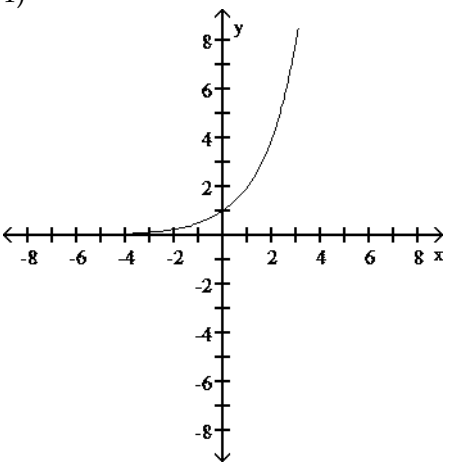
Exam
Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.
Match the graph to the function.

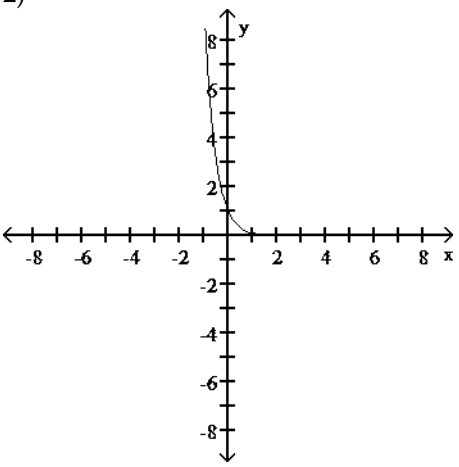
1)



1) _____

A) f(x) = 2^x + 1 B) f(x) = 2^x - 1 C) f(x) = 2^{x-1} D) f(x) = 2^x

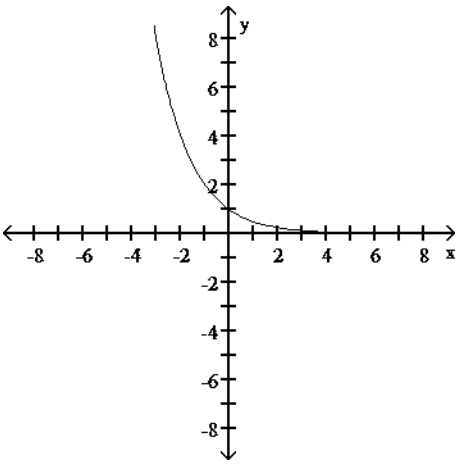
2)



2) _____

A) f(x) = 10^x B) f(x) = $-\left(\frac{1}{10}\right)^x$ C) f(x) = $\left(\frac{1}{10}\right)^x$ D) f(x) = -10^x

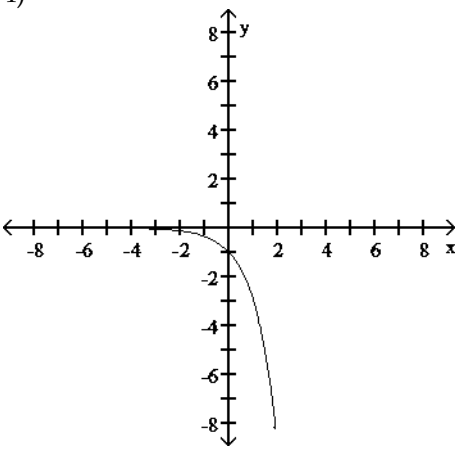
3)



3) _____

A) f(x) = 2^x B) f(x) = -2^x C) f(x) = 2^{-x} D) f(x) = -2^{-x}

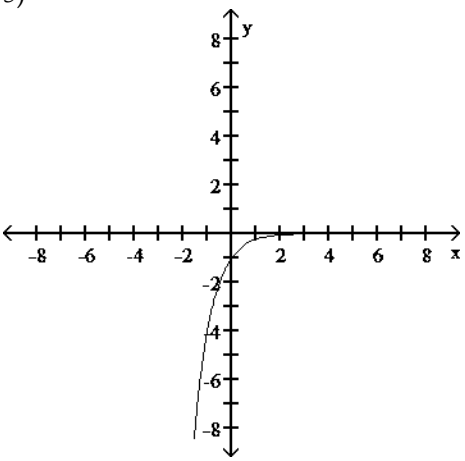
4)



4) _____

A) f(x) = -3^{-x} B) f(x) = 3^x C) f(x) = 3^{-x} D) f(x) = -3^x

5)



5) _____

A) f(x) = -4^{-x} B) f(x) = 4^x C) f(x) = 4^{-x} D) f(x) = -4^x

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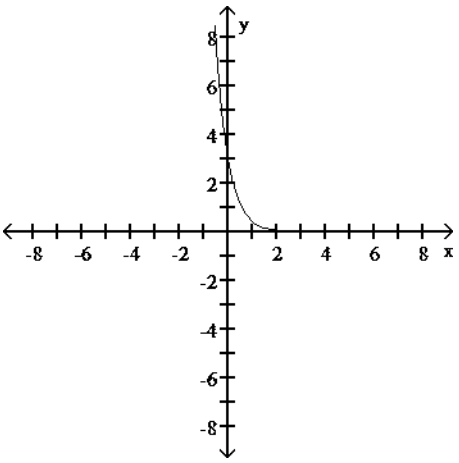
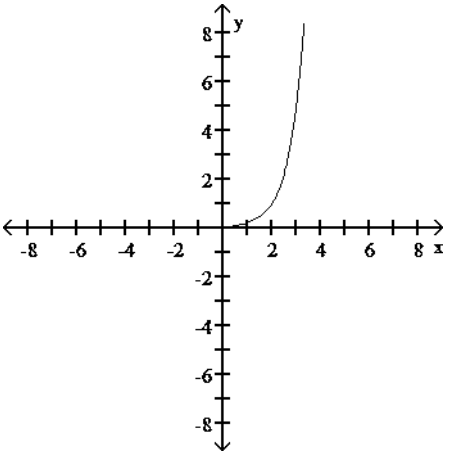


6) _____

A) $f(x) = -3\left(\frac{1}{7}\right)^x$ B) $f(x) = 3\left(\frac{1}{7}\right)^x$ C) $f(x) = 3^{(7)x}$ D) $f(x) = -3^{(7)x}$

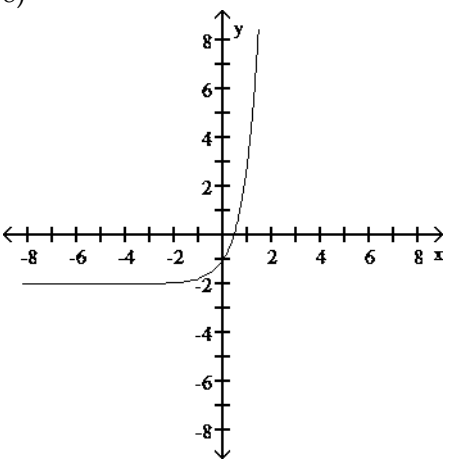
7)



7) _____

A) $f(x) = 5^x - 2$ B) $f(x) = 5^x$ C) $f(x) = 5^{x-2}$ D) $f(x) = 5^x + 2$

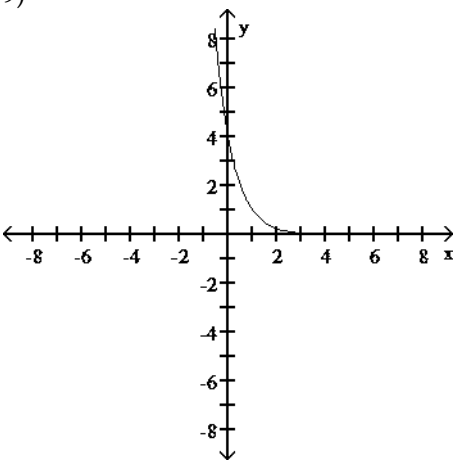
8)



8) _____

A) $f(x) = 5^{x-2}$ B) $f(x) = 5^x + 2$ C) $f(x) = 5^x$ D) $f(x) = 5^x - 2$

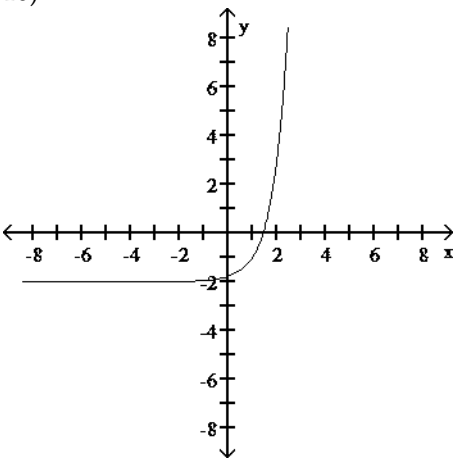
9)



9) _____

A) $y = \left(\frac{1}{4}\right)^{x-1}$ B) $y = \left(\frac{1}{4}\right)^{1-x}$ C) $y = 4^{x+1}$ D) $y = 4^{-x-1}$

10)



10) _____

A) $y = 5^{x+1} - 2$ B) $y = \left(\frac{1}{5}\right)^{x-1} - 2$ C) $y = 5^{x-1} - 2$ D) $y = \left(\frac{1}{5}\right)^{x+1} - 2$

Solve the equation.

11) $4^x = 64$ 11) _____

A) 2 B) 4 C) 3 D) 16

12) $4^{-x} = \frac{1}{64}$ 12) _____

A) -3 B) $\frac{1}{3}$ C) $\frac{1}{16}$ D) 3

13) $3^{(12 - 3x)} = 729$ 13) _____

A) 4 B) -2 C) 243 D) 2

14) $3^{(1 + 2x)} = 27$ 14) _____

A) -1 B) 9 C) 3 D) 1

15) $4^{(7 - 3x)} = \frac{1}{16}$ 15) _____

A) 4 B) $\frac{1}{4}$ C) 3 D) -3

16) $5^{x} = \frac{1}{125}$ 16) _____

A) -3 B) $\frac{1}{3}$ C) $\frac{1}{25}$ D) 3

17) $4^{(7 + 3x)} = \frac{1}{16}$ 17) _____

A) 3 B) -3 C) 4 D) $\frac{1}{4}$

18) $e^{-2x} = (e^{7})^{3 - x}$ 18) _____

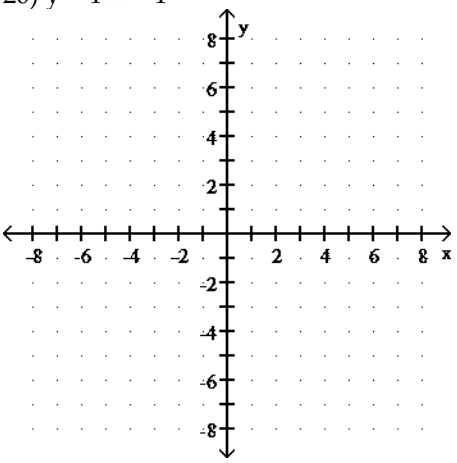
A) $\frac{21}{5}$ B) $\frac{3}{5}$ C) 0 D) $-\frac{21}{5}$

19) $2^{-|x|} = \frac{1}{8}$ 19) _____

A) 2, -2 B) 3, -3 C) 3 D) 1, -1

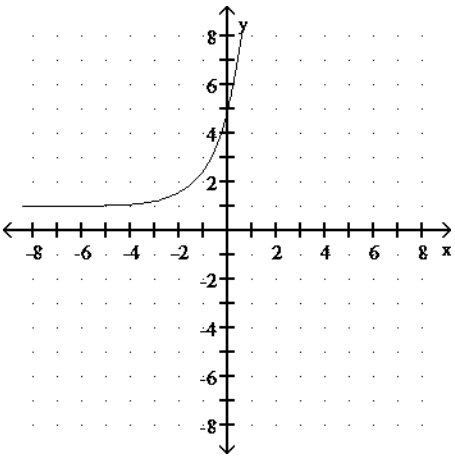
Graph the function.

20) $y = 4^{e^{x}} - 1$



20) _____

A)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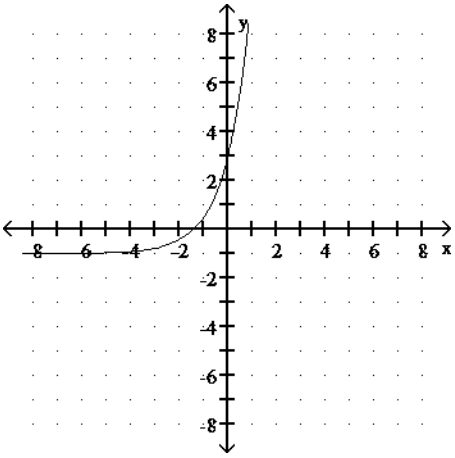
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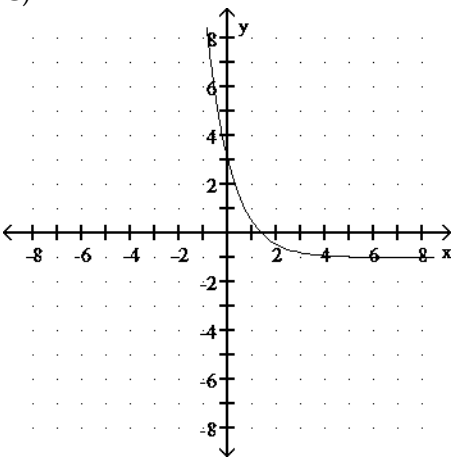
C)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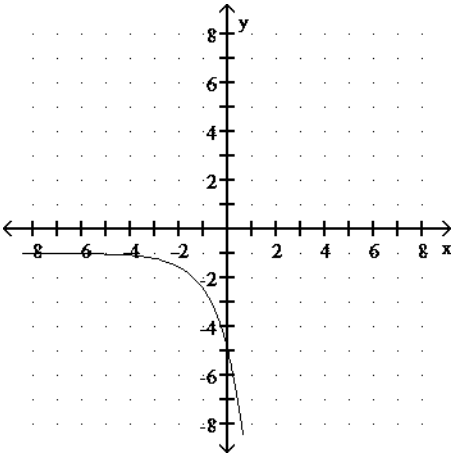
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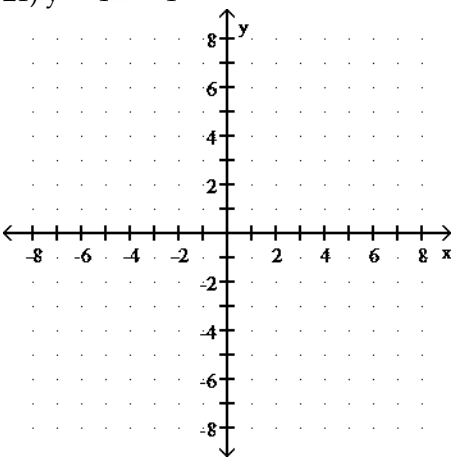
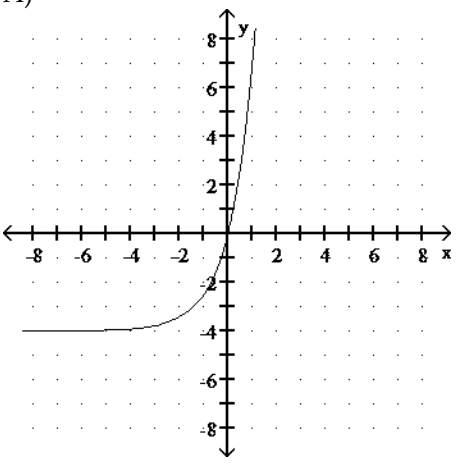
21) $y = -4^{eX} - 4$



