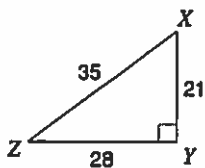


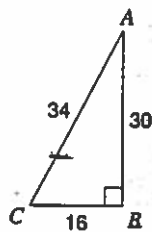
Trigonometric Ratios

Find the value of each trigonometric ratio.

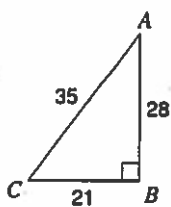
1) $\tan Z$



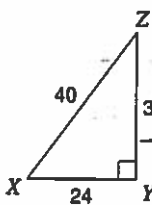
2) $\cos C$



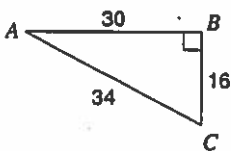
3) $\sin C$



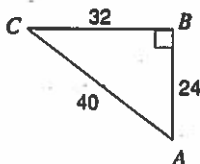
4) $\tan X$



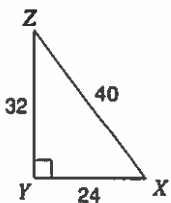
5) $\cos A$



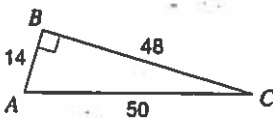
6) $\sin A$



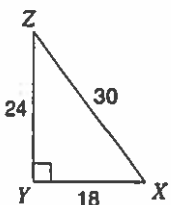
7) $\sin Z$



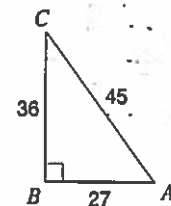
8) $\sin C$



9) $\cos Z$

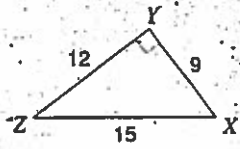


10) $\tan C$

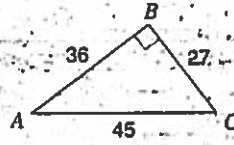


Find the value of each trigonometric ratio to the nearest ten-thousandth.

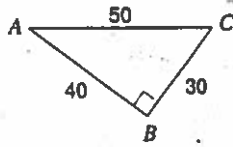
11) $\cos Z$



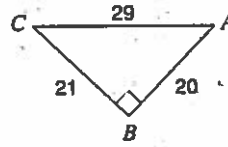
12) $\cos C$



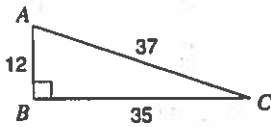
13) $\tan C$



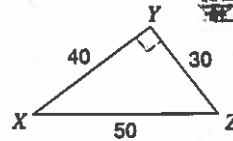
14) $\tan A$



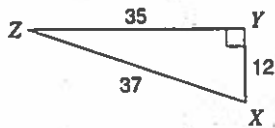
15) $\tan C$



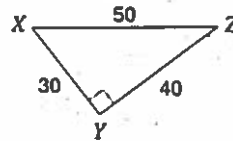
16) $\tan X$



17) $\sin Z$



18) $\sin Z$



19) $\sin 48^\circ$

20) $\sin 38^\circ$

21) $\cos 61^\circ$

22) $\cos 51^\circ$

Critical thinking questions:

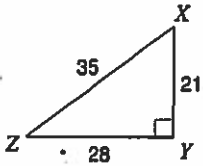
23) Can the sine of an angle ever equal 2?
Why or why not?

24) $\sin x = \frac{1}{3}$
Find $\cos x$.

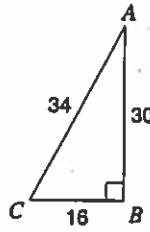
Trigonometric Ratios

Find the value of each trigonometric ratio.

