Name_____ Date _____

11.5 Solving Right Triangles

For use with Exploration 11.5

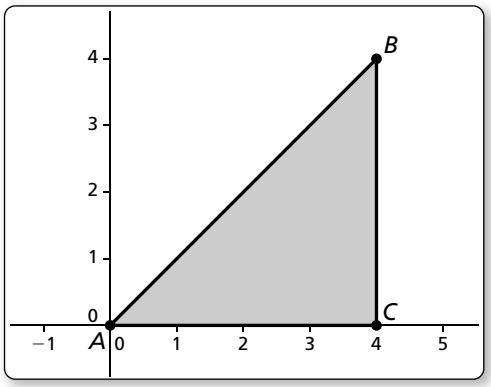
Essential Question When you know the lengths of the sides of a right triangle, how can you find the measures of the two acute angles?

1 EXPLORATION: Solving Special Right Triangles

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use the figures to find the values of the sine and cosine of $\angle A$ and $\angle B$. Use these values to find the measures of $\angle A$ and $\angle B$. Use dynamic geometry software to verify your answers.

a.



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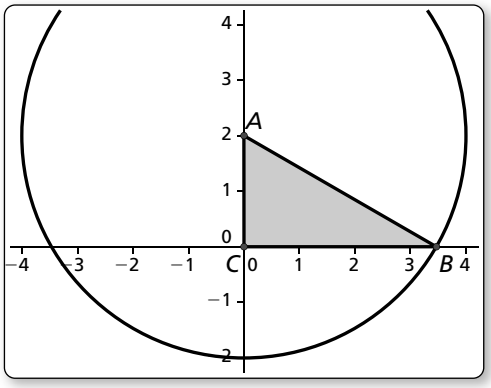
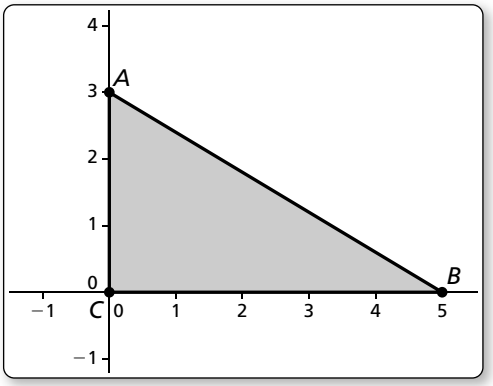


2 EXPLORATION: Solving Right Triangles

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. You can use a calculator to find the measure of an angle when you know the value of the sine, cosine, or tangent of the angle. Use the inverse sine, inverse cosine, or inverse tangent feature of your calculator to approximate the measures of $\angle A$ and $\angle B$ to the nearest tenth of a degree. Then use dynamic geometry software to verify your answers.

a.



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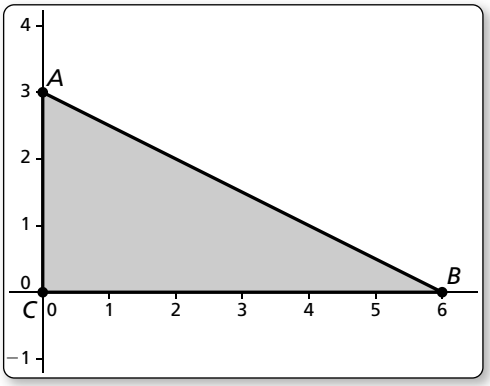

Communicate Your Answer

3. When you know the lengths of the sides of a right triangle, how can you find the measures of the two acute angles?

4. A ladder leaning against a building forms a right triangle with the building and the ground. The legs of the right triangle (in meters) form a 5-12-13 Pythagorean triple. Find the measures of the two acute angles to the nearest tenth of a degree.

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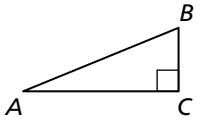
11.5 Practice
For use after Lesson 11.5

Core Concepts

Inverse Trigonometric Ratios

Let $\angle A$ be an acute angle.



