

1.1 Find the measures of two angles, one positive and one negative, that are coterminal with the given angle.

1) 162°

2) -132°

3) $\frac{\pi}{6}$

For the given angle, name the quadrant in which the terminal side lies.

4) 153°

5) -686°

Find the angle of smallest possible positive measure that is coterminal with the given angle.

6) -72°

7) 662°

Convert the angle to decimal degrees and round to the nearest hundredth of a degree.

8) $175^\circ 58' 13''$

Convert the angle to degrees, minutes, and seconds.

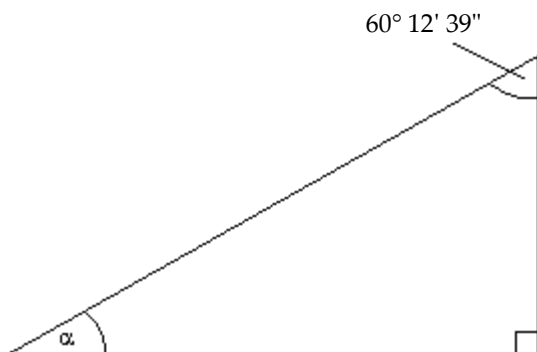
9) -47.46°

Perform the calculation. Express the answer in degree–minutes–seconds format.

10) $62^\circ 24' - 45^\circ 30'$

Find the degree measure of the angle α in the figure.

11)



1.2 Convert the angle to radians. Leave as a multiple of π .

12) -45°

Convert the degree measure to radian measure. Use the value of π found on a calculator and round answers to three decimal places.

13) 32.7°

14) $16^\circ 28' 7''$

Convert the radian measure to degree measure. Use the value of π found on a calculator and round answers to two decimal places.

15) $\frac{7\pi}{10}$

16) -2.9757

Find the measures of two angles, one positive and one negative, that are coterminal with the given angle.

17) $\frac{2\pi}{5}$

For the given angle, name the quadrant in which the terminal side lies.

18) -682°

19) $\frac{7\pi}{12}$

20) 27.1

Draw the angle in standard position.

21) $\frac{2\pi}{3}$

22) $\frac{7\pi}{4}$

23) $-\frac{7\pi}{6}$

Find the measure in radians of the smallest possible angle that is coterminal with the given angle. For angles given in terms of π , express the answer in terms of π . Otherwise, round to the nearest hundredth.

24) $\frac{15\pi}{7}$

Perform the indicated operation.

25) $-\frac{\pi}{11} + 2\pi$

Find the length of the arc intercepted by the given central angle α in a circle of radius r .

26) $\alpha = \frac{4\pi}{5}$, $r = 24.1$ m

Find the radius of a circle with central angle α intercepting an arc of length s .

27) $\alpha = 1.5$ radians, $s = 9$ in.

Find the area of a sector with the given central angle α in a circle of radius r .

28) $\alpha = 90^\circ$, $r = 8$ cm

Solve the problem.

29) The minute hand of a clock is 7 inches long. What distance does its tip move in 29 minutes?

1.3 Solve.

30) An engine is "turning over" at an angular velocity of 2100 rpm. Express this angular velocity in rad/min.

Solve the problem.

31) A pulley of radius 7 cm rotates 9 times in 32 sec. Find the angular velocity of the pulley.

32) A wheel is rotating at 3 radians/sec, and the wheel has a 73-inch diameter. To the nearest foot per minute, what is the linear velocity of a point on the rim?

33) A wheel with a 15-inch diameter is turning at the rate of 48 revolutions per minute. To the nearest inch per minute, what is the linear velocity of a point on the rim?

1.4 Given that α is an angle in standard position whose terminal side contains the given point, provide the exact value of the indicated function.

34) (6, 8); $\cos \alpha$

35) (5, 6); $\sin \alpha$

36) (-7, 5) Find $\tan \alpha$.

Find the exact value of the following expression without using a calculator.

