

Practice for Chapter 12

Disclaimer. The actual exam is different. This is a study aid.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Given $f(x)$ and $g(x)$, find the indicated composition.

1) $f(x) = x^2 + 7$; $g(x) = 5x + 3$

Find $(f \circ g)(x)$.

1) _____

2) $f(x) = 4x^2 + 6x + 8$; $g(x) = 6x - 4$

Find $(g \circ f)(x)$.

2) _____

3) $f(x) = \frac{9}{x^2}$; $g(x) = x - 4$

Find $(g \circ f)(x)$.

3) _____

4) $f(x) = 2\sqrt{x+7}$; $g(x) = 7x + 10$

Find $(f \circ g)(x)$.

4) _____

5) $f(x) = \frac{1}{x}$; $g(x) = \sqrt{6x}$

Find $(g \circ f)(x)$.

5) _____

Given $f(x)$ and $g(x)$, find the indicated composition and evaluate.

6) $f(x) = 3x + 6$; $g(x) = \frac{2}{x}$

Find $(g \circ f)(3)$.

6) _____

7) $f(x) = \sqrt{x}$; $g(x) = 4x - 14$

Find $(f \circ g)(9)$.

7) _____

8) $f(x) = \sqrt{x}$; $g(x) = 4x - 14$

Find $(f \circ g)(14)$.

8) _____

9) $f(x) = \sqrt{3x+8}$; $g(x) = 2x^2$

Find $(g \circ f)(2)$.

9) _____

Determine whether the function is one-to-one.

10) $f(x) = -8 - 7x$

10) _____

11) $f(x) = -4 - x^2$

11) _____

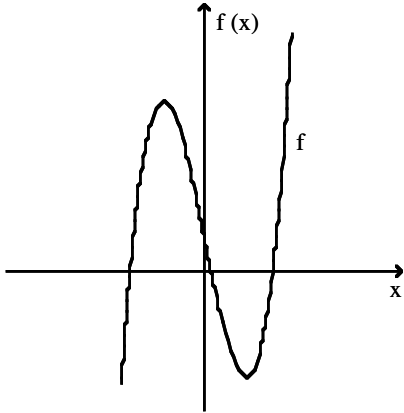
Determine whether the function is one-to-one. Give a valid reason.

12) $f(x) = 3x^2 + 8$

12) _____

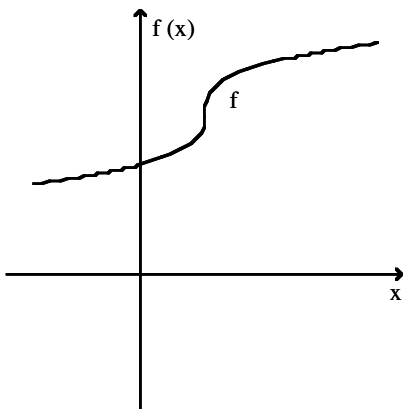
Determine whether the function is one-to-one.

13)



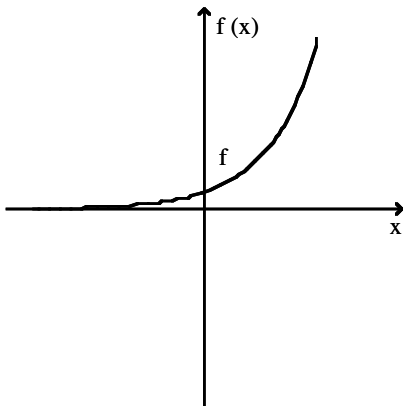
13) _____

14)



14) _____

15)



15) _____

Determine whether the function is one-to-one. If so, find a formula for the inverse.

16) $g(x) = 2x$

16) _____

17) $h(x) = 6x - 9$

17) _____

18) $g(x) = x^2 - 3$

18) _____

19) $h(x) = \frac{4}{x}$

19) _____

20) $f(x) = -10$

20) _____

21) $h(x) = x^3 - 7$

21) _____

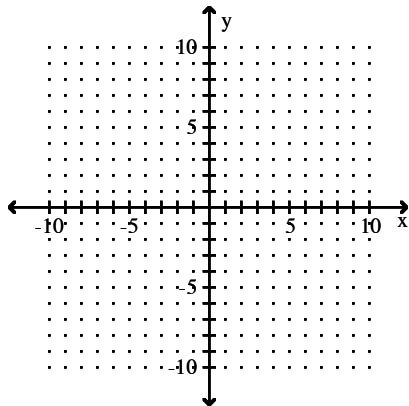
22) $f(x) = \sqrt{x - 9}$

22) _____

Graph the function using a solid line and its inverse using a dashed line on the same set of axes.

23) $f(x) = 2x + 2$

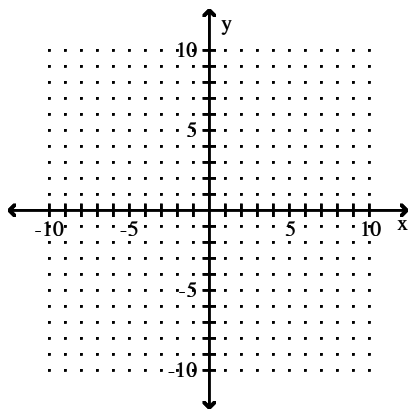
23) _____



Graph the function using a solid line and its inverse using a dashed line on the same set of axes. Label two points on each line.

