

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Convert the angle in degrees to radians. Express answer as a multiple of  $\pi$ .

1)  $-480^\circ$

A)  $-\frac{9\pi}{4}$  radians

B)  $-\frac{7}{3}\pi$  radians

C)  $-\frac{7\pi}{2}$  radians

D)  $-\frac{8\pi}{3}$  radians

1) \_\_\_\_\_

Convert the angle in radians to degrees.

2)  $\frac{11}{4}\pi$

A)  $164^\circ$

B)  $65\pi^\circ$

C)  $495^\circ$

D)  $990^\circ$

2) \_\_\_\_\_

Find a positive angle less than  $360^\circ$  or  $2\pi$  that is coterminal with the given angle.

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

A)  $-\frac{17\pi}{5}$

B)  $\frac{7\pi}{5}$

C)  $\frac{12\pi}{5}$

D)  $\frac{3\pi}{5}$

3) \_\_\_\_\_

Use the unit circle to find the value of the trigonometric function.

4)  $\csc \frac{3\pi}{2}$

A)  $-1$

B)  $0$

C) undefined

D)  $1$

4) \_\_\_\_\_

Use periodic properties of the trigonometric functions to find the exact value of the expression.

5)  $\sin \frac{22\pi}{3}$

A)  $\frac{\sqrt{3}}{2}$

B)  $-1$

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

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

5) \_\_\_\_\_

Find a cofunction with the same value as the given expression.

6)  $\cos 39^\circ$

A)  $\sin 51^\circ$

B)  $\csc 51^\circ$

C)  $\sin 39^\circ$

D)  $\sec 39^\circ$

6) \_\_\_\_\_

Solve the problem.

7) A surveyor is measuring the distance across a small lake. He has set up his transit on one side of the lake 150 feet from a piling that is directly across from a pier on the other side of the lake. From his transit, the angle between the piling and the pier is  $50^\circ$ . What is the distance between the piling and the pier to the nearest foot?

A) 115 feet

B) 179 feet

C) 126 feet

D) 96 feet

7) \_\_\_\_\_

Find the exact value of the indicated trigonometric function of  $\theta$ .

8)  $\sin \theta = -\frac{2}{9}$ ,  $\tan \theta > 0$

Find  $\sec \theta$ .

A)  $-\frac{2\sqrt{77}}{77}$

B)  $-\frac{\sqrt{77}}{9}$

C)  $-\frac{9\sqrt{77}}{77}$

D)  $\frac{\sqrt{9}}{2}$

8) \_\_\_\_\_

Find the reference angle for the given angle.

9)  $-\frac{11\pi}{12}$

A)  $\frac{13\pi}{12}$

B)  $\frac{11\pi}{12}$

C)  $\frac{\pi}{12}$

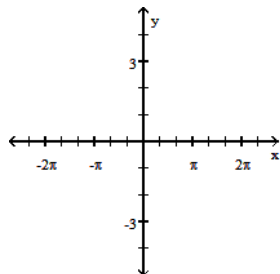
D)  $\frac{\pi}{24}$

9) \_\_\_\_\_

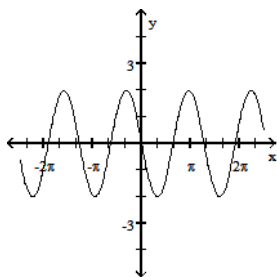
Graph the following functions.

10)  $y = -2 \sin \frac{1}{2}x$

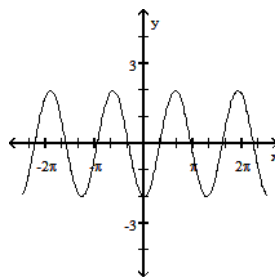
10) \_\_\_\_\_



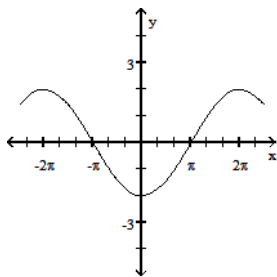
A)