37) $\sin\left(\frac{5\pi}{4}\right)$

38) $\cos\left(\frac{4\pi}{3}\right)$

39) $\tan\left(\frac{\pi}{3}\right)$

40) $\sec\left(\frac{\pi}{4}\right)$

41) $\sec 120^\circ$

Find the exact value of the expression.

42) $\frac{\sin(5\pi/4)}{\cos(5\pi/4)}$

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

Use a calculator to find the function value to four decimal places.

44) $\cos(42.7^\circ)$

45) $\sin(3.13)$

Find the exact value of the expression. Do not use a calculator.

46) $\frac{\cos \theta}{8}$, if $\theta = 45^\circ$

47) $\tan \alpha$, if $\sin \alpha = -\frac{3}{5}$ and $\cos \alpha < 0$

Find the quadrant that contains the terminal side of angle α .

48) $\csc \alpha > 0$ and $\sec \alpha > 0$

49) $\cos \alpha > 0$ and $\csc \alpha < 0$

50) $\csc \alpha < 0$ and $\cot \alpha > 0$

1.5 Solve the problem.

51) Find the acute angle α (in degrees) that satisfies the equation $\alpha = \sin^{-1}\left(\frac{\sqrt{2}}{2}\right)$.

Evaluate each expression without using a calculator. Give the result in degrees.

52) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

53) $\cos^{-1}\left(\frac{\sqrt{2}}{2}\right)$

54) $\csc^{-1}(-2)$

55) $\tan^{-1}(1)$

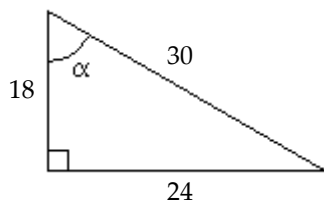
Use a calculator to find the acute angle α (to the nearest tenth of a degree) that satisfies the equation.

56) $\sin \alpha = 0.31148755$

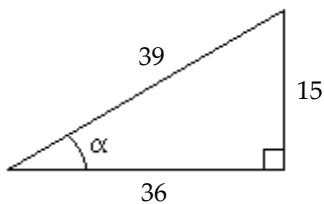
57) $\alpha = \cos^{-1}(0.26927809)$

Evaluate the function requested. Write your answer as a fraction in lowest terms.

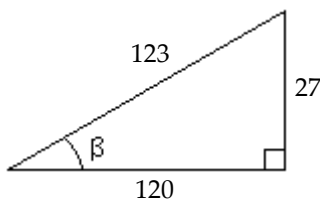
58) Find $\sin \alpha$.



59) Find $\tan \alpha$.



60) Find $\cos \beta$.



Solve the right triangle with the given sides and angles.

61) $a = 3.0, \beta = 28.1^\circ$

62) $\beta = 43.2^\circ, c = 2.2$

Solve the problem.

63) The angle of elevation from a point on the ground to the top of a tower is $38^\circ 39'$. The angle of elevation from a point 111 feet farther back from the tower is $27^\circ 36'$. Find the height of the tower (to the nearest foot).

64) When sitting atop a tree and looking down at his pal Joey, the angle of depression of Mack's line of sight is $31^\circ 9'$. If Joey is known to be standing 33 feet from the base of the tree, how tall is the tree (to the nearest foot)?

65) The chairlift at a ski resort has a vertical rise of 3400 feet. If the length of the ride is 1.8 miles, what is the average angle of elevation of the lift (to the nearest tenth of a degree)?

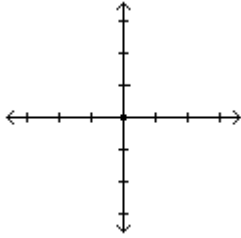
1.6 Solve the problem.

66) Find $\sin(\alpha)$, given that $\cos(\alpha) = \frac{2}{7}$ and α is in quadrant IV.

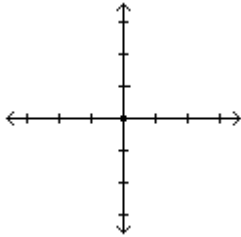
67) Find $\sin(\alpha)$, given that $\cos(\alpha) = \frac{6}{7}$ and $\sin(\alpha) > 0$.