21) _____

A)



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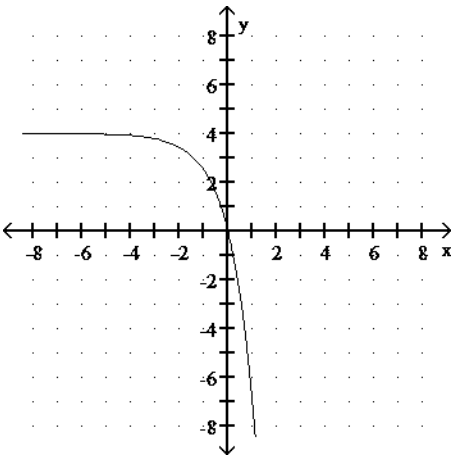

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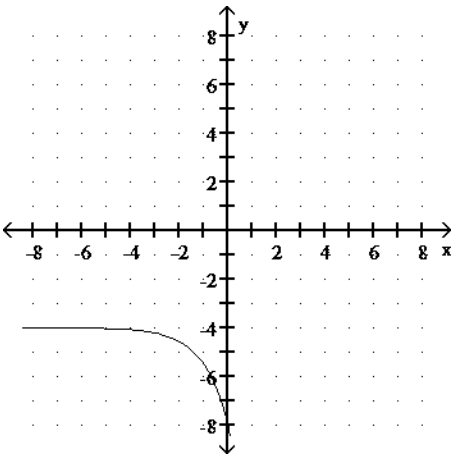

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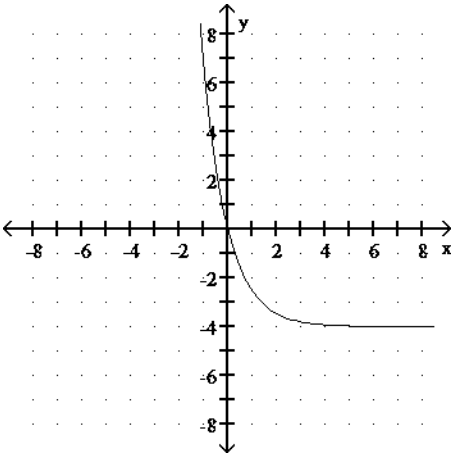
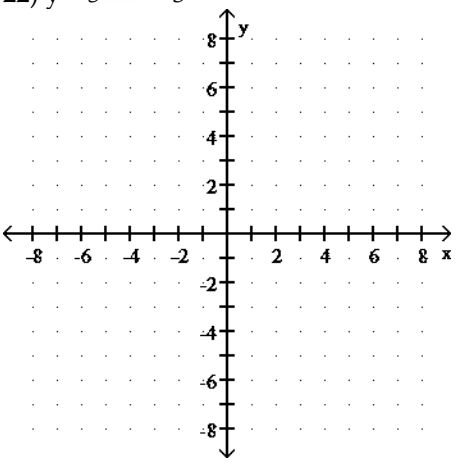
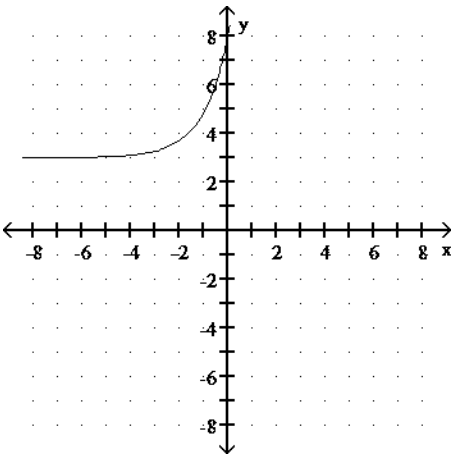


22) $y = 5^{e^{-x}} + 3$



22) _____

A)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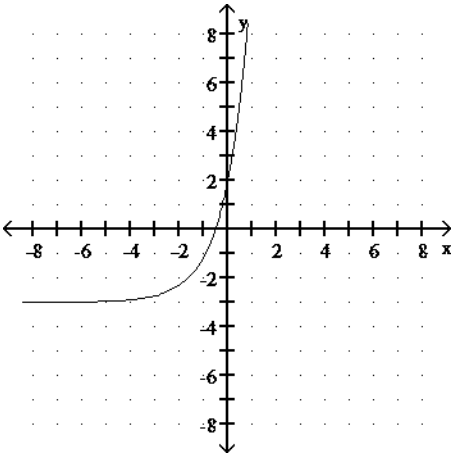
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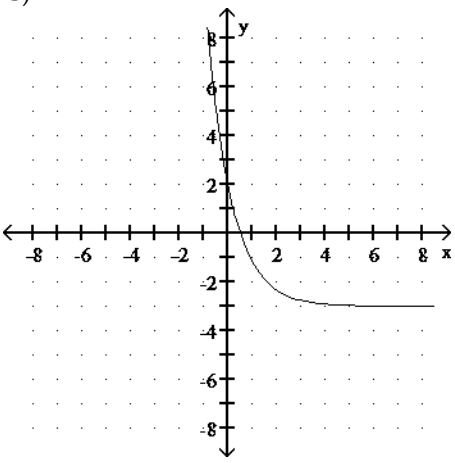
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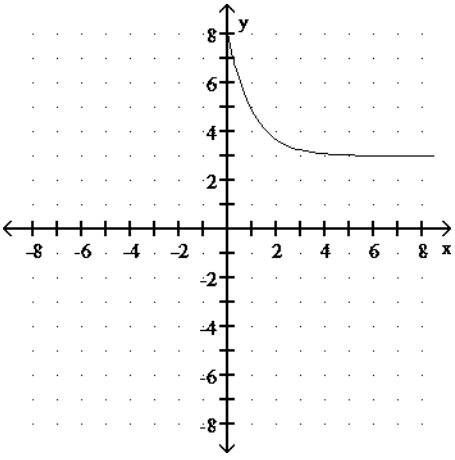
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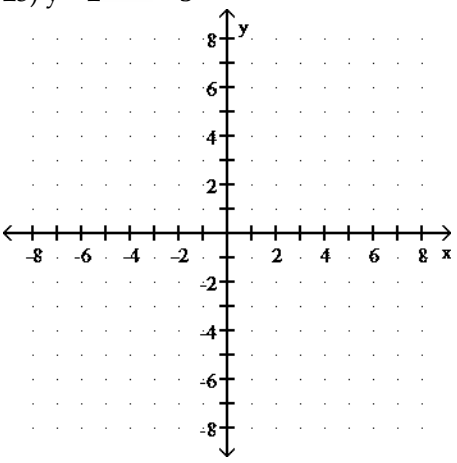
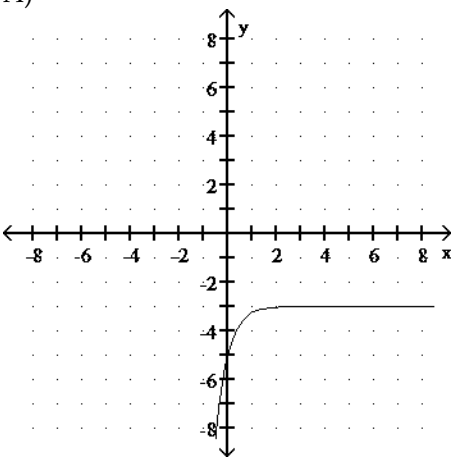
23) $y = 2^{e^{-2x}} - 3$



23) _____

A)



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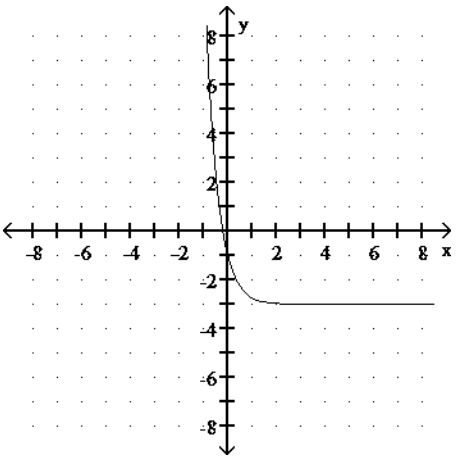
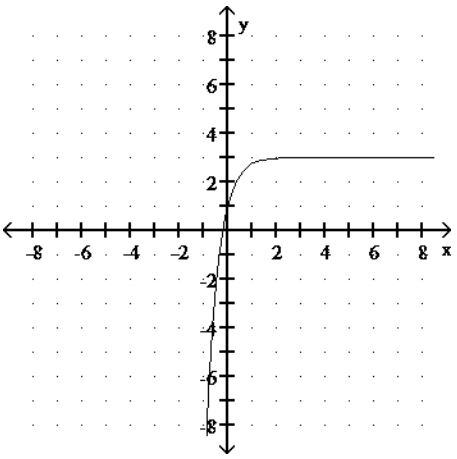
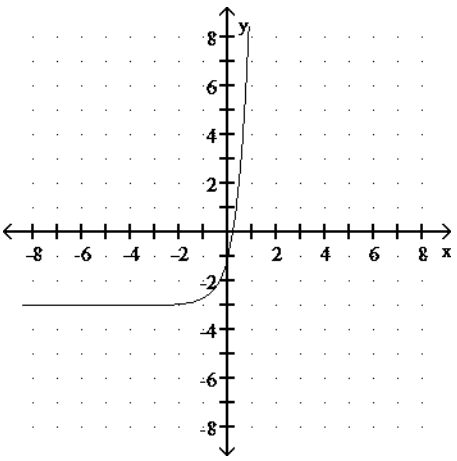


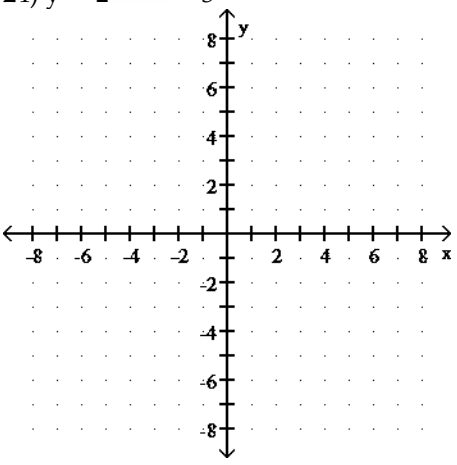
C)



D)

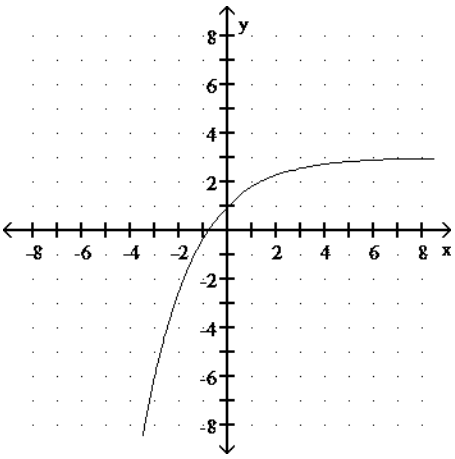


24) $y = -2^{e^{-x/2}} + 3$



24) _____

A)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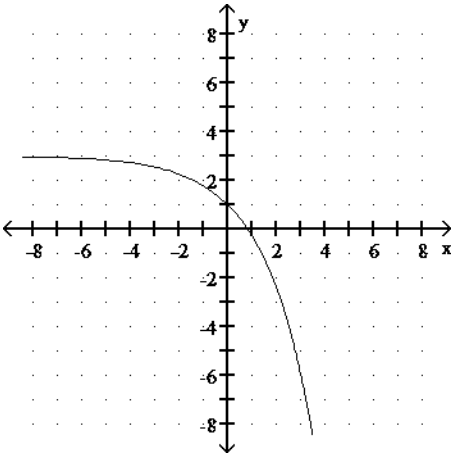
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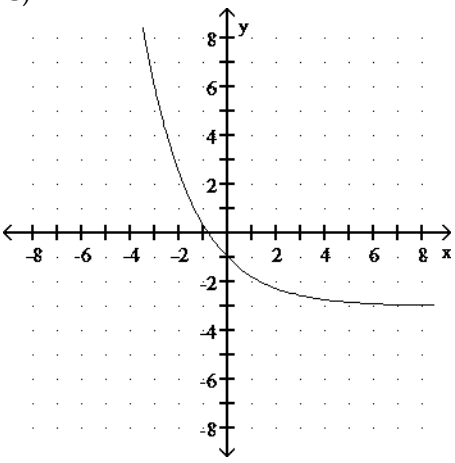
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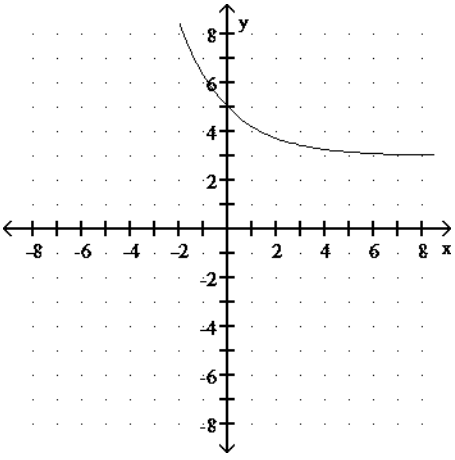
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Solve the problem.