Inverse Tangent If $\tan A = x$, then $\tan^{-1} x = m\angle A$. $\mathbf{\tan^{-1}\frac{BC}{AC} = m\angle A}$

Inverse Sine If $\sin A = y$, then $\sin^{-1} y = m\angle A$. $\mathbf{\sin^{-1}\frac{BC}{AB} = m\angle A}$

Inverse Cosine If $\cos A = z$, then $\cos^{-1} z = m\angle A$. $\mathbf{\cos^{-1}\frac{AC}{AB} = m\angle A}$

Notes:

Solving a Right Triangle

To **solve a right triangle** means to find all unknown side lengths and angle measures. You can solve a right triangle when you know either of the following.

- two side lengths
- one side length and the measure of one acute angle

Notes:

Name _____ Date _____

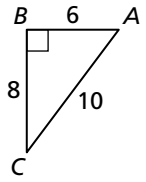
11.5 Practice (continued)

Worked-Out Examples

Example #1

Determine which of the two acute angles has the given trigonometric ratio.

The cosine of the angle is $\frac{4}{5}$



$\cos(\text{angle}) = \frac{\text{adjacent}}{\text{hypotenuse}}$

Note that $\frac{4}{5} = \frac{8}{10}$.

The side adjacent to angle C is 8 and the hypotenuse is 10; therefore, C is the angle where $\cos C = \frac{8}{10} = \frac{4}{5}$.

The acute angle that has a cosine of $\frac{4}{5}$ is $\angle C$.

Example #2

Solve the right triangle. Round decimal answers to the nearest tenth.

$m\angle K = 90° - 40° = 50°$

$\sin 40° = \frac{KL}{8}$

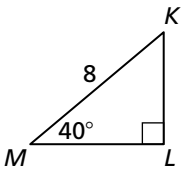
$8 \cdot \sin 40° = KL$

$5.1 \approx KL$

$\cos 40° = \frac{ML}{8}$

$8 \cdot \cos 40° = ML$

$6.1 \approx ML$

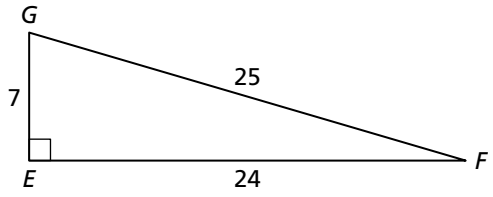


In $\triangle KML$, $ML \approx 6.1$, $KL \approx 5.1$, and $m\angle K = 50°$.

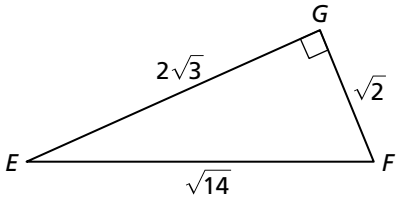
Practice A

In Exercises 1 and 2, determine which of the two acute angles has the given trigonometric ratio.

1. The cosine of the angle is $\frac{24}{25}$.



2. The sine of the angle is about 0.38.



In Exercises 3–6, let $\angle H$ be an acute angle. Use a calculator to approximate the measure of $\angle H$ to the nearest tenth of a degree.

3. $\sin H = 0.2$ **4.** $\tan H = 1$ **5.** $\cos H = 0.33$ **6.** $\sin H = 0.89$

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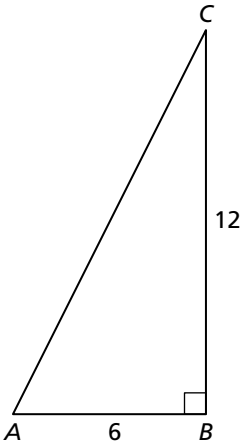
11.5 Practice (continued)

In Exercises 7–10, solve the right triangle. Round decimal answers to the nearest tenth.

7.