Draw the angle having the given radian measure.

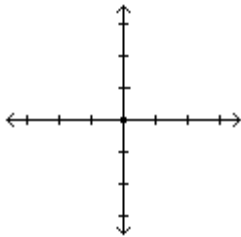
68) $\frac{\pi}{3}$



69) $-\frac{5\pi}{6}$



70) $-\frac{5\pi}{4}$



Find the reference angle for the given angle.

71) 434°

72) -362°

Use reference angles to find the exact value of the expression.

73) $\sin\left(\frac{5\pi}{4}\right)$

74) $\tan\frac{-5\pi}{6}$

75) $\tan 750^\circ$

$$76) \csc \frac{-2\pi}{3}$$

Determine if the equation is true or false.

$$77) \sin(66^\circ) = \sin(426^\circ)$$

$$78) \sin\left(\frac{7\pi}{9}\right) = \sin\left(-\frac{25\pi}{9}\right)$$

Solve.

79) The ferris wheel at an amusement park is 47 ft in diameter, turns at a rate of 7 rpm, and is 3 ft off the ground at the low point. What is the height of a passenger 20 seconds into the ride?

2.1 Find the exact value of the trigonometric function.

$$80) \sin \frac{5\pi}{3}$$

$$81) \cos\left(-\frac{5\pi}{4}\right)$$

$$82) \tan\left(-\frac{2\pi}{3}\right)$$

$$83) \sec \frac{3\pi}{4}$$

$$84) \csc \frac{4\pi}{3}$$

$$85) \cot \frac{-11\pi}{6}$$

Solve the problem.

86) Find the coordinates of $(\pi/3, -5)$ after it is moved $\pi/3$ units to the left.

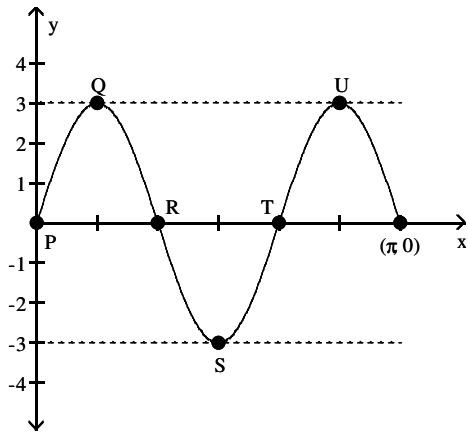
87) Find the coordinates of $(\pi, -8)$ after it is moved $\pi/6$ units to the right and 1 units upward.

Determine the midpoint that lies between the two given points.

88) $(8\pi, 1)$ and $(4\pi, 9)$

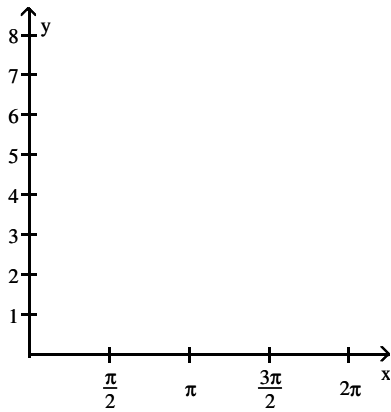
Determine the coordinates of the specified point.

89) Point T



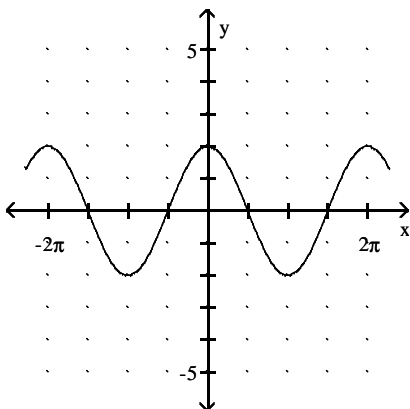
Graph the function over a one-period interval.

