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UNIT 3 - Unit circle and trig functions

4.1 angle measurements, degrees vs. radians
4.2 unit circle, trig functions, the two triangles
4.3 reference angles, evaluating trig functions
4.4 graphs of sine and cosine, amplitude, period
4.5 graphs of tangent, secant, and cosecant
4.6 inverse trigonometric functions, evaluating and finding the domain and codomain of inverse trig functions
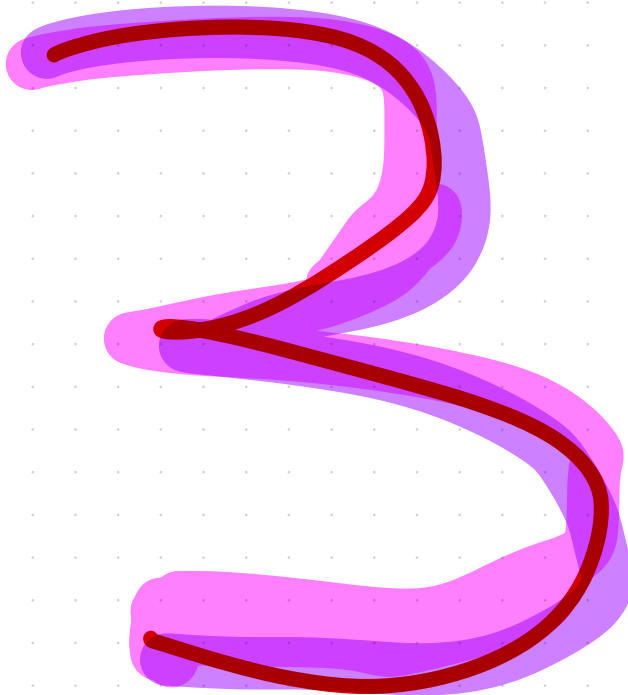
Building Skills

In Exercises 9–16, draw each angle in standard position.

9. $30°$

10. $150°$

11. $-120°$

12. $-330°$

13. $\dfrac{5\pi}{3}$

14. $\dfrac{11\pi}{6}$

15. $-\dfrac{4\pi}{3}$

16. $-\dfrac{13\pi}{4}$

In Exercises 17–22, convert each angle to decimal degree notation. Round your answers to two decimal places.

17. $70°45'$

18. $38°38'$

19. $23°42'30''$

20. $45°50'50''$

21. $-15°42'57''$

22. $-70°18'13''$

In Exercises 23–28, convert each angle to DMS notation. Round your answers to the nearest second.

23. $27.32°$

24. $120.64°$

25. $13.347°$

26. $110.433°$

27. $19.0511°$

28. $82.7272°$

In Exercises 29–36, convert each angle from degrees to radians. Express each answer as a multiple of π.

29. $20°$

30. $40°$

31. $-180°$

32. $-210°$

33. $315°$

34. $330°$

35. $-510°$

36. $-420°$

In Exercises 37–44, convert each angle from radians to degrees.

37. $\dfrac{\pi}{12}$

38. $\dfrac{3\pi}{8}$

39. $-\dfrac{5\pi}{9}$

40. $-\dfrac{3\pi}{10}$

41. $\dfrac{5\pi}{3}$

42. $\dfrac{11\pi}{6}$

43. $-\dfrac{11\pi}{4}$

44. $-\dfrac{7\pi}{3}$

In Exercises 45–48, convert each angle from degrees to radians. Round your answers to two decimal places.

45. $12°$

46. $127°$

47. $-84°$

48. $-175°$

In Exercises 49–52, convert each angle from radians to degrees. Round your answers to two decimal places.

49. 0.94

50. 5

51. -8.21

52. -6.28

In Exercises 53–58, find the angle between 0 and 2π radians that is coterminal with the given angle.

53. $-\dfrac{\pi}{4}$

54. $-\dfrac{2\pi}{3}$

55. $-\dfrac{7\pi}{4}$

56. $-\dfrac{5\pi}{3}$

57. $\dfrac{16\pi}{3}$

58. $\dfrac{23\pi}{6}$

In Exercises 59–64, find the angle between 0° and 360° that is coterminal with the given angle.