24) $f(x) = \frac{5}{3}x - 2$

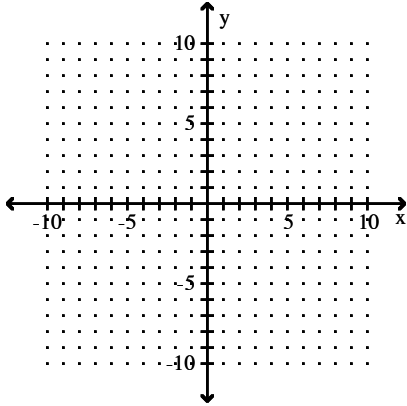
24) _____



Graph the function using a solid line and its inverse using a dashed line on the same set of axes.

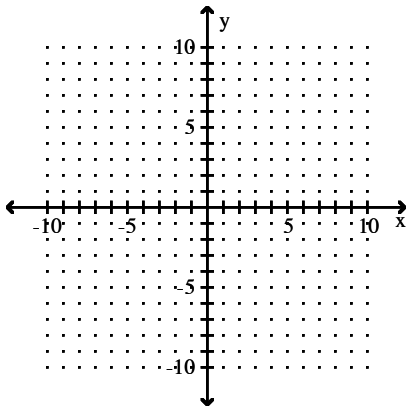
25) $f(x) = x^3 + 1$

25) _____



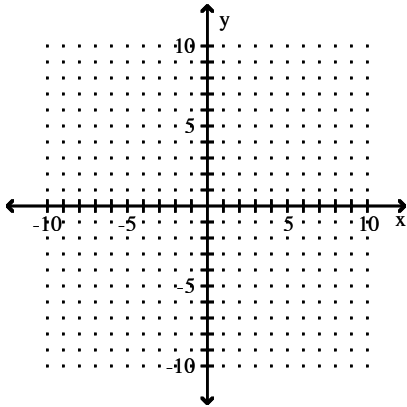
26) $f(x) = \sqrt{x+4}$

26) _____



27) $f(x) = x^2 - 5, x \geq 0$

27) _____



For the function f , use composition of functions to show that f^{-1} is as given.

28) Let $f(x) = \sqrt[3]{x+27}$. Show that $f^{-1}(x) = x^3 - 27$.

28) _____

29) Let $f(x) = \sqrt[3]{x+3}$. Show that $f^{-1}(x) = x^3 - 3$.

29) _____

30) Let $f(x) = (2 - x)/x$. Show that $f^{-1}(x) = \frac{2}{x+1}$.

30) _____

Find a formula for the inverse of the function described below.

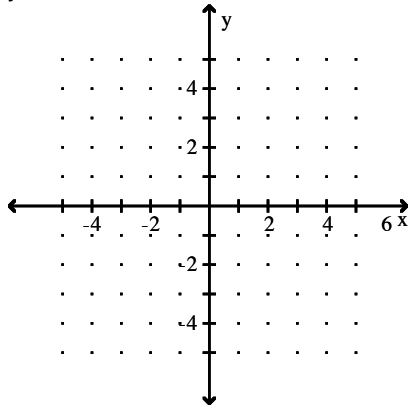
31) 32° Fahrenheit = 0° Celsius. A function that converts temperatures in Fahrenheit to those in Celsius is $f(x) = \frac{5}{9}(x - 32)$ Fahrenheit.

31) _____

Graph. Label at least two points on each graph.

32) $y = 3^x$

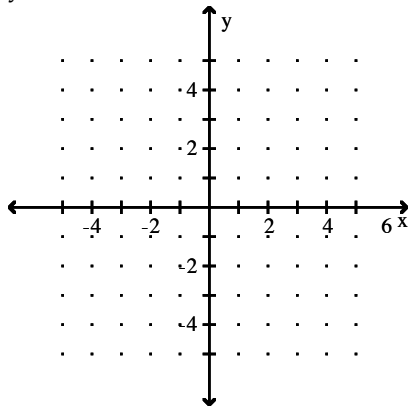
32) _____



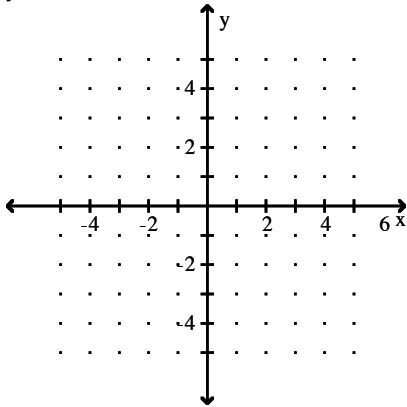
Graph. Label two points on the graph.