90) $y = 4 \sin(x - \pi) + 4$



Determine the equation of the function that is graphed.

91)



2.2 Find the amplitude, period, or phase shift as specified.

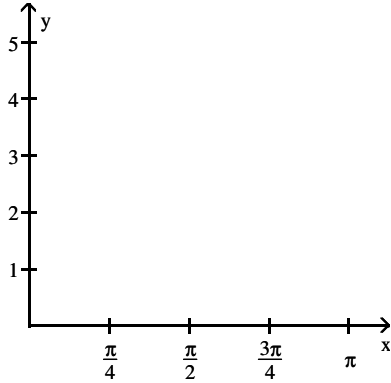
92) Find the amplitude of $y = 4 \cos\left(3x + \frac{\pi}{2}\right)$.

93) Find the period of $y = 4 \sin\left(6x + \frac{\pi}{2}\right)$.

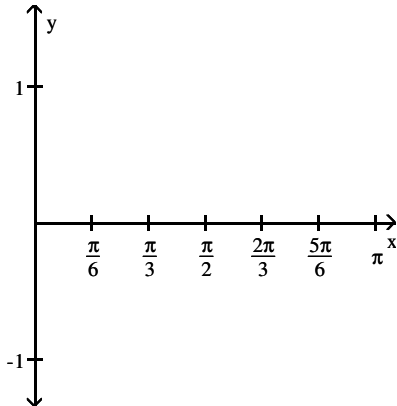
94) Find the phase shift of $y = 5 + 3 \sin\left(2x + \frac{\pi}{2}\right)$.

Graph the function over a one-period interval.

95) $y = \frac{1}{3} \sin(2x - \pi) + 2$

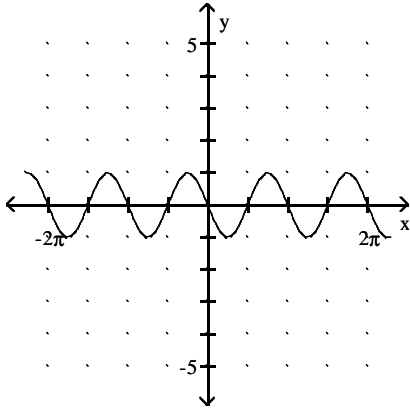


96) $y = \frac{1}{2} \cos\left(4\left[x - \frac{\pi}{3}\right]\right)$

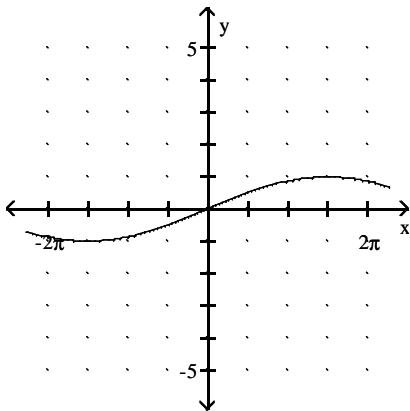


Determine the equation of the function that is graphed.

97)



98)



Solve the problem.

99) Let $f(x) = \cos x$, $g(x) = x - \pi/2$, and $h(x) = 2x$. Find $f(g(\pi/2))$.

100) The voltage E in an electrical circuit is given by $E = 2.8 \cos 50\pi t$, where t is time measured in seconds. Find the period.

101) The voltage E in an electrical circuit is given by $E = 2.2 \cos 160\pi t$, where t is time measured in seconds. Find the frequency of the function (that is, find the number of cycles or periods completed in one second).