59. $-65°$

60. $-120°$

61. $-200°$

62. $-280°$

63. $700°$

64. $1270°$

In Exercises 65–70, find the complement and the supplement of the given angle or explain why the angle has no complement or supplement.

65. $47°$

66. $75°$

67. $120°$

68. $160°$

69. $210°$

70. $-50°$

In Exercises 71–90, use the following notations: θ = central angle of a circle, r = radius of a circle, s = length of the intercepted arc, v = linear velocity, ω = angular velocity, A = area of the sector of a circle, and t = time.

In each case, find the missing quantity. Find the exact answer.

71. $r = 25$ in, $s = 7$ in, $\theta = ?$

72. $r = 5$ ft, $s = 6$ ft, $\theta = ?$

73. $r = 10.5$ cm, $s = 22$ cm, $\theta = ?$

74. $r = 60$ m, $s = 120$ m, $\theta = ?$

75. $r = 3$ m, $\theta = 25°$, $s = ?$

76. $r = 0.7$ m, $\theta = 357°$, $s = ?$

77. $r = 6.5$ m, $\theta = 12$ radians, $s = ?$

78. $r = 6$ m, $\theta = \dfrac{\pi}{6}$ radians, $s = ?$

Building Skills

In Exercises 9–14, determine whether the given point (x, y) is on the unit circle.

9. $\left(\dfrac{3}{5}, \dfrac{4}{5}\right)$

10. $\left(\dfrac{12}{13}, \dfrac{5}{13}\right)$

11. $\left(\dfrac{3}{4}, -\dfrac{\sqrt{7}}{4}\right)$

12. $\left(-\dfrac{\sqrt{13}}{7}, \dfrac{6}{7}\right)$

13. $\left(\dfrac{1}{3}, \dfrac{2}{3}\right)$

14. $\left(-\dfrac{3}{4}, \dfrac{1}{4}\right)$

In Exercises 15–20, find all numbers u (if any) so that the given point (u, y) or (x, u) is on the unit circle.

15. $\left(u, \dfrac{1}{2}\right)$

16. $\left(u, -\dfrac{1}{3}\right)$

17. $\left(-\dfrac{3}{4}, u\right)$

18. $\left(-\dfrac{2}{5}, u\right)$

19. $\left(u, \dfrac{3}{2}\right)$

20. $\left(-\dfrac{4}{3}, u\right)$

In Exercises 21–26, $P(t) = (x, y)$ is the terminal point on the unit circle that corresponds to the real number t. Find the values of $\sin t$, $\cos t$, and $\tan t$.

21. $\left(\dfrac{2\sqrt{2}}{3}, \dfrac{1}{3}\right)$

22. $\left(\dfrac{1}{2}, \dfrac{\sqrt{3}}{2}\right)$

23. $\left(-\dfrac{1}{3}, \dfrac{2\sqrt{2}}{3}\right)$

24. $\left(-\dfrac{\sqrt{3}}{2}, \dfrac{1}{2}\right)$

25. $\left(\dfrac{1}{5}, -\dfrac{2\sqrt{6}}{5}\right)$

26. $\left(\dfrac{1}{2}, -\dfrac{\sqrt{3}}{2}\right)$

In Exercises 27–32, let $P(t) = (x, y)$. Find the values of $\sec t$, $\csc t$, and $\cot t$.

27. $\left(\dfrac{3}{4}, \dfrac{\sqrt{7}}{4}\right)$

28. $\left(\dfrac{5}{6}, -\dfrac{\sqrt{11}}{6}\right)$

29. $\left(-\dfrac{\sqrt{3}}{3}, \dfrac{\sqrt{6}}{3}\right)$

30. $\left(-\dfrac{2\sqrt{2}}{3}, -\dfrac{1}{3}\right)$

31. $\left(-\dfrac{2\sqrt{6}}{5}, -\dfrac{1}{5}\right)$

32. $\left(-\dfrac{2}{7}, \dfrac{3\sqrt{5}}{7}\right)$

In Exercises 33–38, find the values (if any) of the six trigonometric functions of each value of t.

33. $t = 5\pi$

34. $t = 3\pi$

35. $t = -\dfrac{3\pi}{2}$

36. $t = \dfrac{5\pi}{2}$

37. $t = \dfrac{7\pi}{2}$

38. $t = -\dfrac{9\pi}{2}$

In Exercises 39–50, find each trigonometric function value.