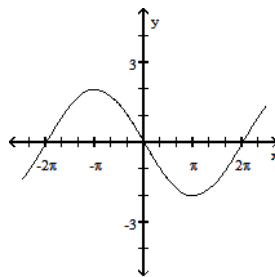
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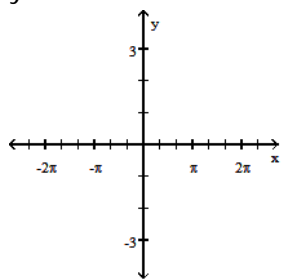
C)



D)

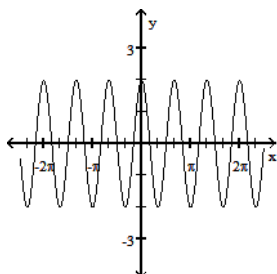


11)  $y = 2 \cos 3x$

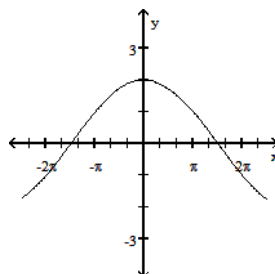


11) \_\_\_\_\_

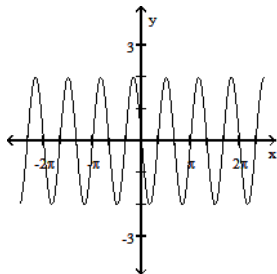
A)



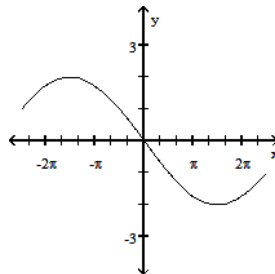
B)



C)

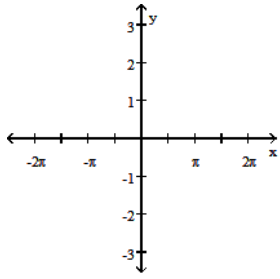


D)

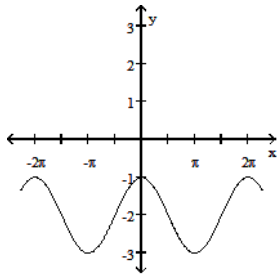


12)  $y = \sin x - 2$

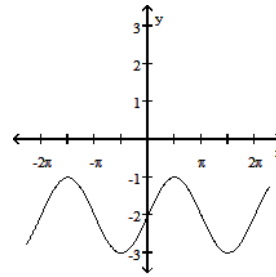
12) \_\_\_\_\_



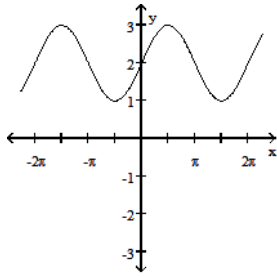
A)



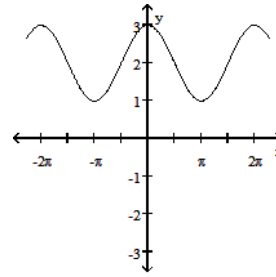
B)



C)

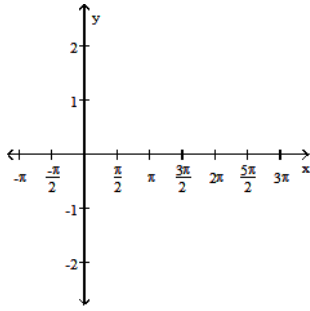


D)

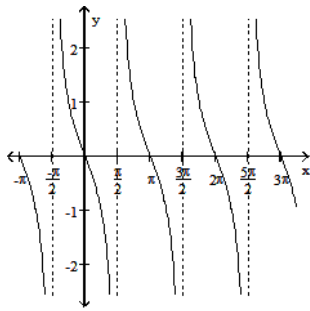


13)  $y = -\tan x$

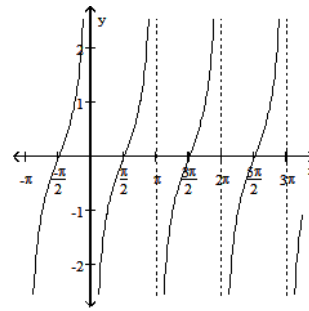
13) \_\_\_\_\_



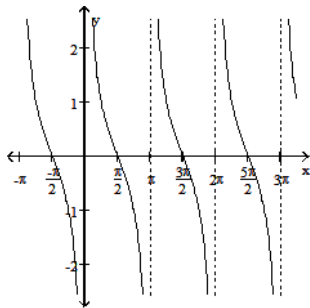
A)