25) Find the amount of interest earned on the following deposit: $1000 at 6% compounded annually for 8 years 25) _____

A) $689.48 B) $1593.85 C) $503.63 D) $593.85

26) How long will it take for prices in the economy to double at a 5% annual inflation rate? Round to the nearest hundredth when necessary. 26) _____

A) 11.9 yr B) 14.21 yr C) 23.45 yr D) 22.52 yr

27) An economist predicts that the buying power B(x) of a dollar x years from now will decrease according to the formula $B(x) = 0.46^x$. How much will today's dollar be worth in 3 years? Round to the nearest cent. 27) _____

A) $1.38 B) $0.10 C) $1.66 D) $0.79

28) Find the interest earned on $\$11{,}000$ invested for 5 years at 6.7% interest compounded quarterly. Round to the nearest cent. 28) _____

A) $15,334.74 B) $1987.77 C) $1.39 D) $4334.74

29) Find the interest earned on $\$9000$ invested for 6 years at 6.8% interest compounded monthly. Round to the nearest cent. 29) _____

A) $4355.80 B) $4518.69 C) $4528.02 D) $4487.93

30) Suppose that the number of bacteria in a culture after x hours is given by $f(x) = 1000 \cdot 5^{0.125x}$. How many bacteria are in the culture after 10 hours? 30) _____

A) 13,133 bacteria B) 7477 bacteria
C) 828,614 bacteria D) 3 bacteria

31) Suppose that the number of bacteria in a culture after x hours is given by $f(x) = 500 \cdot 6^{0.5x}$. How many bacteria are in the culture after 4 hours? 31) _____

A) 18,000 bacteria B) 39 bacteria C) 1661 bacteria D) 134 bacteria

32) The population of a particular city is increasing at a rate proportional to its size. It follows the function $P(t) = 1 + ke^{0.04t}$ where k is a constant and t is the time in years. If the current population is 37,000, in how many years is the population expected to be 92,500? 32) _____

A) 13 yr B) 10 yr C) 23 yr D) 147 yr

33) The number of dislocated electric impulses per cubic inch in a transformer increases when lightning strikes by $D = 9200(5)^x$, where x is the time in milliseconds of the lightning strike. Find the number of dislocated impulses at x = 0 and x = 4. 33) _____

A) 46,000; 5,750,000 B) 9200; 5,750,000
C) 9200; 184,000 D) 9200; 28,750,000

34) The number of bacteria growing in an incubation culture increases with time according to $B = 7800(5)^x$, where x is

time in days. Find the number of bacteria when x = 0 and x = 4. 34) _____

A) 7800 bacteria, 4,875,000 bacteria B) 7800 bacteria, 156,000 bacteria
C) 39,000 bacteria, 4,875,000 bacteria D) 7800 bacteria, 24,375,000 bacteria

35) The number of books in a small library increases according to the function $B = 5400e^{0.02t}$, where t is measured in years. How many books will the library have after 9 years? 35) _____

A) 4022 books B) 8173 books C) 6465 books D) 9260 books

Write the exponential equation in logarithmic form.

36) $7^2 = 49$ 36) _____
A) $\log_7 49 = 2$ B) $\log_2 49 = 7$ C) $\log_7 2 = 49$ D) $\log_{49} 7 = 2$

37) $4^2 = 16$ 37) _____
A) $\log_4 16 = 2$ B) $\log_2 16 = 4$ C) $\log_4 2 = 16$ D) $\log_{16} 4 = 2$

38) $4^{-2} = \frac{1}{16}$ 38) _____

A) $\log_{1/16} 4 = -2$ B) $\log_4 -2 = \frac{1}{16}$ C) $\log_{-2} \frac{1}{16} = 4$ D) $\log_4 \frac{1}{16} = -2$

39) $\left(\frac{3}{2}\right)^{-2} = \frac{4}{9}$ 39) _____

A) $\log_{3/2} (-2) = \frac{4}{9}$ B) $\log_{3/2} \frac{4}{9} = -2$
C) $\log_{4/9} (-2) = \frac{3}{2}$ D) $\log_{4/9} \frac{3}{2} = -2$

Write the logarithmic equation in exponential form.

40) $\log_4 \frac{1}{16} = -2$ 40) _____

A) $\left(\frac{1}{16}\right)^2 = 4$ B) $2^4 = \frac{1}{16}$ C) $4^{16} = 2$ D) $4^{-2} = \frac{1}{16}$

41) $\log_2 8 = 3$ 41) _____
A) $3^2 = 8$ B) $8^3 = 2$ C) $2^8 = 3$ D) $2^3 = 8$

42) $\log 0.00001 = -5$ 42) _____
A) $0.00001^{-5} = 10$ B) $-5^{10} = 0.00001$ C) $10^{-5} = 0.00001$ D) $10^{0.00001} = -5$

43) $\log_2 16 = 4$ 43) _____

A) $2^4 = 16$ B) $2^4 = \frac{1}{16}$ C) $2^4 = 4$ D) $2^4 = 16 + 1$

44) $\log 100 = 2$ 44) _____

A) $10^2 = 100$ B) $10^2 = \frac{1}{100}$ C) $10^2 = 2$ D) $10^2 = 1000$

45) $\ln x = 7$ 45) _____

A) $e^7 = x$ B) $x^7 = e$ C) $7^e = x$ D) $e^x = 7$

46) $\ln \frac{1}{e^6} = -6$ 46) _____

A) $\left(\frac{1}{e^6}\right)^e = -6$ B) $-6^e = \frac{1}{e^6}$ C) $e^{-6} = \frac{1}{e^6}$ D) $\left(\frac{1}{e^6}\right)^{-6} = e$

47) $\ln e^8 = 8$ 47) _____

A) $\ln 8 = 8$ B) $e^8 = 8$ C) $\ln e^8 = e^8$ D) $e^8 = e^8$

48) $\ln e^{1/8} = \frac{1}{8}$ 48) _____

A) $e^8 = e^{1/8}$ B) $\ln \frac{1}{8} = e^{1/8}$ C) $e^{1/8} = e^{1/8}$ D) $e^{1/8} = \frac{1}{8}$

Evaluate the logarithm without using a calculator.

49) $\log_4 64$ 49) _____

A) 64 B) 4 C) 3 D) 12

50) $\log_4 \frac{1}{4}$ 50) _____

A) 0 B) -1 C) 1 D) 4

51) $\log_7 \frac{1}{49}$ 51) _____

A) 7 B) -2 C) 2 D) -7

52) $\log_{10} 10$ 52) _____

A) 1 B) -1 C) 0 D) 10

53) $\log_9 \frac{1}{729}$ 53) _____

A) -81 B) 3 C) -3 D) 81

54) $\log_8 32$ 54) _____

A) $\frac{4}{3}$ B) $\frac{3}{2}$ C) $\frac{5}{4}$ D) $\frac{5}{3}$

55) ln e 55) _____
A) 1 B) 0 C) -1 D) e

56) ln 1 56) _____
A) -1 B) e C) 0 D) 1

57) $\log_4 \sqrt[4]{\frac{1}{16}}$ 57) _____

A) - 2 B) 2 C) $-\frac{1}{2}$ D) $\frac{1}{2}$

58) ln $e^{5/7}$ 58) _____
A) $\frac{5}{7}$e B) $\frac{5}{7}$ C) $\frac{7}{5}$ D) $\frac{7}{5}$e

Rewrite the expression as a sum, difference, or product of simpler logarithms.

59) $\log_8 11x$ 59) _____
A) $\log_8 11 - \log_8 x$ B) $\log_8 11 + \log_8 x$ C) $\log_4 11 + \log_4 x$ D) $\log_4 11 - \log_4 x$

60) $\log_6 xy$ 60) _____
A) $\log_3 x + \log_3 y$ B) $\log_3 x - \log_3 y$ C) $\log_6 x + \log_6 y$ D) $\log_6 x - \log_6 y$

61) $\log_4 \frac{9}{10}$ 61) _____

A) $\log_2 9 - \log_2 10$ B) $\log_4 9 - \log_4 10$ C) $\log_4 9 + \log_4 10$ D) $\log_4 10 - \log_4 9$

62) $\log_4 \frac{\sqrt{6}}{11}$ 62) _____

A) $\left(\frac{1}{2}\right) \log_2 6 - \log_2 11$ B) $\log_4 11 - \left(\frac{1}{2}\right) \log_4 6$
C) $\left(\frac{1}{2}\right) \log_4 6 + \log_4 11$ D) $\left(\frac{1}{2}\right) \log_4 6 - \log_4 11$

63) $\log_5 \frac{3p}{5k}$ 63) _____

A) $\log_5 3p - \log_5 5k$ B) $\frac{\log_5 3 \log_5 p}{\log_5 k}$
C) $\frac{\log_5 3 + \log_5 p}{1 + \log_5 k}$ D) $\log_5 3 + \log_5 p - 1 - \log_5 k$

64) $\log_5 \frac{2\sqrt[5]{6}}{\sqrt[4]{3}}$ 64) _____

A) $\log_5 2 + \frac{1}{5}\log_5 6 - \frac{1}{4}\log_5 3$ B) $\log_5 2 + 5^{\log_5 6} - 4^{\log_5 3}$

C) $\frac{\log_5 2 + \frac{1}{5}\log_5 6}{\frac{1}{4}\log_5 3}$ D) $\frac{\log_5 2 + 5\log_5 6}{4\log_5 3}$

Use the properties of logarithms to find the value of the expression.

65) Let $\log_b A = 2$ and $\log_b B = -3$. Find $\log_b AB$. 65) _____

A) -6 B) 6 C) -1 D) 5

66) Let $\log_b A = 4$ and $\log_b B = -20$. Find $\log_b \frac{A}{B}$. 66) _____

A) -16 B) $\frac{1}{5}$ C) 24 D) $-\frac{1}{5}$

67) Let $\log_b A = 3$ and $\log_b B = -4$. Find $\log_b B^2$. 67) _____

A) 6 B) -16 C) -8 D) 16

68) Let $\log_b A = 3$ and $\log_b B = -2$. Find $\log_b \sqrt{AB}$. 68) _____

A) -2.449 B) 0.500 C) 2.449 D) $\sqrt{-6}$

69) Let $\log_b A = 2.518$ and $\log_b B = 0.186$. Find $\log_b AB$. 69) _____

A) 2.332 B) 13.538 C) 0.468 D) 2.704

70) Let $\log_b A = 3.098$ and $\log_b B = 0.234$. Find $\log_b \frac{A}{B}$. 70) _____

A) 2.864 B) 0.725 C) 3.098 D) 3.332

71) Let $\log_b 6 = a$ and $\log_b 3 = c$. Find $\log_b (216b^5)$. 71) _____

A) 3ab B) 3(a + b) C) 3b + a - 5 D) 3a + 5

Use natural logarithms to evaluate the logarithm to the nearest thousandth.

72) $\log_9 33$ 72) _____

A) 3.667 B) 1.591 C) 1.519 D) 0.628

73) $\log_2 0.358$ 73) _____

A) -0.446 B) -1.482 C) 5.587 D) -0.675

74) $\log_{7.9} 192$ 74) _____

A) 2.283 B) 0.393 C) 24.304 D) 2.544

75) $\log_{3.4} 2.3$ 75) _____

A) 1.469 B) 0.681 C) 0.676 D) 0.362

76) $\log_{\sqrt{3}} 180.1$ 76) _____

A) 0.106 B) 9.455 C) 4.727 D) 0.239

Solve the equation.

77) $\log 3x = \log 2 + \log (x + 5)$ 77) _____

A) $\frac{7}{2}$ B) 10 C) -10 D) 2

78) $\log (x + 5) = \log (2x + 3)$ 78) _____

A) 8 B) $-\frac{2}{3}$ C) -2 D) 2

79) $\log_2 x = 3$ 79) _____

A) 8 B) 9 C) 1.58 D) 6

80) $\log_y 13 = 2$ 80) _____

A) 13^2 B) $13^{1/2}$ C) $\frac{13}{2}$ D) $2^{1/13}$

81) $\log (3 + x) - \log (x - 4) = \log 2$ 81) _____

A) $\frac{3}{2}$ B) 11 C) -11 D) No solution

82) $\log_7 (5x - 3) = \log_7 (2x + 6)$ 82) _____

A) 3 B) 3 C) 1 D) No solution

83) $\log_8 (6x + 5) = \log_8 (6x + 7)$ 83) _____

A) $\frac{5}{7}$ B) - 6 C) 0 D) No solution

84) $\log_9 x^2 = \log_9 (4x + 12)$ 84) _____

A) 6, -2 B) $\frac{2}{3}$ C) 6 D) No solution

85) $\frac{1}{2} \log_2 x^2 = \log_4 4x$ 85) _____

A) 4 B) 8 C) 4, 0 D) No solution

Solve the equation. Round decimal answers to the nearest thousandth.

86) $2^x = 13$ 86) _____

A) 1.872 B) 3.700 C) 6.500 D) 0.270

87) $e^{-0.02x} = 0.05$ 87) _____

A) 2.996 B) -2.5 C) -149.787 D) 149.787

88) $e^{y+8} = 2$ 88) _____
A) -7.699 B) -7.307 C) 0.087D) 8.693

89) $4^{(3x-2)} = 11$ 89) _____
A) 1.004 B) -0.090 C) 1.583D) 1.243

90) $6^{e^{5x+1}} = 18$ 90) _____
A) 0.020 B) -0.104 C) 0.420D) 3.400

91) $8e^{4x+9} = 2$ 91) _____
A) -4.507 B) -0.687 C) -3.813 D) -2.597

92) $10^{0.68^x} = 9^{0.89^x}$ 92) _____
A) -8.96 B) 0.21 C) 0.164D) 0.000

Write the expression using base e rather than base 10.

93) 10^{x+9} 93) _____
A) $10^{e^{x+9}}$ B) $e^{(\ln 10)(x+9)}$ C) $e^{10(x+9)}$ D) $(x+9)^{e^{10}}$

94) 10^{x^7} 94) _____
A) $e^{(\ln 10)x^7}$ B) x^7e^{10} C) $10^{e^{x^7}}$ D) e^{10x^7}

Approximate the expression in the form a^x without using e. Round to the nearest thousandth when necessary.

95) e^{8x} 95) _____
A) 21.746^x B) 2.079^x C) 2980.958^x D) 285.005^x

96) e^{-4x} 96) _____
A) 0.68^x B) 0.018^x C) -10.873^x D) -1.386^x

Find the domain of the function.

97) f(x) = log (x - 6) 97) _____
A) x > 0 B) x > 6 C) x > -6 D) x > 1

98) f(x) = ln (-5 - x) 98) _____
A) x < -5 B) x > -5C) x > 5 D) x < 5

99) $f(x) = \log_8 (4 - x^2)$ 99) _____
A) $-2 \le x \le 2$ B) x < -2 and x > 2 C) -2 < x < 2 D) -4 < x < 4

100) $f(x) = \ln (7x - x^2)$ 100) _____
A) -7 < x < 7 B) $-7 \le x < 0$ C) $x \le 7$ D) 0 < x < 7

Solve the problem.

