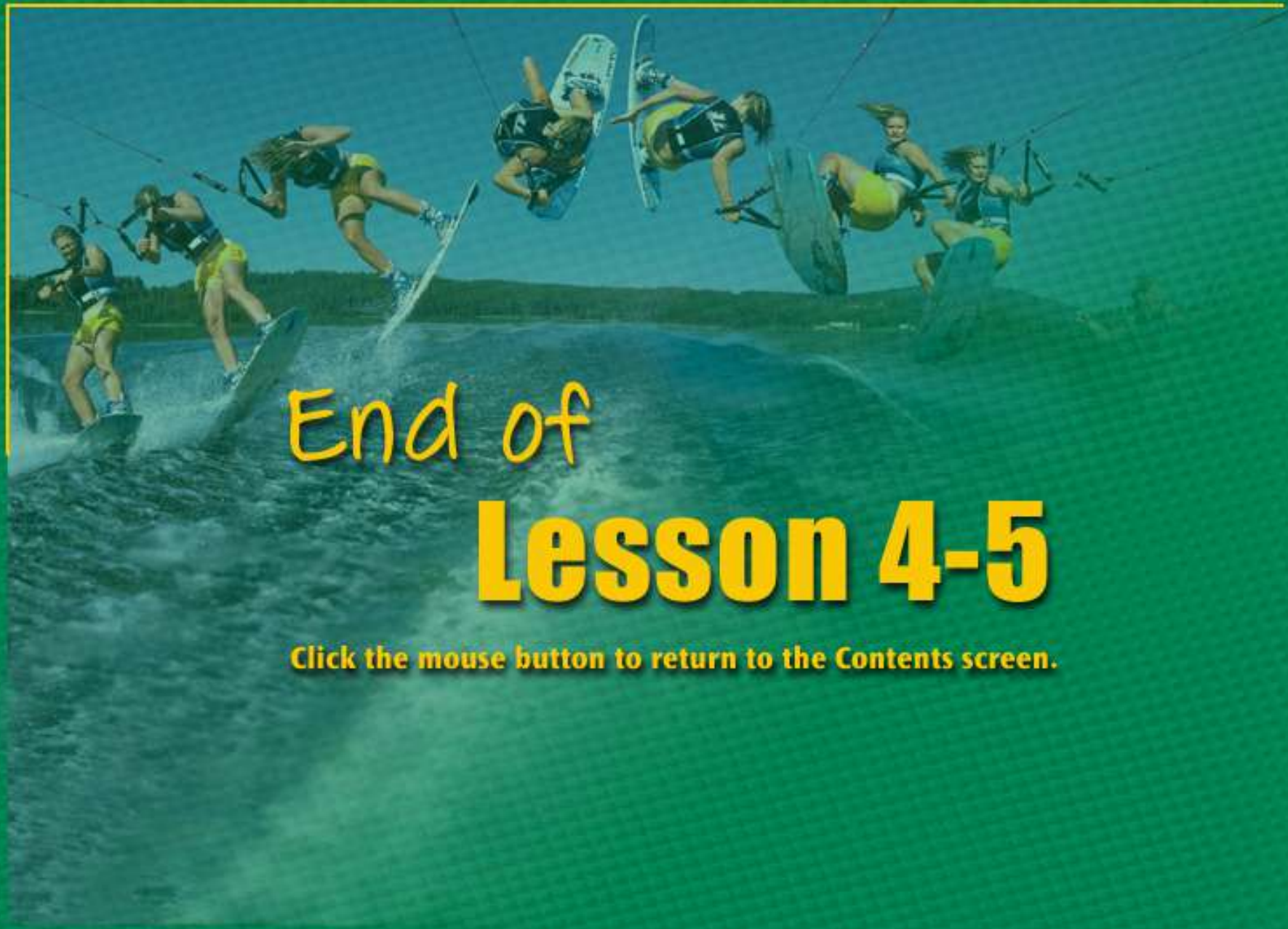
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Lesson 4-5
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Lesson 4-6 Contents

Example 1Find a Missing Measurement

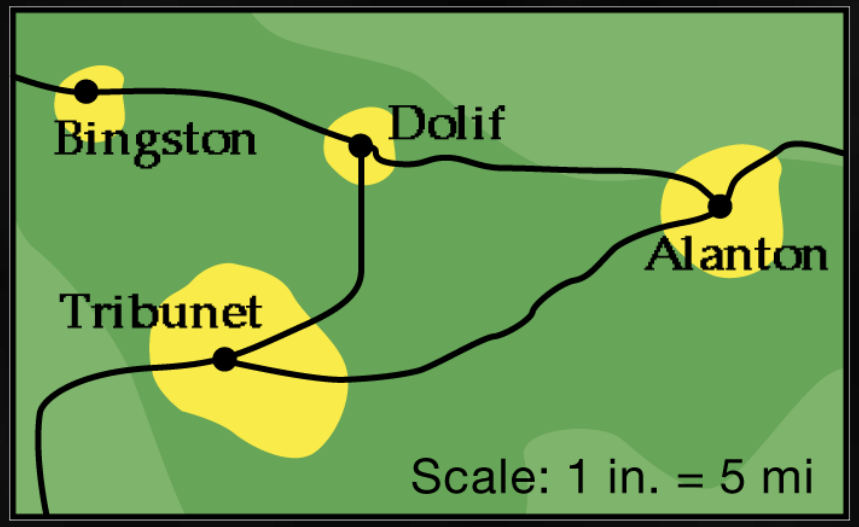
Example 2Find the Scale Factor

Example 3Find the Scale

Example 4Construct a Scale Model

Example 1

MAPS The distance from Bingston to Alanton is 1.5 inches on the map. Find the actual distance.



Let x represent the actual distance from Bingston to Alanton. Write and solve a proportion.

STOP! End of slide— continued on the next slide

Example 1

Map Scale → $\frac{1 \text{ in.}}{5 \text{ mi}}$ = $\frac{1.5 \text{ in.}}{x \text{ mi}}$ ← Actual Distance

map distance → $\frac{1 \text{ in.}}{5 \text{ mi}}$ = $\frac{1.5 \text{ in.}}{x \text{ mi}}$ ← map distance

actual distance → $\frac{1 \text{ in.}}{5 \text{ mi}}$ = $\frac{1.5 \text{ in.}}{x \text{ mi}}$ ← actual distance

$1 \cdot x = 5 \cdot 1.5$ Find the cross products.

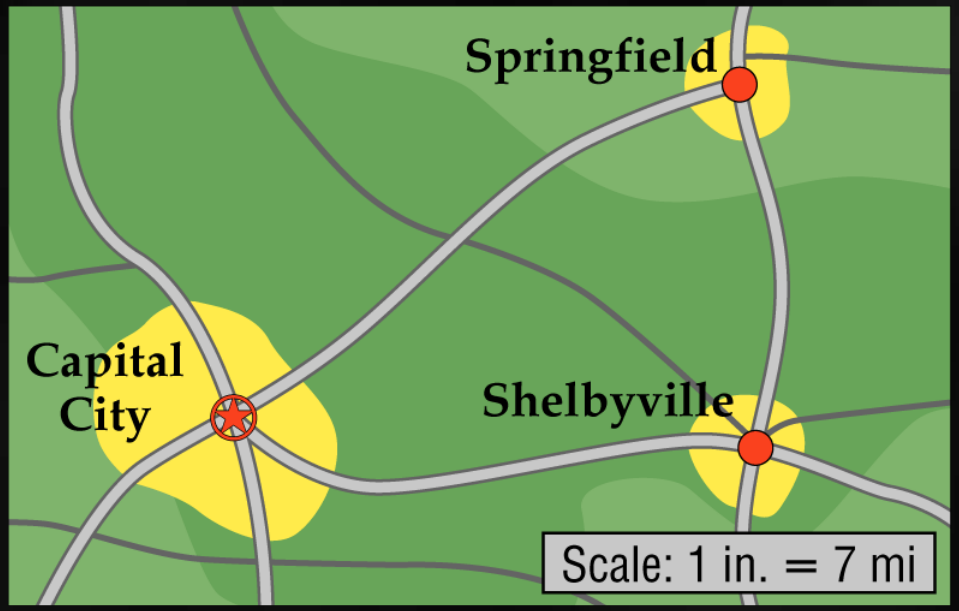
$x = 7.5$ Simplify.

Answer: The actual distance from Bingston to Alanton is 7.5 miles.