33) $y = 5x - 3$

33) _____

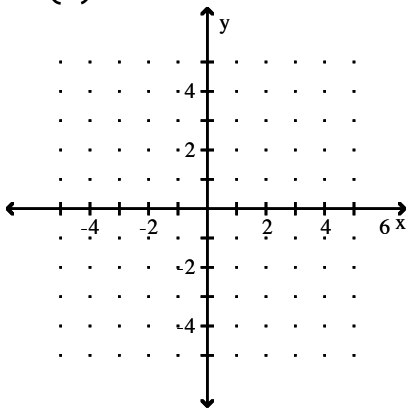


34) $y = 4(x+1)$



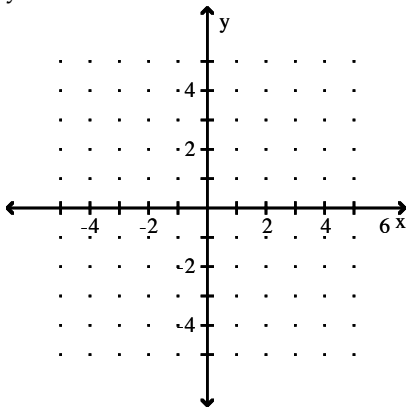
34) _____

35) $y = \left(\frac{1}{3}\right)^x$



35) _____

36) $y = 5^{-x}$

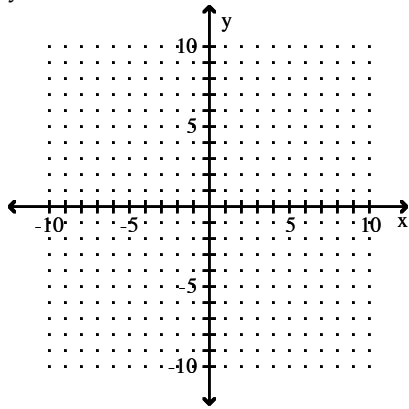


36) _____

Graph the pair of equations on the same set of axes. Graph the equation on the left using a solid line and the function on the right with a dashed line. Label two points on each line.

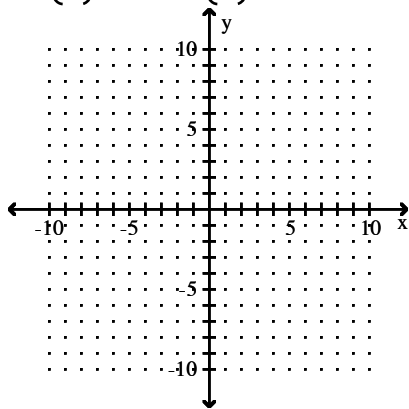
37) $y = 5x$, $x = 5^y$

37) _____



38) $y = \left(\frac{1}{2}\right)^x$, $x = \left(\frac{1}{2}\right)^y$

38) _____



Solve the problem.

39) The amount of particulate matter left in solution during a filtering process decreases by the equation $P = 600 (0.5)^{6n}$, where n is the number of filtering steps. Find the amounts left for $n = 0$ and $n = 5$. (Round to the nearest whole number.) 39) _____

40) The amount of particulate matter left in solution during a filtering process decreases by the equation $P = 300 (0.5)^{4n}$, where n is the number of filtering steps. Find the amounts left for $n = 0$ and $n = 5$. (Round to the nearest whole number.) 40) _____

41) The half-life of a certain radioactive substance is 13 years. Suppose that at time $t = 0$, there are 30 g of the substance. Then after t years, the number of grams of the substance remaining will be 41) _____

$$N(t) = 30 \left(\frac{1}{2}\right)^{t/26}$$

How many grams of the substance will remain after 52 years?
Round to the nearest hundredth of a gram.

Simplify.

42) $\log_8 \frac{1}{64}$

42) _____

43) $\log_{10} 0.01$

43) _____

44) $\log_6 6^5$

44) _____

45) $\log_7 7^2$

45) _____

46) $\log_8 512$

46) _____

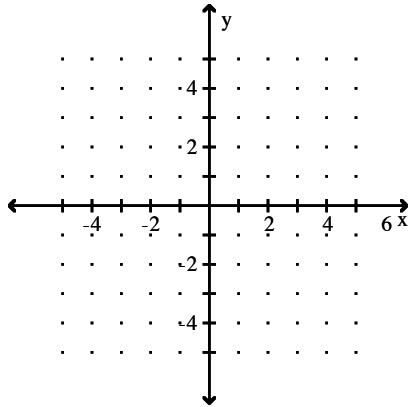
47) $10^{\log 7}$

47) _____

Graph. Label two points on the graph.

48) $y = \log_{1/8} x$

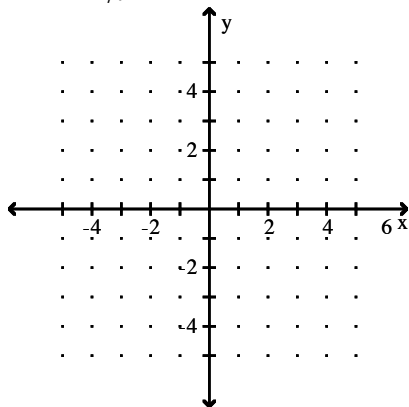
48) _____



Graph. Label at least two points on the graph.

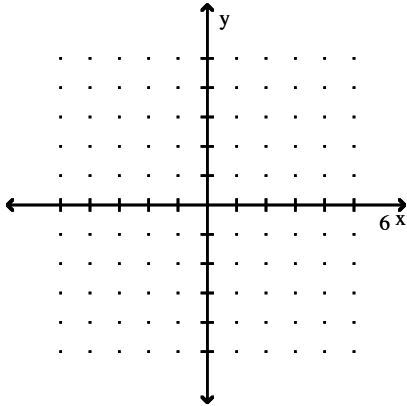
49) $y = \log_{1/9} x$

49) _____



Graph. Label two points on the graph.

