

Name\_\_\_\_\_

**Solve. Round any approximate solution to the fourth decimal place.**

1)  $5^x = 625$

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

2)  $4^x = 16$

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

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

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

4)  $2^{2x+1} = 8$

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

5)  $4^{3x-1} = 1024$

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

6)  $3^{3x-1} = 9$

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

7)  $2^x + 8 = 5$

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

8)  $2^x + 8 = 6$

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

9)  $5^x + 8 = 6$

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

10)  $5^x + 7 = 3$

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

11)  $2^{5x} = 4.8$

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

12)  $2^{7x} = 4.7$

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

13)  $3^x + 6 = 5$

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

14)  $4^x + 7 = 6$

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

15)  $3(2)^x = 23$

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

16)  $9(4)^x = 39$

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

17)  $2(4)^x = 34$

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

Solve the equation. Round the solution to four decimal places, if necessary.

18)  $e^{2x} = 7$

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

19)  $e^{2x} = 6$

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

20)  $e^{(x+5)} = 3$

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

21)  $e^{(x+2)} = 8$

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

22)  $\ln(6x) + \ln(8x) = 2$

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

23)  $\ln(9x) + \ln(4x) = 5$

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

24)  $3 \ln(8x^2) + 5 \ln(7x^5) = 4$

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

25)  $-3 \ln(5x^3) + 4 \ln(3x^4) = 8$

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

26)  $e^{2x-9} \cdot e^{4x} = 121$

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

$$27) e^{5x} - 1 \cdot e^{5x} = 128$$

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

$$28) 7e^x - 16 = 2e^x + 43$$

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

$$29) 7e^x - 26 = 2e^x + 60$$

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

$$30) \ln(2x^9) - 2 \ln(x^4) = 3$$

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

$$31) \ln(7x^{13}) - 4 \ln(x^3) = 4$$

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

**Write the equation in exponential form. Assume that all constants are positive and not equal to 1.**

$$32) \log_4(16) = 2$$

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

$$33) \log_3(9) = 2$$

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

$$34) \log_{16}(4) = \frac{1}{2}$$

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

$$35) \log_{25}(5) = \frac{1}{2}$$

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

**Simplify. Write the expression as a single logarithm with a coefficient of 1.**

36)  $5 \ln(a) - 9 \ln(b)$

