Exercises 1.7

Exercises 1–4 give angles in degrees. Change them to radians.

1. 510° **2.** 120° **3.** −42° **4.** −150°

Exercises 5–8 give angles in radians. Change them to degrees.

5. 6.2 **6.** $-\frac{\pi}{6}$ **7.** −2 **8.** $\frac{3\pi}{4}$

In Exercises 9–14, the angle lies at the center of a circle and subtends an arc of the circle. Find the missing angle measure, circle radius, or arc length.

	Angle	Radius	Arc length
9.	$\frac{5\pi}{8}$	2	?
10.	75°	10	?
11.	$\frac{\pi}{6}$	?	3π
12.	175°	?	10
13.	?	14	7
14.	?	6	$\frac{3\pi}{2}$

Exercises 15–20 give angles in radians. Find the sine, cosine, tangent, cotangent, secant, and cosecant of each angle (when defined).

15. a) $\frac{\pi}{3}$ **b)** $-\frac{\pi}{3}$ **16. a)** 2.5 **b)** −2.5

17. a) 6.5 **b)** −6.5 **18. a)** 3.7 **b)** −3.7

19. a) $\frac{\pi}{2}$ **b)** $\frac{3\pi}{2}$ **20. a)** 0 **b)** π

Give the measure of the angles in Exercises 21–24 in radians and degrees. Give exact values whenever possible.

21. $\sin^{-1}(0.5)$ **22.** $\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

23. $\tan^{-1}(-5)$ **24.** $\cos^{-1}(0.7)$

Explain how to use a grapher in parametric mode to compute $\sin t$ and $\cos t$ for the values of t specified in Exercises 25 and 26.

25. $0, 0.5, 1, 1.5, \ldots, 6$

26. $0°, 5°, 10°, \ldots, 360°$

27. Choose appropriate viewing windows to support the graphs of $y = \sin x$, $y = \cos x$, and $y = \tan x$ given in Fig. 1.100.

28. Choose appropriate viewing windows to support the graphs of $y = \sec x$, $y = \csc x$, and $y = \cot x$ given in Fig. 1.100.

29. Choose appropriate viewing windows to display two complete periods of $y = \sec x, y = \csc x$, and $y = \cot x$ in degree mode.

30. Choose appropriate viewing windows to display two complete periods of $y = \sin x, y = \cos x$, and $y = \tan x$ in degree mode.

In Exercises 31–34, draw the graphs of both functions over the given intervals of x-values.

31. $y = \sin x$ and $y = \csc x, -\pi \le x \le \pi$

32. $y = \cos x$ and $y = \sec x, -\frac{3\pi}{2} \le x \le \frac{3\pi}{2}$

33. $y = \cos 4x$ and $y = \cos x, 0 \le x \le 2\pi$

34. $y = \sin\frac{x}{4}$ and $y = \sin x, 0 \le x \le 8\pi$

Determine the amplitude, period, horizontal shift, and vertical shift and draw a complete graph of the function in Exercises 35–38.

35. $y = 2\cos\frac{x}{3}$ **36.** $y = 2\cos 3x$

37. $y = \cot\left(2x + \frac{\pi}{2}\right)$ **38.** $y = 3\cos\left(x + \frac{\pi}{4}\right) - 2$

In Exercises 39–42, determine the period, domain, and range, and draw a complete graph of the function. Describe how the function's graph can be obtained from the graph of one of the six basic trigonometric functions.

39. $y = 3\csc(3x + \pi) - 2$ **40.** $y = 2\sin(4x + \pi) + 3$

41. $y = -3\tan(3x + \pi) + 2$

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

Solve the equations in Exercises 43–50.

43. $\cos x = -0.7$ **44.** $\sin x = 0.2$

45. $\tan x = 4$ **46.** $\sin x = -0.2$

47. $\sin x = 0.2x$ **48.** $\cos x = 0.2x$

49. $\sin x = \ln x, x > 0$ **50.** $\cos x = -0.23x^2 + 0.5$

Solve the inequalities in Exercises 51 and 52.