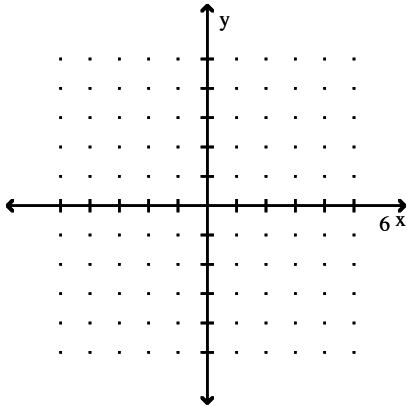
50) $y = \log_5(x - 2)$



50) _____

Graph both functions using the same set of axes. Label two points on each graph.

51) $f(x) = 3^x$, $f^{-1}(x) = \log_3 x$



51) _____

Rewrite as an equivalent exponential equation. Do not solve.

52) $t = \log_3 81$

52) _____

53) $\log_9 81 = 2$

53) _____

54) $\log_3 \frac{1}{9} = -2$

54) _____

55) $\log_w Q = 12$

55) _____

Rewrite as an equivalent logarithmic equation. Do not solve.

56) $3^2 = 9$

56) _____

57) $2^{-2} = \frac{1}{4}$

57) _____

58) $100.8451 = 7$

58) _____

59) $yz = 8$

59) _____

Solve the problem.

60) $\log_4 16 = x$

60) _____

61) $\log_2 \frac{1}{8} = x$

61) _____

62) $\log_x 32 = 5$

62) _____

63) $\log_5 x = -2$

63) _____

64) $\log_3 x = -4$

64) _____

65) $\log_{64} x = \frac{2}{3}$

65) _____

Express as a sum of logarithms.

66) $\log_2 (16 \cdot 8)$

66) _____

67) $\log_r (4T)$

67) _____

68) $\log_6 (xy)$

68) _____

69) $\log_x (5yz)$

69) _____

Express as a single logarithm.

70) $\log_6 13 + \log_6 12$

70) _____

71) $\log_c m + \log_c n$

71) _____

Express as a product.

72) $\log_c Z^{-3}$

72) _____

73) $\log_c Z^{-7}$

73) _____

Express as a difference of logarithms.

74) $\log_g \frac{M}{61}$

74) _____

75) $\log_a \frac{q}{r}$

75) _____

Express as a single logarithm.

76) $\log_b y - \log_b z$

76) _____

Express as a sum, difference, and product of logarithms, without using exponents.

77) $\log_7 \frac{15\sqrt{m}}{n}$

77) _____

78) $\log_4 \frac{9\sqrt{x}}{y}$

78) _____

79) $\log_b \frac{m^5 p^9}{n^6 b^8}$

79) _____

80) $\log_b \frac{m^2 p^4}{n^6 b^3}$

80) _____

81) $\log_b \sqrt{\frac{x^4 y^7}{z^5}}$

81) _____

82) $\log_b \sqrt[3]{\frac{x^9}{y^2 z^6}}$

82) _____

83) $\log_b \sqrt{\frac{a^6 b^9}{a^2 b^3}}$

83) _____

Express as a single logarithm, and, if possible, simplify.

84) $\frac{1}{4} \log_a x + 6 \log_a y - 2 \log_a x$

84) _____

85) $\frac{1}{3} \log_a x + 7 \log_a y - 4 \log_a x$

85) _____

86) $\log_b 4x + 3(\log_b x - \log_b y)$

86) _____

87) $\log_w (x^2 - 64) - \log_w (x - 8)$

87) _____

Solve the problem. Decimal answers are expected.

88) Given $\log_b A = 3.940$ and $\log_b B = 0.253$.

88) _____

Find $\log_b \frac{A}{B}$.

Solve the problem.

89) Given $\log_b 5 = 2.5179$ and $\log_b 7 = 1.4873$.

89) _____

Find $\log_b \frac{5}{7}$.

90) Given $\log_b 5 = 1.2301$ and $\log_b 7 = 1.4873$.

90) _____

Find $\log_b \sqrt{b^7}$.

Simplify.

91) $\log_a a^{4059}$

91) _____

92) $\log_e e^5$

92) _____

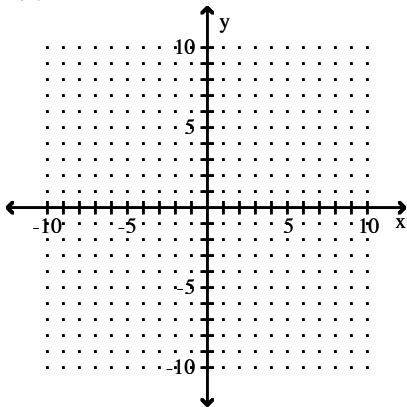
93) $\log_e e^9$

93) _____

Graph and state the domain and the range of the function. Label two points on the graph.