101) Sonja and Chris both accept new jobs on March 1, 2001. Sonja starts at $44,000 with a raise each March 1 of 3%. Chris starts at $27,000 with a raise on March 1 of each year of 6%. In what year will Chris' salary exceed Sonja's? 101)

_____

A) 2019 B) 2018 C) 2016 D) 2017

102) A college student invests $8000 in an account paying 8% per year compounded annually. In how many years will the amount at least double? Round to the nearest tenth when necessary. 102) _____

A) 16.3 yr B) 9 yr C) 11.9 yr D) 14.3 yr

103) How long will it take for prices in the economy to double at a 4% annual inflation rate? Round to the nearest hundredth when necessary. 103) _____

A) 23.45 yr B) 17.67 yr C) 14.21 yr D) 28.01 yr

104) Assume the cost of a car is $27,000. With continuous compounding in effect, find the number of years it would take to double the cost of the car at an annual inflation rate of 4%. Round to the nearest hundredth. 104) _____

A) 17.33 yr B) 272.42 yr C) 2.55 yr D) 255.09 yr

105) Suppose the consumption of electricity grows at 8% per year, compounded continuously. Find the number of years before the use of electricity has tripled. Round to the nearest hundredth. 105) _____

A) 1.37 yr B) 13.73 yr C) 37.50 yr D) 0.14 yr

106) The purchasing power of a dollar is decreasing at the rate of 4% annually, compounded continuously. How long will it take for the purchasing power of $1.00 to be worth $0.36? Round to the nearest hundredth. 106) _____

A) 2.55 yr B) 25.54 yr C) 9.00 yr D) 0.26 yr

107) At what interest rate must $4400 be compounded annually to equal $8711.70 after 14 years? Round to the nearest percent.107) _____

A) 7% B) 4% C) 5% D) 6%

108) Kimberly invested $\$4000$ in her savings account for 5 years. When she withdrew it, she had $\$5647.96$. Interest was compounded continuously. What was the interest rate on the account? Round to the nearest tenth of a percent when necessary. 108) _____

A) 6.8% B) 7% C) 6.9% D) 7.05%

109) The magnitude of an earthquake, measured on the Richter scale, is given by $R(I) = \log \frac{I}{I_0}$, where I is the amplitude registered on a seismograph located 100 km from the epicenter of the earthquake, and I_0 is the amplitude of a certain small size earthquake. Find the Richter scale rating of an earthquake with an amplitude of 63,096 I_0. 109) _____

A) 3.8 B) 0.48 C) 11.1 D) 4.8

110) The magnitude of an earthquake, measured on the Richter scale, is given by $R(I) = \log \frac{I}{I_0}$, where I is the amplitude registered on a seismograph located 100 km from the epicenter of the earthquake, and I_0 is the amplitude of a certain

small size earthquake. An earthquake measured 4.5 on the Richter scale. Express this reading in terms of I_0. 110) _____

A) 25,119 I_0 B) 90 I_0 C) 31,623 I_0 D) 3162 I_0

111) The magnitude of an earthquake, measured on the Richter scale, is given by $R(I) = \log \frac{I}{I_0}$, where I is the amplitude registered on a seismograph located 100 km from the epicenter of the earthquake, and I_0 is the amplitude of a certain small size earthquake. Find the Richter scale rating of an earthquake with an amplitude of $10^{5.9}\ I_0$. 111) _____

A) 15.9 B) 5.9 C) 13.6 D) 4.1

112) A certain noise has intensity $8.62 \times 10^8\ I_0$. What is the decibel rating of this sound? Use the formula $D = 10 \log I_0$, where I_0 is a faint threshold sound, and I is the intensity of the sound." 112) _____

A) 9 decibels B) 79 decibels C) 89 decibels D) 206 decibels

113) The pH of a solution is defined as pH = -log[H^+], where [H^+] is the concentration of hydrogen ions in the solution. The pH of pure water is 7, while the pH of lemon juice is about 2. How much greater is the concentration of hydrogen ions in lemon juice than in pure water? 113) _____

A) 10,000 times greater B) 5 times greater
C) 10 times greater D) 100,000 times greater

114) An RC circuit is a simple electronic circuit consisting of a resistor, a capacitor, and a battery. The current i in the circuit at some time t after the battery is connected is $i = \frac{V}{R} e^{-t/(RC)}$, where V is the battery's voltage, R is the resistance, and C is the capacitance. Solve this equation for C. 114) _____

A) $C = \frac{Ve^{-t}}{R^2 C}$ B) $C = \frac{t}{R \ln\left(\frac{V}{iR}\right)}$ C) $C = \frac{-R}{t \ln\left(\frac{iR}{V}\right)}$ D) $C = \frac{V}{R} e^{-t/(iR)}$

115) One hundred rats are being trained to run through a maze and are rewarded when they run through it correctly. Once a rat successfully runs the maze, it continues to run the maze correctly in all subsequent trials. The number of rats that run the maze *incorrectly* after t attempts is given approximately by $N(t) = 100e^{-.14t}$. Find the number of trials required such that only 45% of the rats are running the maze incorrectly. Round to the nearest trial. 115) _____

A) 23 trials B) 6 trials C) 5 trials D) 27 trials

116) The population growth of an animal species is described by $F(t) = 300 + 80 \log_3 (2t + 1)$ where t is measured in months. Find the population of this species in an area 1 month(s) after the species is introduced. 116) _____

A) 380 B) 200 C) 290 D) 540

117) Coyotes are one of the few species of North American animals with an expanding range. The future population of coyotes in a region of Mississippi can be modeled by the equation $P = 59 + 16 \ln(14t + 1)$, where t is time in years. Use the equation to determine when the population will reach 140. (Round to the nearest tenth of a year.) 117) _____

A) 8248.4 yr B) 11.5 yr C) 11.2 yr D) 11.4 yr

118) Find the effective rate corresponding to the nominal rate. 6% compounded monthly. Round to the nearest hundredth. 118) _____

A) 6.26% B) 6.23% C) 6.17% D) 6.12%

119) Find the effective rate corresponding to the nominal rate. 6% compounded quarterly. Round to the nearest hundredth. 119) _____

A) 6.23% B) 6.14% C) 6.09% D) 6.20%

120) Find the present value of the deposit. $5000 at 4% compounded monthly for 5 years. Round to the nearest cent. 120) _____

A) $6084.98 B) $4115.02 C) $4095.02 D) $6104.98

121) Find the present value of the deposit. $7000 at 6% compounded quarterly for 3 years. Round to the nearest cent. 121) _____

A) $5872.71 B) $8351.33 C) $5854.71 D) $8369.33

122) Find the present value of the deposit. $500 at 7% compounded continuously for 10 years. Round to the nearest dollar. 122) _____

A) $248 B) $10,690 C) $3547 D) $7240

123) Find the present value of the deposit. $10,000 at 4% compounded continuously for 10 years. Round to the nearest dollar. 123) _____

A) $167,587 B) $122,941 C) $6703 D) $417,587

124) Barbara knows that she will need to buy a new car in 5 years. The car will cost $15,000 by then. How much should she invest now at 6%, compounded quarterly, so that she will have enough to buy a new car? Round to the nearest cent. 124) _____

A) $12,939.13 B) $11,137.06 C) $11,881.40 D) $10,574.41

125) Southwest Dry Cleaners believes that it will need new equipment in 6 years. The equipment will cost $26,000. What lump sum should be invested today at 6% compounded semiannually, to yield $26,000? Round to the nearest cent. 125) _____

A) $18,235.88 B) $21,894.60 C) $23,593.24 D) $21,731.62

126) An investment of $13,335 earns 8% interest compounded monthly for 2 years. (a) What is the value of the investment after 2 years? (b) If money can be deposited at 6% compounded quarterly, find the present value of the investment. Round to the nearest cent. 126) _____

A) (a) $15,640.46
(b) $13,884.21 B) (a) $15,536.88
(b) $14,518.42 C) (a) $16,640.46

(b) $15,518.42 D) (a) $14,063.02
(b) $14,092.47

127) If money can be invested at 6% compounded quarterly, which is larger -- $1000 now or the present value of $1210 left at 6% interest for 5 years? 127) _____

A) $1000 now B) Present value of $1210 left for 5 years

128) A certificate of deposit pays 5% interest compounded quarterly. What effective interest rate does the CD pay? Round to the nearest tenth when necessary. 128) _____

A) 5.1% B) 5.8% C) 21.6% D) 4%

129) The sales of a new model of notebook computer are approximated by: $S(x) = 4000 - 14{,}000e^{-x/9}$, where x represents the number of months the computer has been on the market and S represents sales in thousands of dollars. In how many months will the sales reach $2,200,000? Round to the nearest month. 129) _____

A) 21 months B) 25 months C) 28 months D) 18 months

130) The sales of a mature product (one which has passed its peak) will decline by the function $S(t) = S_0 e^{-at}$, where t is time in years. Find the sales after 11 years if a = 0.24 and S_0 = 20,700. Round to the nearest sale. 130) _____

A) 739 sales B) 1477 sales C) 1162 sales D) 16,283 sales

131) The number of books in a small library increases according to the function $B = 2100e^{0.03t}$, where t is measured in years. How many books will the library have after 8 years? Round to the nearest book. 131) _____

A) 3649 books B) 2997 books C) 1302 books D) 2670 books

132) In the formula $N = Ie^{kt}$, N is the number of items in terms of an initial population I at a given time t and k is a growth constant equal to the percent of growth per unit time. How long will it take for the population of a certain country to double if its annual growth rate is 6%? Round to the nearest year. 132) _____

A) 33 yr B) 5 yr C) 12 yr D) 1 yr

133) In the formula $N = Ie^{kt}$, N is the number of items in terms of an initial population I at a given time t and k is a growth constant equal to the percent of growth per unit time. How long will it take for the population of a certain country to triple if its annual growth rate is 0.5%? Round to the nearest year. 133) _____

A) 1 yr B) 600 yr C) 95 yr D) 220 yr

134) In the formula $N = Ie^{kt}$, N is the number of items in terms of an initial population I at a given time t and k is a growth constant equal to the percent of growth per unit time. There are currently 73 million cars in a certain country, increasing by 3.8% annually. How many years will it take for this country to have 101 million cars? Round to the nearest year.
134) _____

A) 4 yr B) 7 yr C) 88 yr D) 9 yr

135) The number of acres in a landfill decreases according to the function $B = 6200e^{-0.03t}$, where t is measured in years. How many acres will the landfill have after 5 years? 135) _____

A) 11,762 acres B) 5336 acres C) 5108 acres D) 4389 acres

136) A bacteria colony doubles in 5 hr. How long does it take the colony to triple? Use $N = N_0\, 2^{t/T}$, where N_0 is the initial number of bacteria and T is the time in hours it takes the colony to double. (Round to the nearest hundredth, as necessary.) 136) _____

A) 7.92 hr B) 7.5 hr C) 2.03 hr D) 15 hr

137) The population of a small country increases according to the function $B = 1{,}100{,}000e^{0.05t}$, where t is measured in years. How many people will the country have after 9 years? 137) _____

A) 3,100,221 people B) 878,358 people
C) 1,725,143 people D) 381,466 people

138) Use the formula $P = Ie^{kt}$. A bacterial culture has an initial population of 10,000. If its population declines to 5000 in 6 hours, what will it be at the end of 8 hours? 138) _____

A) 2500 bacteria B) 1985 bacteria C) 3969 bacteria D) 4353 bacteria

139) In the formula $A(t) = A_0e^{kt}$, A(t) is the amount of radioactive material remaining from an initial amount A_0 at a given time t and k is a negative constant determined by the nature of the material. A certain radioactive isotope has a half-life of approximately 1950 years. How many years would be required for a given amount of this isotope to decay to 45% of that amount? 139) _____

A) 1682 yr B) 2201 yr C) 2246 yr D) 1072.5 yr

140) In the formula $A(t) = A_0e^{kt}$, A(t) is the amount of radioactive material remaining from an initial amount A_0 at a given time t and k is a negative constant determined by the nature of the material. An artifact is discovered at a certain site. If it has 74% of the carbon-14 it originally contained, what is the approximate age of the artifact, rounded to the nearest year? (carbon-14 decays at the rate of 0.0125% annually.) 140) _____

A) 1046 yr B) 2080 yr C) 5920 yr D) 2409 yr

141) In the formula $A(t) = A_0e^{kt}$, A(t) is the amount of radioactive material remaining from an initial amount A_0 at a given time t and k is a negative constant determined by the nature of the material. A certain radioactive isotope decays at a rate of 0.3% annually. Determine the half-life of this isotope, to the nearest year. 141) _____

A) 2 yr B) 231 yr C) 167 yr D) 100 yr

142) The amount of particulate matter left in solution during a filtering process decreases by the equation $P = 600(2)^{-0.6n}$, where n is the number of filtering steps. Find the amounts left for n = 0 and n = 5. (Round to the nearest whole number.) 142) _____

A) 600, 4800 B) 1200, 75 C) 600, 19 D) 600, 75

143) The decay of 279 mg of an isotope is given by $A(t) = 279e^{-0.012t}$, where t is time in years. Find the amount left after 60 years. 143) _____

A) 276 mg B) 136 mg C) 134 mg D) 68 mg

144) Newton's law of cooling states that the temperature f(t) of a body at time t is given by: $f(t) = T_0 + Ce^{-kt}$, where C and k are constants and T_0 is the temperature of the environment in which the object rests. If C = -28.5 and k = 0.04 and t is in hours, how long will it take for a frozen roast to thaw to a temperature of 0°C in a refrigerator that is at 5°C? Round your answer to the nearest hour. 144) _____

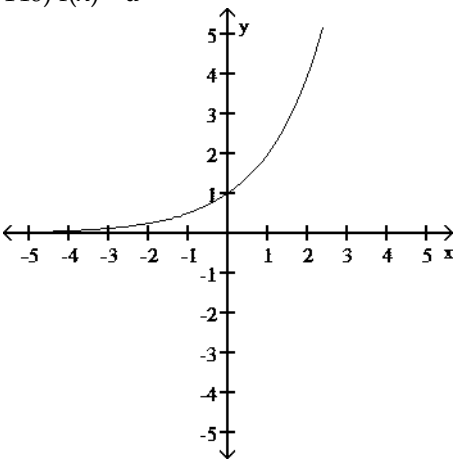
A) 48 hr B) 38 hr C) 42 hr D) 44 hr

145) Newton's law of cooling states that the temperature f(t) of a body at time t is given by: $f(t) = T_0 + Ce^{-kt}$, where C and k are constants and T_0 is the temperature of the environment in which the object rests. If C = 280 and k = 0.17 and t is in minutes, how long will it take for a glass baking dish containing brownies to cool to a comfortable-to-touch temperature of 93°F in a room that is at 72°F? Round your answer to the nearest minute. 145) _____

A) 19 min B) 15 min C) 10 min D) 12 min

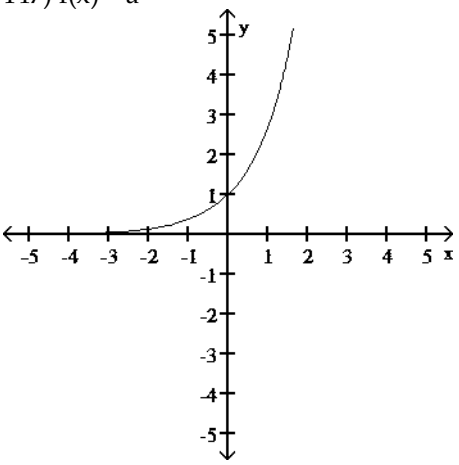
SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question. Provide an appropriate response.