End of slide

Your Turn

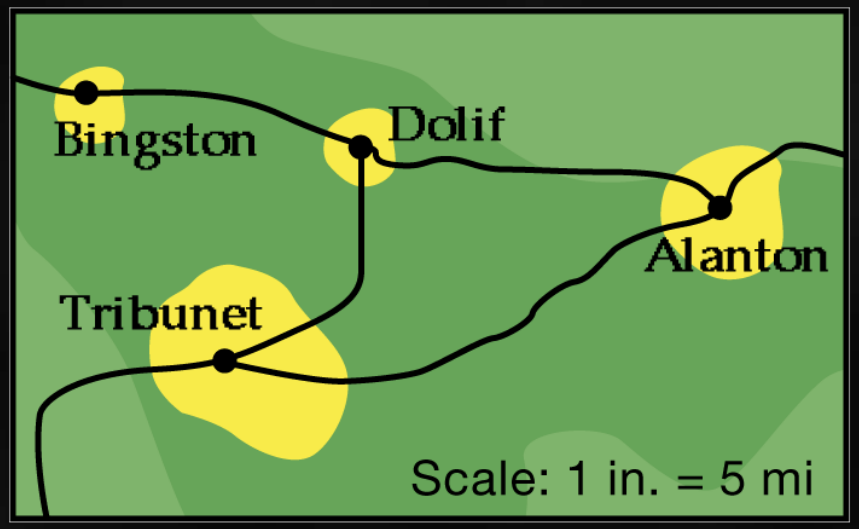
MAPS The distance from Springfield to Capital City is 1.4 inches on the map. Find the actual distance.



Answer: 9.8 miles

Example 2

Find the scale factor for the map.



$$\frac{1 \text{ in.}}{5 \text{ mi}} = \frac{1 \cancel{\text{in.}}}{316{,}800 \cancel{\text{in.}}}$$

Convert 5 miles to inches.

End of slide—continued on the next slide

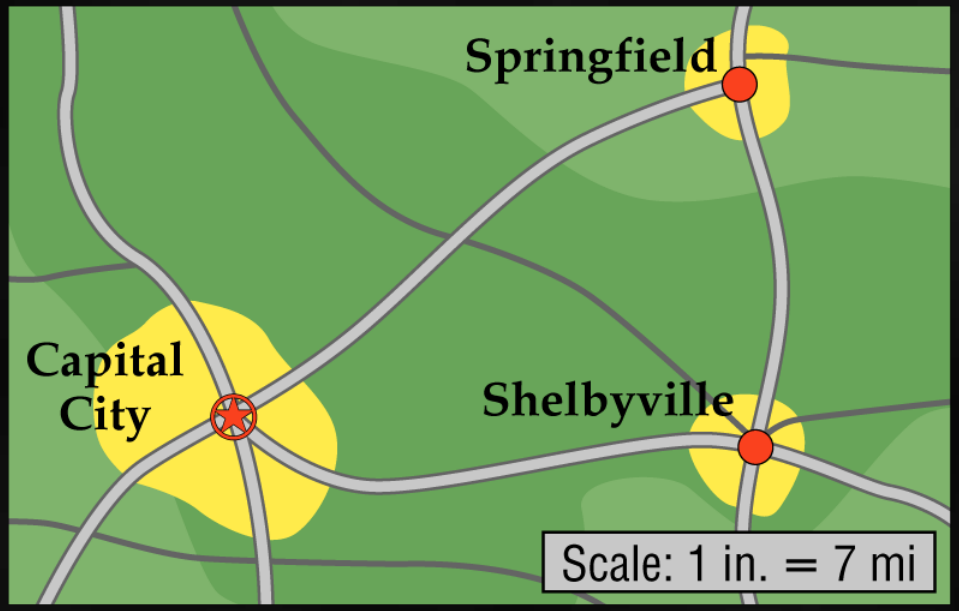
Example 2

Answer: The scale factor is $\frac{1}{316,800}$ or 1:316,800.

This means that each distance on the map is $\frac{1}{316,800}$ the actual distance.

Your Turn

Find the scale factor for the map.



Answer: $\frac{1}{443,520}$ or 1:443,520

End of slide

Example 3

SCALE DRAWINGS **A wall in a room is 15 feet long. On a scale drawing it is shown as 6 inches. What is the scale of the drawing?**

Write a ratio comparing the length of the drawing to the actual length of the room. Using x to represent the actual length of the room, write and solve a proportion to find the scale of the drawing.

End of slide—
continued on
the next slide

Example 3

Length of room → scale drawing length → $\frac{6 \text{ in.}}{15 \text{ ft}}$ = $\frac{1 \text{ in.}}{x \text{ ft}}$ ← scale drawing length ← Scale Drawing

actual length → ← actual length

$6 \cdot x = 15 \cdot 1$ Find the cross products.

$\frac{6x}{6} = \frac{15}{6}$ Multiply. Then divide each side by 6.

$x = 2.5$ Simplify.

Answer: So, the scale is 1 inch = 2.5 feet.

End of slide

Your Turn

SCALE DRAWINGS The length of a garage is 24 feet. On a scale drawing the length of the garage is 10 inches. What is the scale of the drawing?

Answer: 1 inch = 2.4 feet

End of slide

Example 4

STATUE OF LIBERTY Auguste Bartholdi created several smaller models of the Statue of Liberty before creating the 152-foot statue that stands in New York Harbor. One such model was only 21 inches tall. What is the scale of this model to the final version? Use the scale to determine the length of the statue's index finger on the model, which is 8 feet long on the actual statue.

End of slide—continued on the next slide

Example 4

Determine the scale of the model to the final version.

$$\frac{21 \text{ in.}}{152 \text{ ft}} = \frac{1 \text{ in.}}{x \text{ ft}}$$

← model height

← actual height

$21 \cdot x = 152 \cdot 1$ Find the cross products.

$\frac{21x}{21} = \frac{152}{21}$ Multiply. Then divide each side by 21.

$x \approx 7.2$ Simplify.

The scale of the model to the actual statue is 1 inch $\approx$ 7.2 feet.

End of slide—
continued on
the next slide

Example 4

Use this scale to find the length of the statue's index finger on the model.

$$\frac{1 \text{ in.}}{7.2 \text{ ft}} = \frac{x \text{ in.}}{8 \text{ ft}}$$

$$1 \cdot 8 = 7.2 \cdot x$$

$$\frac{8}{7.2} = \frac{7.2x}{7.2}$$

$$1.1 \approx x$$

Answer: The finger in the model is about 1.1 inches long.