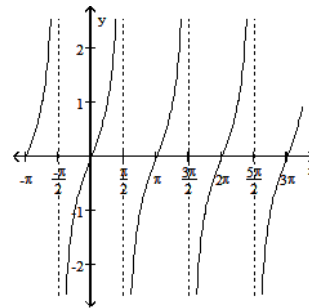
B)



C)



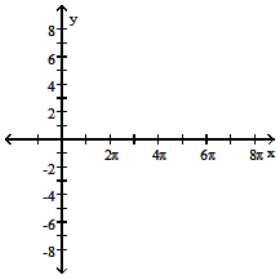
D)



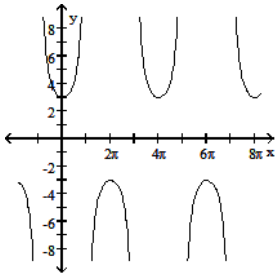
Graph the function.

14)  $y = 3 \sec \frac{x}{2}$

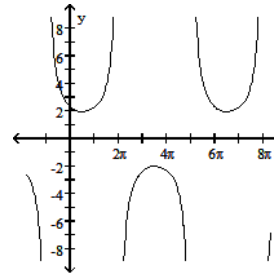
14) \_\_\_\_\_



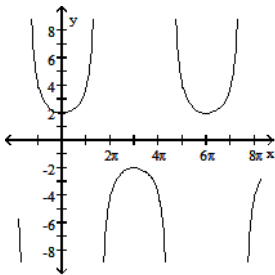
A)



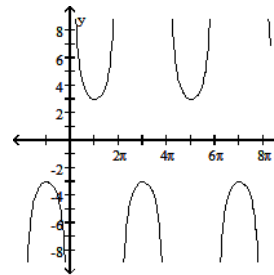
B)



C)



D)



Find the exact value of the expression.

15)  $\sin^{-1} \frac{\sqrt{3}}{2}$

15) \_\_\_\_\_

A)  $\frac{\pi}{4}$

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

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

D)  $\frac{3\pi}{4}$

Use a sketch to find the exact value of the expression.

16)  $\cot\left(\sin^{-1}\frac{\sqrt{2}}{2}\right)$

16) \_\_\_\_\_

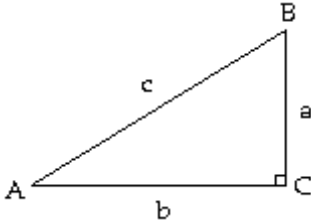
A) 2

B)  $\frac{\sqrt{2}}{2}$

C)  $\sqrt{2}$

D) 1

Solve the right triangle shown in the figure. Round lengths to one decimal place and express angles to the nearest tenth of a degree.



17)  $A = 59^\circ, c = 48.4$

17) \_\_\_\_\_

A)  $B = 31^\circ, a = 24.9, b = 41.5$

B)  $B = 59^\circ, a = 41.5, b = 24.9$

C)  $B = 31^\circ, a = 41.5, b = 24.9$

D)  $B = 59^\circ, a = 24.9, b = 41.5$

Using a calculator, solve the following problems. Round your answers to the nearest tenth.

18) A ship is 21 miles west and 49 miles south of a harbor. What bearing should the captain set to sail directly to harbor?

18) \_\_\_\_\_

A) N  $111.8^\circ$  E

B) N  $66.8^\circ$  E

C) N  $113.2^\circ$  E

D) N  $23.2^\circ$  E

An object is attached to a coiled spring. The object is pulled down (negative direction from the rest position) and then released. Write an equation for the distance of the object from its rest position after  $t$  seconds.