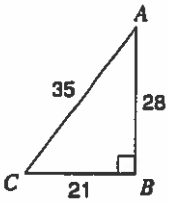
1) $\tan Z = \frac{3}{4}$



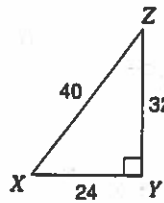
2) $\cos C = \frac{8}{17}$



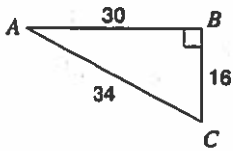
3) $\sin C = \frac{4}{5}$



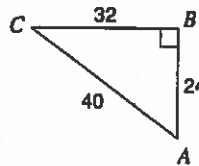
4) $\tan X = \frac{4}{3}$



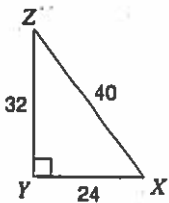
5) $\cos A = \frac{15}{17}$



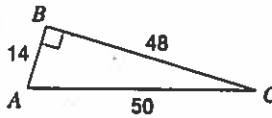
6) $\sin A = \frac{4}{5}$



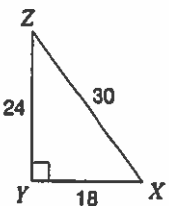
7) $\sin Z = \frac{3}{5}$



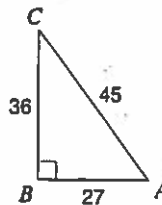
8) $\sin C = \frac{7}{25}$



9) $\cos Z = \frac{4}{5}$

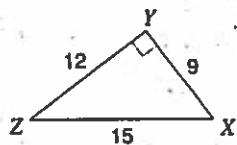


10) $\tan C = \frac{3}{4}$



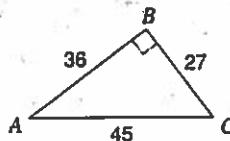
Find the value of each trigonometric ratio to the nearest ten-thousandth.

11) $\cos Z$



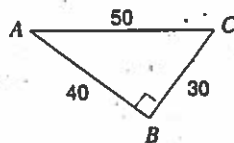
0.8000

12) $\cos C$



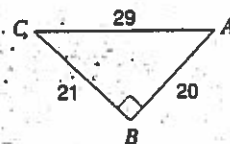
0.6000

13) $\tan C$



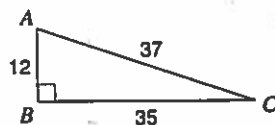
1.3333

14) $\tan A$



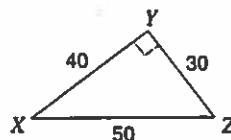
1.0500

15) $\tan C$



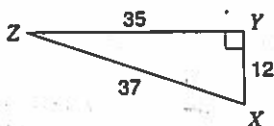
0.3429

16) $\tan X$



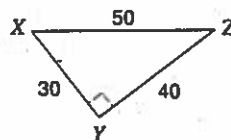
0.7500

17) $\sin Z$



0.3243

18) $\sin Z$



0.6000

19) $\sin 48^\circ$

0.7431

20) $\sin 38^\circ$

0.6157

21) $\cos 61^\circ$

0.4848

22) $\cos 51^\circ$

0.6293

Critical thinking questions:

23) Can the sine of an angle ever equal 2?
Why or why not?

No, the hypotenuse > opposite side.

24) $\sin x = \frac{1}{3}$

Find $\cos x$.

$$\frac{2\sqrt{2}}{3}$$

Solving Right Triangles

Find the missing side. Round to the nearest tenth.

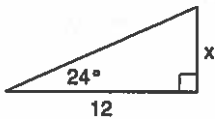
1)



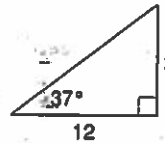
2)



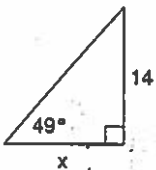
3)



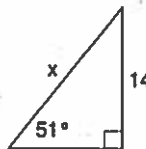
4)



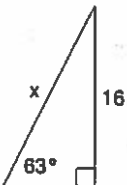
5)



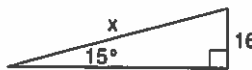
6)