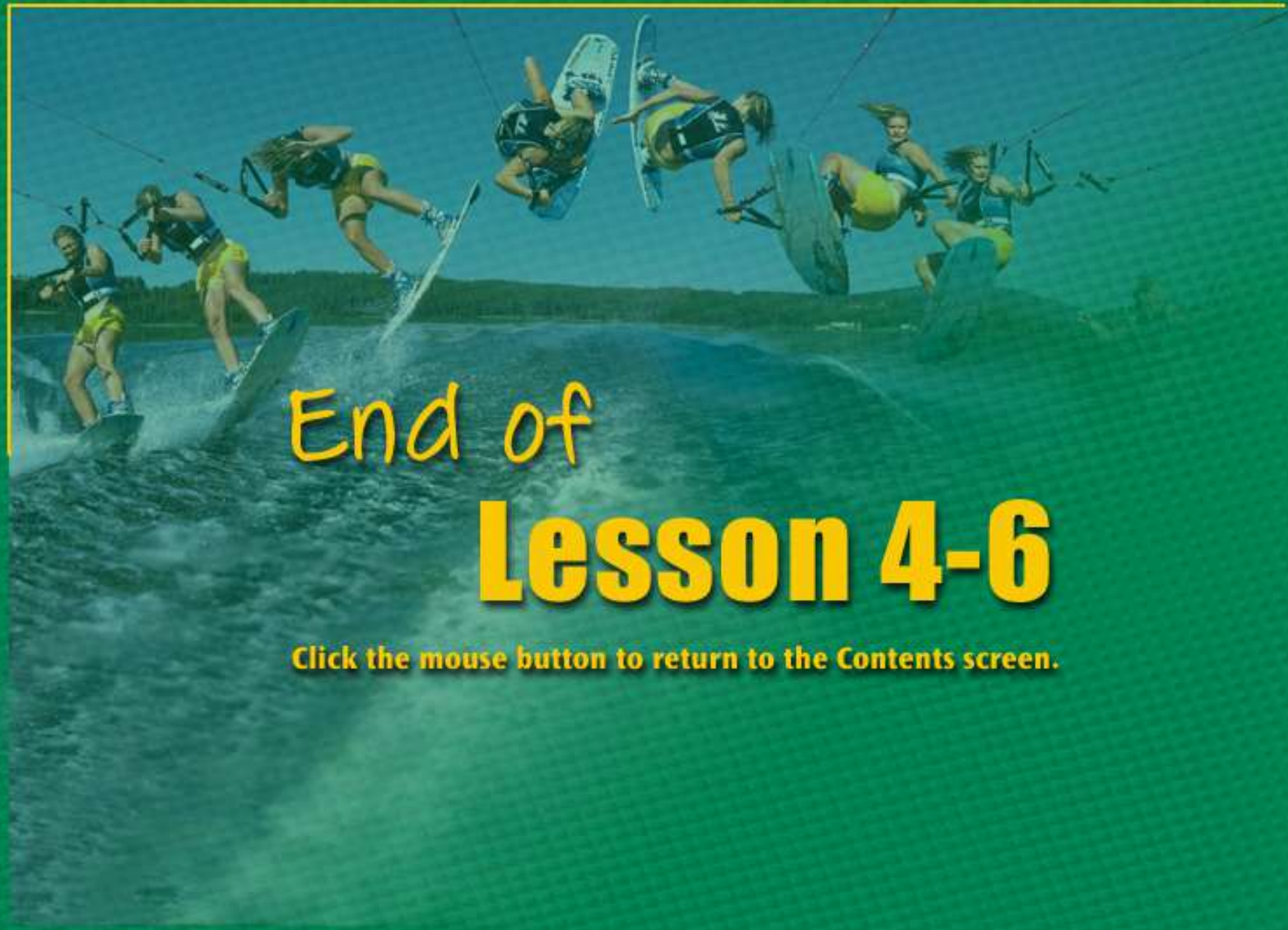
End of slide

Your Turn

STATUE Marnie created a model of her town's statue of Jebediah Springfield. Her model was 6 inches high. The actual statue is 27 feet tall. What is the scale of this model to the actual statue? Use the scale to determine the length of the statue's mustache on the model, which is 3 feet long on the actual statue.

Answer: 1 inch = 4.5 feet; about 0.67 inch

End of slide


End of
Lesson 4-6
Click the mouse button to return to the Contents screen.

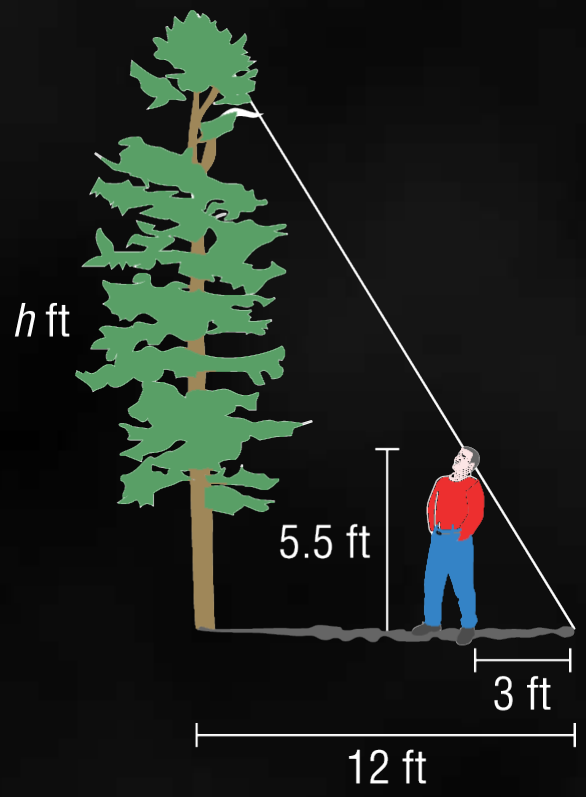
Lesson 4-7 Contents

Example 1Use Shadow Reckoning

Example 2Use Indirect Measurement

Example 1

TREES A tree in front of Marcel's house has a shadow 12 feet long. At the same time, Marcel has a shadow 3 feet long. If Marcel is 5.5 feet tall, how tall is the tree?



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Example 1

tree's shadow → $\frac{12}{3} = \frac{h}{5.5}$ ← tree's height

Marcel's shadow → ← Marcel's height

$12 \cdot 5.5 = 3 \cdot h$ Find the cross products.

$66 = 3h$ Multiply.

$\frac{66}{3} = \frac{3h}{3}$ Divide each side by 3.

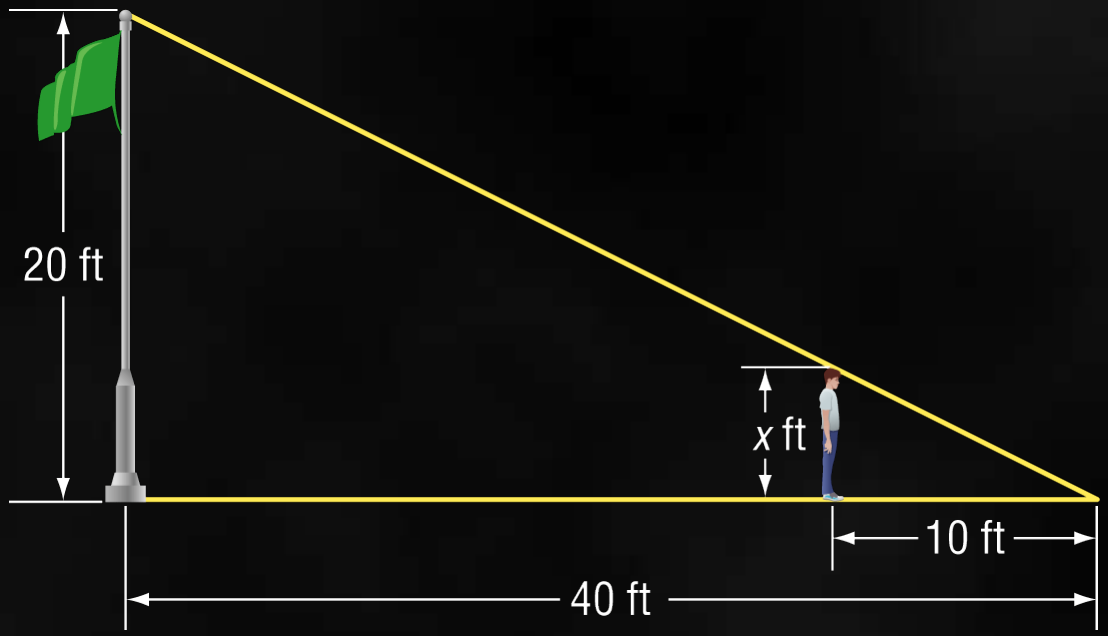
$22 = h$ Simplify.

Answer: The tree is 22 feet tall.

End of slide

Your Turn

Jayson casts a shadow that is 10 feet. At the same time, a flagpole casts a shadow that is 40 feet. If the flagpole is 20 feet tall, how tall is Jayson?

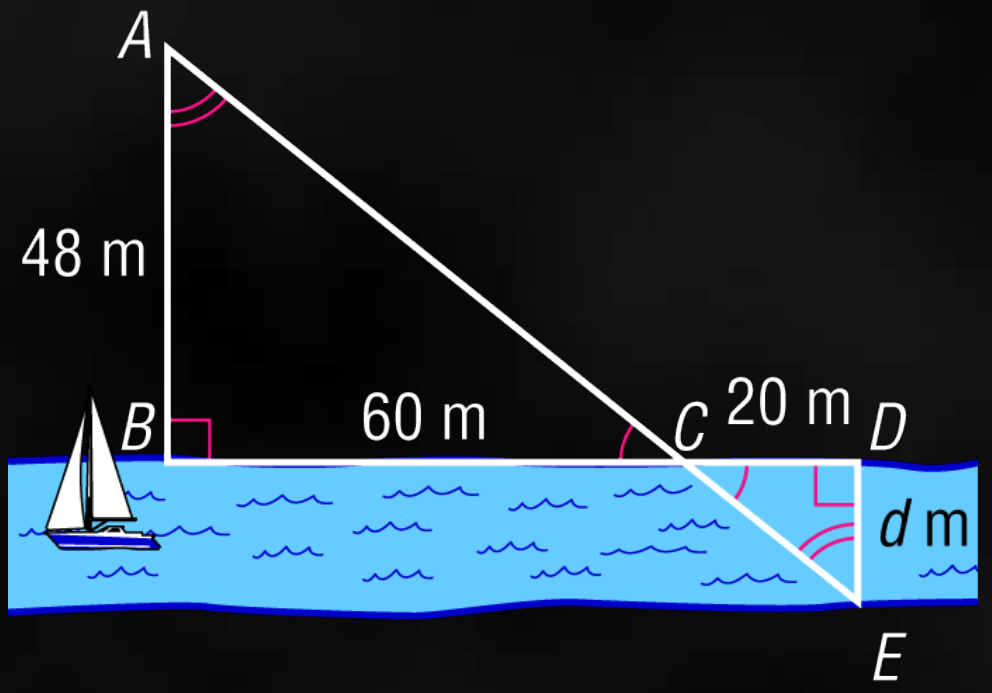


Answer: 5 feet

End of slide

Example 2

SURVEYING
The two triangles shown in the figure are similar. Find the distance *d* across the stream.