19) amplitude = 11 cm; period =  $3\pi$  seconds

19) \_\_\_\_\_

A)  $d = -11 \cos \frac{2}{3}\pi t$

B)  $d = -11 \sin \frac{2}{3}\pi t$

C)  $d = -11 \cos \frac{2}{3}t$

D)  $d = -3 \cos \frac{2}{11}t$

Solve the triangle. Round lengths to the nearest tenth and angle measures to the nearest degree.

20)  $A = 38^\circ$

20) \_\_\_\_\_

$B = 30^\circ$

$a = 42.0$

A)  $C = 113^\circ, b = 63.3, c = 34.1$

B)  $C = 113^\circ, b = 34.1, c = 63.3$

C)  $C = 112^\circ, b = 63.3, c = 34.1$

D)  $C = 112^\circ, b = 34.1, c = 63.3$

Two sides and an angle (SSA) of a triangle are given. Determine whether the given measurements produce one triangle, two triangles, or no triangle at all. Solve each triangle that results. Round lengths to the nearest tenth and angle measures to the nearest degree.

21)  $B = 24^\circ, b = 2, a = 20$

21) \_\_\_\_\_

A)  $A = 22^\circ, C = 133^\circ, c = 22$

B)  $A = 20^\circ, C = 135^\circ, c = 19$

C) no triangle

D)  $A = 23^\circ, C = 134^\circ, c = 23.5$

22)  $B = 13^\circ, b = 19.0, a = 42.23$

A) no triangle

B)  $A = 150^\circ, C = 17^\circ, c = 24.7$

22) \_\_\_\_\_

C)  $A_1 = 30^\circ, C_1 = 137^\circ, c_1 = 57.6;$

$A_2 = 150^\circ, C_2 = 17^\circ, c_2 = 24.7$

D)  $A = 30^\circ, C = 137^\circ, c = 57.6$

Solve the triangle. Round lengths to the nearest tenth and angle measures to the nearest degree.

23)  $b = 2, c = 3, A = 95^\circ$

A)  $a = 4.7, B = 33^\circ, C = 52^\circ$

C)  $a = 2.7, B = 52^\circ, C = 33^\circ$

B)  $a = 3.7, B = 33^\circ, C = 52^\circ$

D)  $a = 3.7, B = 52^\circ, C = 33^\circ$

23) \_\_\_\_\_

Use Heron's formula to find the area of the triangle. Round to the nearest square unit.

24)  $a = 10$  meters,  $b = 18$  meters,  $c = 10$  meters

A) 21 square meters

C) 41 square meters

B) 82 square meters

D) 84 square meters

24) \_\_\_\_\_

Find the unit vector that has the same direction as the vector  $v$ .

25)  $v = 4i + 3j$

A)  $u = \frac{4}{5}i + \frac{3}{5}j$

B)  $u = \frac{5}{4}i + \frac{5}{3}j$

C)  $u = -\frac{3}{5}i - \frac{4}{5}j$

D)  $u = 20i + 15j$

25) \_\_\_\_\_

Write the vector  $v$  in terms of  $i$  and  $j$  whose magnitude  $\|v\|$  and direction angle  $\theta$  are given.

26)  $\|v\| = 10, \theta = 120^\circ$

A)  $v = -5i + 5\sqrt{3}j$

C)  $v = -5\sqrt{2}i + 5\sqrt{2}j$

B)  $v = 5i - 5\sqrt{3}j$

D)  $v = 5\sqrt{3}i - 5j$

26) \_\_\_\_\_

Find the specified vector or scalar.

27)  $u = -9i - 4j, v = -4i + 8j$ ; Find  $u + v$ .

A)  $-14i + 4j$

B)  $5i + 4j$

C)  $-13i + 4j$

D)  $-5i - 14j$

27) \_\_\_\_\_

Use the given vectors to find the specified scalar.

28)  $u = 12i + 8j$  and  $v = 15i - 5j$ ; Find  $u \cdot v$ .

A) 180

B) 220

C) -40

D) 140

28) \_\_\_\_\_

Find the angle between the given vectors. Round to the nearest tenth of a degree.