2.3 Find the exact value for the expression.

102) $\sec \frac{3\pi}{4}$

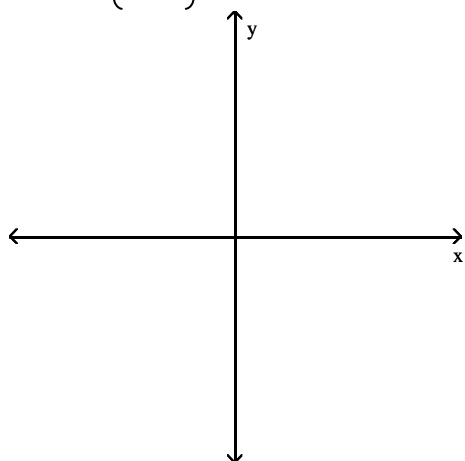
103) $\csc \frac{4\pi}{3}$

Use a calculator to find the function value to four decimal places.

104) $\csc (4.04)$

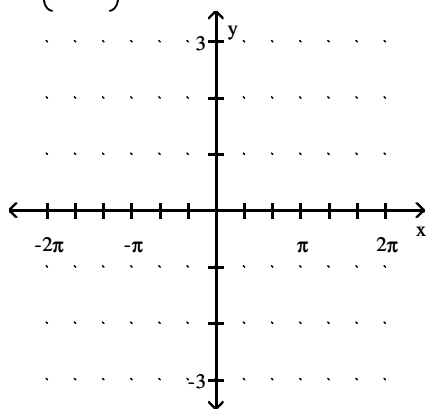
Indicate the period and the range of the given function.

$$105) y = 2 \sec\left(x + \frac{\pi}{3}\right)$$

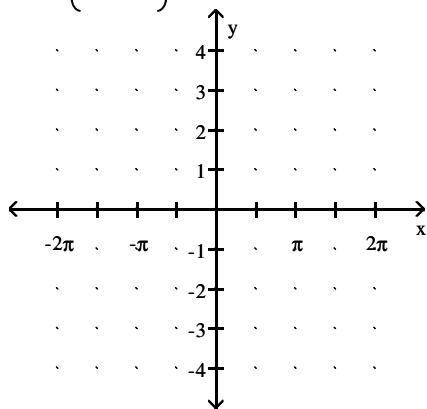


Graph the function.

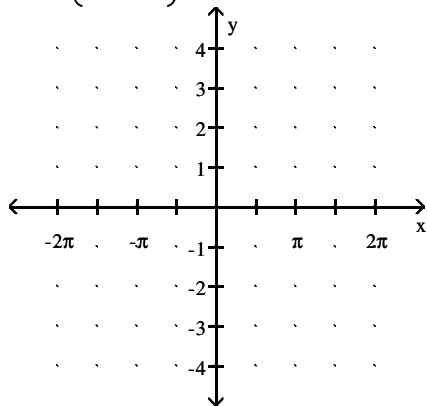
$$106) y = \csc\left(x - \frac{\pi}{5}\right)$$



$$107) y = \frac{5}{2} \csc\left(3x + \frac{\pi}{3}\right)$$



$$108) y = \frac{5}{6} \sec\left(\frac{5}{4}x + \frac{\pi}{5}\right)$$



Find the equation for the curve in its final position.

109) The graph of $y = \cot(x)$ is shifted a distance of $\pi/6$ to the right, stretched by a factor of 2, translated 7 units upward, then reflected in the x -axis.

Find the equations for all vertical asymptotes for the function.

110) $y = \csc(4x + \pi)$

111) $y = \sec\left(\frac{x}{3}\right)$

2.4 Find the exact value for the expression.

112) $\tan\frac{-2\pi}{3}$

113) $\cot\frac{3\pi}{4}$

Use a calculator to find the function value to four decimal places.

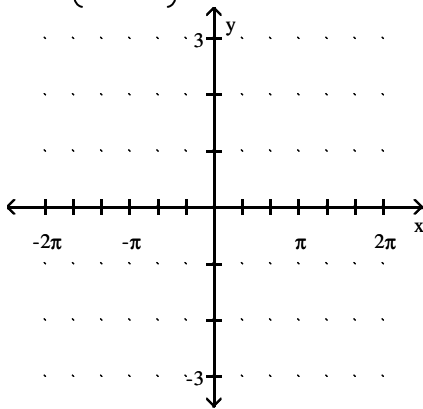
114) $\cot(4.32)$

Determine the period of the function.