In this figure $\Delta ABC \sim \Delta EDC$.

So, $\overline{AB}$ corresponds to $\overline{ED}$, and $\overline{BC}$ corresponds to $\overline{DC}$.

STOP! End of slide—continued on the next slide

Example 2

$$\frac{AB}{ED} = \frac{BC}{DC}$$ Write a proportion.

$$\frac{48}{d} = \frac{60}{20}$$ $AB = 48$, $ED = d$, $BC = 60$, and $DC = 20$

$48 \cdot 20 = d \cdot 60$ Find the cross products.

$$\frac{960}{60} = \frac{60d}{60}$$ Multiply. Then divide each side by 60.

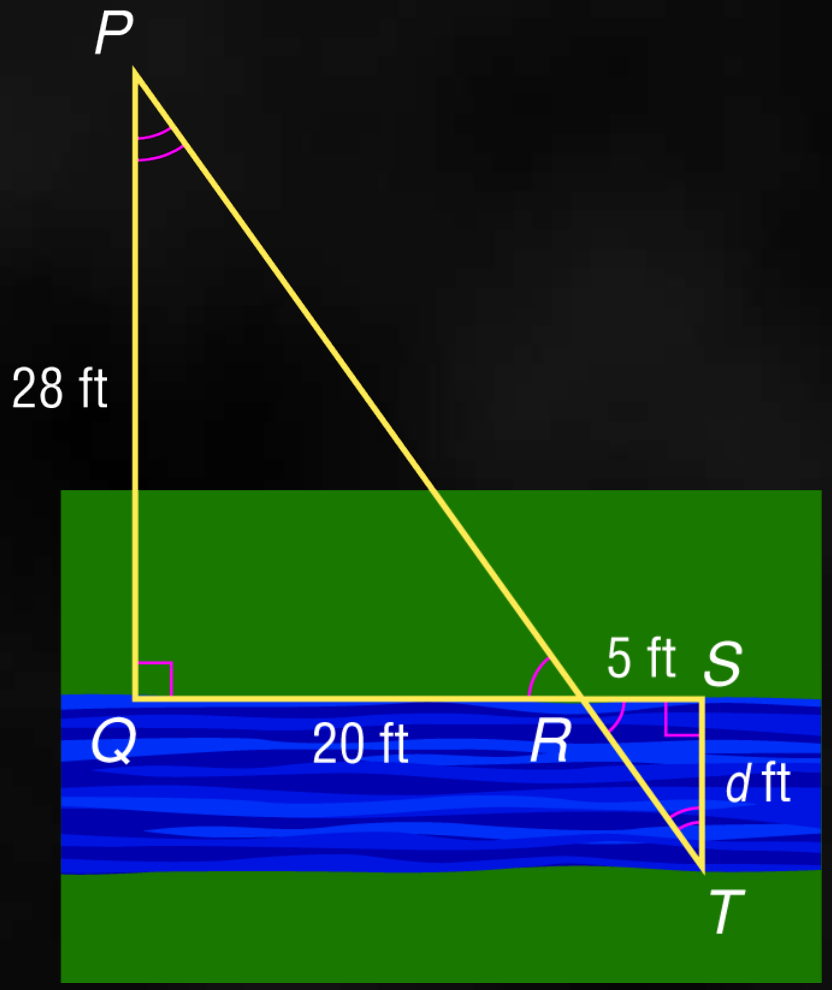
$16 = d$ Simplify.

Answer: The distance across the stream is 16 meters.

End of slide

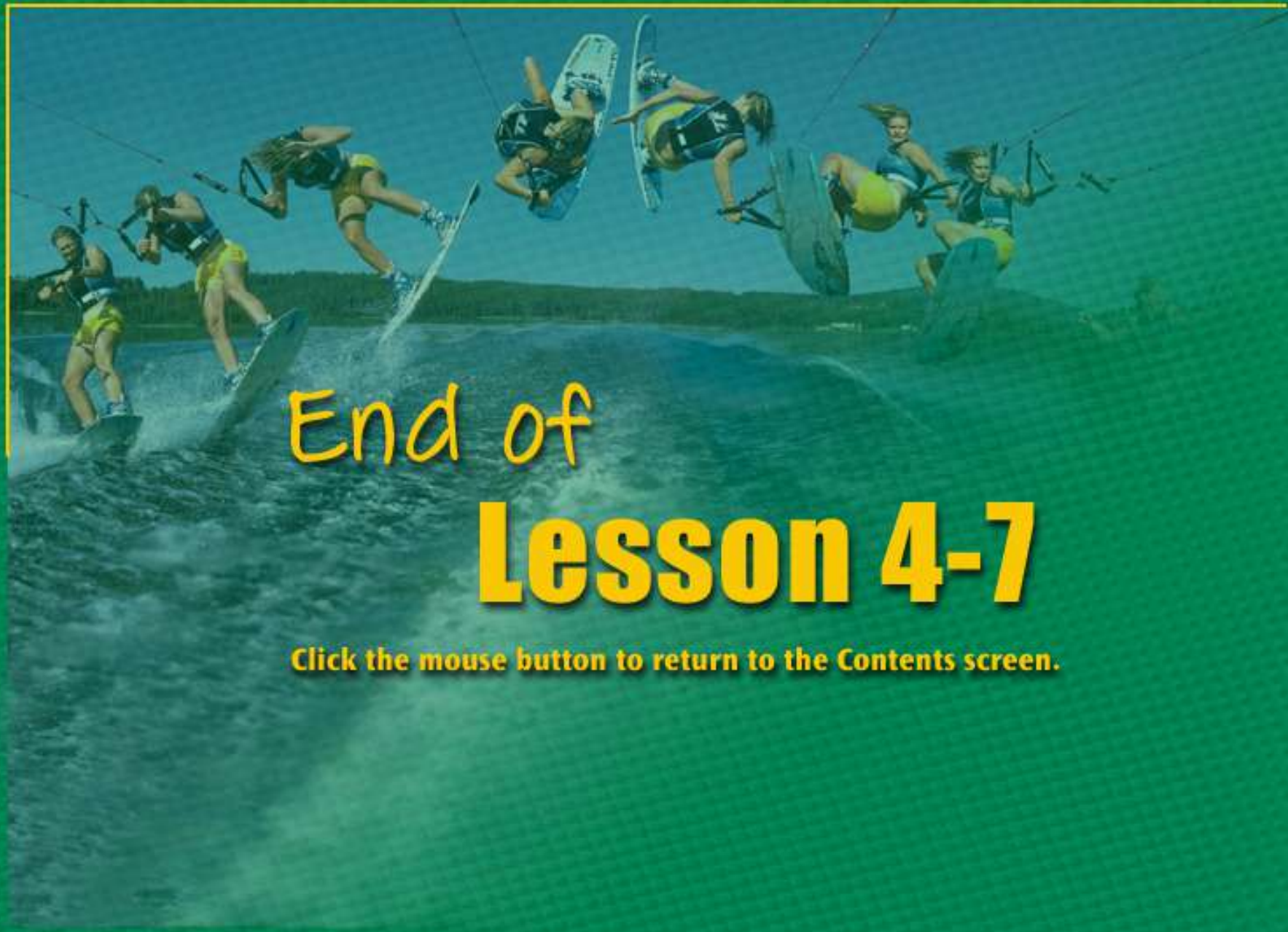
Your Turn

SURVEYING The two triangles shown in the figure are similar. Find the distance *d* across the river.



Answer: 7 feet

End of slide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Lesson 4-7
Click the mouse button to return to the Contents screen.

Lesson 4-8 Contents

Example 1Graph a Dilation

Example 2Find and Classify a Scale Factor

Example 3Use a Scale Factor

Example 1

Graph ΔMNO with vertices $M(3, -1)$, $N(2, -2)$, and $O(0, 4)$. Then graph its image $\Delta M'N'O'$ after a dilation with a scale factor of $\frac{3}{2}$.