39. $\tan(4\pi)$

40. $\sec(7\pi)$

41. $\sin(-2\pi)$

42. $\cos(-5\pi)$

43. $\cos\left(-\dfrac{3\pi}{2}\right)$

44. $\sin\left(-\dfrac{\pi}{2}\right)$

45. $\sin(-180°)$ **46.** $\cos(360°)$ **47.** $\tan(540°)$

48. $\sec(270°)$ **49.** $\csc(-720°)$ **50.** $\cot(-630°)$

In Exercises 51–62, use Table 4.1 to find the exact value of each expression.

51. $\sin 180° - \cos 90°$ **52.** $\cos 180° - \sin 90°$

53. $\sin 30° \sec 60°$ **54.** $\sin 270° \csc 45°$

55. $2 \tan 60° \cos 30° - \cot 30° \csc 60°$

56. $3 \tan 30° \cot 60° + \csc 30° \cos 60°$

57. $\sin\dfrac{\pi}{4} - \cos\pi$ **58.** $\sec\pi + \sin\dfrac{\pi}{6}$

59. $\tan\dfrac{\pi}{4} - \cot\dfrac{\pi}{3}$ **60.** $\csc\dfrac{\pi}{2} + \cos\dfrac{\pi}{3}$

61. $\sin\dfrac{3\pi}{2} \tan\dfrac{\pi}{4}$ **62.** $\cos\dfrac{\pi}{2} \sec\pi$

In Exercises 63–92, use Table 4.1 and symmetry (see Figure 4.32) to find the exact value of each expression.

63. $\sin\left(\dfrac{7\pi}{6}\right)$ **64.** $\cos\left(\dfrac{11\pi}{6}\right)$ **65.** $\tan\left(\dfrac{2\pi}{3}\right)$

66. $\cot\left(\dfrac{3\pi}{4}\right)$ **67.** $\sec\left(\dfrac{4\pi}{3}\right)$ **68.** $\tan\left(\dfrac{7\pi}{6}\right)$

69. $\csc\left(\dfrac{11\pi}{6}\right)$ **70.** $\sin\left(\dfrac{7\pi}{4}\right)$ **71.** $\cos\left(\dfrac{5\pi}{3}\right)$

72. $\sin 120°$ **73.** $\cos 135°$ **74.** $\sec 150°$

75. $\tan 210°$ **76.** $\sin 225°$ **77.** $\cot 240°$

78. $\sin 300°$ **79.** $\cos 315°$ **80.** $\tan 330°$

81. $\sin\left(-\dfrac{5\pi}{6}\right)$ **82.** $\cos\left(-\dfrac{5\pi}{4}\right)$ **83.** $\tan\left(-\dfrac{2\pi}{3}\right)$

84. $\sec\left(-\dfrac{7\pi}{6}\right)$ **85.** $\csc\left(-\dfrac{5\pi}{3}\right)$ **86.** $\tan\left(-\dfrac{7\pi}{4}\right)$

87. $\sin(-30°)$ **88.** $\cos(-45°)$ **89.** $\tan(-120°)$

90. $\sec(-150°)$ **91.** $\csc(-240°)$ **92.** $\cot(-300°)$

Building Skills

In Exercises 9–14, a point on the terminal side of an angle θ in standard position is given. Find the exact values of $\sin\theta$, $\cos\theta$, and $\tan\theta$.

9. $(-4, 3)$ 10. $(-3, 5)$

11. $(-\sqrt{3}, -1)$ 12. $(-1, -2)$

13. $(3, 3)$ 14. $(-2, -2)$

In Exercises 15–20, a point on the terminal side of an angle θ in standard position is given. Find the exact value of $\csc\theta$, $\sec\theta$, and $\cot\theta$.

15. $(12, -5)$ 16. $(7, -2)$

17. $(7, -24)$ 18. $(5, -5)$

19. $(-\sqrt{2}, \sqrt{6})$ 20. $(-\sqrt{5}, -\sqrt{11})$

In Exercises 21–28, use the given information to find the quadrant in which each angle θ lies.

