1. Match each trigonometric function with its right triangle definition.

(a) sine (b) cosine (c) tangent (d) cosecant (e) secant (f) cotangent

(i) $\frac{\text{hypotenuse}}{\text{adjacent}}$ (ii) $\frac{\text{adjacent}}{\text{opposite}}$ (iii) $\frac{\text{hypotenuse}}{\text{opposite}}$ (iv) $\frac{\text{adjacent}}{\text{hypotenuse}}$ (v) $\frac{\text{opposite}}{\text{hypotenuse}}$ (vi) $\frac{\text{opposite}}{\text{adjacent}}$

In Exercises 2–4, fill in the blanks.

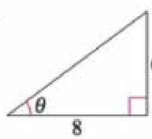
2. Relative to the acute angle θ, the three sides of a right triangle are the ________ side, the ________ side, and the ________.

3. Cofunctions of ________ angles are equal.

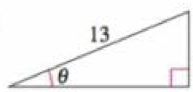
4. An angle that measures from the horizontal upward to an object is called the angle of ________, whereas an angle that measures from the horizontal downward to an object is called the angle of ________.

Evaluating Trigonometric Functions **In Exercises 5–8, find the exact values of the six trigonometric functions of the angle θ shown in the figure. (Use the Pythagorean Theorem to find the third side of the triangle.)**

5.

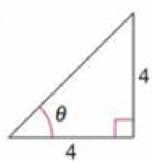


6.



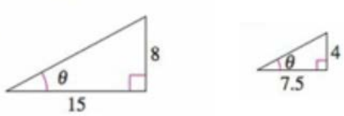
7.

8.



Evaluating Trigonometric Functions **In Exercises 9–12, find the exact values of the six trigonometric functions of the angle θ for each of the two triangles. Explain why the function values are the same.**

9.



Evaluating Trigonometric Functions **In Exercises 13–20, sketch a right triangle corresponding to the trigonometric function of the acute angle θ. Use the Pythagorean Theorem to determine the third side and then find the other five trigonometric functions of θ.**

13. $\tan\theta = \frac{3}{4}$ **14.** $\cos\theta = \frac{5}{6}$

17. $\sin\theta = \frac{1}{5}$ **20.** $\csc\theta = 9$

Using a Calculator **In Exercises 31–40, use a calculator to evaluate each function. Round your answers to four decimal places. (Be sure the calculator is in the correct mode.)**

32. (a) $\tan 23.5°$ (b) $\cot 66.5°$

33. (a) $\sin 16.35°$ (b) $\csc 16.35°$

34. (a) $\cot 79.56°$ (b) $\sec 79.56°$

35. (a) $\cos 4° 50' 15''$ (b) $\sec 4° 50' 15''$

38. (a) $\sec 56° 8' 10''$ (b) $\cos 56° 8' 10''$

Applying Trigonometric Identities **In Exercises 41–46, use the given function value(s) and the trigonometric identities to find the indicated trigonometric functions.**

41. $\sin 60° = \frac{\sqrt{3}}{2}$, $\cos 60° = \frac{1}{2}$

(a) $\sin 30°$ (b) $\cos 30°$

(c) $\tan 60°$ (d) $\cot 60°$

42. $\sin 30° = \frac{1}{2}$, $\tan 30° = \frac{\sqrt{3}}{3}$

(a) $\csc 30°$ (b) $\cot 60°$

(c) $\cos 30°$ (d) $\cot 30°$

43. $\cos\theta = \frac{1}{3}$

(a) $\sin\theta$ (b) $\tan\theta$

43. $\cos\theta = \frac{1}{3}$

(a) $\sin\theta$ (b) $\tan\theta$

(c) $\sec\theta$ (d) $\csc(90° - \theta)$

45. $\cot\alpha = 5$

(a) $\tan\alpha$ (b) $\csc\alpha$

(c) $\cot(90° - \alpha)$ (d) $\cos\alpha$

46. $\cos\beta = \frac{\sqrt{7}}{4}$

(a) $\sec\beta$ (b) $\sin\beta$

(c) $\cot\beta$ (d) $\sin(90° - \beta)$

Using Trigonometric Identities **In Exercises 47–56, use trigonometric identities to transform the left side of the equation into the right side ($0 < \theta < \pi/2$).**