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

37)  $4 \ln(a) - 7 \ln(b)$

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

38)  $11 \ln(x - 5) - 8 \ln(x)$

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

39)  $9 \ln(x - 10) - 8 \ln(x)$

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

40)  $4 \ln(x^2) + 4 \ln(4x)$

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

41)  $2 \ln(x^2) + 3 \ln(6x)$

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

42)  $2 \ln(w^2) - \ln(2w^8)$

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

43)  $2 \ln(w^2) - \ln(3w^8)$

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

**Write the equation in exponential form. Assume that all constants are positive and not equal to 1.**

44)  $\log_4 \left( \frac{1}{64} \right) = -3$

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

$$45) \log_4 \left( \frac{1}{16} \right) = -2$$

45) \_\_\_\_\_

**Solve the problem.**

$$46) \text{ Let } f(x) = 3^x.$$

46) \_\_\_\_\_

$$\text{i) Find } f(3).$$

$$\text{ii) Find } f^{-1}(3).$$

$$\text{iii) Find } x \text{ when } f(x) = 9.$$

$$\text{iv) Find } x \text{ when } f^{-1}(x) = 9.$$

**Solve.**

$$47) \log_4 (x) = 1$$

47) \_\_\_\_\_

$$48) \log_6 (x) = 1$$

48) \_\_\_\_\_

$$49) \log (x) = 2$$

49) \_\_\_\_\_

$$50) \log (x) = 4$$

50) \_\_\_\_\_

$$51) \log_4 (x) = -3$$

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

$$52) \log_5 (x) = -3$$

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

53)  $\log_6 (x + 4) = 3$

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

54)  $\log_6 (x - 2) = 2$

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

55)  $\log_4 (x + 2) = -1$

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

56)  $\log_3 (x - 3) = -2$

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

57)  $\log_6 (x + 2) = -2$

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

58)  $\log_6 (x + 3) = -1$

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

59)  $\log_2 (16 - 4x) = 3$

59) \_\_\_\_\_

60)  $\log_3 (15 - 4x) = 3$

60) \_\_\_\_\_

61)  $\log (2x + 5) = 1$

61) \_\_\_\_\_

62)  $\log (5x + 4) = 2$

62) \_\_\_\_\_

63)  $3\log_{729}(x) + 1 = 2$

63) \_\_\_\_\_

64)  $3\log_{125}(x) - 6 = -5$

64) \_\_\_\_\_

65)  $\log_3(\log_2(y)) = 2$

65) \_\_\_\_\_

66)  $\log_3(\log_3(y)) = 1$

66) \_\_\_\_\_

67)  $\log_9(x^2) = 4$

67) \_\_\_\_\_

68)  $\log_x(25) = 2$

68) \_\_\_\_\_

69)  $\log_x(25) = 2$

69) \_\_\_\_\_

70)  $\log_x(27) = 3$

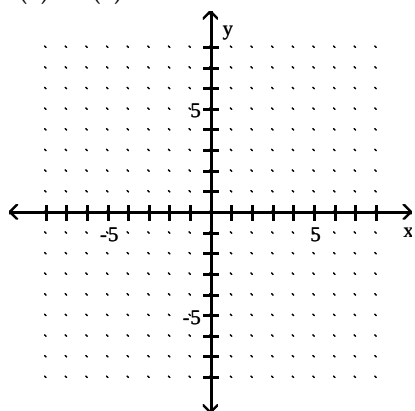
70) \_\_\_\_\_



Sketch the graph of the given function, its inverse, and  $y = x$  on the same set of axes. Graph the function with a solid line, and graph  $y = x$  and the function's inverse using dotted lines.

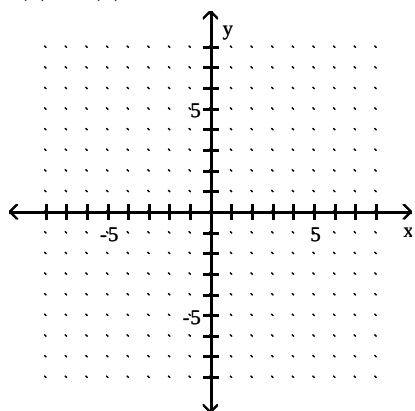
71)  $f(x) = 4(6)^x$

71) \_\_\_\_\_



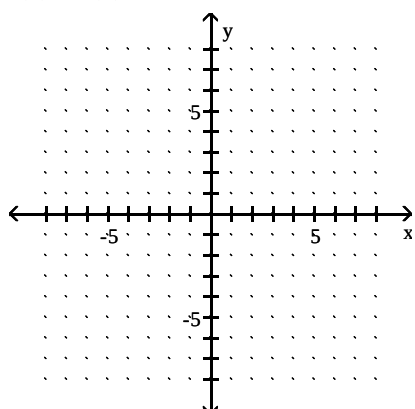
72)  $f(x) = 5(4)^x$

72) \_\_\_\_\_



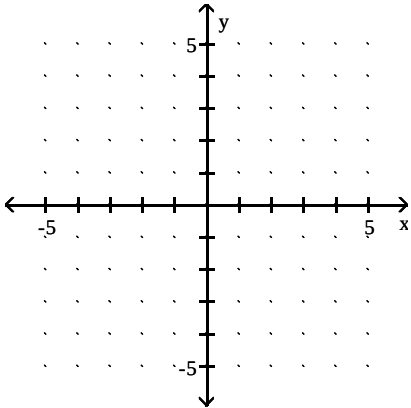
73)  $f(x) = 4(7)^x$

73) \_\_\_\_\_



74)  $f(x) = 5\left(\frac{1}{3}\right)^x$

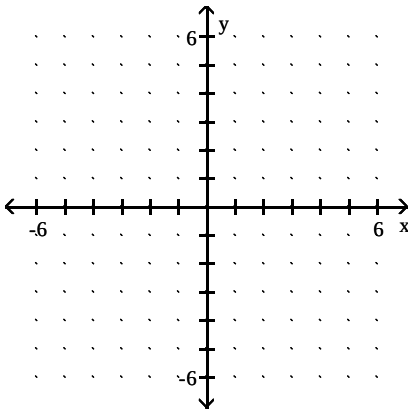
74) \_\_\_\_\_



Sketch the graph of the function.