51. $\sin x > 0.2x$ **52.** $\cos x > 0.2x$

Use parametric mode to draw a complete graph of each circle in Exercises 53–56. Specify the viewing rectangle and the range of values for the parameter used.

53. $x^2 + y^2 = 5$ **54.** $x^2 + y^2 = 4$

55. $(x-2)^2 + (y+3)^2 = 9$

56. $(x+1)^2 + (y+3)^2 = 16$

Show that the functions in Exercises 57–60 are sinusoids, $a\sin(bx + c)$. Use a graph to conjecture the values of a, b, and c. Confirm algebraically.

57. $y = 2\sin x + 3\cos x$ **58.** $y = \sin x + \sqrt{3}\cos x$

59. $y = \sin 2x + \cos 2x$ **60.** $y = 2\sin 3x + 2\cos 3x$

61. Which equations have the same graph? Confirm algebraically.

a) $y = \sin x$ **b)** $y = \cos x$

c) $y = \sin(-x)$ **d)** $y = \cos(-x)$

e) $y = -\sin x$ **f)** $y = -\cos x$

62. Which equations have the same graph? Confirm algebraically.
 a) $y = \sin\left(x + \frac{\pi}{2}\right)$ b) $y = \sin\left(x - \frac{\pi}{2}\right)$
 c) $y = \cos\left(x + \frac{\pi}{2}\right)$ d) $y = \cos\left(x - \frac{\pi}{2}\right)$
 e) $y = \cos(x + \pi)$ f) $y = \cos(x - \pi)$
 g) $y = \sin(x + \pi)$ h) $y = \sin(x - \pi)$

Two More Useful Identities

Verify the following identities. Support graphically.

63. $\sec^2\theta = 1 + \tan^2\theta$ 64. $\csc^2\theta = 1 + \cot^2\theta$

65. What symmetries do the graphs of cosine, sine, and tangent have?

66. What symmetries do the graphs of secant, cosecant, and cotangent have?

67. Consider the function $y = \sqrt{(1 + \cos 2x)/2}$.
 a) Can x take on any real value?
 b) How large can $\cos 2x$ become? How small?
 c) How large can $(1 + \cos 2x)/2$ become? How small?
 d) What are the domain and range of $y = \sqrt{(1 + \cos 2x)/2}$?

68. Consider the function $y = \tan(x/2)$.
 a) What values of $x/2$ must be excluded from the domain of $\tan(x/2)$?
 b) What values of x must be excluded from the domain of $\tan(x/2)$?
 c) What values does $y = \tan(x/2)$ assume on the interval $-\pi < x < \pi$?
 d) What are the domain and range of $y = \tan(x/2)$?

69. *Temperature in Fairbanks, Alaska.* Find the (a) amplitude, (b) period, (c) horizontal shift, and (d) vertical shift of the general sine function

$$f(x) = 37\sin\left[\frac{2\pi}{365}(x - 101)\right] + 25.$$

70. *Temperature in Fairbanks, Alaska.* Use the equation in Exercise 69 to approximate the answers to the following questions about the temperature in Fairbanks, Alaska, shown in Fig. 1.105. Assume that the year has 365 days.
 a) What are the highest and lowest mean daily temperatures shown?
 b) What is the average of the highest and lowest mean daily temperature shown? Why is this average the vertical shift of the function?

71. What happens if you take $A = B$ in Eqs. (7)? Do these results agree with some things you already know?

72. What happens if you take $B = \pi/2$ in Eqs. (7)? Do these results agree with some things you already know?

73. What happens if you take $B = \pi/2$ in Eqs. (6)? Do these results agree with some things you already know?

74. What happens if you take $B = \pi$ in Eqs. (6)? In Eqs. (7)?

75. Evaluate $\cos 15°$ as $\cos(45° - 30°)$.

76. Evaluate $\sin 75°$ as $\sin(45° + 30°)$.

77. Evaluate $\sin\frac{7\pi}{12}$ (radians) as $\sin\left(\frac{\pi}{4} + \frac{\pi}{3}\right)$.

78. Evaluate $\cos\frac{10\pi}{24}$ (radians) as $\cos\left(\frac{\pi}{4} + \frac{\pi}{6}\right)$.

Use the Double-Angle formulas to find the exact function values in Exercises 79–82 (angles in radians).