To find the vertices of the dilation, multiply each coordinate in the ordered pairs by $\frac{3}{2}$. Then graph both images on the same axes.

End of slide—continued on the next slide

Example 1

$M(3, -1) \longrightarrow \left(3 \cdot \frac{3}{2}, -1 \cdot \frac{3}{2}\right) \longrightarrow M'\left(\frac{9}{2}, -\frac{3}{2}\right)$

$N(2, -2) \longrightarrow \left(2 \cdot \frac{3}{2}, -2 \cdot \frac{3}{2}\right) \longrightarrow N'(3, -3)$

$O(0, 4) \longrightarrow \left(0 \cdot \frac{3}{2}, 4 \cdot \frac{3}{2}\right) \longrightarrow O'(0, 6)$

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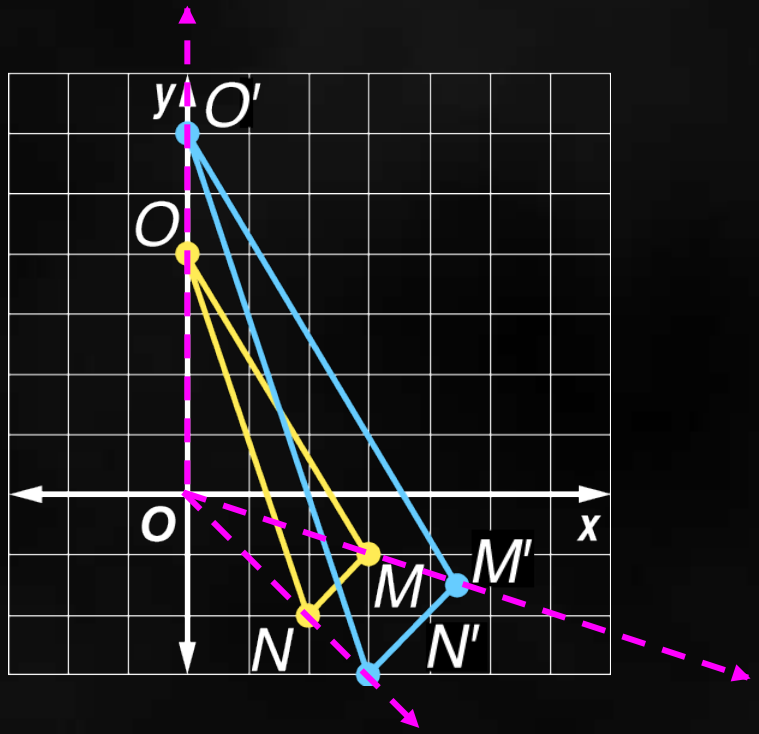
continued on
the next slide

Example 1

Answer:



Check Draw lines through the origin and each of the vertices of the original figure. The vertices of the dilation should lie on those same lines.

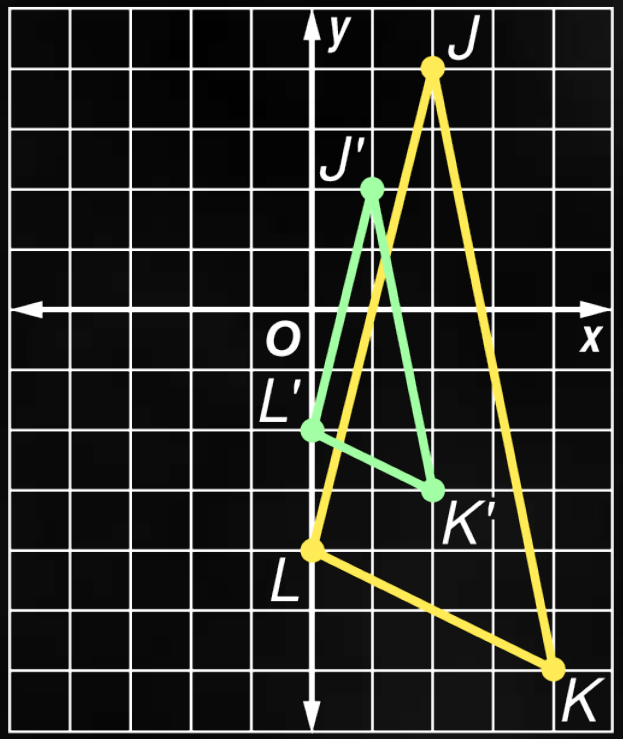
STOP! End of slide

Help Extra Examples 5-Minute Check

Your Turn

Graph ΔJKL with vertices $J(2, 4)$, $K(4, -6)$, and $L(0, -4)$. Then graph its image $\Delta J'K'L'$ after a dilation with a scale factor of $\frac{1}{2}$.

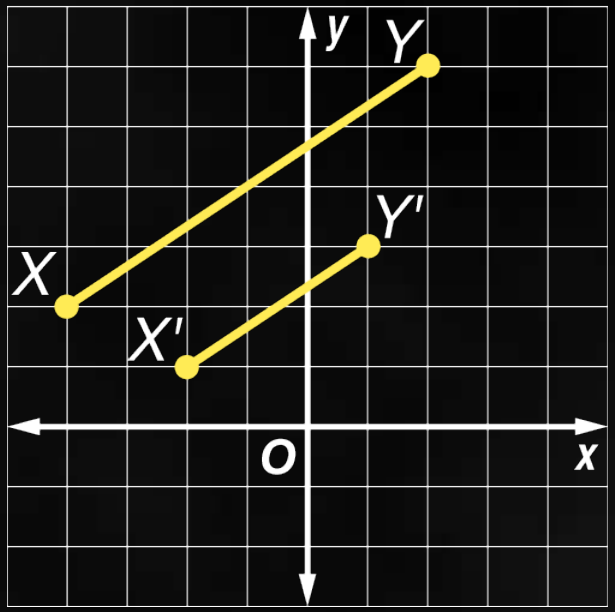
Answer:



End of slide

Example 2

In the figure, segment $X'Y'$ is a dilation of segment *XY*. Find the scale factor of the dilation, and classify it as an *enlargement* or as a *reduction*.



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continued on
the next slide

Example 2

Write a ratio of the *x*- or *y*-coordinate of one vertex of the dilation to the *x*- or *y*-coordinate of the corresponding vertex of the original figure. Use the *y*-coordinates of $X(-4, 2)$ and $X'(-2, 1)$.

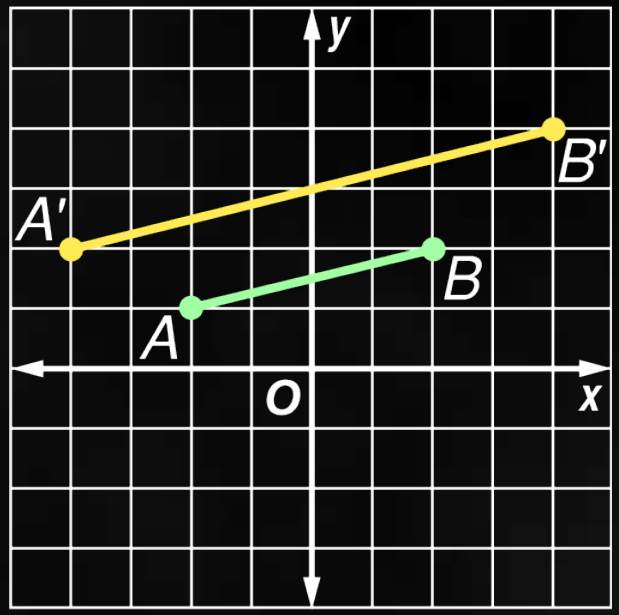
$$\frac{y\text{- coordinate of } X'}{y\text{- coordinate of } X} = \frac{1}{2}$$

Answer: The scale factor is $\frac{1}{2}$. Since the image is smaller than the original figure, the dilation is a reduction.

End of slide

Your Turn

In the figure, segment $A'B'$ is a dilation of segment *AB*. Find the scale factor of the dilation, and classify it as an *enlargement* or as a *reduction*.



Answer: 2; enlargement

Example 3

EYES The pupil of Josh's eye is 6 millimeters in diameter. His eye doctor uses medicine to dilate his pupils by a factor of $\frac{3}{2}$. Find the new diameter once his pupil is dilated.

Write a proportion using the scale factor.