51. $(1 + \sin\theta)(1 - \sin\theta) = \cos^2\theta$

52. $(1 + \cos\theta)(1 - \cos\theta) = \sin^2\theta$

53. $(\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$

54. $\sin^2\theta - \cos^2\theta = 2\sin^2\theta - 1$

55. $\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \csc\theta\sec\theta$

56. $\frac{\tan\beta + \cot\beta}{\tan\beta} = \csc^2\beta$

Evaluating Trigonometric Functions **In Exercises 57–62, find each value of θ in degrees ($0° < \theta < 90°$) and radians ($0 < \theta < \pi/2$) without using a calculator.**

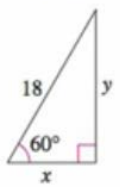
59. (a) $\sec\theta = 2$ (b) $\cot\theta = 1$

61. (a) $\csc\theta = \frac{2\sqrt{3}}{3}$ (b) $\sin\theta = \frac{\sqrt{2}}{2}$

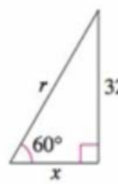
62. (a) $\cot\theta = \frac{\sqrt{3}}{3}$ (b) $\sec\theta = \sqrt{2}$

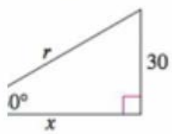
Finding Side Lengths of a Triangle **In Exercises 63–66, find the exact values of the indicated variables.**

63. Find x and y.

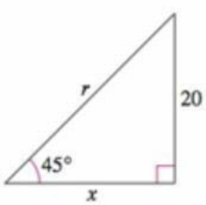


65. Find x and r. x and r.





66. Find x and r.



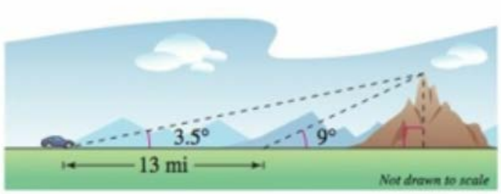
68. Height A six-foot-tall person walks from the base of a broadcasting tower directly toward the tip of the shadow cast by the tower. When the person is 132 feet from the tower and 3 feet from the tip of the shadow, the person's shadow starts to appear beyond the tower's shadow.

(a) Draw a right triangle that gives a visual representation of the problem. Show the known quantities of the triangle and use a variable to indicate the height of the tower.

(b) Use a trigonometric function to write an equation involving the unknown quantity.

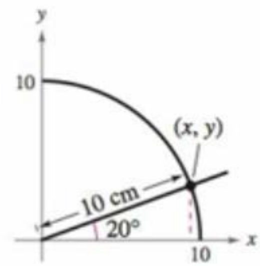
(c) What is the height of the tower?

72. Height of a Mountain In traveling across flat land, you notice a mountain directly in front of you. Its angle of elevation (to the peak) is 3.5°. After you drive 13 miles closer to the mountain, the angle of elevation is 9° (see figure). Approximate the height of the mountain.



74. Machine Shop Calculations A tapered shaft has a diameter of 5 centimeters at the small end and is 15 centimeters long (see figure). The taper is 3°. Find the diameter d of the large end of the shaft.

75. Geometry Use a compass to sketch a quarter of a circle of radius 10 centimeters. Using a protractor, construct an angle of 20° in standard position (see figure). Drop a perpendicular line from the point of intersection of the terminal side of the angle and the arc of the circle. By actual measurement, calculate the coordinates (x, y) of the point of intersection and use these measurements to approximate the six trigonometric functions of a 20° angle.



True or False? **In Exercises 79–84, determine whether the statement is true or false. Justify your answer.**

79. $\sin 60° \csc 60° = 1$ **80.** $\sec 30° = \csc 60°$