29)  $u = -i + 6j, v = 2i - 4j$

A)  $45.9^\circ$

B)  $1^\circ$

C)  $162.9^\circ$

D)  $72.9^\circ$

29) \_\_\_\_\_

Use the dot product to determine whether the vectors are parallel, orthogonal, or neither.

30)  $v = 4i + 3j, w = 3i - 4j$

A) parallel

B) orthogonal

C) neither

30) \_\_\_\_\_

The rectangular coordinates of a point are given. Find polar coordinates of the point. Express  $\theta$  in radians.

31)  $(6\sqrt{3}, 6)$

A)  $\left(6, \frac{\pi}{6}\right)$

B)  $\left(6, \frac{\pi}{3}\right)$

C)  $\left(12, \frac{\pi}{3}\right)$

D)  $\left(12, \frac{\pi}{6}\right)$

31) \_\_\_\_\_



Convert the polar equation to a rectangular equation.

32)  $r = -4 \cos \theta$

A)  $x = -4$

C)  $(x - 2)^2 + y^2 = 16$

B)  $(x + 2)^2 + y^2 = 4$

D)  $x^2 + y^2 = 4$

32) \_\_\_\_\_

Find the x-intercepts of the polynomial function. State whether the graph crosses the x-axis, or touches the x-axis and turns around, at each intercept.

33)  $f(x) = (x + 1)(x - 6)(x - 1)^2$

- A) 1, crosses the x-axis;  
 -6, touches the x-axis and turns around;  
 -1, touches the x-axis and turns around

- C) 1, crosses the x-axis;  
 -6, crosses the x-axis;  
 -1, touches the x-axis and turns around

- B) -1, crosses the x-axis;  
 6, crosses the x-axis;  
 1, touches the x-axis and turns around

- D) -1, crosses the x-axis;  
 6, crosses the x-axis;  
 1, crosses the x-axis

33) \_\_\_\_\_

Solve the problem.

34) A deposit of \$5000 is made in an account that earns 9% interest compounded quarterly. The balance in the account after n quarters is given by the sequence

$$a_n = 5000 \left( 1 + \frac{0.09}{4} \right)^n \quad n = 1, 2, 3, \dots$$

Find the balance in the account after 24 quarters.

A) \$8389.83

B) \$8528.83

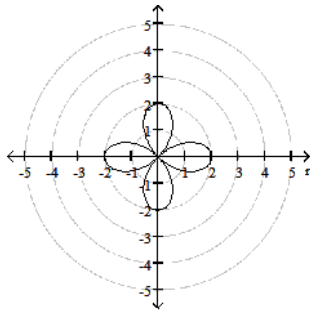
C) \$8607.83

D) \$8588.83

34) \_\_\_\_\_

The graph of a polar equation is given. Select the polar equation for the graph.

35)



A)  $r = 2 \sin(2\theta)$

B)  $r = 2 \cos(2\theta)$

C)  $r = 2 + \cos(2\theta)$

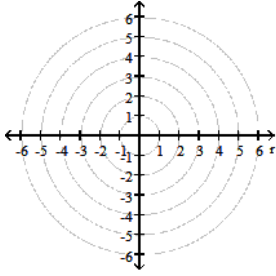
D)  $r = 2$

35) \_\_\_\_\_

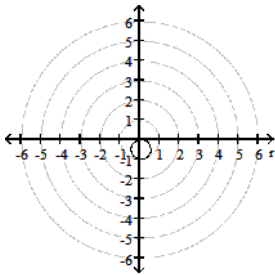
Graph the polar equation.

36)  $r = 3 + \sin \theta$

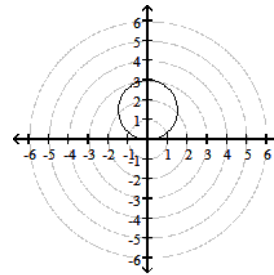
36) \_\_\_\_\_



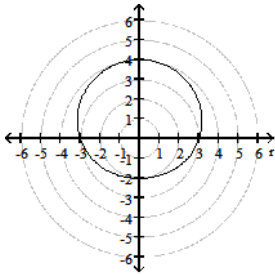
A)



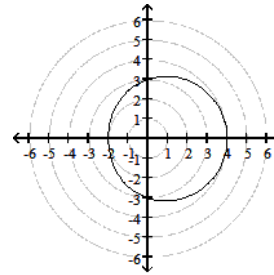
B)



C)



D)



Write the complex number in polar form. Express the argument in degrees.