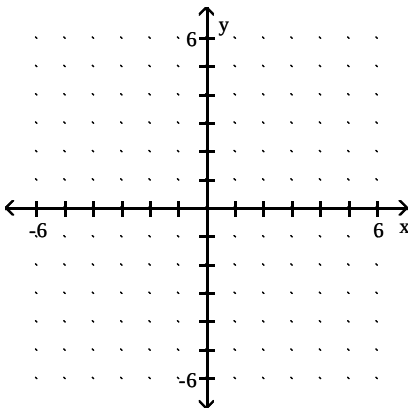
75)  $y = \log_5(x)$

75) \_\_\_\_\_



76)  $y = \log_{1/3}(x)$

76) \_\_\_\_\_



**Solve the problem.**

- 77) The loudness of sound can be measured on a decibel scale. The sound level  $L$  (in decibels) of a sound is given by  $L = 10\log\left(\frac{I}{I_0}\right)$ , where  $I$  is the intensity of the sound (in watts per square meter,  $\text{W/m}^2$ ) and  $I_0 = 10^{-12} \text{ W/m}^2$ . A certain sound has intensity of  $9.53 \times 10^{-5} \text{ W/m}^2$ . Find the decibel value of this sound? (Round to the nearest whole number.) 77) \_\_\_\_\_
- 78) The loudness of sound can be measured on a decibel scale. The sound level  $L$  (in decibels) of a sound is given by  $L = 10\log\left(\frac{I}{I_0}\right)$ , where  $I$  is the intensity of the sound (in watts per square meter,  $\text{W/m}^2$ ) and  $I_0 = 10^{-12} \text{ W/m}^2$ . A certain sound has intensity of  $3.27 \times 10^{-5} \text{ W/m}^2$ . Find the decibel value of this sound? (Round to the nearest whole number.) 78) \_\_\_\_\_
- 79) The pH of a solution ranges from 0 to 14. An acid has a pH less than 7. Pure water is neutral and has a pH of 7. The pH of a solution is given by  $\text{pH} = -\log(\text{H}^+)$  where  $\text{H}^+$  represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is  $1 \times 10^{-3}$ . 79) \_\_\_\_\_
- 80) The pH of a solution ranges from 0 to 14. An acid has a pH less than 7. Pure water is neutral and has a pH of 7. The pH of a solution is given by  $\text{pH} = -\log(\text{H}^+)$  where  $\text{H}^+$  represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is  $1 \times 10^{-6}$ . 80) \_\_\_\_\_
- 81) The pH of a solution ranges from 0 to 14. An acid has a pH less than 7. Pure water is neutral and has a pH of 7. The pH of a solution is given by  $\text{pH} = -\log(\text{H}^+)$  where  $\text{H}^+$  represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is  $2.2 \times 10^{-12}$ . 81) \_\_\_\_\_

- 82) The value of a particular investment follows a pattern of exponential growth. In the year 2000, you invested money in a money market account. The value of your investment  $t$  years after 2000 is given by the exponential growth model  $f(t) = 2500e^{0.06t}$ . How much did you initially invest in the account? 82) \_\_\_\_\_
- 83) The value of a particular investment follows a pattern of exponential growth. In the year 2000, you invested money in a money market account. The value of your investment  $t$  years after 2000 is given by the exponential growth model  $f(t) = 1200e^{0.065t}$ . How much did you initially invest in the account? 83) \_\_\_\_\_
- 84) The value of a particular investment follows a pattern of exponential growth. In the year 2000, you invested money in a money market account. The value of your investment  $t$  years after 2000 is given by the exponential growth model  $f(t) = 2300e^{0.05t}$ . When will the account be worth \$2672? 84) \_\_\_\_\_
- 85) The value of a particular investment follows a pattern of exponential growth. In the year 2000, you invested money in a money market account. The value of your investment  $t$  years after 2000 is given by the exponential growth model  $f(t) = 6600e^{0.051t}$ . When will the account be worth \$8963? 85) \_\_\_\_\_
- 86) The function  $y = 200e^{-0.0099x}$  models the amount in pounds of a particular radioactive material stored in a concrete vault, where  $x$  is the number of years since the material was put into the vault. If 200 pounds of the material are placed in the vault, how much time will need to pass for only 82 pounds to remain? 86) \_\_\_\_\_
- 87) The function  $y = 900e^{-0.00866x}$  models the amount in pounds of a particular radioactive material stored in a concrete vault, where  $x$  is the number of years since the material was put into the vault. If 900 pounds of the material are placed in the vault, how much time will need to pass for only 189 pounds to remain? 87) \_\_\_\_\_

Use synthetic division to find the quotient and the remainder when the first polynomial is divided by the second polynomial.