End of slide—continued on the next slide

Example 3

dilated eye → $\frac{x}{6} = \frac{3}{2}$ ← dilated eye

normal eye → $\frac{x}{6} = \frac{3}{2}$ ← normal eye

$x \cdot 2 = 6 \cdot 3$ Find the cross products.

$\frac{2x}{2} = \frac{18}{2}$ Multiply. Then divide each side by 2.

$x = 9$ Simplify.

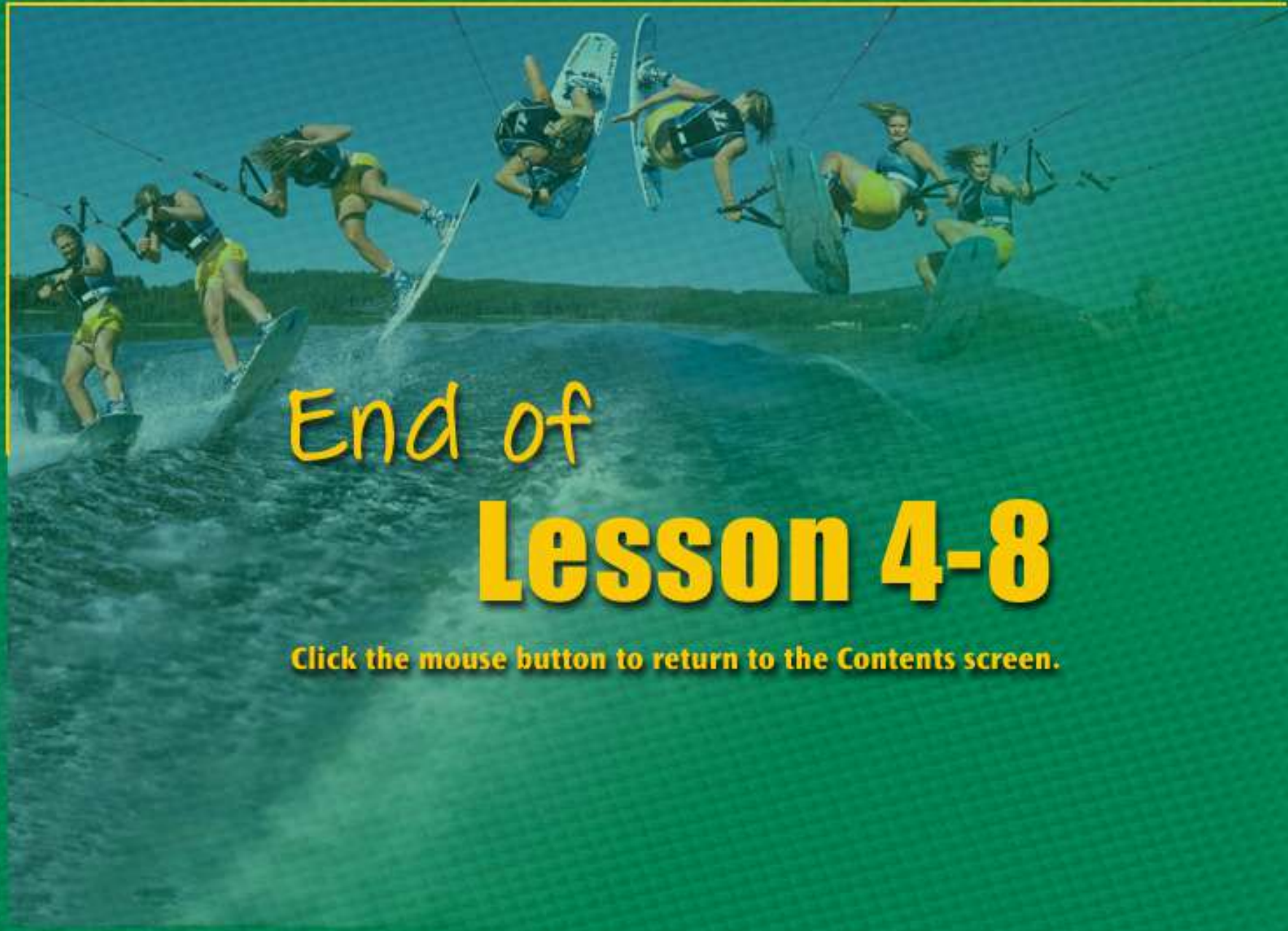
Answer: His pupil will be 9 millimeters in diameter once dilated.

End of slide

Your Turn

EYES The pupil of Laden's eye is 8 millimeters in diameter. Her eye doctor uses medicine to dilate her pupils by a factor of $\frac{3}{2}$. Find the new diameter once her pupil is dilated.

Answer: 12 mm


End of
Lesson 4-8
Click the mouse button to return to the Contents screen.

Extra Examples

Explore online information about the information introduced in this chapter.

Click on the **Connect** button to launch your browser and go to the *Mathematics: Applications and Concepts, Course 3* Web site. At this site, you will find extra examples for each lesson in the Student Edition of your textbook. When you finish exploring, exit the browser program to return to this presentation. If you experience difficulty connecting to the Web site, manually launch your Web browser and go to **www.msmath3.net/extra_examples**.

Find each square root. Estimate to the nearest whole number if necessary.

1. $-\sqrt{121}$

2. $\sqrt{81}$

3. Name all sets of numbers to which $-\sqrt{9}$ belongs.

4. Write an equation and solve to find the length of the hypotenuse of a right triangle that has legs measuring 5 centimeters and 7 centimeters.

5. What is the distance between (1, 3) and (3, 1) to the nearest tenth?

6. **Standardized Test Practice** Which is a solution to the equation $x^2 + 3 = 67$?

A -8 B 64 C 9 D 32

Find each square root. Estimate to the nearest whole number if necessary.

1. $-\sqrt{121}$ -11

2. $\sqrt{81}$ 9

3. Name all sets of numbers to which $-\sqrt{9}$ belongs. real, rational, integers, negative integers

4. Write an equation and solve to find the length of the hypotenuse of a right triangle that has legs measuring 5 centimeters and 7 centimeters. $5^2 + 7^2 = h^2$; 8.6 cm

5. What is the distance between (1, 3) and (3, 1) to the nearest tenth? 2.8

6. **Standardized Test Practice** Which is a solution to the equation $x^2 + 3 = 67$?

A -8 B 64 C 9 D 32

Express each ratio in simplest form.

1. 6 grape candies out of a package of 24
2. 3 cups to 2 pints

Express each rate as a unit rate.

3. $27 for 6 pizzas
4. 2,550 people in 5 days
5. 198 miles in 3 hours

6. **Standardized Test Practice** Which is the best buy for a bag of flour?

A. 1 pound at $0.79

B. 5 pounds at $1.70

C. 4 pounds at $ 1.40

D. 10 pounds at $3.60

Express each ratio in simplest form.

1. 6 grape candies out of a package of 24 $\frac{1}{4}$
2. 3 cups to 2 pints 3:4

Express each rate as a unit rate.

3. $27 for 6 pizzas $4.50/pizza
4. 2,550 people in 5 days 510 people/day
5. 198 miles in 3 hours 66 mi/h

6. **Standardized Test Practice** Which is the best buy for a bag of flour?

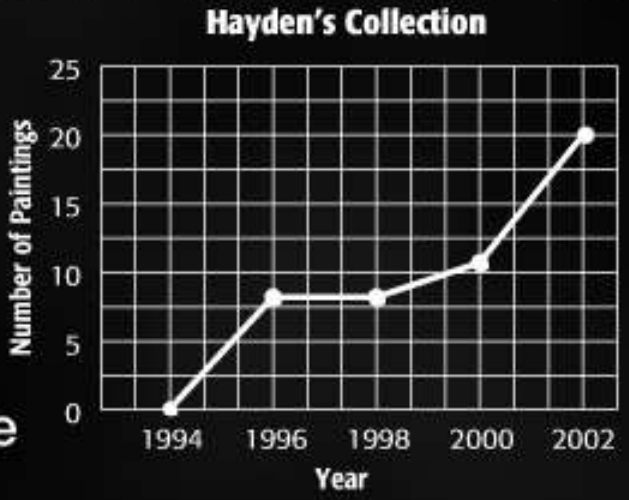
A 1 pound at $0.79

B 5 pounds at $1.70

C 4 pounds at $ 1.40

D 10 pounds at $3.60

For exercises 1–5, use the graph about Hayden's collection of paintings.