21. $\sin\theta < 0$ and $\cos\theta < 0$ 22. $\sin\theta < 0$ and $\tan\theta > 0$

23. $\sin\theta > 0$ and $\cos\theta < 0$ 24. $\tan\theta > 0$ and $\csc\theta < 0$

25. $\cos\theta > 0$ and $\csc\theta < 0$ 26. $\cos\theta < 0$ and $\cot\theta > 0$

27. $\sec\theta < 0$ and $\csc\theta > 0$ 28. $\sec\theta < 0$ and $\tan\theta > 0$

In Exercises 29–36, find the exact values of the trigonometri functions of θ from the given information.

29. $\cos\theta = -\dfrac{5}{13}$, θ in quadrant III, find $\tan\theta$.

30. $\tan\theta = -\dfrac{3}{4}$, θ in quadrant IV, find $\sin\theta$.

31. $\cot\theta = -\dfrac{3}{4}$, θ in quadrant II, find $\cos\theta$.

32. $\sec\theta = \dfrac{4}{\sqrt{7}}$, θ in quadrant IV, find $\csc\theta$.

33. $\sin\theta = \dfrac{3}{5}$, $\tan\theta < 0$, find $\sec\theta$.

34. $\cot\theta = \dfrac{3}{2}$, $\sec\theta > 0$, find $\sin\theta$.

35. $\sec\theta = 3$, $\sin\theta < 0$, find $\cot\theta$.

36. $\tan\theta = -2$, $\sin\theta > 0$, find $\cos\theta$.

In Exercises 37–48, find the reference angle for each angle.

37. $120°$ 38. $275°$ 39. $-50°$

40. $500°$ 41. $420°$ 42. $-110°$

43. $\dfrac{19\pi}{4}$ 44. $\dfrac{28\pi}{6}$ 45. $-\dfrac{3\pi}{4}$

46. $\dfrac{31\pi}{6}$ 47. $\dfrac{5\pi}{6}$ 48. $-\dfrac{15\pi}{4}$

In Exercises 49–60, use the reference angle to find the exact value of each expression.

49. $\cos 120°$

50. $\sin 315°$

51. $\tan 510°$

52. $\cot 750°$

53. $\sec 210°$

54. $\csc 300°$

55. $\sin \dfrac{7\pi}{6}$

56. $\cos \dfrac{4\pi}{3}$

57. $\sec \dfrac{15\pi}{4}$

58. $\cot \dfrac{19\pi}{4}$

59. $\sin \dfrac{29\pi}{3}$

60. $\tan \dfrac{55\pi}{3}$

In Exercises 61–66, use reciprocal and quotient identities to find the exact value of each expression.

61. Given $\sin t = \dfrac{1}{3}$ and $\cos t = \dfrac{2\sqrt{2}}{3}$, find $\tan t$.

62. Given $\sin t = -\dfrac{1}{4}$ and $\cos t = -\dfrac{\sqrt{15}}{2}$, find $\cot t$.

63. Given $\sin t = \dfrac{2}{3}$ and $\cot t = -\dfrac{\sqrt{5}}{2}$, find $\cos t$.

64. Given $\cos t = -\dfrac{2}{5}$ and $\tan t = -\dfrac{\sqrt{21}}{2}$, find $\sin t$.

65. Given $\csc t = \dfrac{7}{2}$ and $\cos t = -\dfrac{3\sqrt{5}}{7}$, find $\tan t$.

66. Given $\csc t = \dfrac{8}{3}$ and $\sec t = \dfrac{8\sqrt{55}}{55}$, find $\cot t$.

In Exercises 67–78, use fundamental identities to find the exact value of each expression.

67. $\sin 70° \csc 70°$

68. $\tan 65° \cot 65°$

69. $\cos 35° \sec 35°$

70. $\sin^2 \dfrac{2\pi}{9} + \cos^2 \dfrac{2\pi}{9}$

71. $\cos^2 47° + \sin^2 47°$

72. $\sec^2 \dfrac{5\pi}{12} - \tan^2 \dfrac{5\pi}{11}$

73. $\sin^2 \dfrac{\pi}{7} + \cos^2 \dfrac{\pi}{7} + \cot^2 \dfrac{\pi}{6}$

74. $\csc^2 32° - \cot^2 32°$

75. $\tan \dfrac{3\pi}{13} - \dfrac{\sin \dfrac{3\pi}{13}}{\cos \dfrac{3\pi}{13}}$

76. $\cot 76° - \dfrac{\cos 76°}{\sin 76°}$

77. $\cos 390° \sec 30°$

78. $\sin \dfrac{3\pi}{11} \csc \dfrac{47\pi}{11}$

In Exercises 79–86, use the Pythagorean identities to find the exact value of each expression.