146) $f(x) = a^x$



The graph of an exponential function with base a is given. Sketch the graph of $g(x) = -a^x$. Give the domain and range of g.
146) _____

147) $f(x) = a^x$



The graph of an exponential function with base a is given. Sketch the graph of $h(x) = a^{-x}$. Give the domain and range of h.

147) _____

148) Explain how the graph of $y = 3^{x-5} - 5$ can be obtained from the graph of $y = 3^x$. 148) _____

149) Explain how the graph of $y = (1/2)^x - 3$ can be obtained from the graph of $y = 2^x$. 149) _____

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

Convert the degree measure to radians. Leave the answer as a multiple of π.

150) 90° 150) _____

A) $\frac{\pi}{3}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{2}$ D) $\frac{\pi}{8}$

151) -30° 151) _____

A) $-\frac{\pi}{7}$ B) $-\frac{\pi}{8}$ C) $-\frac{\pi}{6}$ D) $-\frac{\pi}{5}$

152) 570° 152) _____

A) $\frac{19\pi}{5}$ B) $\frac{19\pi}{6}$ C) $\frac{19\pi}{3}$ D) $\frac{19\pi}{12}$

153) 630° 153) _____

A) 7π B) $\frac{7\pi}{2}$ C) $-\frac{7\pi}{2}$ D) $-\frac{7\pi}{4}$

154) 330° 154) _____

A) $\frac{10\pi}{5}$ B) $\frac{12\pi}{7}$ C) $\frac{11\pi}{6}$ D) $\frac{5}{3}\pi$

155) 162° 155) _____

A) $\frac{4\pi}{5}$ B) $\frac{9\pi}{5}$ C) π D) $\frac{9\pi}{10}$

156) 470° 156) _____

A) $\frac{11\pi}{18}$ B) $\frac{47\pi}{9}$ C) $\frac{47\pi}{18}$ D) $\frac{47\pi}{36}$

157) 370° 157) _____

A) $\frac{37}{9}\pi$ B) $\frac{37}{18}\pi$ C) $\frac{1}{18}\pi$ D) $\frac{37}{36}\pi$

Convert the radian measure to degrees.

158) $\frac{\pi}{4}$ 158) _____

A) 90° B) 45° C) 32.5° D) 22.5°

159) $-\frac{\pi}{3}$ 159) _____

A) -30° B) -60° C) -40° D) -120°

160) $\frac{11\pi}{2}$ 160) _____

A) 495° B) 1980° C) 990° D) 505°

161) $-\frac{5\pi}{2}$ 161) _____

A) -900° B) -225° C) -450° D) -235°

Find the indicated trigonometric function for θ, given that θ is an angle in standard position with the terminal side defined by the given point.

162) (18, 24); find sin θ 162) _____

A) $\frac{3}{5}$ B) $\frac{4}{3}$ C) $\frac{3}{4}$ D) $\frac{4}{5}$

163) (12, 16); find cos θ 163) _____

A) $\frac{4}{5}$ B) $\frac{4}{3}$ C) $\frac{3}{4}$ D) $\frac{3}{5}$

164) (-15, 36); find sin θ 164) _____

A) $-\frac{12}{13}$ B) $-\frac{5}{13}$ C) $\frac{12}{13}$ D) $\frac{5}{13}$

165) (-20, -48); find cos θ 165) _____

A) $-\frac{12}{13}$ B) $-\frac{13}{5}$ C) $-\frac{5}{13}$ D) $\frac{5}{13}$

166) (-10, 24); find sec θ 166) _____

A) $-\frac{13}{5}$ B) $-\frac{5}{13}$ C) $\frac{13}{5}$ D) $-\frac{13}{12}$

167) (21, 28); find csc θ 167) _____

A) $\frac{4}{3}$ B) $\frac{5}{3}$ C) $\frac{3}{4}$ D) $\frac{5}{4}$

168) (15, -20); find csc θ 168) _____

A) $-\frac{5}{3}$ B) $\frac{5}{4}$ C) $\frac{4}{5}$ D) $-\frac{5}{4}$

169) (-6, 9); find tan θ 169) _____

A) $-\frac{2}{3}$ B) $-\frac{3}{2}$ C) $-\frac{6}{11}$ D) $\frac{9}{11}$

170) (4, 8); find cot θ 170) _____

A) $\frac{8}{9}$ B) $\frac{1}{2}$ C) 2 D) $\frac{4}{9}$

If θ is an angle in the indicated quadrant, determine whether the given function is positive or negative.

171) II, sec θ 171) _____

A) Negative B) Positive

172) III, cot θ 172) _____

A) Positive B) Negative

173) IV, cot θ 173) _____

A) Positive B) Negative

174) II, sin θ 174) _____

A) Positive B) Negative

175) III, cos θ 175) _____

A) Positive B) Negative

176) IV, sin θ 176) _____

A) Positive B) Negative

177) II, tan θ 177) _____

A) Positive B) Negative

178) III, csc θ 178) _____

A) Positive B) Negative

179) IV, sec θ 179) _____

A) Positive B) Negative

180) I, csc θ 180) _____

A) Negative B) Positive

Give the exact value.

181) cot 30° 181) _____

A) 1 B) $\frac{\sqrt{3}}{3}$ C) $\sqrt{3}$ D) $\frac{\sqrt{3}}{2}$

182) sin 60° 182) _____

A) $\frac{\sqrt{2}}{2}$ B) $\frac{\sqrt{3}}{2}$ C) $\frac{\sqrt{3}}{3}$ D) $\frac{1}{2}$

183) cos 45° 183) _____

A) $\frac{\sqrt{3}}{2}$ B) $\sqrt{2}$ C) $\frac{1}{2}$ D) $\frac{\sqrt{2}}{2}$

184) cos 210° 184) _____

A) $-\frac{\sqrt{2}}{2}$ B) $\frac{\sqrt{2}}{2}$ C) $-\frac{\sqrt{3}}{2}$ D) $\frac{\sqrt{3}}{2}$

185) tan 300° 185) _____

A) $-\frac{\sqrt{3}}{3}$ B) $\sqrt{3}$ C) $-\sqrt{3}$ D) $\frac{\sqrt{3}}{3}$

186) cot 120° 186) _____

A) $\frac{\sqrt{3}}{3}$ B) -1 C) $-\sqrt{3}$ D) $-\frac{\sqrt{3}}{3}$

187) sec 240° 187) _____

A) $-\frac{2\sqrt{3}}{3}$ B) $\frac{2\sqrt{3}}{3}$ C) -2 D) 2

188) sec 150° 188) _____

A) $\frac{2\sqrt{3}}{3}$ B) $\sqrt{2}$ C) $-\frac{2\sqrt{3}}{3}$ D) $-\sqrt{2}$

189) csc 240° 189) _____

A) -2 B) 2 C) $-\frac{2\sqrt{3}}{3}$ D) $\frac{2\sqrt{3}}{3}$

190) csc 330° 190) _____

A) $-\frac{2\sqrt{3}}{3}$ B) -2 C) 2 D) $\frac{2\sqrt{3}}{3}$

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

191) csc $\frac{\pi}{6}$ 191) _____

A) $\frac{2\sqrt{3}}{3}$ B) $\frac{1}{2}$ C) $\sqrt{2}$ D) 2

192) sec $\frac{\pi}{3}$ 192) _____

A) $\sqrt{2}$ B) $\frac{\sqrt{3}}{2}$ C) 2 D) $\frac{2\sqrt{3}}{3}$

193) cos $\frac{\pi}{4}$ 193) _____

A) $\frac{\sqrt{2}}{2}$ B) $\sqrt{2}$ C) $\frac{1}{2}$ D) $\frac{\sqrt{3}}{2}$

194) $\sin \frac{5\pi}{4}$ 194) _____

A) $\frac{\sqrt{2}}{2}$ B) $-\frac{\sqrt{3}}{2}$ C) $-\frac{\sqrt{2}}{2}$ D) $\frac{\sqrt{3}}{2}$

195) $\cos \frac{11\pi}{6}$ 195) _____

A) $\frac{\sqrt{3}}{2}$ B) $\frac{1}{2}$ C) $-\frac{\sqrt{3}}{2}$ D) $-\frac{1}{2}$

196) $\tan \frac{5\pi}{3}$ 196) _____

A) $-\sqrt{3}$ B) $\sqrt{3}$ C) $\frac{\sqrt{3}}{2}$ D) $-\frac{\sqrt{3}}{3}$

197) $\csc \frac{5\pi}{3}$ 197) _____

A) $-\frac{1}{2}$ B) $-\sqrt{3}$ C) $-\frac{2\sqrt{3}}{3}$ D) $-\sqrt{2}$

198) $\sec \frac{5\pi}{4}$ 198) _____

A) $-\sqrt{2}$ B) $-\frac{2\sqrt{3}}{3}$ C) $\frac{\sqrt{2}}{2}$ D) -2

199) $\cot \frac{-11\pi}{6}$ 199) _____

A) $-\frac{\sqrt{3}}{3}$ B) $\frac{\sqrt{3}}{3}$ C) $-\sqrt{3}$ D) $\sqrt{3}$

200) sec(π) 200) _____
A) -1 B) 0 C) 1 D) Undefined

Find all values of x between 0 and 2π that satisfy the equation.

201) $\cos x = \frac{\sqrt{3}}{2}$ 201) _____

A) $\frac{\pi}{4}, \frac{7\pi}{4}$ B) $\frac{\pi}{3}, \frac{2\pi}{3}$ C) $\frac{\pi}{6}, \frac{5\pi}{6}$ D) $\frac{\pi}{6}, \frac{11\pi}{6}$

202) $\sin x = \frac{1}{2}$ 202) _____

A) $\frac{\pi}{6}, \frac{11\pi}{6}$ B) $\frac{\pi}{3}, \frac{5\pi}{3}$ C) $\frac{5\pi}{4}, \frac{7\pi}{4}$ D) $\frac{\pi}{6}, \frac{5\pi}{6}$

203) $\tan x = \frac{1}{\sqrt{3}}$ 203) _____

A) $\frac{5\pi}{6}, \frac{11\pi}{6}$ B) $\frac{\pi}{3}, \frac{4\pi}{3}$ C) $\frac{\pi}{6}, \frac{7\pi}{6}$ D) $\frac{3\pi}{4}, \frac{7\pi}{4}$

204) $\csc x = 2$ 204) _____

A) $\frac{\pi}{3}, \frac{5\pi}{3}$ B) $\frac{3\pi}{4}, \frac{7\pi}{4}$ C) $\frac{\pi}{6}, \frac{11\pi}{6}$ D) $\frac{\pi}{6}, \frac{5\pi}{6}$

205) $\sec x = -\sqrt{2}$ 205) _____

A) $\frac{5\pi}{4}, \frac{7\pi}{4}$ B) $\frac{2\pi}{3}, \frac{4\pi}{3}$ C) $\frac{3\pi}{4}, \frac{5\pi}{4}$ D) $\frac{\pi}{4}, \frac{7\pi}{4}$

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

206) sin 72.9° 206) _____
A) 0.9558 B) 0.2940 C) 3.2505 D) -0.5999

207) cos 27.2° 207) _____
A) 0.8894 B) 0.5139 C) 0.4571 D) -0.4763

208) cot 70.7° 208) _____
A) 2.8555 B) 0.9438 C) 0.3502 D) -70.5904

209) tan 47.7° 209) _____
A) 0.7396 B) 0.6496 C) 1.0990 D) 0.9099

210) csc 75.1° 210) _____
A) 0.2571 B) 0.9664 C) -0.2938 D) 1.0348

211) tan 459° 211) _____
A) -0.1564 B) 2.6051 C) -6.3138 D) -1.2349

212) sin 0.1630 212) _____
A) 0.1645 B) 1.0134 C) 0.9867 D) 0.1623

213) sec 0.56 213) _____
A) 0.5312 B) 0.6269 C) 1.1803 D) 0.8473

214) tan 3.95 214) _____
A) -1.4479 B) 1.0471 C) -0.6907 D) -0.7232

Give the amplitude or period as requested.

215) Amplitude of $f(x) = 3 \sin x$ 215) _____

A) $\frac{\pi}{3}$ B) 2π C) 3π D) 3

216) Amplitude of f(x) = -3 sin 5x 216) _____

A) $\frac{\pi}{3}$ B) $\frac{\pi}{5}$ C) $\frac{3}{5}$ D) 3

217) Period of f(x) = sin 5x 217) _____

A) $\frac{2\pi}{5}$ B) 1 C) 2π D) 5

218) Amplitude of f(x) = $\frac{1}{3}$ cos 4x 218) _____

A) $\frac{4\pi}{3}$ B) 4 C) $\frac{1}{3}$ D) $\frac{\pi}{4}$

219) Period of f(x) = cos 3x 219) _____

A) 3 B) 1 C) $\frac{2\pi}{3}$ D) 2π

220) Period of f(x) = 4 cos $\frac{1}{2}$x 220) _____

A) $\frac{4\pi}{2}$ B) 4π C) $\frac{\pi}{2}$ D) 4

221) Period of f(x) = 3 cos x 221) _____

A) 3 B) $\frac{\pi}{3}$ C) 2π D) π

222) Amplitude of f(t) = -2 cos$\left(\frac{\pi}{7}t + 9\right)$ 222) _____

A) -2 B) 14 C) 9 D) 2

223) Period of f(t) = 3 cos $\left(\frac{\pi}{5}t - 4\right)$ 223) _____

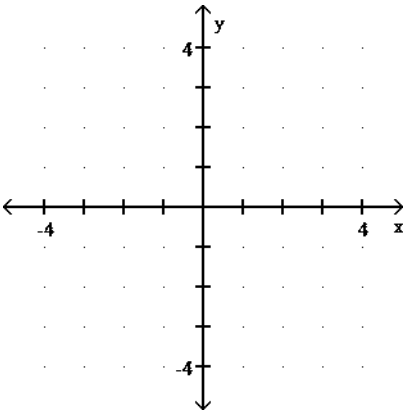
A) 10π B) 10 C) 5 D) $\frac{\pi}{5}$

224) Period of f(x) = 2 cos(7πx + 2) 224) _____

A) 7π B) $\frac{2\pi}{7}$ C) 2 D) $\frac{2}{7}$

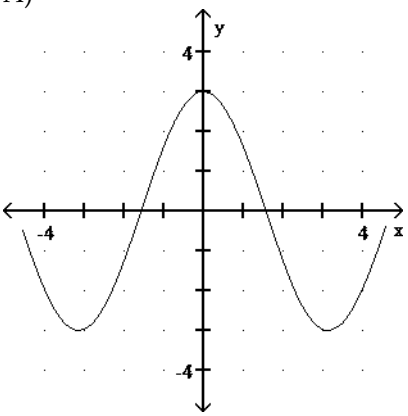
Graph the function.