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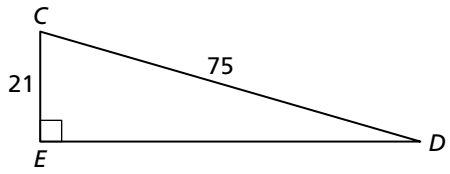

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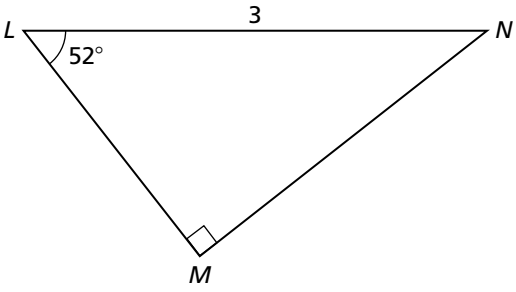
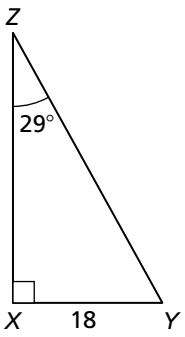
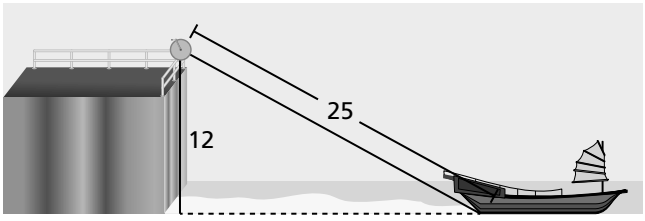


10.



11. A boat is pulled in by a winch on a dock 12 feet above the deck of the boat. When the winch is fully extended to 25 feet, what is the angle of elevation from the boat to the winch?



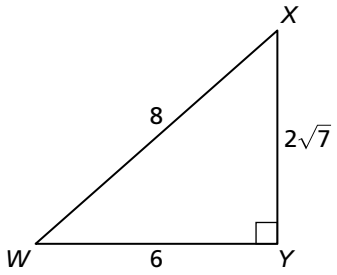
Name_____ Date _____

Practice B

In Exercises 1 and 2, determine which of the two acute angles has the given trigonometric ratio.

1. The cosine of the angle is $\frac{3}{4}$.

2. The tangent of the angle is $\frac{3\sqrt{7}}{7}$.

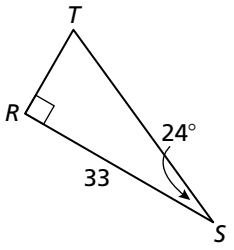


In Exercises 3–5, let $\angle H$ be an acute angle. Use a calculator to approximate the measure of $\angle H$ to the nearest tenth of a degree.

3. $\sin H = 0.41$ **4.** $\cos H = 0.05$ **5.** $\tan H = 5.18$

In Exercises 6–8, solve the right triangle. Round decimal answers to the nearest tenth.

6.



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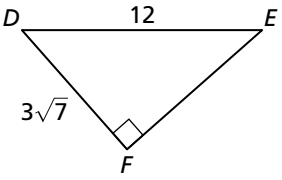

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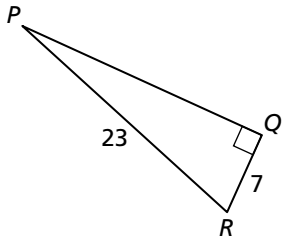
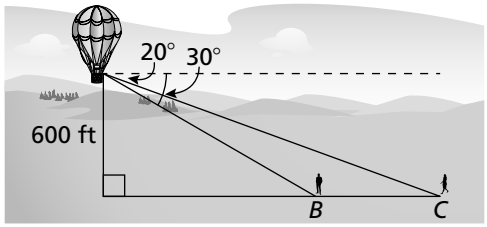


9. You are in a hot air balloon that is 600 feet above the ground. You can see two people. The angles of depression to person B and to person C are $30°$ and $20°$, respectively.

a. How far is person B from the point on the ground below the hot air balloon?

b. How far is person C from the point on the ground below the hot air balloon?

c. How far apart are the two people?



10. On a *typographic map,* the contour lines show changes in elevation of the land. You and a friend are hiking on Kasatochi Island.

a. Find the difference in elevation (in miles) between you and your friend.

b. Use a ruler to find the horizontal distance (in miles) between you and your friend.

c. What is the angle of elevation from you to your friend?