79. Given $\sin t = \dfrac{2}{5}$ and $\cos t < 0$, find $\cos t$.

80. Given $\cos t = \dfrac{1}{6}$ and $\sin t < 0$, find $\sin t$.

81. Given $\sec t = -5$ and $\tan t < 0$, find $\tan t$.

82. Given $\cot t = 4$ and $\csc t < 0$, find $\csc t$.

83. Given $\tan t = -3$ and $\sec t > 0$, find $\sec t$.

In Exercises 9–28, sketch the graph of each given equation over the interval $[-2\pi, 2\pi]$.

9. $y = 2 \sin x$

10. $y = 4 \cos x$

11. $y = -\dfrac{1}{2} \sin x$

12. $y = -2 \sin x$

13. $y = \dfrac{3}{2} \cos x$

14. $y = \dfrac{5}{4} \sin x$

15. $y = \cos 2x$

16. $y = \sin 4x$

17. $y = \cos \dfrac{2}{3}x$

18. $y = \sin \dfrac{4}{3}x$

19. $y = \cos\left(x + \dfrac{\pi}{2}\right)$

20. $y = \sin\left(x + \dfrac{\pi}{4}\right)$

21. $y = \cos\left(x - \dfrac{\pi}{3}\right)$

22. $y = \sin(x - \pi)$

23. $y = 2 \cos\left(x - \dfrac{\pi}{2}\right)$

24. $y = 2 \sin\left(x + \dfrac{\pi}{3}\right)$

25. $y = \sin x + 1$

26. $y = \cos x - 2$

27. $y = -\cos x + 1$

28. $y = \sin x - 3$

In Exercises 29–36, find the amplitude, period, and phase shift of each given function.

29. $y = 5 \cos(x - \pi)$

30. $y = 3 \sin\left(x - \dfrac{\pi}{8}\right)$

31. $y = 7 \cos\left[9\left(x + \dfrac{\pi}{6}\right)\right]$

32. $y = 11 \sin\left[8\left(x + \dfrac{\pi}{3}\right)\right]$

33. $y = -6 \cos\left[\dfrac{1}{2}(x + 2)\right]$

34. $y = -8 \sin\left[\dfrac{1}{5}(x + 9)\right]$

35. $y = 0.9 \sin\left[0.25\left(x - \dfrac{\pi}{4}\right)\right]$

36. $y = \sqrt{5} \cos[\pi(x + 1)]$

Building Skills

In Exercises 9–12, find the slope–intercept form of the equation of each line that passes through the point P and makes angle θ with the positive x-axis.

9. $P = (-2, 3)$, $\theta = 45°$

10. $P = (3, -1)$, $\theta = 60°$

11. $P = (-3, -2)$, $\theta = 120°$

12. $P = (2, 5)$, $\theta = 135°$

In Exercises 13–30, graph each function over a one-period interval.

13. $y = \tan\left(x - \dfrac{\pi}{4}\right)$　　　14. $y = \tan\left(x + \dfrac{\pi}{4}\right)$

15. $y = \cot\left(x + \dfrac{\pi}{4}\right)$　　　16. $y = \cot\left(x - \dfrac{\pi}{4}\right)$

17. $y = \tan 2x$　　　18. $y = \tan\dfrac{x}{2}$

19. $y = \cot\dfrac{x}{2}$　　　20. $y = \cot 2x$

21. $y = -\tan x$　　　22. $y = -\cot x$

23. $y = 3\tan x$　　　24. $y = 3\cot x$

25. $y = \sec\dfrac{x}{2}$　　　26. $y = \sec 2x$

27. $y = \csc 3x$　　　28. $y = \csc\dfrac{x}{3}$

29. $y = \sec(x - \pi)$　　　30. $y = \csc(x - \pi)$

In Exercises 31–48, graph each function over a two-period interval.