79. $\cos^2\frac{\pi}{8}$ 80. $\cos^2\frac{\pi}{12}$

81. $\sin^2\frac{\pi}{12}$ 82. $\sin^2\frac{\pi}{8}$

83. Use graphs to support the Double-Angle formulas, Eqs. (8) and (9).

84. Prove that for all real numbers a and b, there are real numbers A and α so that $a\sin x + b\cos x = A\sin(x + \alpha)$.

85. *The tangent sum formula.* The standard formula for the tangent of the sum of two angles is

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}.$$

Derive the formula by writing $\tan(A + B)$ as

$$\frac{\sin(A + B)}{\cos(A + B)}$$

and applying Eqs. (6) and (7).

86. Derive a formula for $\tan(A - B)$ by replacing B by $-B$ in the formula for $\tan(A + B)$ in Exercise 85.

Even vs. Odd

87. a) Show that $\cot x$ is an odd function of x.
 b) Show that the quotient of an even function and an odd function is always odd (on their common domain).
 c) Describe how the graph of $y = \cot(-x)$ can be obtained from the graph of $y = \cot x$.

88. a) Show that $\csc x$ is an odd function of x.
 b) Show that the reciprocal of an odd function (when defined) is odd.
 c) Describe how the graph of $y = \csc(-x)$ can be obtained from the graph of $y = \csc x$.

89. a) Show that the product $y = \sin x \cos x$ is an odd function of x.
 b) Show that the product of an even function and an odd function is always odd (on their common domain).

90. a) Show that the function $y = \sin^2 x$ is an even function of x (even though the sine itself is odd).
 b) Show that the square of an odd function is always even.
 c) Show that the product of any two odd functions is even (on their common domain).

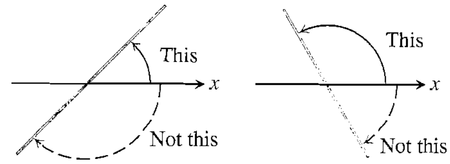
In Exercises 91 and 92, draw a complete graph that shows exactly one period.

91. $f(x) = \sin(60x)$

92. $f(x) = \cos(60\pi x)$

Angles of Inclination

The **angle of inclination** of a line that crosses the x-axis is the smallest angle that we find when we measure counterclockwise from the x-axis around the point of intersection (see figure at right). The angle of inclination of a horizontal line is taken to be 0°. Thus, angles of inclination may have any measure from 0° up to but not including 180°.



93. Show that the tangent of the angle of inclination of a line in the coordinate plane is the slope of the line.

In Exercises 94–97, find the angle of inclination of the line

94. that contains the points $(1, 5)$ and $(3, 1)$.

95. that contains the points $(-1, 2)$ and $(3, 5.5)$.

96. given by $y = 2.5x$.

97. given by $2x - 6y = 7$.