88)  $x^3 - 3; x - 1$

88) \_\_\_\_\_

89)  $2x^4 - 4x^2 - 1; x - \frac{1}{4}$

89) \_\_\_\_\_

90)  $2x^4 + 3x^2 - 1; x + \frac{1}{3}$

90) \_\_\_\_\_

91)  $x^5 - 2x^4 - 18x^3 + 17x^2 - 8x - 8; x - 5$

91) \_\_\_\_\_

92)  $6x^5 - 5x^4 + x - 4; x + \frac{1}{2}$

92) \_\_\_\_\_

93)  $2x^3 + 3x^2 + 4x - 10; x + 1$

93) \_\_\_\_\_

94)  $2x^4 - x^3 - 15x^2 + 3x; x + 3$

94) \_\_\_\_\_

95)  $2x^5 - x^4 + 3x^2 - x + 5; x - 1$

95) \_\_\_\_\_

96)  $3x^5 + 4x^4 + 2x^2 - 1; x + 2$

96) \_\_\_\_\_

$$97) 2x^5 - x^4 + 3x^2 - x + 5; x - 1$$

97) \_\_\_\_\_

$$98) x^2 + 11x + 24; x + 4$$

98) \_\_\_\_\_

$$99) x^2 + 13x + 29; x + 9$$

99) \_\_\_\_\_

**Use synthetic division and the Remainder Theorem to find the function value.**

$$100) f(x) = x^3 + 4x^2 - 5x - 2; \text{ find } f(2)$$

100) \_\_\_\_\_

$$101) f(x) = x^3 - 4x^2 - 5x - 1; \text{ find } f(-3)$$

101) \_\_\_\_\_

$$102) f(x) = 3x^3 + 7x^2 - 5x + 13; \text{ find } f(-4)$$

102) \_\_\_\_\_

$$103) f(x) = 3x^3 + 5x^2 - 7x + 21; \text{ find } f(-2)$$

103) \_\_\_\_\_

$$104) f(x) = 6x^3 - 27x^2 - 15x; \text{ find } f\left(-\frac{1}{2}\right)$$

104) \_\_\_\_\_

$$105) f(x) = 8x^3 - 12x^2 + 8x; \text{ find } f\left(\frac{1}{2}\right)$$

105) \_\_\_\_\_

Use the Factor Theorem to determine whether the linear polynomial is a factor of the second polynomial.