37)  $-12 + 16i$

37) \_\_\_\_\_

A)  $20(\cos 53.1^\circ + i \sin 53.1^\circ)$

B)  $20(\cos 306.9^\circ + i \sin 306.9^\circ)$

C)  $20(\cos 126.9^\circ + i \sin 126.9^\circ)$

D)  $20(\cos 233.1^\circ + i \sin 233.1^\circ)$

Find the product of the complex numbers. Leave answer in polar form.

38)  $z_1 = 5(\cos 20^\circ + i \sin 20^\circ)$

38) \_\_\_\_\_

$z_2 = 4(\cos 10^\circ + i \sin 10^\circ)$

A)  $9(-\cos 200^\circ - i \sin 200^\circ)$

B)  $20(\cos 30^\circ + i \sin 30^\circ)$

C)  $20(\cos 200^\circ + i \sin 200^\circ)$

D)  $9(\cos 30^\circ + i \sin 30^\circ)$

Find the quotient  $\frac{z_1}{z_2}$  of the complex numbers. Leave answer in polar form.

39)  $z_1 = 5(\cos 200^\circ + i \sin 200^\circ)$

39) \_\_\_\_\_

$z_2 = 4(\cos 50^\circ + i \sin 50^\circ)$

A)  $\frac{5}{4}(\cos 250^\circ + i \sin 250^\circ)$

B)  $\frac{5}{4}(\sin 150^\circ + i \cos 150^\circ)$

C)  $\frac{5}{4}(\cos 150^\circ - i \sin 150^\circ)$

D)  $\frac{5}{4}(\cos 150^\circ + i \sin 150^\circ)$

Use DeMoivre's Theorem to find the indicated power of the complex number. Write the answer in rectangular form.

40)  $(1 - i)^{10}$

40) \_\_\_\_\_

A)  $-32i$

B)  $32 - 32i$

C)  $32$

D)  $-32 + 32i$

Determine whether the equation defines  $y$  as a function of  $x$ .

41)  $y = -\sqrt{x - 5}$

41) \_\_\_\_\_

A)  $y$  is a function of  $x$

B)  $y$  is not a function of  $x$

Evaluate the function at the given value of the independent variable and simplify.

42)  $g(x) = 4x + 2$ ;  $g(x + 1)$

42) \_\_\_\_\_

A)  $4x + 2$

B)  $4x + 6$

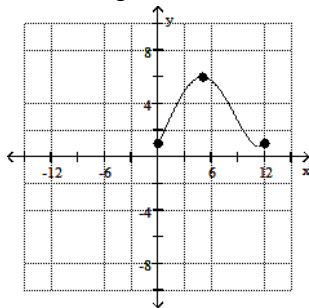
C)  $4x - 1$

D)  $\frac{1}{4}x + 2$

Identify the intervals where the function is changing as requested.

43) Increasing

43) \_\_\_\_\_



A)  $(1, 6)$

B)  $(0, 5)$

C)  $(0, 6)$

D)  $(1, 5)$

Evaluate the piecewise function at the given value of the independent variable.

44)  $h(x) = \begin{cases} \frac{x^2 + 1}{x - 8} & \text{if } x \neq 8 \\ x - 4 & \text{if } x = 8 \end{cases}$ ;  $h(8)$

44) \_\_\_\_\_

A)  $12$

B)  $4$

C) undefined

D)  $-4$

Solve the problem.

- 45) Suppose a car rental company charges \$146 for the first day and \$96 for each additional or partial day. Let  $S(x)$  represent the cost of renting a car for  $x$  days. Find the value of  $S(5.5)$ . 45) \_\_\_\_\_
- A) \$578                      B) \$528                      C) \$626                      D) \$674

Find and simplify the difference quotient  $\frac{f(x+h) - f(x)}{h}$ ,  $h \neq 0$  for the given function.