Chapter 1 Review Questions

1. How do you find the distance between two points in the xy-plane? Between a point and a line in the plane? Give examples.
2. Explain the difference between "sketch a graph" and "draw a graph." What are the basic steps in sketching a graph of an equation in x and y? Illustrate them. What does it mean for a graph to be complete? Can a grapher be used to graph any equation in x and y? Give examples.
3. Distinguish between "screen coordinates" and "Cartesian coordinates." What are viewing dimensions? What is a scale unit? What is a square viewing window?
4. What coordinate tests determine whether a graph in the xy-plane is symmetric with respect to the coordinate axes or the origin? Give examples.
5. How can you write the equation for a line if you know the coordinates of two points on the line? The slope of the line and the coordinates of one point on the line? The slope of the line and the y-intercept? Give examples.
6. What are the standard equations for lines perpendicular to the coordinate axes?
7. How are the slopes of mutually perpendicular lines related? Give examples.
8. What is a function? Give examples. How do you use a graphing utility to graph a real-valued function of a real variable? What do you have to be careful about?
9. Name some typical functions and draw their graphs.
10. What is an even function? An odd function? What symmetries do the graphs of such functions have? Give examples. Give an example of a function that is neither odd nor even.
11. When is it possible to compose one function with another? Give examples of composites and their values at various points. Does the order in which functions are composed ever matter?
12. How can you write an equation for a circle in the xy-plane if you know its radius a and the coordinates (h, k) of its center? Give examples.
13. What inequality is satisfied by the coordinates of the points that lie inside the circle of radius a centered at (h, k)? What inequality is satisfied by the coordinates of the points that lie outside the circle?
14. The graph of a function $y = f(x)$ in the xy-plane is shifted 5 units to the left, vertically stretched by a factor of 2, reflected through the x-axis, and then shifted 3 units straight up. Write an equation for the new graph.
15. What are parabolas? What are their typical equations?
16. What does it mean to solve an equation or inequality with an error of at most 0.01? Give examples.
17. Explain the meaning of algebraic representation of a problem situation, graphical representation of a problem situation, graph of a problem situation. Give examples.
18. How do you convert between degree measure and radian measure? Give examples.
19. Graph the six basic trigonometric functions as functions of radian measure. What symmetries do the graphs have?
20. What does it mean for a function $y = f(x)$ to be periodic? Give examples of functions with various periods. Name some real-world phenomena that we model with periodic functions.
21. List the Angle Sum and Difference formulas for the sine and cosine functions.
22. List the four basic Double-Angle formulas for sines and cosines.

23. Define the function $y = |x|$. Give examples of numbers and their absolute values. How are $|-a|$, $|ab|$, $|a/b|$, and $|a+b|$ related to $|a|$ and $|b|$?

24. How are absolute values used to describe intervals of real numbers?

25. What is the inverse of a relation? How are the graphs, domains, and ranges of relations and their inverses related? Give an example.

26. When is the inverse of a relation a function? How do you tell when functions are inverses of one another? Give examples.

Chapter 1 Practice Exercises

In Exercises 1–4, find the points that are symmetric to the given point (a) across the x-axis, (b) across the y-axis, and (c) across the origin.

1. $(1, 4)$ **2.** $(2, -3)$ **3.** $(-4, 2)$ **4.** $(-2, -2)$

Test the equations in Exercises 5–8 to find out whether their graphs are symmetric with respect to the axes or the origin.

5. a) $y = x$ **b)** $y = x^2$

6. a) $y = x^3$ **b)** $y = x^4$

7. a) $x^2 - y^2 = 4$ **b)** $x - y = 4$

8. a) $y = x^{1/3}$ **b)** $y = x^{2/3}$

Find equations for the vertical and horizontal lines through the points in Exercises 9–12.

9. $(1, 3)$ **10.** $(2, 0)$ **11.** $(0, -3)$ **12.** (x_0, y_0)

In Exercises 13–20, write an equation for the line that passes through point P with slope m. Then use the equation to find the line's intercepts and graph the line.

13. $P(2, 3), m = 2$ **14.** $P(2, 3), m = 0$

15. $P(1, 0), m = -1$ **16.** $P(0, 1), m = -1$

17. $P(1, -6), m = 3$ **18.** $P(-2, 0), m = 1$

19. $P(-1, 2), m = -\frac{1}{2}$ **20.** $P(3, 1), m = \frac{1}{3}$

In Exercises 21–24, find an equation for the line through the two points.

21. $(-2, -2), (1, 3)$ **22.** $(-3, 6), (1, -2)$

23. $(2, -1), (4, 4)$ **24.** $(3, 3), (-2, 5)$

In Exercises 25–28, find an equation for the line with the given slope m and y-intercept b.