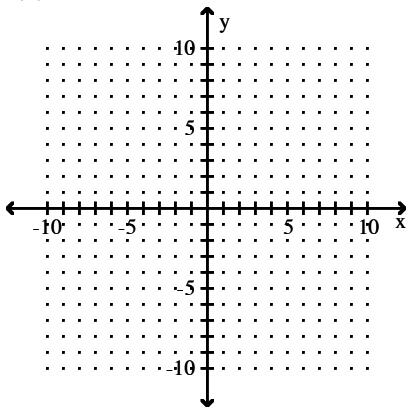
94) $f(x) = -e^{-x}$

94) _____



95) $f(x) = e^x + 1$

95) _____



Solve. Where appropriate, include approximations to the nearest thousandth. If no solution exists, state this.

96) $4(x + 3) = 16$

96) _____

97) $4(2x + 1) = 64$

97) _____

98) $8x = 32(2x + 5)$

98) _____

99) $2(x^2 + 4x) = \frac{1}{8}$

99) _____

100) $42x \cdot 4x^2 = 64$

100) _____

101) $94x = 81(2x + 9)$

101) _____

102) $\ln x = 1$

102) _____

103) $\log_2 (9x - 8) = 3$

103) _____

104) $\log x - \log(x + 7) = 1$

104) _____

105) $\log_4 (x - 4) + \log_4 (x - 4) = 1$

105) _____

106) $\log 3x = \log 4 + \log (x - 3)$

106) _____

107) $\ln (x - 6) + \ln (x + 5) = \ln 42$

107) _____

108) $\ln (x - 9) + \ln (x + 5) = \ln 51$

108) _____

Solve the problem.

109) A college loan of \$24,000 is made at 3% interest, compounded annually. After t years, the amount due, A, is given by the function

109) _____

$$A(t) = 24,000(1.03)^t$$

After what amount of time will the amount reach \$36,000?

110) A loan of \$18,000 is made at 2% interest, compounded annually. After t years, the amount due, A, is given by the function

110) _____

$$A(t) = 18,000(1.02)^t$$

Find the doubling time.

111) The hydrogen ion concentration of a substance is about 8.0×10^{-10} moles per liter. Find the pH. Round to the nearest tenth. Use the formula $\text{pH} = -\log [\text{H}^+]$.

111) _____

Solve the problem. Write answer in scientific notation.

112) Find the hydrogen ion concentration of a solution whose pH is 5.9. Use the formula $\text{pH} = -\log [\text{H}^+]$.

112) _____

Solve the problem.

- 113) Use the formula $L = 10 \cdot \log \frac{I}{I_0}$, where the loudness of a sound in decibels is determined by I , the number of watts per square meter produced by the soundwave, and $I_0 = 10^{-12} \text{ W/m}^2$. A certain noise measures 115 dB. If the intensity is multiplied by 1000, how many decibels will the new noise measure? 113) _____
- 114) Use the formula $L = 10 \cdot \log \frac{I}{I_0}$, where the loudness of a sound in decibels is determined by I , the number of watts per square meter produced by the soundwave, and $I_0 = 10^{-12} \text{ W/m}^2$. What is the intensity of a noise measured at 34 dB? 114) _____
- 115) Suppose that \$4000 is invested at an interest rate of 5.4% per year, compounded continuously. What is the balance after 2 years? 115) _____
- 116) Suppose that \$7000 is invested at an interest rate of 5.6% per year, compounded continuously. What is the doubling time? 116) _____
- 117) How long will it take for \$7000 to grow to \$16,000 at an interest rate of 3.9% if the interest is compounded continuously? 117) _____
- 118) When interest is compounded continuously, the balance in an account after t years is given by $P(t) = P_0 e^{kt}$, where P_0 is the initial investment and k is the interest rate. Suppose that P_0 is invested in a savings account where interest is compounded continuously at 8% per year. Express $P(t)$ in terms of P_0 and 0.08. 118) _____

Solve.

- 119) How long will it take for the population of a certain country to double if its annual growth rate is 6.3 %? (Round to the nearest year.) 119) _____
- 120) There are currently 78 million cars in a certain country, decreasing by 1.5 % annually. How many years will it take for this country to have 65 million cars? (Round to the nearest year.) 120) _____

Solve the problem.

- 121) The population growth of an animal species is described by $F(t) = 400 + 50 \log_3(2t + 1)$, where t is measured in months. Find the population of this species in an area 4 month(s) after the species is introduced. 121) _____
- 122) Use the formula $N = I e^{kt}$, where N is the number of items in terms of the initial population I , at time t , and k is the growth constant equal to the percent of growth per unit of time. An artifact is discovered at a certain site. If it has 80 % of the carbon-14 it originally contained, what is the approximate age of the artifact? (carbon-14 decays at the rate of 0.0125% annually.) 122) _____

123) Use the formula $N = Ie^{kt}$, where N is the number of items in terms of the initial population I , at time t , and k is the growth constant equal to the percent of growth per unit of time. A certain radioactive isotope decays at a rate of 0.3 % annually. Determine the half-life of this isotope, to the nearest year.