- 46)  $f(x) = x^2 + 2x - 9$  46) \_\_\_\_\_
- A)  $2x + h + 2$                       B)  $2x + h - 9$
- C) 1                      D)  $\frac{2x^2 + 2x + 2xh + h^2 + h - 18}{h}$

Find functions  $f$  and  $g$  so that  $h(x) = (f \circ g)(x)$ .

- 47)  $h(x) = \frac{8}{\sqrt{8x+10}}$  47) \_\_\_\_\_
- A)  $f(x) = \sqrt{8x+10}$ ,  $g(x) = 8$                       B)  $f(x) = 8/x$ ,  $g(x) = 8x+10$
- C)  $f(x) = 8$ ,  $g(x) = \sqrt{8+10}$                       D)  $f(x) = 8/\sqrt{x}$ ,  $g(x) = 8x+10$

Find the inverse of the one-to-one function.

- 48)  $f(x) = \sqrt{x+5}$  48) \_\_\_\_\_
- A)  $f^{-1}(x) = \frac{1}{x^2-5}$                       B)  $f^{-1}(x) = x-5$                       C)  $f^{-1}(x) = x^2-5$                       D)  $f^{-1}(x) = x^2+5$

Solve the problem.

- 49) You have 104 feet of fencing to enclose a rectangular plot that borders on a river. If you do not fence the side along the river, find the length and width of the plot that will maximize the area. 49) \_\_\_\_\_
- A) length: 52 feet, width: 26 feet                      B) length: 78 feet, width: 26 feet
- C) length: 26 feet, width: 26 feet                      D) length: 52 feet, width: 52 feet

Find the zeros for the polynomial function and give the multiplicity for each zero. State whether the graph crosses the  $x$ -axis or touches the  $x$ -axis and turns around, at each zero.

- 50)  $f(x) = x^3 + x^2 - 12x$  50) \_\_\_\_\_
- A) - 4, multiplicity 2, touches the  $x$ -axis and turns around  
3, multiplicity 1, crosses the  $x$ -axis
- B) 0, multiplicity 1, crosses the  $x$ -axis  
4, multiplicity 1, crosses the  $x$ -axis  
-3, multiplicity 1, crosses the  $x$ -axis
- C) 0, multiplicity 1, crosses the  $x$ -axis  
- 4, multiplicity 1, crosses the  $x$ -axis  
3, multiplicity 1, crosses the  $x$ -axis
- D) 0, multiplicity 1, touches the  $x$ -axis and turns around;  
- 4, multiplicity 1, touches the  $x$ -axis and turns around;  
3, multiplicity 1, touches the  $x$ -axis and turns around

Divide using synthetic division.

51)  $\frac{2x^3 - 13x^2 + 12x + 15}{x - 5}$

51) \_\_\_\_\_

A)  $\frac{2}{5}x^2 - \frac{13}{5}x + \frac{12}{5}$

B)  $-2x^2 + 5x - 3$

C)  $2x^2 - 3x - 3$

D)  $-2x^2 - 5x + 3$

Solve the polynomial equation. In order to obtain the first root, use synthetic division to test the possible rational roots.

52)  $x^3 + 6x^2 - x - 6 = 0$

52) \_\_\_\_\_

A)  $\{-1, -2, -3\}$

B)  $\{1, -1, 6\}$

C)  $\{1, -2, 3\}$

D)  $\{1, -1, -6\}$

Find a rational zero of the polynomial function and use it to find all the zeros of the function.

53)  $f(x) = x^4 - 5x^3 + 6x^2 + 54x - 108$

53) \_\_\_\_\_

A)  $\{-3, 2, 3 + 4i, 3 - 4i\}$

B)  $\{-3, 2, 3 + 3i, 3 - 3i\}$

C)  $\{-2, 3 + 3i, 3 - 3i\}$

D)  $\{3, -2, 3 + \sqrt{3}, 3 - \sqrt{3}\}$

Find the vertical asymptotes, if any, of the graph of the rational function.