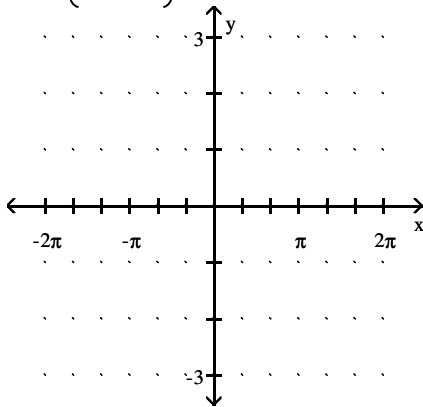
115) $y = \cot\frac{13\pi}{4}$

Graph the function.

$$116) y = \frac{1}{3} \tan\left(\frac{3}{5}x + \frac{\pi}{5}\right)$$



$$117) y = \frac{2}{3} \cot\left(\frac{2}{5}x + \frac{\pi}{2}\right)$$



Find the equation for the curve in its final position.

- 118) The graph of $y = \cot(x)$ is shifted a distance of $\pi/2$ to the left, reflected in the x -axis, then translated 7 units upward.

Answer Key

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1) $522^\circ, -198^\circ$

2) $228^\circ, -492^\circ$

3) $\frac{13\pi}{6}, -\frac{11\pi}{6}$

4) II

5) I

6) 288°

7) 302°

8) 175.97°

9) $-47^\circ 27' 36''$

10) $16^\circ 54'$

11) $29^\circ 47' 21''$

12) $-\frac{\pi}{4}$

13) 0.571

14) 0.287

15) 126°

16) -170.49°

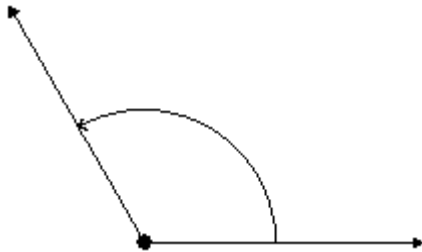
17) $\frac{12\pi}{5}, -\frac{8\pi}{5}$

18) I

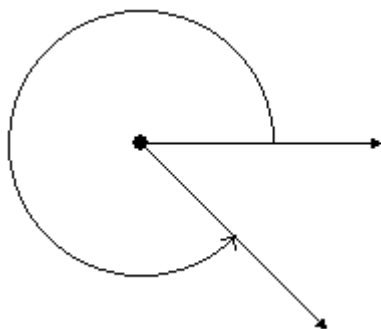
19) II

20) II

21)



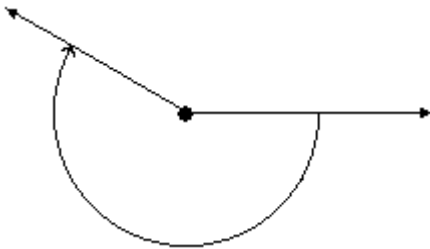
22)



Answer Key

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23)



24) $\frac{\pi}{7}$

25) $-\frac{\pi}{11}$

26) 60.6 m

27) 6 in.

28) 16π sq cm

29) $\frac{203}{30}\pi$ in.