106)  $x - 6; x^3 - 12x^2 + 45x - 54$

106) \_\_\_\_\_

107)  $x - 2; x^3 + 13x^2 + 34x - 48$

107) \_\_\_\_\_

108)  $x + 3; x^3 - 7x^2 - 9x + 63$

108) \_\_\_\_\_

109)  $x + 4; x^3 - 11x^2 + 20x + 96$

109) \_\_\_\_\_

110)  $x - 5; 4x^3 - 21x^2 + 32x - 15$

110) \_\_\_\_\_

111)  $x - 6; 4x^3 - 25x^2 + 41x - 20$

111) \_\_\_\_\_

112)  $x + 4; 2x^3 - 11x^2 - 35x + 98$

112) \_\_\_\_\_

113)  $x - 7; 3x^3 - 22x^2 - 3x + 70$

113) \_\_\_\_\_

114)  $x - 5; 2x^3 - 7x^2 - 29x + 70$

114) \_\_\_\_\_

$$115) x - 5; 4x^3 - 27x^2 + 20x + 75$$

115) \_\_\_\_\_

$$116) x - 2; x^4 - 10x^3 + 35x^2 - 50x + 24$$

116) \_\_\_\_\_

$$117) x + 2; x^4 - x^3 - 3x^2 + 4x + 7$$

117) \_\_\_\_\_

**Find the set of possible rational zeros given the function.**

$$118) f(x) = x^3 - 10x^2 + 5x - 24$$

118) \_\_\_\_\_

$$119) f(x) = x^3 - 5x^2 + 7x - 24$$

119) \_\_\_\_\_

$$120) f(x) = 2x^3 + 6x^2 + 10x - 8$$

120) \_\_\_\_\_

$$121) f(x) = 2x^3 + 9x^2 + 10x - 8$$

121) \_\_\_\_\_

$$122) f(x) = 3x^3 + 36x^2 + 36x + 27$$

122) \_\_\_\_\_

$$123) f(x) = 3x^3 + 35x^2 + 35x + 27$$

123) \_\_\_\_\_



124)  $f(x) = 2x^3 - 5x^2 + 7x - 13$

124) \_\_\_\_\_

125)  $f(x) = 2x^3 - 5x^2 + 7x - 5$

125) \_\_\_\_\_

126)  $f(x) = 22x^7 + 88x^3 + 2x - 11$

126) \_\_\_\_\_

127)  $f(x) = 6x^7 + 24x^3 + 2x - 3$

127) \_\_\_\_\_

**Find all rational zeros.**

128)  $f(x) = x^3 + 5x^2 - 52x - 224$

128) \_\_\_\_\_

129)  $f(x) = x^3 + 9x^2 - 4x - 96$

129) \_\_\_\_\_

130)  $f(x) = x^3 - 9x^2 + 14x + 24$

130) \_\_\_\_\_

131)  $f(x) = x^3 - 6x^2 + 5x + 12$

131) \_\_\_\_\_

132)  $f(x) = 4x^3 - 8x^2 - x + 2$

132) \_\_\_\_\_

133)  $f(x) = 4x^3 - 20x^2 - x + 5$

133) \_\_\_\_\_

134)  $f(x) = 12x^3 + 61x^2 + 4x - 5$

134) \_\_\_\_\_

135)  $f(x) = 12x^3 + 37x^2 + 2x - 3$

135) \_\_\_\_\_

136)  $f(x) = 10x^3 + 13x^2 + 2x - 1$

136) \_\_\_\_\_

137)  $f(x) = 10x^3 + 43x^2 + 11x - 4$

137) \_\_\_\_\_

138)  $f(x) = 8x^3 + 2x^2 - 5x + 1$

138) \_\_\_\_\_

139)  $f(x) = 8x^3 + 18x^2 - 17x + 3$

139) \_\_\_\_\_

140)  $f(x) = x^4 - 8x^3 + 4x^2 + 24x - 21$

140) \_\_\_\_\_

141)  $f(x) = x^4 - 9x^3 + 5x^2 + 27x - 24$

141) \_\_\_\_\_

142)  $f(x) = x^4 + 2x^3 + 2x^2 - 4x - 8$

142) \_\_\_\_\_

$$143) f(x) = x^4 + 3x^3 + 3x^2 - 6x - 27$$

143) \_\_\_\_\_

**Use Descartes' Rule of Signs to determine the possible number of positive real zeros and the possible number of negative real zeros for the function.**