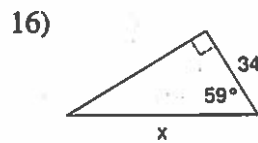
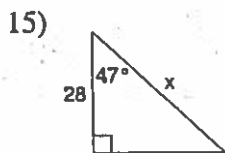
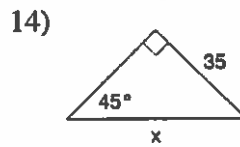
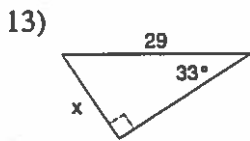
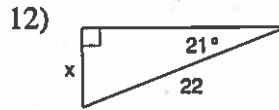
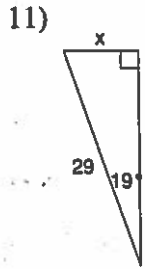
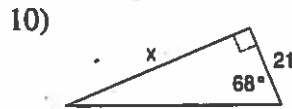
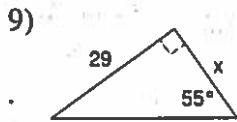


7)



8)





Critical thinking question:

17) Write a new problem that is similar to the others on this worksheet. Solve the question you wrote.

Solving Right Triangles

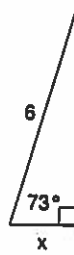
Find the missing side. Round to the nearest tenth.

1)



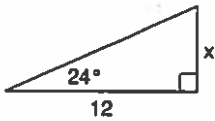
19.4

2)



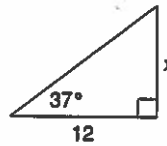
1.8

3)



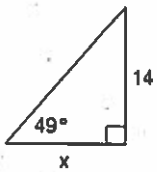
5.3

4)



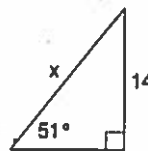
9.0

5)



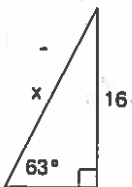
12.2

6)



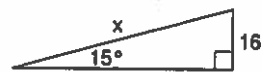
18.0

7)



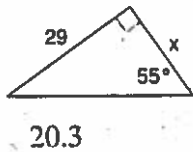
18.0

8)

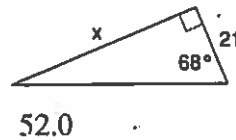


61.8

9)



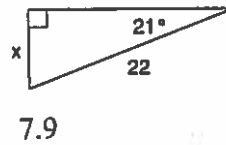
10)



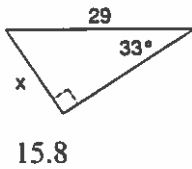
11)



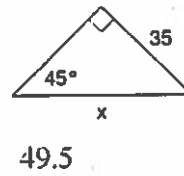
12)



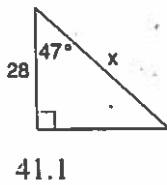
13)



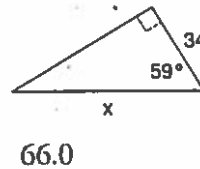
14)



15)



16)



Critical thinking question:

17) Write a new problem that is similar to the others on this worksheet. Solve the question you wrote.

Many answers.

Exercises

GUIDED PRACTICE

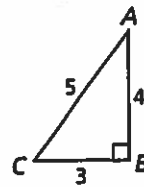
Vocabulary Apply the vocabulary from this lesson to answer each question.

- In $\triangle JKL$, $\angle K$ is a right angle. Write the *sine* of $\angle J$ as a ratio of side lengths.
- In $\triangle MNP$, $\angle M$ is a right angle. Write the *tangent* of $\angle N$ as a ratio of side lengths.

EXAMPLE
p. 525

Write each trigonometric ratio as a fraction and as a decimal rounded to the nearest hundredth.

- $\sin C$
- $\cos C$
- $\tan A$
- $\tan C$
- $\cos A$
- $\sin A$



EXAMPLE
p. 526

Use a special right triangle to write each trigonometric ratio as a fraction.

- $\cos 60^\circ$
- $\tan 30^\circ$
- $\sin 45^\circ$

EXAMPLE
p. 526

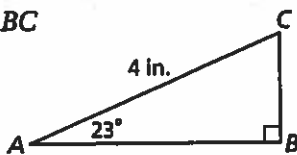
Use your calculator to find each trigonometric ratio. Round to the nearest hundredth.