30) 4200π rad/min

31) $\frac{9\pi}{16}$ radians/sec

32) 548 ft/min

33) 2262 in./min

34) $\frac{3}{5}$

35) $\frac{6}{\sqrt{61}}$

36) $-\frac{5}{7}$

37) $-\frac{\sqrt{2}}{2}$

38) $-\frac{1}{2}$

39) $\sqrt{3}$

40) $\sqrt{2}$

41) -2

42) 1

43) $\frac{1}{2}$

44) 0.7349

45) 0.0116

46) $\frac{\sqrt{2}}{16}$

47) $\frac{3}{4}$

48) I

49) IV

Answer Key

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50) III

51) 45°

52) 60°

53) 45°

54) -30°

55) 45°

56) 18.1°

57) 74.4°

58) $\frac{4}{5}$

59) $\frac{5}{12}$

60) $\frac{40}{41}$

61) $\alpha = 61.9^\circ$, $b = 1.6$, $c = 3.4$

62) $a = 1.6$, $\alpha = 46.8^\circ$, $b = 1.5$

63) 168 ft

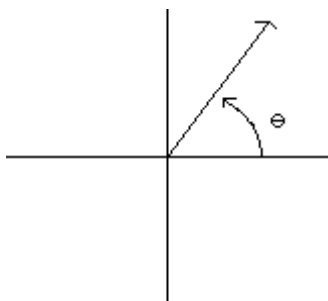
64) 20 ft

65) 21°

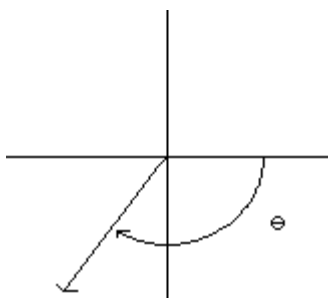
66) $-\frac{\sqrt{45}}{7}$

67) $\frac{\sqrt{13}}{7}$

68)



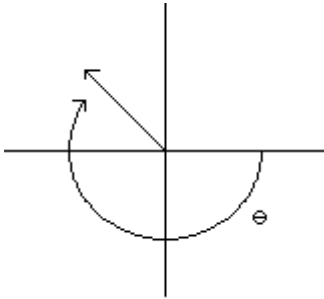
69)



Answer Key

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70)



71) 74°

72) 2°

73) $-\frac{\sqrt{2}}{2}$

74) $\frac{\sqrt{3}}{3}$

75) $\frac{\sqrt{3}}{3}$

76) $-\frac{2\sqrt{3}}{3}$

77) True

78) False

79) 38 ft

80) $-\frac{\sqrt{3}}{2}$

81) $-\frac{\sqrt{2}}{2}$

82) $\sqrt{3}$

83) $-\sqrt{2}$

84) $-\frac{2\sqrt{3}}{3}$

85) $\sqrt{3}$

86) (0, -5)

87) $(7\pi/6, -7)$

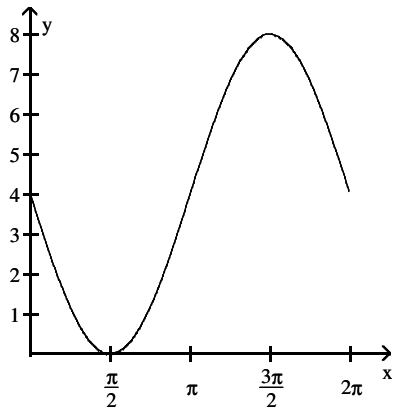
88) $(6\pi, 5)$

89) $\left(\frac{2\pi}{3}, 0\right)$

Answer Key

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90)



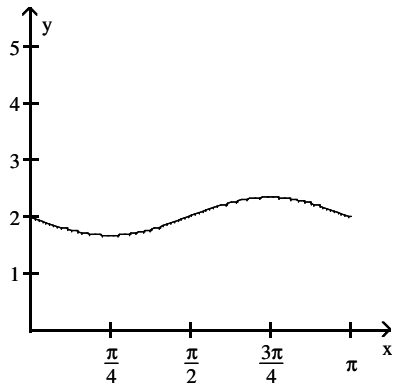
91) $y = 2 \cos x$

92) 4

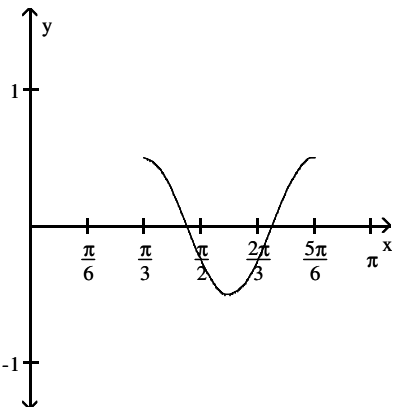
93) $\frac{\pi}{3}$

94) $-\frac{\pi}{4}$

95)