31. $y = \tan\left[2\left(x + \dfrac{\pi}{2}\right)\right]$　　　32. $y = \tan\left[2\left(x - \dfrac{\pi}{2}\right)\right]$

33. $y = \cot\left[2\left(x - \dfrac{\pi}{2}\right)\right]$　　　34. $y = \cot\left[2\left(x + \dfrac{\pi}{2}\right)\right]$

35. $y = \tan\left[\dfrac{1}{2}(x + 2\pi)\right]$　　　36. $y = \tan\left[\dfrac{1}{2}(x - 2\pi)\right]$

37. $y = \cot\left[\dfrac{1}{2}(x - 2\pi)\right]$　　　38. $y = \cot\left[\dfrac{1}{2}(x + 2\pi)\right]$

39. $y = \sec\left[4\left(x - \dfrac{\pi}{4}\right)\right]$　　　40. $y = \sec\left[\dfrac{1}{2}\left(x - \dfrac{\pi}{2}\right)\right]$

41. $y = 3\csc\left(x + \dfrac{\pi}{2}\right)$　　　42. $y = 3\sec\left[2\left(x - \dfrac{\pi}{6}\right)\right]$

43. $y = \tan\left[\dfrac{2}{3}\left(x - \dfrac{\pi}{2}\right)\right]$　　　44. $y = 2\cot\left[2\left(x - \dfrac{\pi}{6}\right)\right]$

45. $y = -5\tan\left[2\left(x + \dfrac{\pi}{3}\right)\right]$　　46. $y = -3\cot\left[\dfrac{1}{2}\left(x - \dfrac{\pi}{3}\right)\right]$

Building Skills

In Exercises 9–30, find each exact value of y or state that y is undefined.

9. $y = \sin^{-1} 0$

10. $y = \cos^{-1} 0$

11. $y = \sin^{-1}\left(-\dfrac{1}{2}\right)$

12. $y = \cos^{-1}\left(-\dfrac{\sqrt{3}}{2}\right)$

13. $y = \arccos(-1)$

14. $y = \arcsin\dfrac{1}{2}$

15. $y = \arccos\dfrac{\pi}{2}$

16. $y = \arcsin \pi$

17. $y = \tan^{-1}\sqrt{3}$

18. $y = \tan^{-1} 1$

19. $y = \arctan(-1)$

20. $y = \arctan\left(-\dfrac{\sqrt{3}}{3}\right)$

21. $y = \cot^{-1}(-1)$

22. $y = \sin^{-1}\left(-\dfrac{\sqrt{2}}{2}\right)$

23. $y = \cos^{-1}(-2)$

24. $y = \sin^{-1}\sqrt{3}$

25. $y = \sec^{-1}(-2)$

26. $y = \csc^{-1}(-2)$

27. $y = \arcsin 1$

28. $y = \arccos 1$

29. $y = \text{arccot}(-\sqrt{3})$

30. $y = \text{arcsec}(-\sqrt{2})$

In Exercises 31–36, use the four-step procedure (page 122) to find $f^{-1}(x)$ for the given one-to-one function $f(x)$.

31. $f(x) = 2\sin x + 1, -\dfrac{\pi}{2} \le x \le \dfrac{\pi}{2}$

32. $f(x) = \dfrac{1}{2}\cos x - 1, 0 \le x \le \pi$

33. $f(x) = 3\cos(2x - 1), \dfrac{1}{2} \le x \le \dfrac{\pi}{2} + \dfrac{1}{2}$

34. $f(x) = 4\sin(3x - 2), -\dfrac{\pi}{6} + \dfrac{2}{3} \le x \le \dfrac{\pi}{6} + \dfrac{2}{3}$

35. $f(x) = \tan(x - 1) + 2, 1 - \dfrac{\pi}{2} < x < 1 + \dfrac{\pi}{2}$

36. $f(x) = \cot(x + 1) - 3, -1 \le x \le \pi - 1$

In Exercises 37–52, find each exact value of y or state that y is undefined.