225) y = 3 cos x



225) _____

A)



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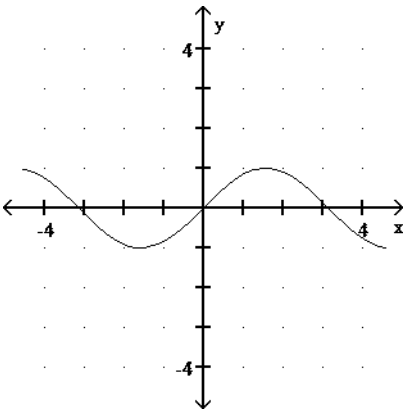

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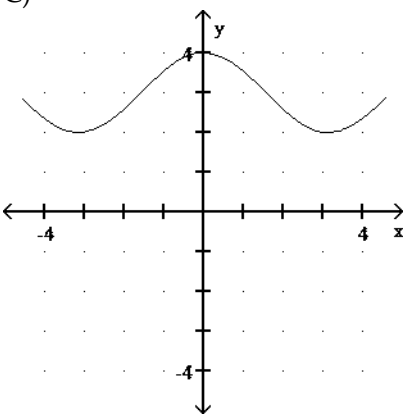

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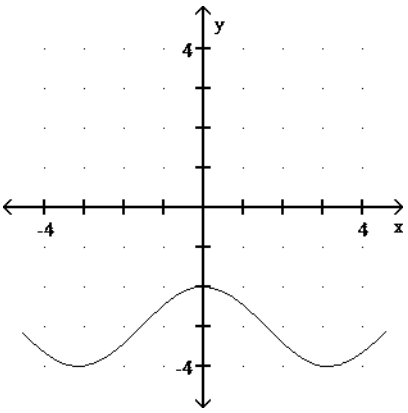
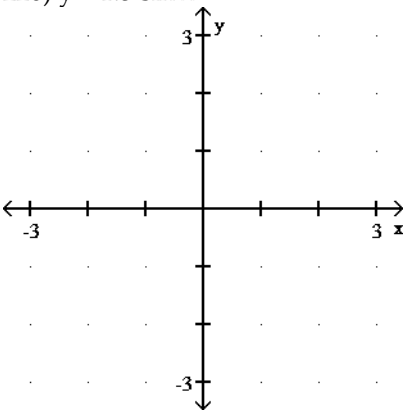
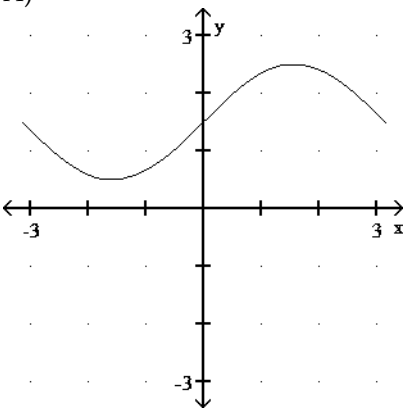


226) y = 1.5 sin x



226) _____

A)



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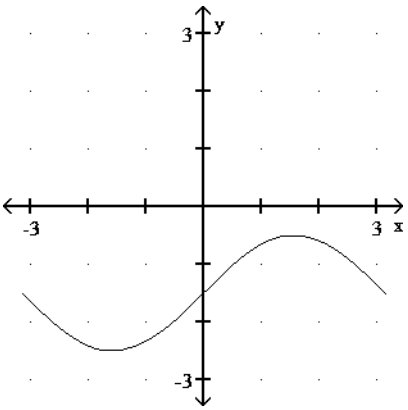

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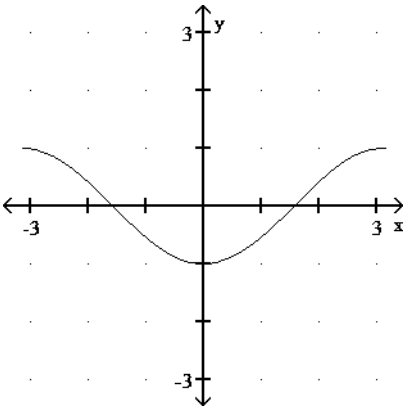

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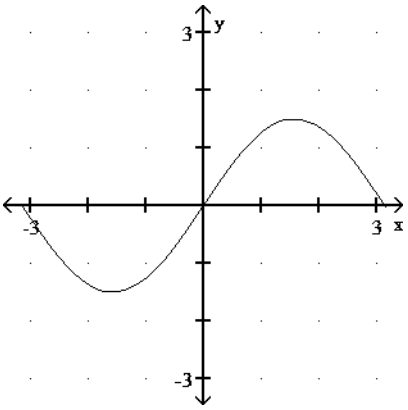
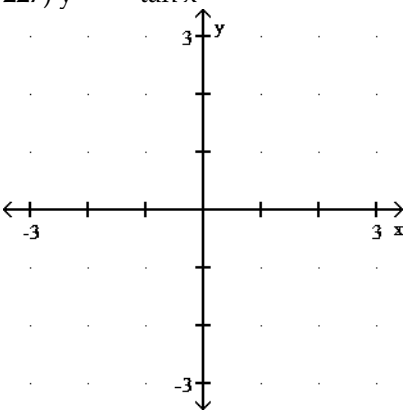
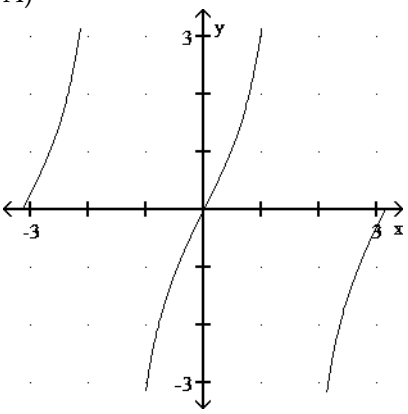


227) $y = \frac{1}{2} \tan x$



227) _____

A)



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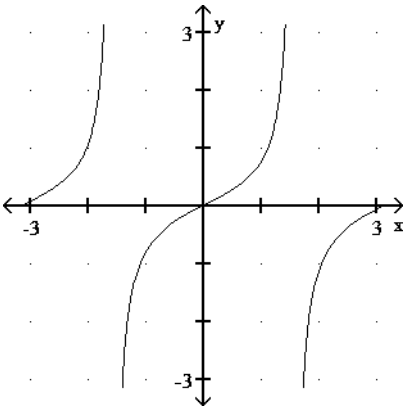

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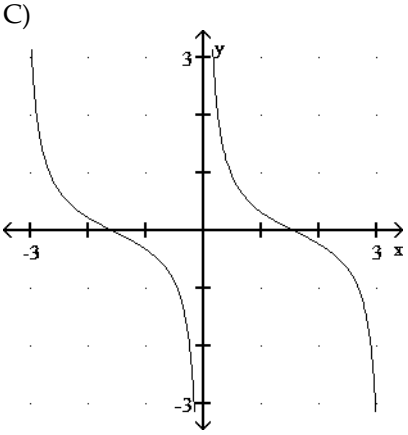

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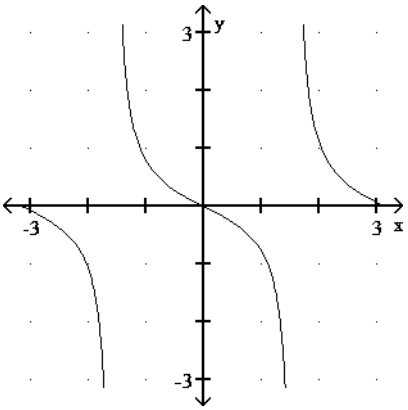
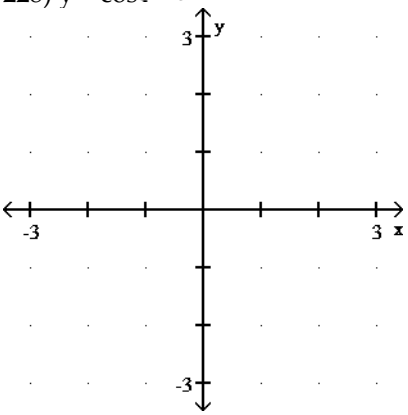
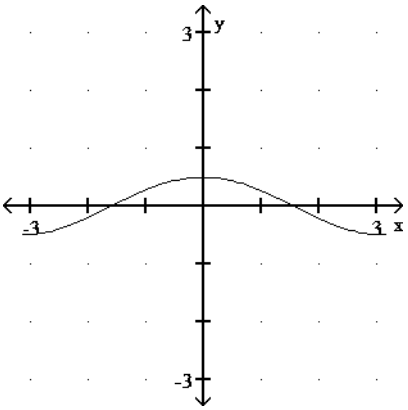


228) $y = \cos\left(\frac{1}{2}x\right)$

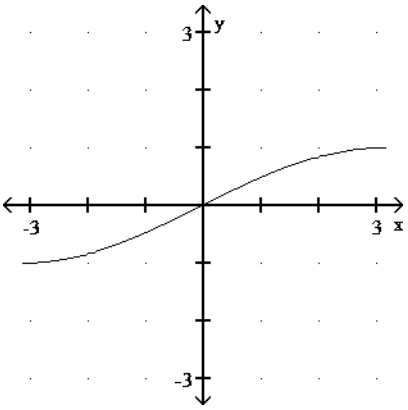


228) _____

A)



B)



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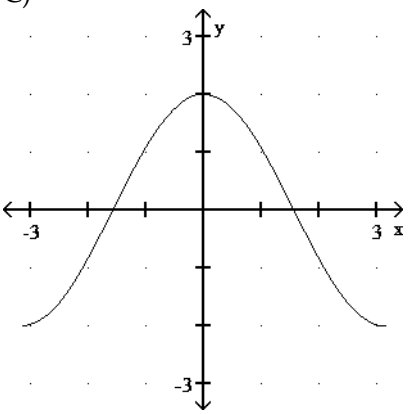

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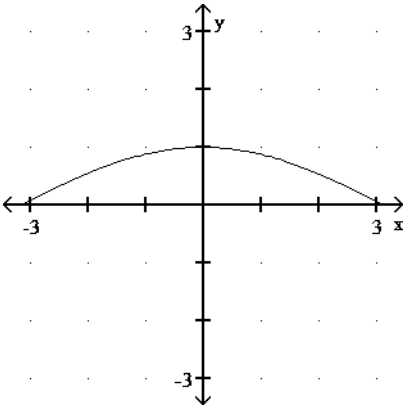
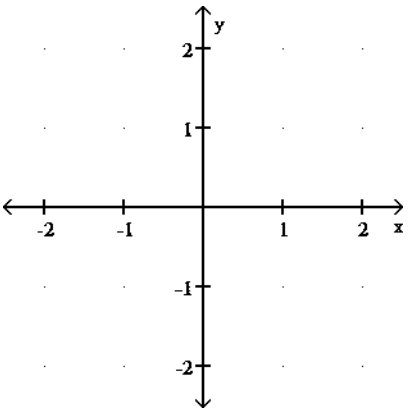
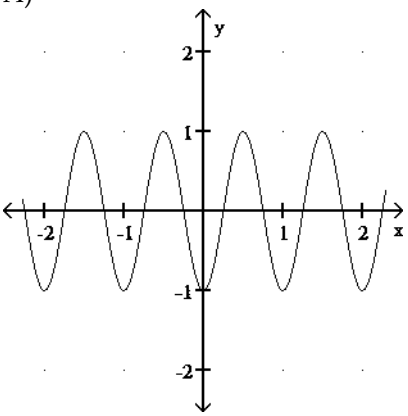


229) $y = -\cos(\pi x)$



229) _____

A)



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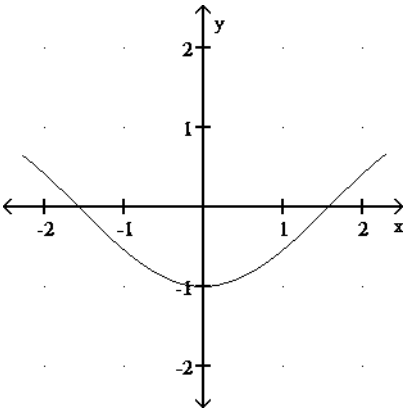

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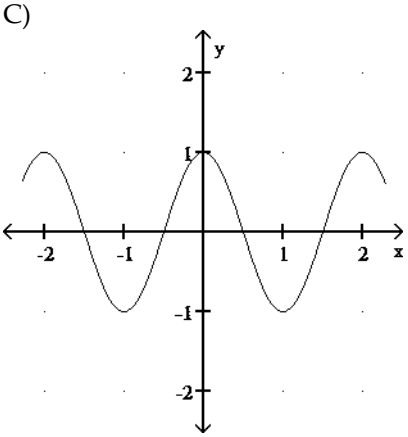