96)



97) $y = \sin(-2x)$

98) $y = \sin\left(\frac{1}{3}x\right)$

Answer Key

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99) 1

100) $\frac{1}{25}$

101) 80

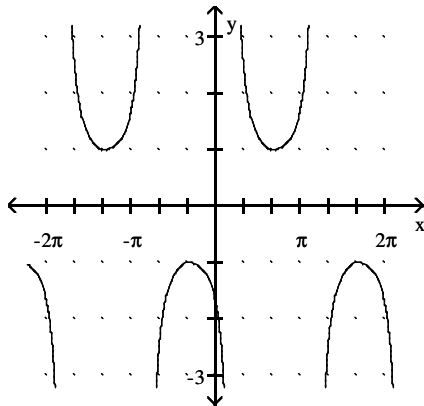
102) $-\sqrt{2}$

103) $-\frac{2\sqrt{3}}{3}$

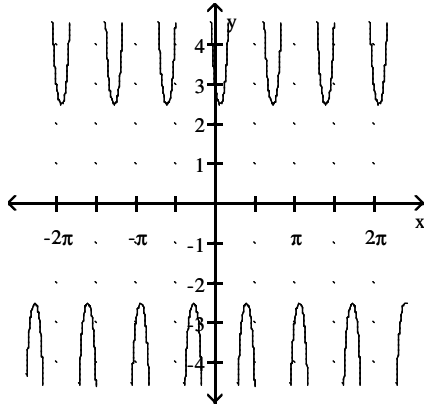
104) -1.2782

105) $P = 2\pi$; Range: $|y| \geq 2$

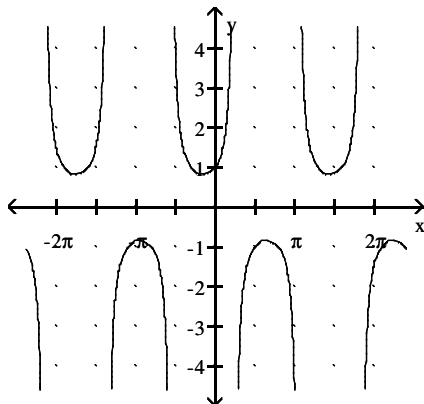
106)



107)



108)



Answer Key

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109) $y = -2 \cot\left(x - \frac{\pi}{6}\right) - 7$

110) $x = \frac{k\pi}{4}$

111) $x = \frac{3\pi}{2} + 3k\pi$

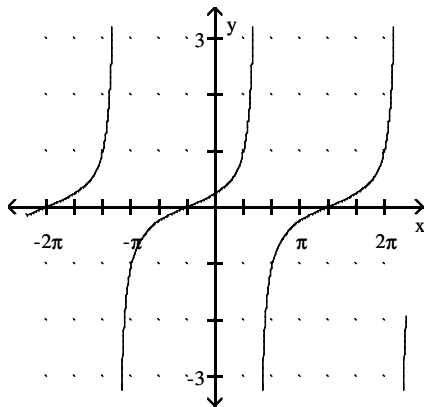
112) $\sqrt{3}$

113) -1

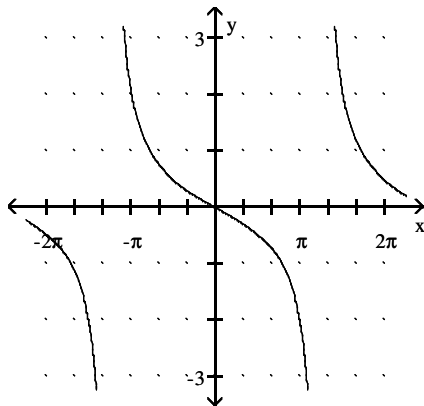
114) 0.4139

115) 1

116)



117)



118) $y = -\cot\left(x + \frac{\pi}{2}\right) + 7$