37. $y = \sin\left(\sin^{-1}\dfrac{1}{8}\right)$

38. $y = \cos\left(\cos^{-1}\dfrac{1}{5}\right)$

39. $y = \tan^{-1}\left(\tan\dfrac{\pi}{7}\right)$

40. $y = \tan^{-1}\left(\tan\dfrac{\pi}{4}\right)$

41. $y = \tan(\tan^{-1} 247)$

42. $y = \tan(\tan^{-1} 7)$

43. $y = \sin^{-1}\left(\sin\dfrac{4\pi}{3}\right)$

44. $y = \cos^{-1}\left(\cos\dfrac{5\pi}{3}\right)$

45. $y = \tan^{-1}\left(\tan\dfrac{2\pi}{3}\right)$

46. $y = \tan\left(\tan^{-1}\dfrac{2\pi}{3}\right)$

47. $y = \sin^{-1}\left(\sin\dfrac{3\pi}{4}\right)$

48. $y = \cos^{-1}\left(\cos\dfrac{7\pi}{6}\right)$

49. $y = \sin(\sin^{-1}\sqrt{2})$

50. $y = \cos(\cos^{-1}(-\sqrt{2}))$

51. $y = \cos^{-1}(\cos(-\pi))$

52. $y = \sin^{-1}(\sin 1.2)$

In Exercises 53–68, use the identities on page 422 to find the exact value of each expression.

53. $\cot^{-1}\left(\dfrac{1}{\sqrt{3}}\right)$

54. $\sec^{-1}(\sqrt{2})$

55. $\csc^{-1}(2)$

56. $\csc^{-1}\left(\dfrac{2\sqrt{3}}{3}\right)$

57. $\cot^{-1}\left(-\dfrac{1}{\sqrt{3}}\right)$

58. $\cot^{-1}(-\sqrt{3})$

59. $\sin^{-1}\left(-\dfrac{\sqrt{3}}{2}\right)$

60. $\csc^{-1}\left(-\dfrac{2}{\sqrt{3}}\right)$

61. $\cos^{-1}\left(-\dfrac{1}{2}\right)$

62. $\sec^{-1}\left(-\dfrac{2}{\sqrt{3}}\right)$

63. $\sin\left[\dfrac{\pi}{3} - \sin^{-1}\left(-\dfrac{1}{2}\right)\right]$

64. $\cos\left[\dfrac{\pi}{6} + \cos^{-1}\left(-\dfrac{\sqrt{3}}{2}\right)\right]$

65. $\sin\left[\dfrac{\pi}{2} - \cos^{-1}(-1)\right]$

66. $\tan\left[\dfrac{\pi}{6} + \cot^{-1}\left(-\dfrac{1}{\sqrt{3}}\right)\right]$

67. $\sin\left[\tan^{-1}(-\sqrt{3}) + \cos^{-1}\left(-\dfrac{\sqrt{3}}{2}\right)\right]$

68. $\cos\left[\cot^{-1}(-\sqrt{3}) + \sin^{-1}\left(-\dfrac{1}{2}\right)\right]$

In Exercises 79–92, use a sketch to find each exact value of y.

79. $y = \cos\left(\sin^{-1}\dfrac{2}{3}\right)$

80. $y = \sin\left(\cos^{-1}\dfrac{3}{4}\right)$

81. $y = \sin\left[\cos^{-1}\left(-\dfrac{4}{5}\right)\right]$

82. $y = \cos\left(\sin^{-1}\dfrac{3}{5}\right)$

83. $y = \cos\left(\tan^{-1}\dfrac{5}{2}\right)$

84. $y = \sin\left(\tan^{-1}\dfrac{13}{5}\right)$

85. $y = \tan\left(\cos^{-1}\dfrac{4}{5}\right)$

86. $y = \tan\left[\sin^{-1}\left(-\dfrac{3}{4}\right)\right]$

87. $y = \sin(\tan^{-1} 4)$

88. $y = \cos(\tan^{-1} 3)$

89. $y = \tan(\sec^{-1} 2)$

90. $y = \tan\left[\csc^{-1}(-2)\right]$

91. $y = \sin(\cos^{-1} x), \; |x| < 1$

92. $\tan\left(\sin^{-1}\dfrac{x}{4}\right), \; |x| < 4$