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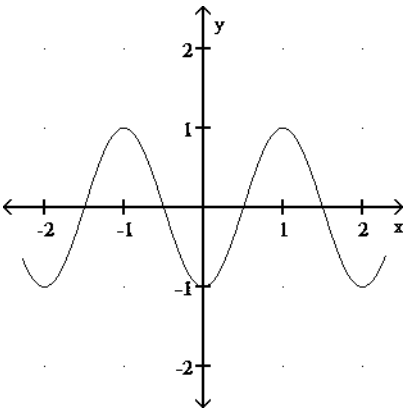
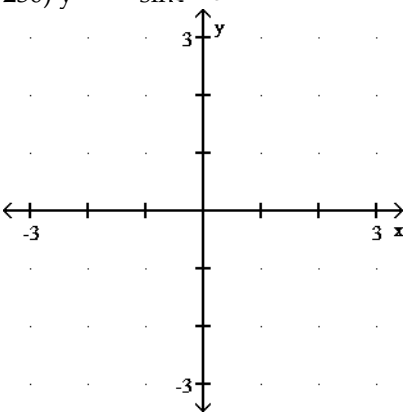
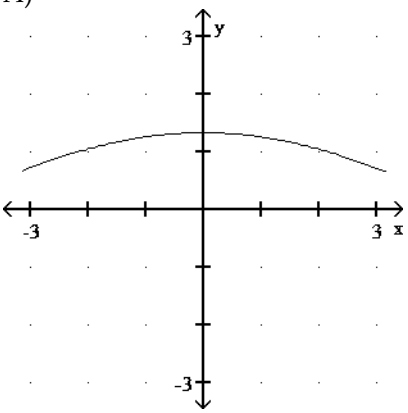


230) $y = \frac{4}{3}\sin\left(\frac{1}{3}x\right)$

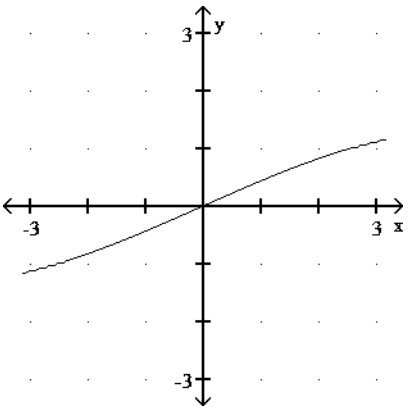


230) _____

A)



B)



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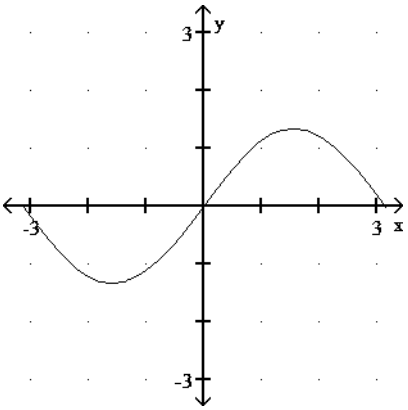

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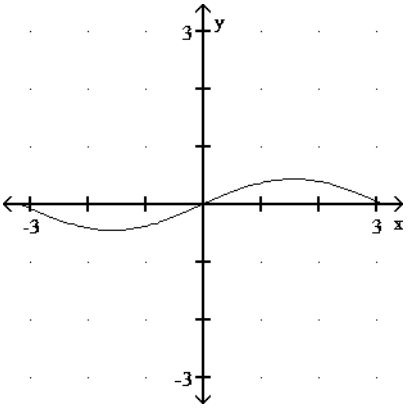
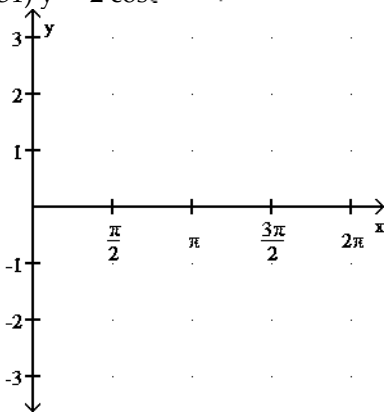
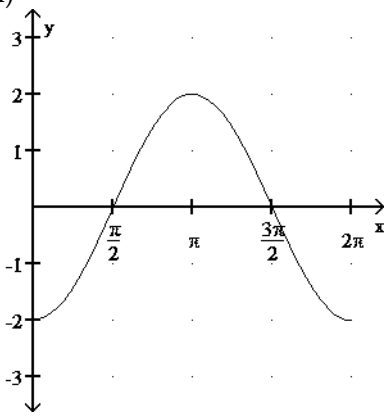


231) $y = -2 \cos\left(x + \frac{\pi}{2}\right)$



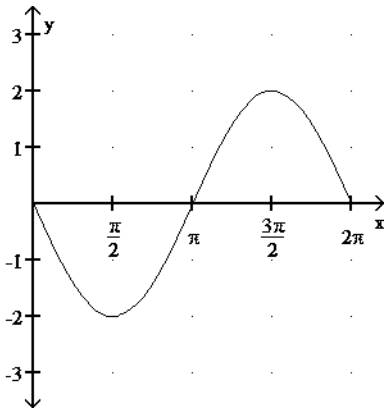
231) _____

A)

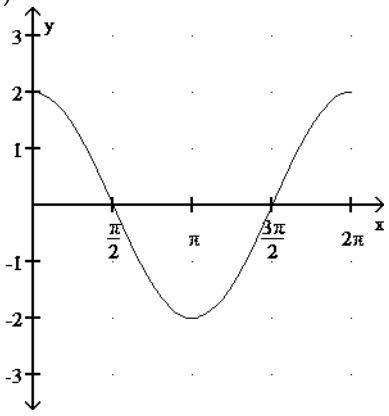


B)

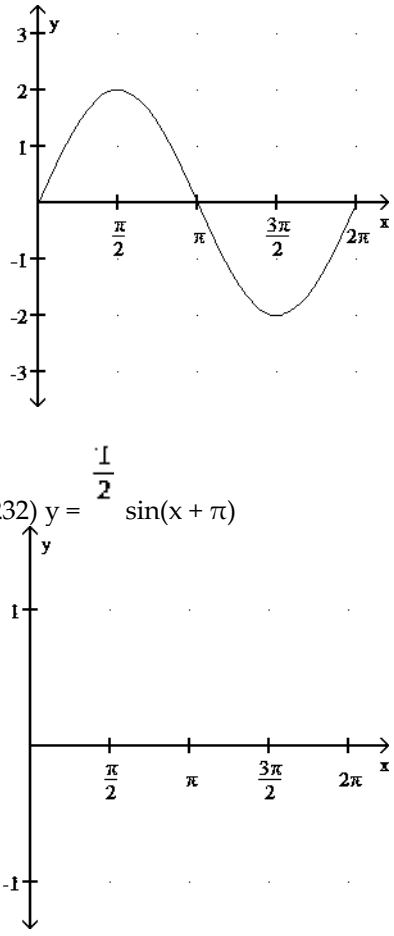
C)



D)

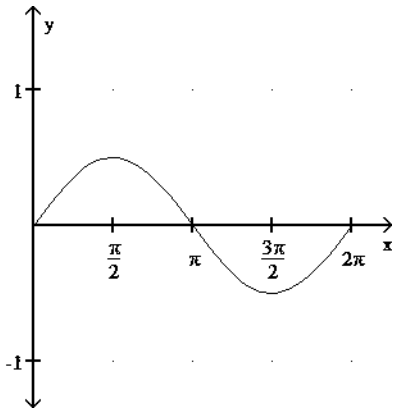


232) $y = \frac{1}{2}\sin(x + \pi)$

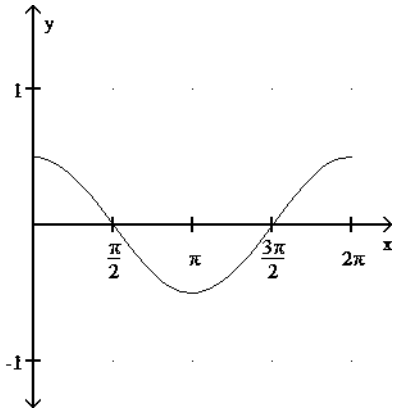


232) _____

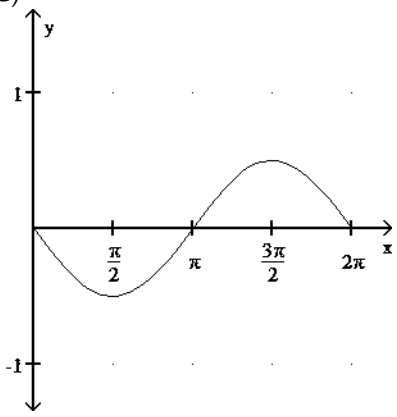
A)



B)



C)



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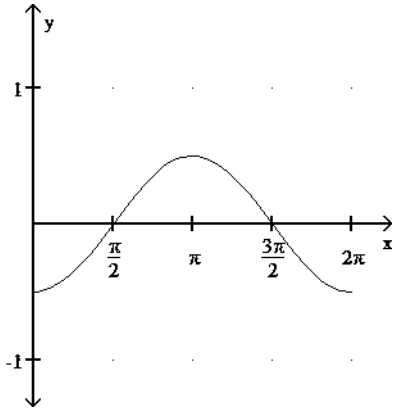
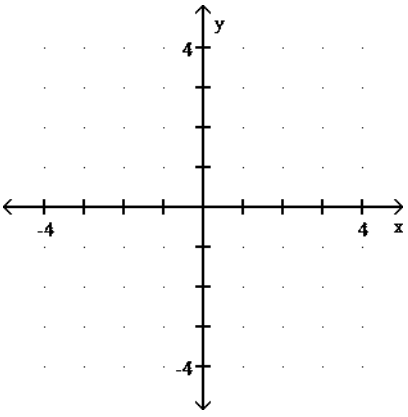
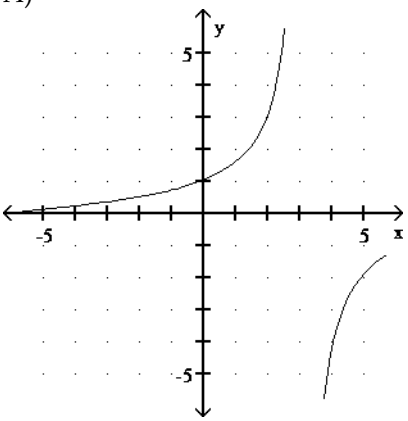


233) $y = \frac{3}{5}\tan\left(\frac{5}{6}x + \frac{\pi}{3}\right)$

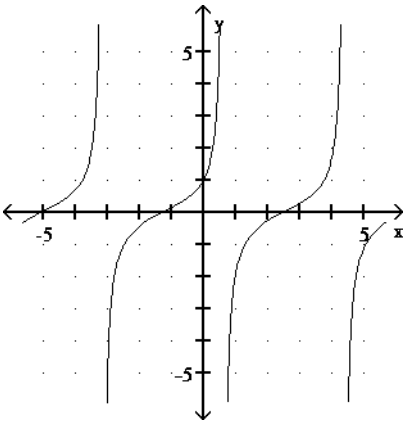


233) _____

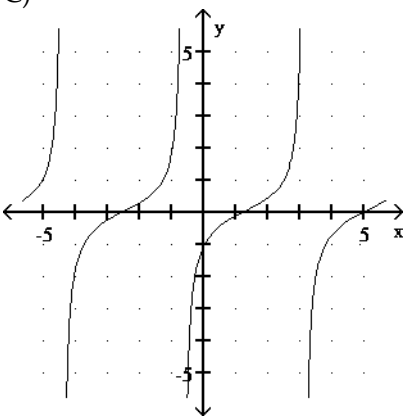
A)



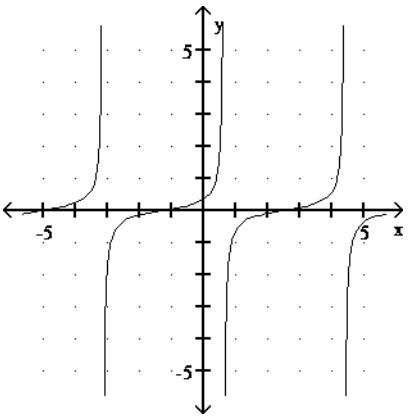
B)



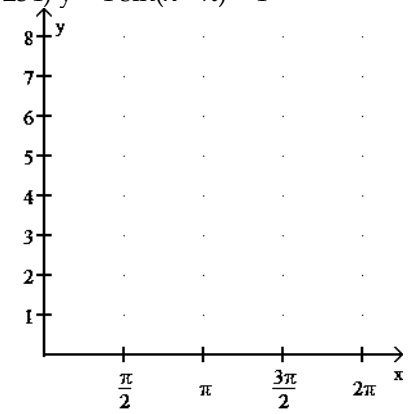
C)



D)

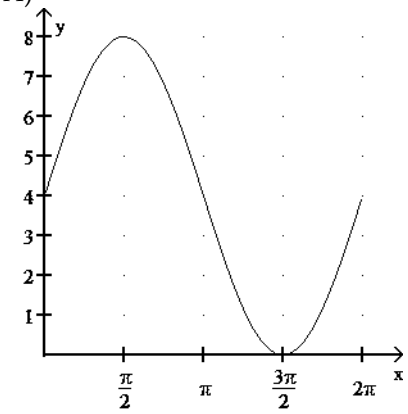


234) $y = 4 \sin(x - \pi) + 4$

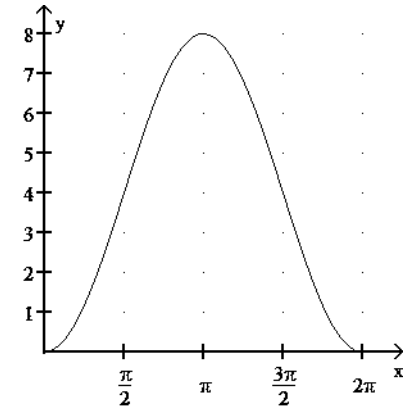


234) _____

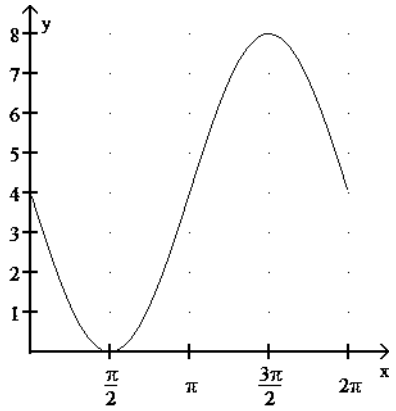
A)



B)



C)



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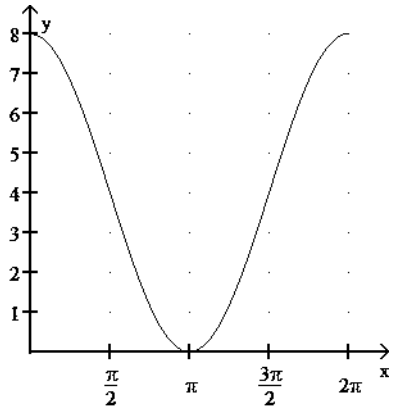


Solve the problem.