123) _____

Answer Key

Testname: 125CH12P

1) $(f \circ g)(x) = 25x^2 + 30x + 16$

2) $(g \circ f)(x) = 24x^2 + 36x + 44$

3) $(g \circ f)(x) = \frac{9}{x^2} - 4$

4) $(f \circ g)(x) = 2\sqrt{7x+17}$

5) $(g \circ f)(x) = \sqrt{\frac{6}{x}}$

6) $\frac{2}{15}$

7) $\sqrt{22}$

8) $\sqrt{42}$

9) 28

10) Yes

11) No

12) No

13) No

14) Yes

15) Yes

16) $g^{-1}(x) = \frac{x}{2}$

17) $h^{-1}(x) = \frac{x+9}{6}$

18) Not a one-to-one function

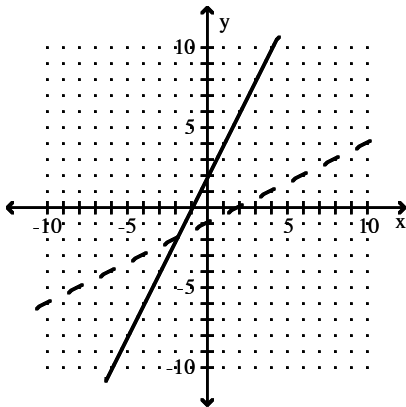
19) $h^{-1}(x) = \frac{4}{x}$

20) Not a one-to-one function

21) $h^{-1}(x) = \sqrt[3]{x+7}$

22) $f^{-1}(x) = x^2 + 9, x \geq 0$

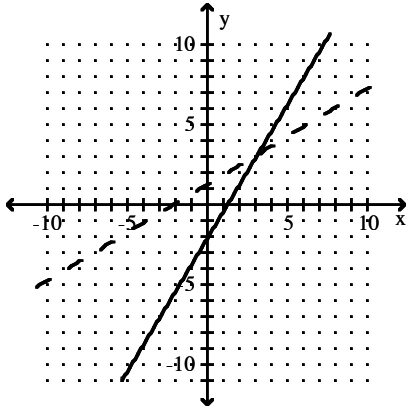
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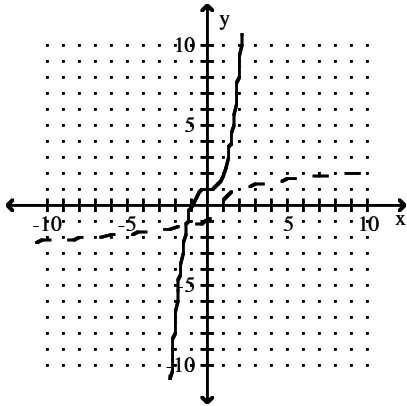
Answer Key

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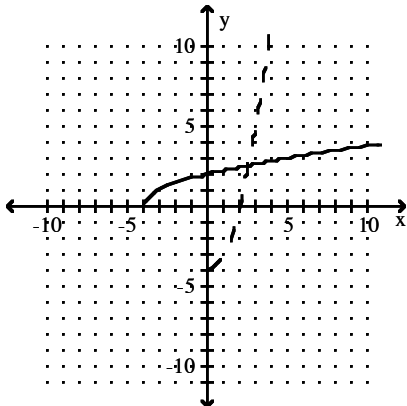
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25)



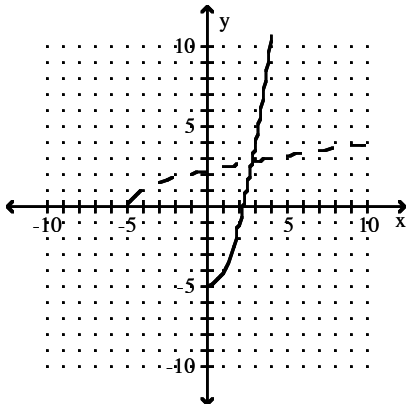
26)



Answer Key

Testname: 125CH12P

27)



28) 1. $(f^{-1} \circ f)(x) = f^{-1}(f(x)) = f^{-1}(\sqrt[3]{x+27}) = \left(\sqrt[3]{x+27}\right)^3 - 27 = x;$

2. $(f \circ f^{-1})(x) = f(f^{-1}(x)) = f(x^3 - 27) = \sqrt[3]{(x^3 - 27) + 27} = x$

29) 1. $(f^{-1} \circ f)(x) = f^{-1}(f(x)) = f^{-1}(\sqrt[3]{x+3}) = \left(\sqrt[3]{x+3}\right)^3 - 3 = x;$

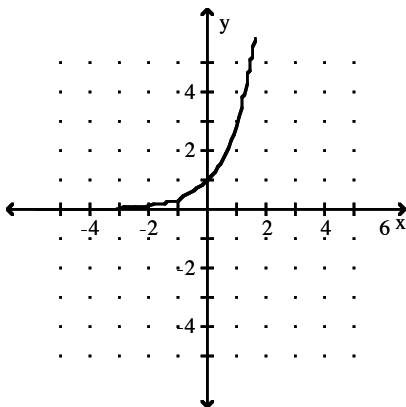
2. $(f \circ f^{-1})(x) = f(f^{-1}(x)) = f(x^3 - 3) = \sqrt[3]{(x^3 - 3) + 3} = x$

30) 1. $(f^{-1} \circ f)(x) = f^{-1}(f(x)) = f^{-1}\left(\frac{2-x}{x}\right) = \frac{2}{\frac{2-x}{x} + 1} = \frac{2}{\frac{2-x+x}{x}} = \frac{2}{\frac{2}{x}} = \frac{2x}{2} = x;$