25. $m = \frac{1}{2}, b = 2$ **26.** $m = -3, b = 3$

27. $m = -2, b = -1$ **28.** $m = 2, b = 0$

In Exercises 29–32, (a) find an equation for the line through P parallel to L; (b) then find an equation for the line through P perpendicular to L and (c) the distance from P to L.

29. $P(6, 0), L{:}\ 2x - y = -2$

30. $P(3, 1), L{:}\ y = x + 2$

31. $P(4, -12), L{:}\ 4x + 3y = 12$

32. $P(0, 1), L{:}\ y = -\sqrt{3}x - 3$

Sketch a complete graph of each equation in Exercises 33–40. Give the domain and range. Support your answer with a grapher.

33. $y = 2x - 3$ **34.** $y = |x| - 2$

35. $y = 2|x - 1| - 1$ **36.** $y = \sec x$

37. $y = \cos x$ **38.** $y = [x]$

39. $x = -y^2$ **40.** $y = -2 + \sqrt{1 - x}$

Find the domain and range and draw a complete graph of each function in Exercises 41–46.

41. $f(x) = x^3 + 8x^2 + x - 37$

42. $f(x) = -1 + \sqrt[3]{1 - x}$

43. $f(x) = \log_7(x - 1) + 1$

44. $f(x) = 3^{2-x} + 1$

45. $f(x) = |x - 2| + |x + 3|$

46. $f(x) = \dfrac{|x - 2|}{x - 2}$

In Exercises 47–50, describe how the graph of f can be obtained from the graph of g.

47. $f(x) = -2(x - 1)^3 + 5, g(x) = x^3$

48. $f(x) = 2\ln(-x + 1) + 3, g(x) = \ln x$

49. $f(x) = 3\sin(3x + \pi), g(x) = \sin x$

50. $f(x) = -2\sqrt[4]{3 - x} + 5, g(x) = \sqrt[4]{x}$

Exercises 51–54 specify the order in which transformations are to be applied to the graph of the given equation. Give an equation for the transformed graph in each case.

51. $y = x^2$, vertical stretch by 2, reflect through x-axis, shift right 2, shift up 3

52. $x = y^2$, horizontal shrink by 0.5, reflect through y-axis, shift left 3, shift down 2

53. $y = \frac{1}{x}$, vertical stretch by 3, shift left 2, shift up 5

54. $x^2 + y^2 = 1$, shift left 3, shift up 5

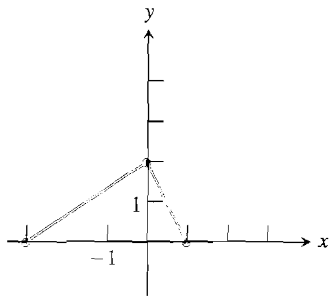
A complete graph of f is shown. Sketch a complete graph of each function in Exercises 55–58.

55. $y = f(-x)$

56. $y = -f(x)$

57. $y = -2f(x+1) + 1$

58. $y = 3f(x-2) - 2$



Determine the vertex and axis of symmetry and sketch a complete graph of each parabola in Exercises 59–60. Support your work with a grapher.

59. $y = -x^2 + 4x - 1$ **60.** $x = 2y^2 + 8y + 3$

In Exercises 61–66, say whether each function is even, odd, or neither.

61. a) $y = \cos x$ b) $y = -\cos x$ c) $y = 1 - \cos x$

62. a) $y = \sin x$ b) $y = -\sin x$ c) $y = 1 - \sin x$

63. a) $y = x^2 + 1$ b) $y = x$ c) $y = x(x^2 + 1)$

64. a) $y = x^3$ b) $y = -x$ c) $y = -x^4$

65. a) $y = \sec x$ b) $y = \tan x$ c) $y = \sec x \tan x$

66. a) $y = \csc x$ b) $y = \cot x$ c) $y = \csc x \cot x$

67. Graph the function $y = x - [x]$. Is the function periodic? If so, what is its period?

68. Graph the function $y = \lceil x \rceil - [x]$. Is the function periodic? If so, what is its period?

Graph the functions in Exercises 69–72.