235) Sales of snow shovels are seasonal. Suppose the sale of snow shovels in Maine is approximated by $s(t) = 10{,}000 + 10{,}000\cos\left(\frac{\pi}{6}t\right)$, where t is time in months and t = 0 is October. What are the sales in December? 235) _____

A) 15,000 snow shovels B) 18,660 snow shovels
C) 13,900 snow shovels D) 17,071 snow shovels

236) The temperature in Fairbanks is approximated by $T(x) = 37\sin\left[\frac{2\pi}{365}(x - 101)\right] + 25$, where T(x) is the temperature on day x, with x = 1 corresponding to Jan 1 and $x = 365$ corresponding to Dec 31. Estimate the temperature, to the nearest degree, on day 345. 236) _____

A) -32° B) 338° C) -25° D) -7°

237) A scientist studying ocean tides places an 8 ft high marker in the water at 6 am on a Monday morning. At that time the water is about 5.5 ft high and receding. The scientist observes that the water reaches its lowest level, 0.1 ft, at 9:18 am and then begins to rise. Assume that the water level, in feet, is given by

$h(t) = 4.9\sin\left(\frac{2\pi}{12.4}t\right) + 5$,

where t represents the number of hours after midnight. (In other words, the marker was placed in the water when t = 6.) Find the first time interval during which the marker is completely underwater. 237) _____

A) Approximately from 1:18 am to 4:54 am Tuesday
B) Approximately from 11:24 pm Monday to 2:00 am Tuesday

C) Approximately from 1:42 pm to 5:18 pm Monday
D) Approximately from 2:06 pm to 4:24 pm Monday

238) The voltage E in an electrical circuit is given by $E = 7.1\cos(60\pi t)$, where t is time measured in seconds. Find the period. 238) _____

A) 30π B) 30 C) $\frac{\pi}{30}$ D) $\frac{1}{30}$

239) The total sales in dollars of some small businesses fluctuates according to the equation $S = A + B\sin\left(\frac{\pi}{6}x\right)$, where x is the time in months, with $x = 1$ corresponding to January, $A = 8500$, and $B = 4200$. Determine the month with the greatest total sales and give the sales in that month. 239) _____

A) September; $4300 B) March; $12,700
C) June; $8500 D) December; $12,700

240) The total sales in dollars of some small businesses fluctuates according to the equation $S = A + B\sin\left(\frac{\pi}{6}x\right)$, where x is the time in months, with $x = 1$ corresponding to January, $A = 7200$, and $B = 3300$. Determine the month with the least sales and give the sales in that month. 240) _____

A) September; $3900 B) December; $7200
C) March; $10,500 D) June; $3300

241) The motion of a spring-mass system is described by the equation $y = 9\sin\left(\pi t - \frac{\pi}{2}\right)$, where y is the distance in feet from the equilibrium position and t is time in seconds. If the weight is 23 feet from the ceiling in a state of equilibrium, find the time at which the weight first passes the equilibrium position. 241) _____

A) $\frac{1}{8}$ sec B) 1 sec C) 4 sec D) $\frac{1}{4}$ sec

242) The motion of a spring-mass system is described by the equation $y = 2\sin\left(\pi t - \frac{\pi}{2}\right)$, where y is the distance in feet from the equilibrium position and t is time in seconds. If the weight is 22 feet from the ceiling in a state of equilibrium, find the closest the weight will ever be to the ceiling. 242) _____

A) 22 ft B) 24 ft C) 20 ft D) 2 ft

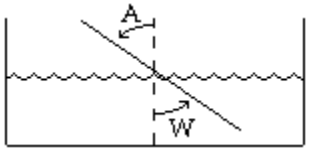
243) The motion of a spring-mass system is described by the equation $y = 11\sin\left(\pi t - \frac{\pi}{4}\right)$, where y is the distance in feet from the equilibrium position and t is time in seconds. If the weight is 22 feet from the ceiling in a state of equilibrium, find the distance from the ceiling at time t = 3. 243) _____

A) 34 ft B) 30 ft C) 32 ft D) 28 ft

244) The position of a weight attached to a spring is $s(t) = -6\cos(12\pi t)$ inches after t seconds. What is the maximum height that the weight reaches above the equilibrium position and when does it first reach the maximum height? 244) _____

A) The maximum height of 12 inches is first reached after 3 seconds.
B) The maximum height of 12 inches is first reached after 6 seconds.
C) The maximum height of 6 inches is first reached after 6 seconds.
D) The maximum height of 6 inches is first reached after 0.08 seconds.

245) The index of refraction for air, I_a, is 1.0003. The index of refraction for water, I_W, is 1.3. If $\frac{I_W}{I_a} = \frac{\sin A}{\sin W}$, and $A = 31.5°$, find W to the nearest tenth.



245) _____

A) 22.7° B) 21.7° C) 20.7° D) 23.7°

246) Snell's Law states that $\frac{c_1}{c_2} = \frac{\sin \theta_1}{\sin \theta_2}$. Use this law to find the requested value. If $c_1 = 7 \times 10^6$, $\theta_1 = 43°$, and $\theta_2 = 38°$, find c_2. 246) _____

A) $c_2 = 6.32 \times 10^5$ B) $c_2 = 6.32 \times 10^6$ C) $c_2 = 6.85 \times 10^6$ D) $c_2 = 6.08 \times 10^8$

247) Snell's Law states that $\frac{c_1}{c_2} = \frac{\sin \theta_1}{\sin \theta_2}$. Use this law to find the requested value. If $c_2 = 2.1 \times 10^8$, $\theta_1 = 57°$ and $\theta_2 = 36°$, find c_1. 247) _____

A) $c_1 = 1.98 \times 10^7$ B) $c_1 = 2.1 \times 10^{10}$ C) $c_1 = 3 \times 10^8$ D) $c_1 = 2.67 \times 10^8$

248) Snell's Law states that $\frac{c_1}{c_2} = \frac{\sin \theta_1}{\sin \theta_2}$. Use this law to find the requested value. If $c_1 = 4 \times 10^7$, $c_2 = 3.17 \times 10^7$, $\theta_1 = 42°$, find θ_2. Round your answer to the nearest degree. 248) _____

A) $\theta_2 = 35°$ B) $\theta_2 = 31°$ C) $\theta_2 = 32°$ D) $\theta_2 = 34°$

249) Snell's Law states that $\frac{c_1}{c_2} = \frac{\sin \theta_1}{\sin \theta_2}$. Use this law to find the requested value. If $c_1 = 7 \times 10^6$, $c_2 = 5.54 \times 10^6$, $\theta_2 = 36°$, find θ_1. Round your answer to the nearest degree. 249) _____

A) $\theta_1 = 48°$ B) $\theta_1 = 49°$ C) $\theta_1 = 46°$ D) $\theta_1 = 51°$

250) From a boat on the lake, the angle of elevation to the top of a cliff is 26°29'. If the base of the cliff is 1429 feet from the boat, how high is the cliff (to the nearest foot)? 250) _____

A) 715 ft B) 712 ft C) 725 ft D) 722 ft

251) From a boat on the river below a dam, the angle of elevation to the top of the dam is 21°31'. If the dam is 437 feet

above the level of the river, how far is the boat from the base of the dam (to the nearest foot)? 251) _____

A) 1078 ft B) 1088 ft C) 1108 ft D) 1098 ft

252) From a balloon 878 feet high, the angle of depression to the ranger headquarters is 67°34'. How far is the headquarters from a point on the ground directly below the balloon (to the nearest foot)? 252) _____

A) 357 ft B) 352 ft C) 362 ft D) 367 ft

253) When sitting atop a tree and looking down at his pal Joey, the angle of depression of Mack's line of sight is 41°24'. If Joey is known to be standing 20 feet from the base of the tree, how tall is the tree (to the nearest foot)? 253) _____

A) 24 ft B) 18 ft C) 20 ft D) 22 ft

254) The air speed of an airplane is 690 km/hr and its angle of climb is 2.07°. What is its ground speed (to the nearest km/hr)? 254) _____

A) 675 km/hr B) 685 km/hr C) 690 km/hr D) 680 km/hr

255) At an altitude of 3500 ft, the engine on a small plane fails. What angle of glide is needed to reach an airport runway that is 4 miles away by land? (Round your answer to the nearest tenth of a degree.) 255) _____

A) 88.9° B) 89.9° C) 10.4° D) 9.4°

256) The chairlift at a ski resort has a vertical rise of 2400 feet. If the length of the ride is 1.2 miles, what is the average angle of inclination of the lift (to the nearest tenth of a degree)? 256) _____

A) 22.3° B) 19.3° C) 16.3° D) 25.3°

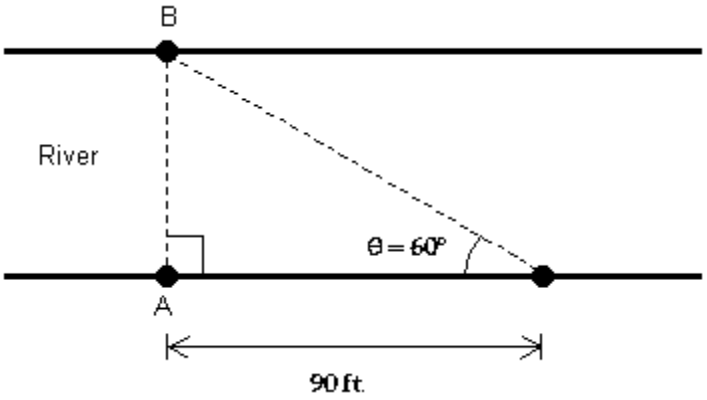
257) A 30-foot ladder is leaning against the side of a building. If the ladder makes an angle of $26° 16'$ with the side of the building, how far is the bottom of the ladder from the base of the building? Round your answer to the hundredths place. 257) _____

A) 13.28 ft B) 3.91 ft C) 18.98 ft D) 14.58 ft

258) A contractor needs to know the height of a building to estimate the cost of a job. From a point 89 feet away from the base of the building, the angle of elevation to the top of the building is found to be $45° 36'$. Find the height of the building. Round your answer to the hundredths place. 258) _____

A) 93.78 ft B) 90.88ft C) 89.35 ft D) 95.11 ft

259) A conservation officer needs to know the width of a river in order to set instruments correctly for a study of pollutants in the river. From point A, the conservation officer walks 90 feet downstream and sights point B on the opposite bank to determine that $\theta = 60°$ (see figure). How wide is the river?



259) _____

A) 52 ft B) 180 ft C) 156 ft D) 78 ft

260) A weight attached to a spring is pulled down 3 inches below the equilibrium position. Assuming that the period of the system is $\frac{1}{5}$ second, determine a trigonometric model that gives the position of the weight at time t seconds. 260) _____

A) y = -3 cos 5πtB) y = -3 cos 10πt C) y = 3 cos 10πt D) y = 3 cos $\frac{1}{5}$t

261) A weight attached to a spring is pulled down 2 inches below the equilibrium position. Assuming that the frequency of the system is $\frac{5}{\pi}$ cycles per second, determine a trigonometric model that gives the position of the weight at time t seconds. 261) _____

A) y = -2 cos 10t B) y = 2 cos 10t C) y = 2 cos 5t D) y = -2 cos 5t

262) Tides go up and down in a 14-hour period. The average depth of a certain river is 14 m and ranges from 11 to 17 m. The depth of the river can be approximated by a sine curve. Write an equation that gives the depth x hours after midnight given that high tide occurs at 7:00 am. 262) _____

A) $d = 3 \sin\left(\frac{\pi x}{14} - \frac{\pi}{2}\right) + 1$ B) $d = 3 \sin\left(\frac{\pi x}{7}\right) + 14$

C) $d = 7 \sin\left(\frac{\pi x}{7} - \frac{\pi}{4}\right)$ D) $d = 3 \sin\left(\frac{\pi x}{7} - \frac{\pi}{2}\right) + 14$

1) D
2) C
3) C
4) D
5) A
6) B
7) C
8) D
9) A
10) C
11) C
12) D
13) D
14) D
15) C
16) A
17) B
18) A
19) B
20) B
21) C
22) D
23) B
24) A
25) D
26) B
27) B
28) D
29) B
30) B
31) A
32) C
33) B
34) A
35) C
36) A
37) A
38) D
39) B
40) D
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42) C
43) A
44) A
45) A
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51) B

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54) D
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58) B
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64) A
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68) B
69) D
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102) B
103) B

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126) A
127) A
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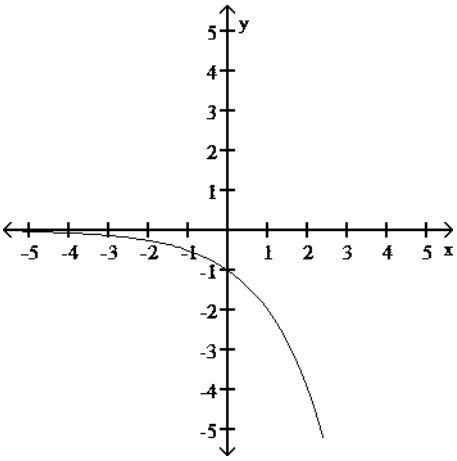
146)



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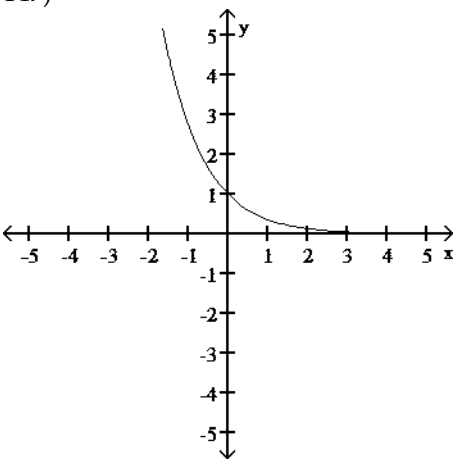
147)



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148) The graph is shifted 5 units to the right and 5 units down.

149) The graph is reflected over the y-axis and then shifted 3 units down.

150) C

151) C

152) B

153) B

154) C

155) D

156) C

157) B

158) B

159) B

160) C

161) C

162) D

163) D

164) C

165) C

166) A

167) D

168) D

169) B

170) B
171) A
172) A
173) B
174) A
175) B
176) B
177) B
178) B
179) A
180) B
181) C
182) B
183) D
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185) C
186) D
187) C
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253) B
254) C
255) D
256) A
257) A
258) B
259) C
260) B
261) A
262) D