- $\tan 67^\circ$
- $\cos 88^\circ$
- $\sin 23^\circ$
- $\cos 12^\circ$
- $\sin 49^\circ$
- $\tan 9^\circ$

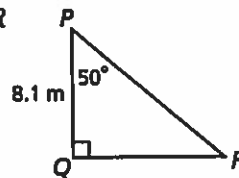
EXAMPLE
p. 527

Find each length. Round to the nearest hundredth.

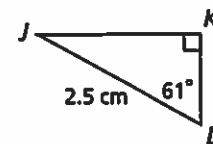
- BC



- QR

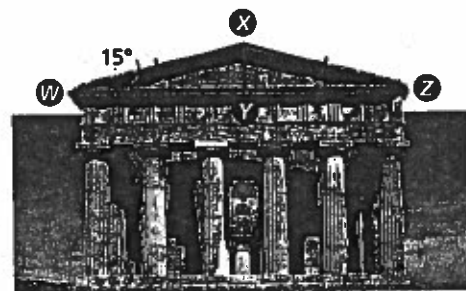


- KL



EXAMPLE
p. 528

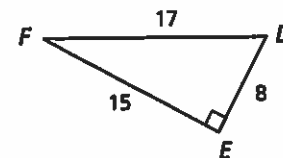
- Architecture** A pediment has a pitch of 15° , as shown. If the width of the pediment, WZ , is 56 ft, what is XY to the nearest inch?



PRACTICE AND PROBLEM SOLVING

Write each trigonometric ratio as a fraction and as a decimal rounded to the nearest hundredth.

- $\cos D$
- $\cos F$
- $\tan D$
- $\sin F$
- $\tan F$
- $\sin D$



Use a special right triangle to write each trigonometric ratio as a fraction.

- $\tan 60^\circ$
- $\sin 30^\circ$
- $\cos 45^\circ$

Use your calculator to find each trigonometric ratio. Round to the nearest hundredth.

- $\tan 51^\circ$
- $\tan 14^\circ$
- $\sin 80^\circ$
- $\sin 55^\circ$
- $\cos 77^\circ$
- $\cos 48^\circ$

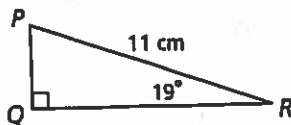
Independent Practice For Exercises	See Example
22-27	1
28-30	2
31-36	3
37-42	4
43	5

Extra Practice

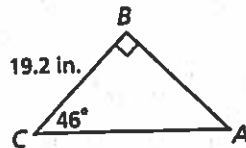
Practice p. 518
 Application Practice p. 535

Find each length. Round to the nearest hundredth.

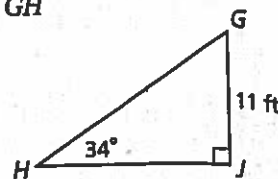
37. PQ



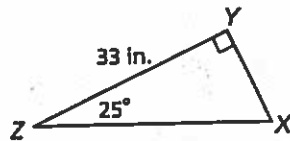
38. AC



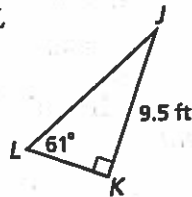
39. GH



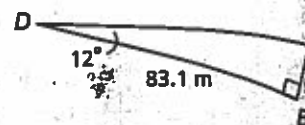
40. XZ



41. KL



42. EF



43. **Sports** A jump ramp for waterskiing makes an angle of 15° with the surface of the water. The ramp rises 1.58 m above the surface. What is the length of the ramp to the nearest hundredth of a meter?

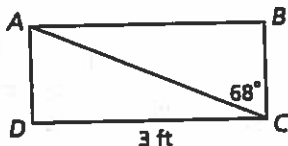


Use special right triangles to complete each statement.