54)  $g(x) = \frac{x}{x^2 - 9}$

54) \_\_\_\_\_

A)  $x = 3, x = -3$

B)  $x = 3, x = -3, x = 0$

C)  $x = 3$

D) no vertical asymptote

Find the slant asymptote, if any, of the graph of the rational function.

55)  $f(x) = \frac{x^2 + 9x - 9}{x - 3}$

55) \_\_\_\_\_

A)  $y = x$

B)  $y = x + 9$

C)  $y = x + 12$

D) no slant asymptote

Write the equation in its equivalent exponential form.

56)  $\log_b 8 = 3$

56) \_\_\_\_\_

A)  $8^b = 3$

B)  $3^b = 8$

C)  $b^3 = 8$

D)  $8^3 = b$

Write the equation in its equivalent logarithmic form.

57)  $7^3 = x$

57) \_\_\_\_\_

A)  $\log_x 7 = 3$

B)  $\log_7 x = 3$

C)  $\log_7 3 = x$

D)  $\log_3 x = 7$

Solve the problem.

58) The long jump record, in feet, at a particular school can be modeled by  $f(x) = 20.2 + 2.5 \ln(x + 1)$  where  $x$  is the number of years since records began to be kept at the school. What is the record for the long jump 7 years after record started being kept? Round your answer to the nearest tenth.

58) \_\_\_\_\_

A) 25.1 feet

B) 25.4 feet

C) 24.7 feet

D) 22.7 feet

Use properties of logarithms to expand the logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator.

59)  $\ln\left(\frac{e^3}{2}\right)$  59) \_\_\_\_\_  
 A)  $\ln e^3 - \ln 2$       B)  $3 - \ln 2$       C)  $3 + \ln 2$       D)  $\ln e^3 + \ln 2$

Use properties of logarithms to condense the logarithmic expression. Write the expression as a single logarithm whose coefficient is 1. Where possible, evaluate logarithmic expressions.

60)  $\log_6(x - 2) - \log_6(x + 6)$  60) \_\_\_\_\_  
 A)  $\log_6 - 8$       B)  $\log_6(x^2 + 4x - 12)$   
 C)  $\log_6\left(\frac{x - 2}{x + 6}\right)$       D)  $\log_6\left(\frac{x - 2}{x - 6}\right)$

Solve the logarithmic equation. Be sure to reject any value that is not in the domain of the original logarithmic expressions. Give the exact answer.

61)  $5 + 9 \ln x = 12$  61) \_\_\_\_\_  
 A)  $\left\{e^{7/9}\right\}$       B)  $\left\{\ln \frac{7}{9}\right\}$       C)  $\left\{\frac{7}{9 \ln 1}\right\}$       D)  $\left\{\frac{e^7}{9}\right\}$

62)  $\log_6(x^2 - 5x) = 1$  62) \_\_\_\_\_  
 A)  $\{6\}$       B)  $\{1\}$       C)  $\{6, -1\}$       D)  $\{-6, 1\}$

Solve.

63) The population of a particular country was 21 million in 1980; in 1993, it was 31 million. The exponential growth function  $A = 21e^{kt}$  describes the population of this country  $t$  years after 1980. Use the fact that 13 years after 1980 the population increased by 10 million to find  $k$  to three decimal places. 63) \_\_\_\_\_  
 A) 0.030      B) 0.177      C) 0.040      D) 0.498

Solve the exponential equation. Express the solution set in terms of natural logarithms.

64)  $e^{x+5} = 8$  64) \_\_\_\_\_  
 A)  $\{\ln 8 - 5\}$       B)  $\{\ln 13\}$       C)  $\{e^8 + 5\}$       D)  $\{e^{40}\}$

Use common logarithms or natural logarithms and a calculator to evaluate to four decimal places

65)  $\log_9 16$  65) \_\_\_\_\_  
 A) 1.2619      B) 0.2499      C) 2.1584      D) 0.7925

Evaluate the expression without using a calculator.

66)  $e^{\ln 2x^5}$  66) \_\_\_\_\_  
 A)  $2x^5$       B)  $\ln 2x^5$       C) 5      D)  $e^{2x^5}$