9.1 EXERCISES

PRACTICE

In Exercises 1–12, find the exact value of each of the given trigonometric functions.

1. $\cos\frac{\pi}{3}$ **2.** $\tan\frac{\pi}{4}$ **3.** $\sin\frac{3\pi}{4}$

4. $\cos\frac{5\pi}{6}$ **5.** $\tan\frac{13\pi}{6}$ **6.** $\sin\frac{8\pi}{3}$

7. $\cot\frac{\pi}{2}$ **8.** $\sec\frac{9\pi}{4}$ **9.** $\csc\left(-\frac{\pi}{6}\right)$

10. $\tan\left(-\frac{2\pi}{3}\right)$ **11.** $\cos\left(-\frac{5\pi}{4}\right)$ **12.** $\sin\left(-\frac{\pi}{2}\right)$

In Exercises 13–20, use a calculator to find the value of each of the given trigonometric functions. Round your answer to four decimal places.

13. $\tan(64.3°)$ **14.** $\cos(102.6°)$ **15.** $\sin(246.1°)$

16. $\sin(-53.2°)$ **17.** $\cos(2.31)$ **18.** $\tan(0.891)$

19. $\cos(-1.32)$ **20.** $\sin(-3.69)$

In Exercises 21–24, sketch the graph of each of the given functions over the interval $[-\pi, 2\pi]$.

21. $y = 3\cos x$ **22.** $y = 4\sin x$ **23.** $y = \sin(2x)$

24. $y = \cos(4x)$

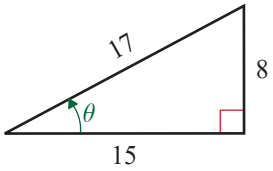
In Exercises 25–28, verify each trigonometric identity.

25. $\csc^2\theta - 1 = \cot^2\theta$ **26.** $\sin(2\theta) = 2\sin\theta\cos\theta$ **(Hint:** $2\theta = \theta + \theta$**)**

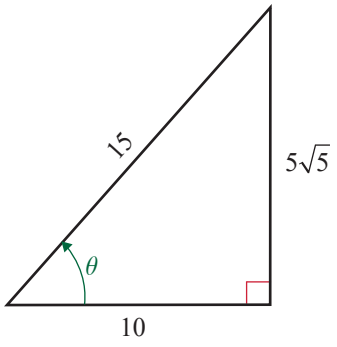
27. $1 - \frac{\cos\theta}{\sec\theta} = \sin^2\theta$ **28.** $\frac{\cos\theta}{\sec\theta} + \frac{\sin\theta}{\csc\theta} = 1$

In Exercises 29 and 30, find the values of the six trigonometric functions of θ.

29.



30.



APPLICATIONS

31. Aviation: An airplane that is approaching an airport is descending at an angle of 3.2°. Find the decrease in altitude if the plane travels a horizontal distance of 40 miles. Round your answer to the nearest thousandth.

32. Safety: In order to use a ladder safely, the angle that the ladder forms with the ground should not exceed 70°. If you have a ladder that is 16 ft long, what is the maximum height on the wall of a building that the ladder will safely reach? Round your answer to the nearest thousandth.

33. Height of a tree: A tree casts a shadow that is 17 ft long. If the sun is at 42° above the horizon, find the height of the tree. Round your answer to the nearest thousandth.

34. Sales: A contractor sells heating and air-conditioning units. The number of units he expects to sell each month is given by $N(t) = 28 + 12\cos\left(\frac{\pi}{3}(t-1)\right)$, where $t = 1$ represents the month of January.

a. Find $N(1)$, $N(4)$, $N(7)$, $N(10)$, and $N(13)$.
b. How many units does the contractor expect to sell in September?

35. Predator-prey model: A predator-prey model (see Example 4) for the relationship between a population of coyotes and a population of rabbits is given by $C(t) = 1000 + 500\sin\left(\frac{\pi}{3}t\right)$ for the number of coyotes and the function $R(t) = 10{,}000 + 2000\cos\left(\frac{2\pi}{9}t\right)$ for the number of rabbits.

a. Find the period T_1 of $C(t)$.
b. Find the period T_2 of $R(t)$.