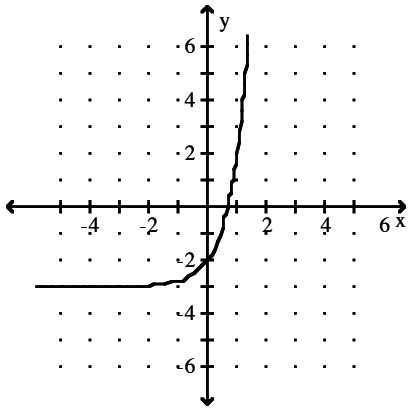
2. $(f \circ f^{-1})(x) = f(f^{-1}(x)) = f\left(\frac{2}{x+1}\right) = \frac{2 - \frac{2}{x+1}}{\frac{2}{x+1}} = \frac{\frac{2(x+1) - 2}{x+1}}{\frac{2}{x+1}} = \frac{2x+2-2}{x+1} \cdot \frac{x+1}{2} = \frac{2x}{2} = x$

31) $f^{-1}(x) = \frac{9}{5}x + 32$

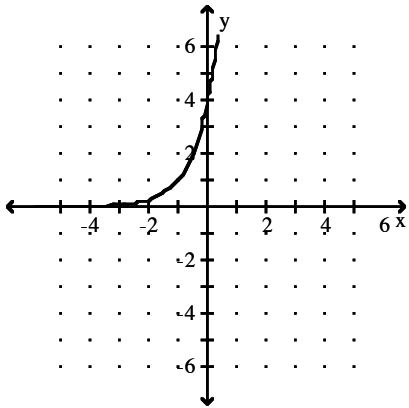
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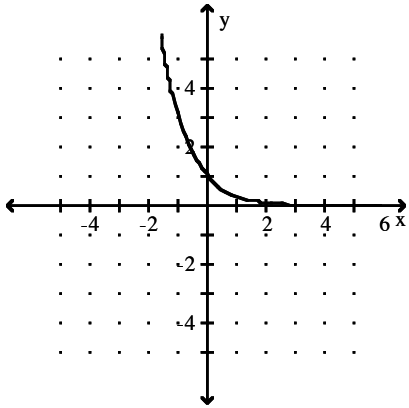
33)



34)



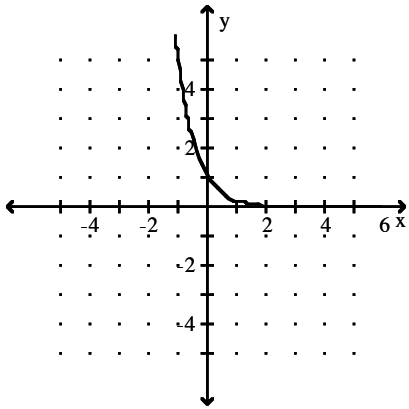
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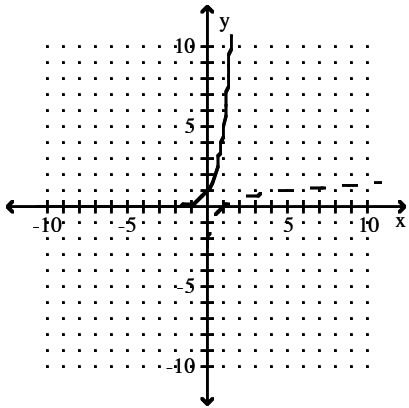
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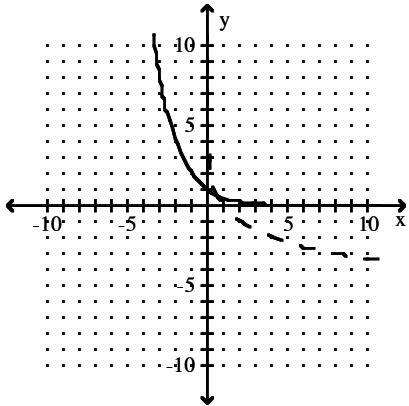
36)



37)



38)



39) 600, 75

40) 300, 75

41) 7.5 g

42) -2

43) -2

44) 5

45) 2

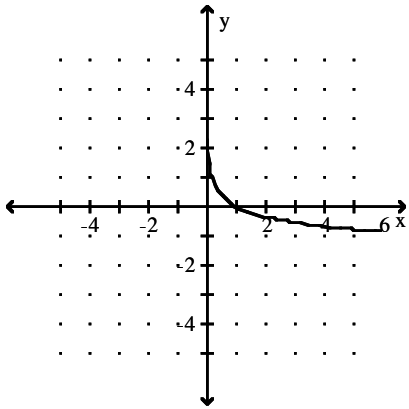
46) 3

47) 7

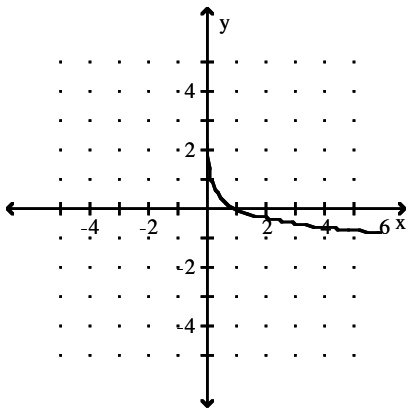
Answer Key

Testname: 125CH12P

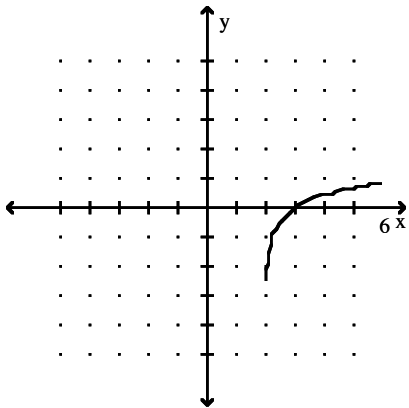
48)