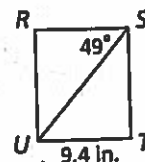
44. An angle that measures $\underline{\quad ? \quad}$ has a tangent of 1.
 45. For a 45° angle, the $\underline{\quad ? \quad}$ and $\underline{\quad ? \quad}$ ratios are equal.
 46. The sine of a $\underline{\quad ? \quad}$ angle is 0.5.
 47. The cosine of a 30° angle is equal to the sine of a $\underline{\quad ? \quad}$ angle.
 48. **Safety** According to the Occupational Safety and Health Administration (OSHA) a ladder that is placed against a wall should make a 75.5° angle with the ground for optimal safety. To the nearest tenth of a foot, what is the maximum height that a 10-ft ladder can safely reach?

Find the indicated length in each rectangle. Round to the nearest tenth.

49. BC



50. SU



51. **Critical Thinking** For what angle measures is the tangent ratio less than 1? greater than 1? Explain.

**MULTI-STEP
TEST PREP**

52. This problem will prepare you for the Multi-Step Test Prep on page 542.

A utility worker is installing a 25-foot pole \overline{AB} at the foot of a hill. Two guy wires, \overline{AC} and \overline{AD} , will help keep the pole vertical.

- a. To the nearest inch, how long should \overline{AC} be?
 b. \overline{AD} is perpendicular to the hill, which makes an angle of 28° with a horizontal line. To the nearest inch, how long should this guy wire be?

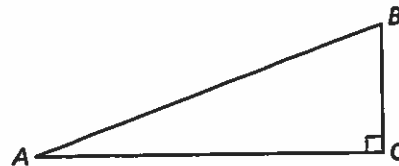


53. Find the sine of the smaller acute angle in a triangle with side lengths of 3, 4, and 5 inches.
54. Find the tangent of the greater acute angle in a triangle with side lengths of 7, 24, and 25 centimeters.

55. **History** The Great Pyramid of Cheops in Giza, Egypt, was completed around 2566 B.C.E. Its original height was 482 ft. Each face of the pyramid forms a 52° angle with the ground. To the nearest foot, how long is the base of the pyramid?

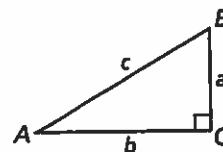
56. **Measurement** Follow these steps to calculate trigonometric ratios.

- Use a centimeter ruler to find AB , BC , and AC .
- Use your measurements from part a to find the sine, cosine, and tangent of $\angle A$.
- Use a protractor to find $m\angle A$.
- Use a calculator to find the sine, cosine, and tangent of $\angle A$.
- How do the values in part d compare to the ones you found in part b?



57. **Algebra** Recall from Algebra I that an *identity* is an equation that is true for all values of the variables.

- Show that the identity $\tan A = \frac{\sin A}{\cos A}$ is true when $m\angle A = 30^\circ$.
- Write $\tan A$, $\sin A$, and $\cos A$ in terms of a , b , and c .
- Use your results from part b to prove the identity $\tan A = \frac{\sin A}{\cos A}$.



Verify that $(\sin A)^2 + (\cos A)^2 = 1$ for each angle measure.

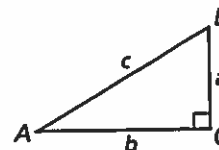
58. $m\angle A = 45^\circ$

59. $m\angle A = 30^\circ$

60. $m\angle A = 60^\circ$

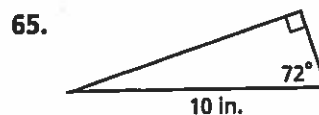
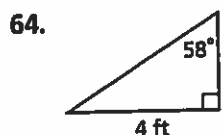
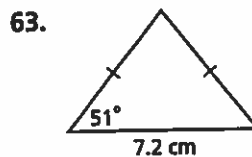
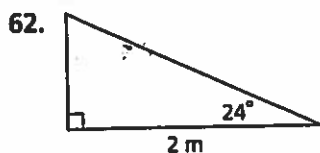
61. **Multi-Step** The equation $(\sin A)^2 + (\cos A)^2 = 1$ is known as a Pythagorean Identity.