1. Find the rate of change between 1996 and 1998.
2. Find the rate of change between 1998 and 2000.
3. During which two-year time period did the number of paintings grow the fastest?
4. Find the average rate of change between 1994 and 2002.
5. Using the rate you found in Exercise 4, how many paintings do you predict Hayden will have in 2012?
6. **Standardized Test Practice** Five years ago, a car lot had 233 less cars than it has now. What was the approximate rate of change for the five-year period?

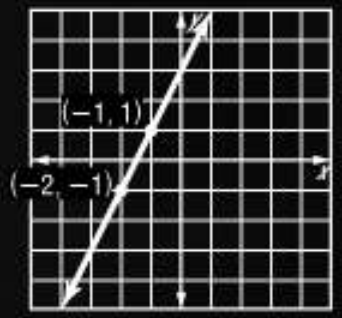
A 5 cars/yr B 233 cars/yr C 1,165 cars/yr D 47 cars/yr

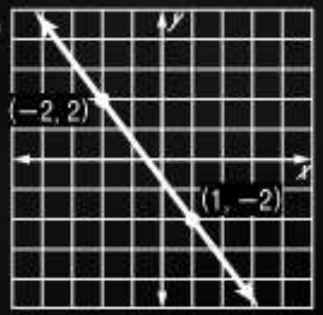
For exercises 1–5, use the graph about Hayden's collection of paintings.

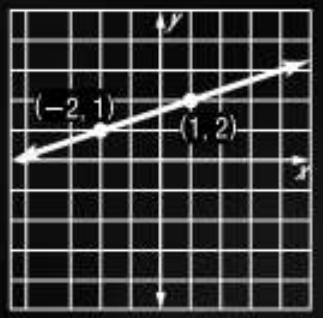
1. Find the rate of change between 1996 and 1998. 0 paintings/yr
2. Find the rate of change between 1998 and 2000. $\frac{3}{2}$ paintings/yr
3. During which two-year time period did the number of paintings grow the fastest? 2000–2002
4. Find the average rate of change between 1994 and 2002. $\frac{5}{2}$ paintings/yr
5. Using the rate you found in Exercise 4, how many paintings do you predict Hayden will have in 2012? 45 paintings
6. **Standardized Test Practice** Five years ago, a car lot had 233 less cars than it has now. What was the approximate rate of change for the five-year period?

A 5 cars/yr B 233 cars/yr C 1,165 cars/yr D 47 cars/yr

Find the slope of each line.

1. 

2. 

3. 

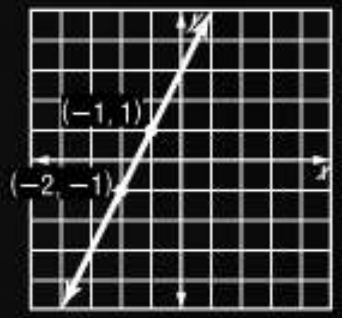
4. Lori saved $100 in 10 weeks, and Casey saved $150 in 14 weeks. Who saved more per week?

5. **Standardized Test Practice** Josh climbed two rocks. The first had a slope of 5. The second had a slope of $\frac{16}{3}$. Which of the following is true?

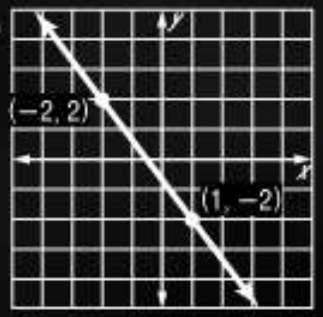
   A The first rock is steeper than the second.
   B The second rock is steeper than the first.
   C Both rocks have the same steepness.
   D Steepness cannot be determined with the given information.

Click the mouse button or press the Space Bar to display the answers.

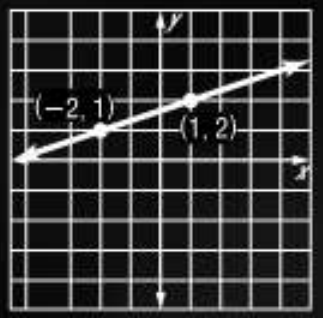
Find the slope of each line.

1. 

2

2. 

$-\frac{4}{3}$

3. 

$\frac{1}{3}$

4. Lori saved $100 in 10 weeks, and Casey saved $150 in 14 weeks. Who saved more per week? Casey

5. **Standardized Test Practice** Josh climbed two rocks. The first had a slope of 5. The second had a slope of $\frac{16}{3}$. Which of the following is true?

A. The first rock is steeper than the second.

B. The second rock is steeper than the first.

C. Both rocks have the same steepness.

D. Steepness cannot be determined with the given information.

Determine whether each pair of ratios form a proportion.

1. $\frac{3}{4}, \frac{9}{12}$

2. $\frac{5}{11}, \frac{6}{13}$

Solve each proportion.

3. $\frac{4}{x} = \frac{2}{8}$

4. $\frac{5}{15} = \frac{b}{9}$

5. Eighty-six cars pass through an intersection in two hours. Write a proportion and solve to find how long it would take 258 cars to pass through the intersection if the same rate of traffic flow continues.

6. **Standardized Test Practice** A train travels 4.4 miles in 4 minutes. At this rate, how many miles will it travel in 58 minutes?

A 3.3 miles B 52.7 miles C 63.8 miles D 13.2 miles

Determine whether each pair of ratios form a proportion.

1. $\frac{3}{4}, \frac{9}{12}$ yes

2. $\frac{5}{11}, \frac{6}{13}$ no

Solve each proportion.

3. $\frac{4}{x} = \frac{2}{8}$ 16

4. $\frac{5}{15} = \frac{b}{9}$ 3

5. Eighty-six cars pass through an intersection in two hours. Write a proportion and solve to find how long it would take 258 cars to pass through the intersection if the same rate of traffic flow continues.

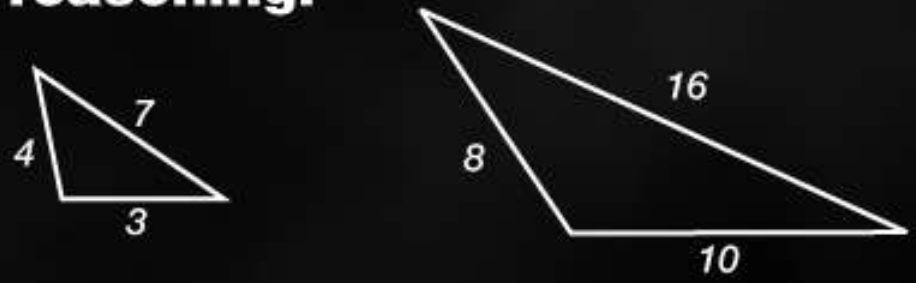
$\frac{86}{2} = \frac{258}{x}$; 6 hours

6. **Standardized Test Practice** A train travels 4.4 miles in 4 minutes. At this rate, how many miles will it travel in 58 minutes?

A 3.3 miles B 52.7 miles C 63.8 miles D 13.2 miles

Determine whether the pair of polygons is similar. Explain your reasoning.

1.



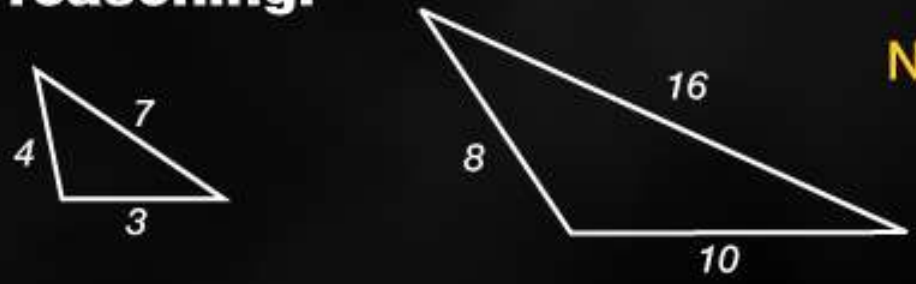
The pair of polygons is similar. Write a proportion to find the missing measure. Then solve.

2.

3. **Standardized Test Practice** A greeting card is 8 inches by 6 inches, but it will have to be cut to fit in an envelope. The scale factor from the original card to the smaller card is 5:4. Find the dimensions of the smaller card.

Determine whether the pair of polygons is similar. Explain your reasoning.

1.



No; corresponding sides are not proportional.

The pair of polygons is similar. Write a proportion to find the missing measure. Then solve.

2.

$\frac{3}{4} = \frac{x}{6}$; $x = 4.5$

3. **Standardized Test Practice** A greeting card is 8 inches by 6 inches, but it will have to be cut to fit in an envelope. The scale factor from the original card to the smaller card is 5:4. Find the dimensions of the smaller card.