49)



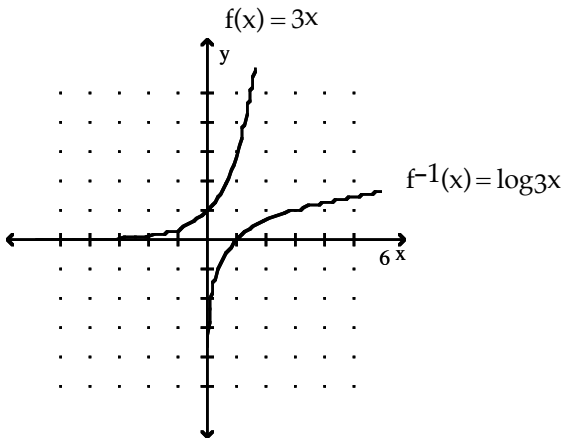
50)



Answer Key

Testname: 125CH12P

51)



52) $3t = 81$

53) $9^2 = 81$

54) $3^{-2} = \frac{1}{9}$

55) $w^{12} = Q$

56) $2 = \log_3 9$

57) $-2 = \log_2 \frac{1}{4}$

58) $0.8451 = \log_{10} 7$

59) $z = \log_y 8$

60) 2

61) -3

62) 2

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

64) $\frac{1}{81}$

65) 16

66) $\log_2 16 + \log_2 8$

67) $\log_r 4 + \log_r T$

68) $\log_6 x + \log_6 y$

69) $\log_x 5 + \log_x y + \log_x z$

70) $\log_6 156$

71) $\log_c m n$

72) $-3 \log_c Z$

73) $-7 \log_c Z$

74) $\log_g M - \log_g 61$

75) $\log_a q - \log_a r$

Answer Key

Testname: 125CH12P

76) $\log_b \frac{y}{z}$

77) $\log_7 15 + \frac{1}{2} \log_7 m - \log_7 n$

78) $\log_4 9 + \frac{1}{2} \log_4 x - \log_4 y$

79) $5\log_b m + 9\log_b p - 6\log_b n - 8$

80) $2\log_b m + 4\log_b p - 6\log_b n - 3$

81) $2\log_b x + \frac{7}{2} \log_b y - \frac{5}{2} \log_b z$

82) $3\log_b x - \frac{2}{3} \log_b y - 2\log_b z$

83) $2\log_b a + 3$

84) $\log_a \frac{y^6}{x^{7/4}}$

85) $\log_a \frac{y^7}{x^{11/3}}$

86) $\log_b \frac{4x^4}{y^3}$

87) $\log_w (x+8)$

88) 3.687

89) 1.0306

90) $\frac{7}{2}$

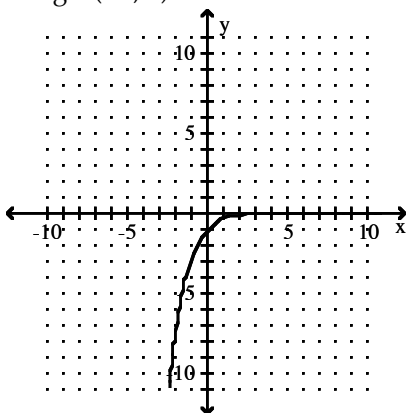
91) 4059

92) 5

93) 9

94) Domain: \mathcal{R}

Range: $(-\infty, 0)$

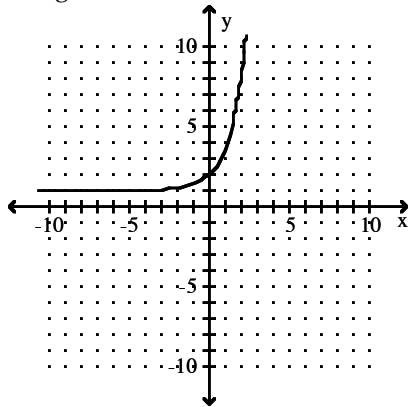


Answer Key

Testname: 125CH12P

95) Domain: \mathcal{R}

Range: $(1, \infty)$



96) -1

97) 1

98) $-\frac{25}{7}$

99) -3, -1

100) -3, 1

101) No solution

102) e

103) $\frac{16}{9}$

104) No solution

105) 6

106) 12

107) 9

108) 12

109) 13.7 yr

110) 35.0 yr

111) 9.1

112) 1.26×10^{-6}

113) 145 dB

114) $2.51 \times 10^{-9} \text{ W/m}^2$

115) \$4456.19

116) 12.4 years

117) 21.2 yr

118) $P(t) = P_0 e^{0.08t}$

119) 11 years

120) 12 years

121) 500

122) 1785 years

123) 231 years