69. $y = \begin{cases} \sqrt{-x}, & -4 \le x \le 0 \\ \sqrt{x}, & 0 < x \le 4 \end{cases}$

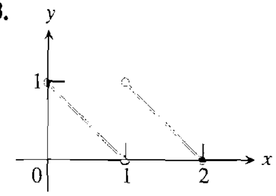
70. $y = \begin{cases} -x - 2, & -2 \le x \le -1 \\ x, & -1 < x \le 1 \\ -x + 2, & 1 < x \le 2 \end{cases}$

71. $y = \begin{cases} \sin x, & 0 \le x \le 2\pi \\ 0, & 2\pi < x \end{cases}$

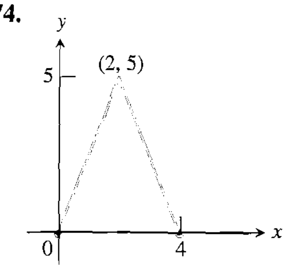
72. $y = \begin{cases} \cos x, & 0 \le x \le 2\pi \\ 0, & 2\pi < x \end{cases}$

Write formulas for the piecewise functions graphed in Exercises 73 and 74.

73.



74.



In Exercises 75 and 76, find the domains and ranges of f, g, $f+g$, $f \cdot g$, f/g, g/f. Also, find the domains and ranges of the composites $f \circ g$ and $g \circ f$.

75. $f(x) = \dfrac{1}{x}$, $g(x) = \dfrac{1}{\sqrt{x}}$

76. $f(x) = \sqrt{x}$, $g(x) = \sqrt{1-x}$

In Exercises 77–80, write an equation for the circle with the given center (h, k) and radius a.

77. $(h,k) = (1,1), a = 1$ **78.** $(h,k) = (2,0), a = 5$

79. $(h,k) = (2,-3), a = \dfrac{1}{2}$ **80.** $(h,k) = (-3,0), a = 3$

In Exercises 81–84 identify the centers and radii of the circles.

81. $(x-3)^2 + (y+5)^2 = 16$

82. $x^2 + (y-5)^2 = 2$

83. $x^2 + y^2 + 2x - 14y = 71$

84. $x^2 + y^2 + 8x + 2y = 64$

In Exercises 85 and 86 use inequalities to describe the regions.

85. a) The interior of the circle of radius 1 centered at the origin.

b) The region consisting of the circle and its interior.

86. a) The exterior of the circle of radius 2 centered at the point (1, 1).

b) The region consisting of the circle and its exterior.

Solve the equations in Exercises 87–90 algebraically. Support your answer with a grapher.

87. $|x - 1| = \dfrac{1}{2}$ **88.** $|2 - 3x| = 1$

89. $\left|\dfrac{2x}{5} + 1\right| = 7$ **90.** $\left|\dfrac{5-x}{2}\right| = 7$

Describe the intervals in Exercises 91–94 with inequalities that do not involve absolute values.

91. $|x + 2| \le \dfrac{1}{2}$ **92.** $|2x - 7| \le 3$

93. $\left|y - \dfrac{2}{5}\right| < \dfrac{3}{5}$ **94.** $\left|8 - \dfrac{y}{2}\right| < 1$

Solve the equations in Exercises 95–98.

95. $x^3 - 7x^2 + 12x - 2 = 0$

96. $4x^3 - 10x^2 + 9 = 0$

97. $2 + \log_3(x - 2) + \log_3(3 - x) = 0$

98. $\sin x = -0.7$

Solve the inequalities in Exercises 99–102 algebraically. Support your answer graphically.

99. $|1 - 2x| < 3$ **100.** $\left|\frac{2x - 1}{5}\right| \leq 1$

101. $\left|\frac{3}{x - 2}\right| < 1$ **102.** $|2 - 3x| > 1$

Solve the inequalities in Exercises 103 and 104.