$6\frac{2}{5} \times 4\frac{4}{5}$

A student is making a model skeleton of the human body. The scale she is using is 0.5 inch = 1 foot. Find the model lengths for each of the following actual lengths.

1. Height . . . 6 feet
2. Arms . . . 2.5 feet
3. Legs . . . 3 feet
4. Hands . . . 6 inches
5. Jesse is putting together a model car. The actual car is 12 feet long. His model is 8 inches long. What scale is he using?
6. **Standardized Test Practice** Which of the following scales could be used to make a model house $\frac{1}{72}$ its actual size?

A. 1 in. = 72 ft

B. 1 in. = 5 ft

C. 0.5 in. = 3 in.

D. 0.5 in. = 3 ft

A student is making a model skeleton of the human body. The scale she is using is 0.5 inch = 1 foot. Find the model lengths for each of the following actual lengths.

1. Height . . . 6 feet — 3 in.
2. Arms . . . 2.5 feet — 1.25 in.
3. Legs . . . 3 feet — 1.5 in.
4. Hands . . . 6 inches — 0.25 in.
5. Jesse is putting together a model car. The actual car is 12 feet long. His model is 8 inches long. What scale is he using? 2 in. = 3 ft
6. **Standardized Test Practice** Which of the following scales could be used to make a model house $\frac{1}{72}$ its actual size?

A. 1 in. = 72 ft

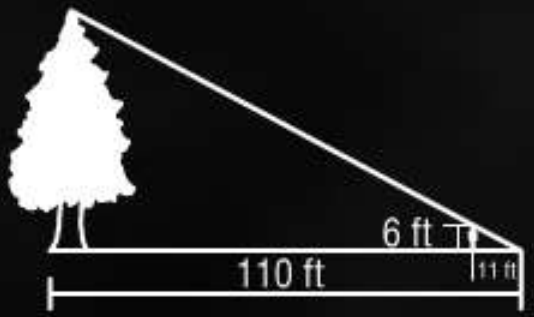
B. 1 in. = 5 ft

C. 0.5 in. = 3 in.

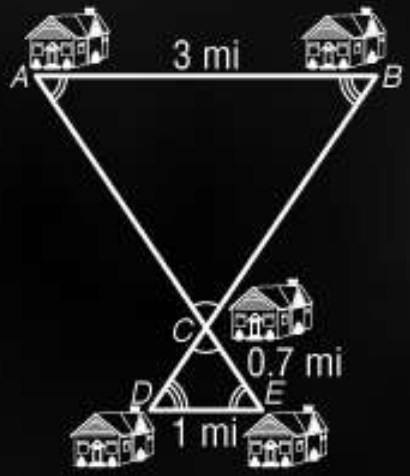
D. 0.5 in. = 3 ft

In Exercises 1–2, the triangles are similar. Write a proportion and solve the problem.

1. How tall is the tree?



2. How far is house *A* from house *C*?



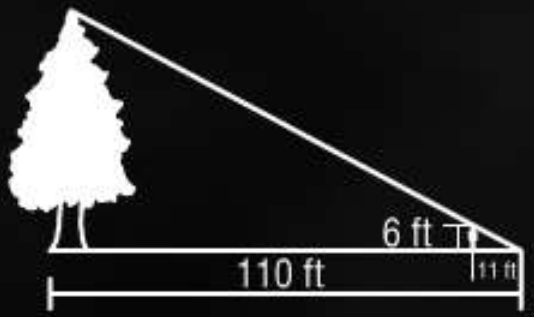
3. A 10-foot tall truck casts an 8-foot shadow. How long is the shadow of a nearby 2-foot tall shrub?

4. **Standardized Test Practice** From the shoreline, the ground slopes down under the water at a constant rate. If the water is 3 feet deep when it is 4.5 feet from the shore, about how deep will it be when it is 60 feet from the shore?

Click the mouse button or press the Space Bar to display the answers.

In Exercises 1–2, the triangles are similar. Write a proportion and solve the problem.

1. How tall is the tree?



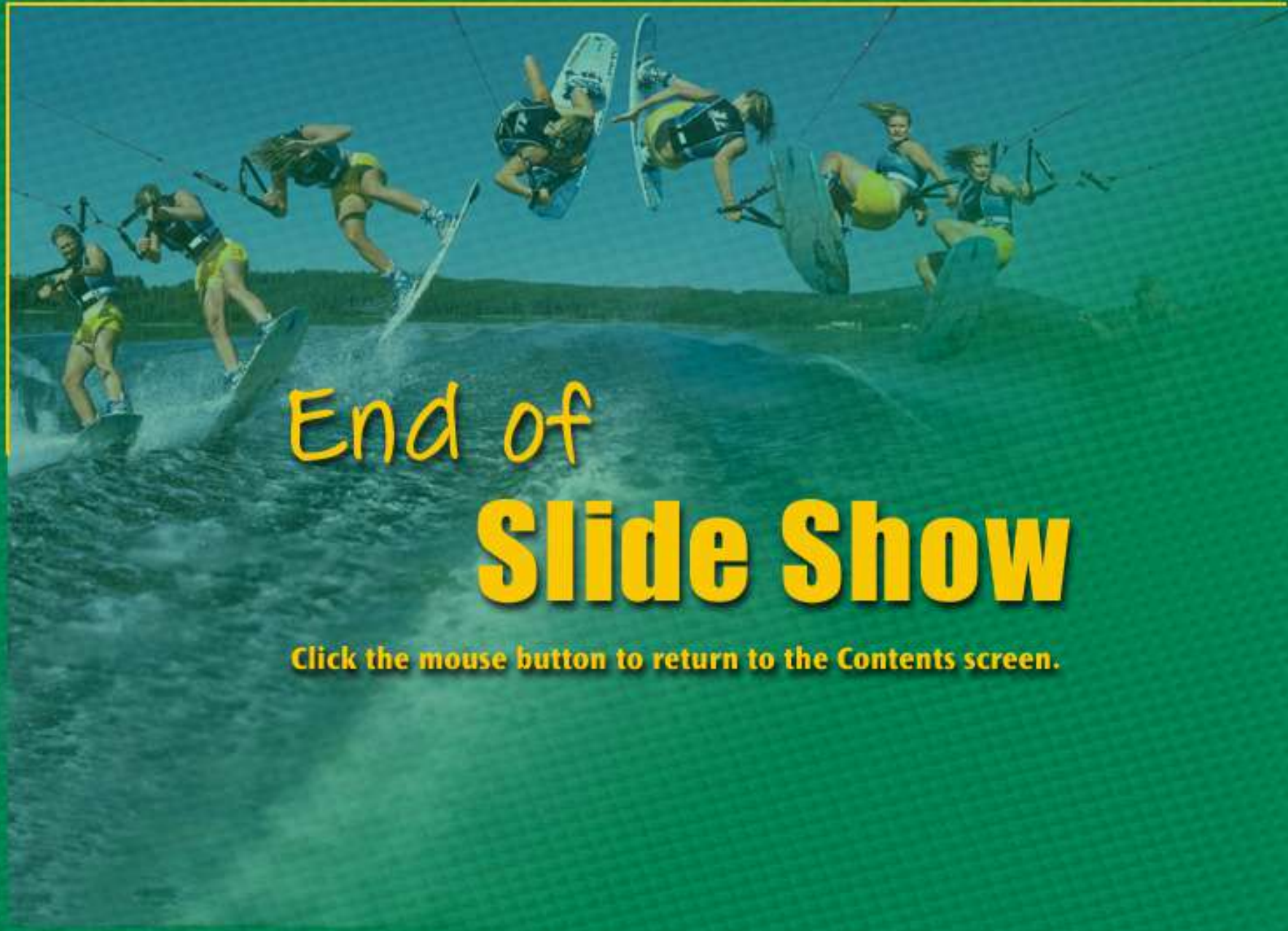
$\frac{h}{110} = \frac{6}{11}$; 60 ft

2. How far is house *A* from house *C*?

$\frac{\overline{AC}}{3} = \frac{0.7}{1}$; 2.1 mi

3. A 10-foot tall truck casts an 8-foot shadow. How long is the shadow of a nearby 2-foot tall shrub? $\frac{10}{8} = \frac{2}{s}$; 1.6 ft

4. **Standardized Test Practice** From the shoreline, the ground slopes down under the water at a constant rate. If the water is 3 feet deep when it is 4.5 feet from the shore, about how deep will it be when it is 60 feet from the shore? 40 ft


End of
Slide Show
Click the mouse button to return to the Contents screen.