- Write $\sin A$ and $\cos A$ in terms of a , b , and c .
- Use your results from part a to prove the identity $(\sin A)^2 + (\cos A)^2 = 1$.



62. **Write About It** Why do you think this identity is called a Pythagorean identity?

Find the perimeter and area of each triangle. Round to the nearest hundredth.

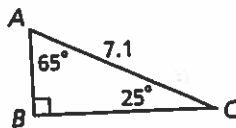


66. **Critical Thinking** Draw $\triangle ABC$ with $\angle C$ a right angle. Write $\sin A$ and $\cos B$ in terms of the side lengths of the triangle. What do you notice? How are $\angle A$ and $\angle B$ related? Make a conjecture based on your observations.

67. **Write About It** Explain how the tangent of an acute angle changes as the angle measure increases.

68. Which expression can be used to find AB ?

- (A) $7.1(\sin 25^\circ)$ (C) $7.1(\sin 65^\circ)$
 (B) $7.1(\cos 25^\circ)$ (D) $7.1(\tan 65^\circ)$



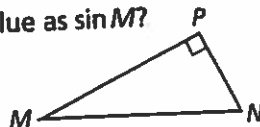
69. A steel cable supports an electrical tower as shown. The cable makes a 65° angle with the ground. The base of the cable is 17 ft from the tower. What is the height of the tower to the nearest foot?

- (F) 8 feet (H) 36 feet
 (G) 15 feet (J) 40 feet



70. Which of the following has the same value as $\sin M$?

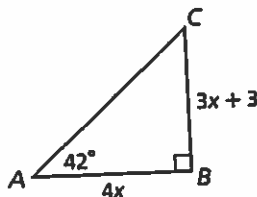
- (A) $\sin N$ (C) $\cos N$
 (B) $\tan M$ (D) $\cos M$



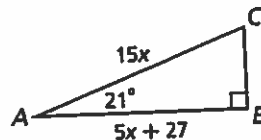
CHALLENGE AND EXTEND

Algebra Find the value of x . Then find AB , BC , and AC . Round each to the nearest unit.

71.

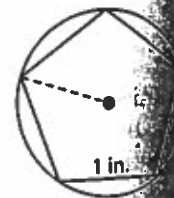


72.



73. **Multi-Step** Prove the identity $(\tan A)^2 + 1 = \frac{1}{(\cos A)^2}$.

74. A regular pentagon with 1 in. sides is inscribed in a circle. Find the radius of the circle rounded to the nearest hundredth.



Each of the three trigonometric ratios has a reciprocal ratio, as defined below. These ratios are *cosecant* (\csc), *secant* (\sec), and *cotangent* (\cot).

$$\csc A = \frac{1}{\sin A}$$

$$\sec A = \frac{1}{\cos A}$$

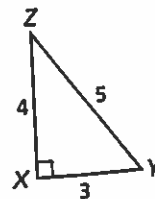
$$\cot A = \frac{1}{\tan A}$$

Find each trigonometric ratio to the nearest hundredth.

75. $\csc Y$

76. $\sec Z$

77. $\cot Y$



SPIRAL REVIEW

Find three ordered pairs that satisfy each function. (Previous course)

78. $f(x) = 3x - 6$

79. $f(x) = -0.5x + 10$

80. $f(x) = x^2 - 4x + 4$

Identify the property that justifies each statement. (Lesson 2-5)

81. $\overline{AB} \cong \overline{CD}$, and $\overline{CD} \cong \overline{DE}$. So $\overline{AB} \cong \overline{DE}$.

82. $\overline{AB} \cong \overline{AB}$

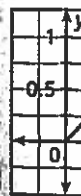
83. If $\angle JKM \cong \angle MLK$, then $\angle MLK \cong \angle JKM$.

Find the geometric mean of each pair of numbers. (Lesson 8-1)

84. 3 and 27

85. 6 and 24

86. 8 and 32



Example

Use the graph to find an inverse function.

$f(x) = \sin x$

$f^{-1}(x) = 90^\circ$

$f^{-1}(x) = \sin^{-1} x$

This

Use the graph to find an inverse function.