103. $x^3 - 7x^2 + 12x < 2$ (See Exercise 95.) **104.** $4x^3 - 10x^2 + 9 \geq 0$ (See Exercise 96.)

105. Change from degrees to radians:
a) 30° **b)** 22° **c)** -130° **d)** -150°

106. Change from radians to degrees:
a) $\frac{3\pi}{2}$ **b)** -0.9 **c)** 2.75 **d)** $-\frac{5\pi}{4}$

Find the sine, cosine, tangent, cotangent, secant, and cosecant of each angle in Exercises 107 and 108. The angles are given in radian measure.

107. a) 1.1 **b)** -1.1 **c)** $\frac{2\pi}{3}$ **d)** $-\frac{2\pi}{3}$

108. a) $\frac{\pi}{4}$ **b)** $-\frac{\pi}{4}$ **c)** 2.7 **d)** -2.7

109. Graph the following functions on the same set of axes over the interval $0 \leq x \leq 2\pi$.
a) $y = \cos 2x$ **b)** $y = 1 + \cos 2x$ **c)** $y = \cos^2 x$

110. Graph the following functions on the same set of axes over the interval $0 \leq x \leq 2\pi$.
a) $y = \cos 2x$ **b)** $y = -\cos 2x$
c) $y = 1 - \cos 2x$ **d)** $y = \sin^2 x$

111. Find $\cos^2 \frac{\pi}{6}$
a) by finding $\cos \frac{\pi}{6}$ and squaring.
b) by using a Double-Angle formula.

112. Find $\sin^2 \frac{\pi}{4}$
a) by finding $\sin \frac{\pi}{4}$ and squaring.
b) by using a Double-Angle formula.

In Exercises 113 and 114, find $f^{-1}(x)$, and show that $f \circ f^{-1}(x) = f^{-1} \circ f(x) = x$. Draw a complete graph of f and f^{-1} in the same viewing window.

113. $f(x) = 2 - 3x$ **114.** $f(x) = (x + 2)^2, x \geq -2$

Draw a graph of the inverse relation of each function in Exercises 115 and 116. Is the inverse relation a function?

115. $y = x^3 - x$ **116.** $y = \frac{x + 2}{x - 1}$

Give the measure of the angles in Exercises 117 and 118 in radians and degrees.

117. $\sin^{-1}(0.7)$ **118.** $\tan^{-1}(-2.3)$

Draw complete graphs of the functions in Exercises 119–122. Explain why your graphs are complete.

119. $y = |\cos x|$ **120.** $y = \frac{\cos x + |\cos x|}{2}$

121. $y = \frac{|\cos x| - \cos x}{2}$ **122.** $y = \frac{\cos x - |\cos x|}{2}$

123. A 100-in. piece of wire is cut into two pieces. Each piece of wire is used to make a square wire frame. Let x be the length of one piece of the wire.
a) Determine an algebraic representation $A(x)$ for the total area of the two squares.
b) Draw a complete graph of $y = A(x)$.
c) What are the domain and range of $A(x)$?
d) What values of x make sense in the problem situation? Which portion of the graph in part (b) is a graph of the problem situation?
e) Use a graph to determine the length of the two pieces of wire if the total area is 400 in.^{2} Confirm your answer algebraically.
f) Use a graph to determine the length of the two pieces of wire if the total area is a maximum.

124. Equal squares of side length x are removed from each corner of a 20- by 30-in. piece of cardboard, and the sides are turned up to form a box with no top.
a) Write the volume V of the box as a function of x.
b) Draw a complete graph of $y = V(x)$.
c) What are the domain and range of $y = V(x)$?
d) What values of x make sense in the problem situation? Draw a graph of the problem situation.
e) Use ZOOM-IN to determine x so that the box has maximum volume. What is the maximum volume?
f) Use a graph to determine the dimensions of a box with volume 750 in.^{3}

125. Draw a complete graph of the equation $|x| + |y| = 1$.