$$144) f(x) = 9x^3 - 4x^2 + 5x + 2$$

144) \_\_\_\_\_

$$145) f(x) = 7x^8 + 6x^6 + 8x^4 + 7x^2 + 3$$

145) \_\_\_\_\_

$$146) f(x) = -8x^4 + 5x^3 - 2x^2 + 4x - 7$$

146) \_\_\_\_\_

$$147) f(x) = 6x^5 - 9x^4 + 4x^3 - 7$$

147) \_\_\_\_\_

$$148) f(x) = -7x^4 - 2x^3 - 8x^2 - 4x + 6$$

148) \_\_\_\_\_

$$149) f(x) = 8x^6 - 5x^4 - 6x^3 + 6x^2 - 5x$$

149) \_\_\_\_\_

**Find the domain of the rational function.**

$$150) g(x) = \frac{x-5}{x+2}$$

150) \_\_\_\_\_

$$151) g(x) = \frac{x-2}{x+3}$$

151) \_\_\_\_\_

$$152) g(x) = \frac{x-3}{x+3}$$

152) \_\_\_\_\_

$$153) f(x) = \frac{x-4}{x^2+1}$$

153) \_\_\_\_\_

$$154) f(x) = \frac{x-9}{x^2+4}$$

154) \_\_\_\_\_

$$155) f(x) = \frac{x-9}{x^2+6}$$

155) \_\_\_\_\_

**Find the vertical asymptote(s), if any, of the graph of the rational function.**

$$156) g(x) = \frac{x+2}{x-8}$$

156) \_\_\_\_\_

$$157) g(x) = \frac{x+7}{x-9}$$

157) \_\_\_\_\_

$$158) h(x) = \frac{x^2-100}{(x-2)(x+3)}$$

158) \_\_\_\_\_

$$159) h(x) = \frac{x^2-100}{(x-4)(x+3)}$$

159) \_\_\_\_\_

$$160) f(x) = \frac{x^2 + 2x}{x^2 - 6x - 16}$$

160) \_\_\_\_\_

$$161) f(x) = \frac{x^2 + 5x}{x^2 - 3x - 40}$$

161) \_\_\_\_\_

$$162) f(x) = \frac{x - 1}{x^2 + 9}$$

162) \_\_\_\_\_

$$163) f(x) = \frac{x - 4}{x^2 + 4}$$

163) \_\_\_\_\_

**Find the horizontal asymptote(s), if any, of the graph of the rational function.**

$$164) g(x) = \frac{x^2 + 6x - 3}{x - 3}$$

164) \_\_\_\_\_

$$165) g(x) = \frac{x^2 + 9x - 7}{x - 7}$$

165) \_\_\_\_\_

$$166) g(x) = \frac{x + 6}{x^2 - 5}$$

166) \_\_\_\_\_

$$167) g(x) = \frac{x + 9}{x^2 - 5}$$

167) \_\_\_\_\_

$$168) h(x) = \frac{-3x + 7}{4x - 2}$$

168) \_\_\_\_\_

$$169) g(x) = \frac{-5x + 2}{3x - 1}$$

169) \_\_\_\_\_

$$170) g(x) = \frac{2x^2 - 9x - 6}{7x^2 - 3x + 2}$$

170) \_\_\_\_\_

$$171) g(x) = \frac{9x^2 - 9x - 7}{7x^2 - 8x + 6}$$

171) \_\_\_\_\_

$$172) g(x) = \frac{x + 7}{x^2 - 4}$$

172) \_\_\_\_\_

$$173) g(x) = \frac{x + 4}{x^2 - 1}$$

173) \_\_\_\_\_

$$174) h(x) = \frac{x^2 - 4}{x + 2}$$

174) \_\_\_\_\_

$$175) h(x) = \frac{x^2 - 36}{x + 6}$$

175) \_\_\_\_\_

$$176) f(x) = \frac{5x^2 + 6x - 3}{3x^3 - 2x + 10}$$

176) \_\_\_\_\_

$$177) f(x) = \frac{3x^2 + 7x - 2}{2x^3 - 3x + 9}$$

177) \_\_\_\_\_

**Solve the problem.**

178) An open-top rectangular box has a square base and it will hold 110 cubic centimeters (cc). Each side of the base has length  $x$  cm, and the box has a height of  $y$  cm. Express the surface area  $S$  as a function of the length  $x$  of a side of the base. 178) \_\_\_\_\_

179) An open-top rectangular box has a square base and it will hold 106 cubic centimeters (cc). Each side of the base has length  $x$  cm, and the box has a height of  $y$  cm. Express the surface area  $S$  as a function of the length  $x$  of a side of the base. 179) \_\_\_\_\_

180) An open-top rectangular box has a square base and it will hold 256 cubic centimeters (cc). Each side of the base has length  $x$  cm. The box's surface area  $S$  is given by  $S(x) = \frac{1024}{x} + x^2$ . Estimate the minimum surface area and the value of  $x$  that will yield it. 180) \_\_\_\_\_

181) Suppose a cost-benefit model is given by  $y = \frac{2.7x}{100 - x}$ , where  $y$  is the cost in thousands of dollars for removing  $x$  percent of a given pollutant. Find the cost of removing 75% to the nearest dollar. 181) \_\_\_\_\_

182) Suppose a cost-benefit model is given by  $y = \frac{6.5x}{100 - x}$ , where  $y$  is the cost in thousands of dollars for removing  $x$  percent of a given pollutant. Find the cost of removing 40% to the nearest dollar. 182) \_\_\_\_\_

- 183) The average number of vehicles waiting in line at a toll booth of a super highway is modeled by the function  $n(x) = \frac{x^2}{0.5(1-x)}$ , where  $x$  is a quantity between 0 and 1 known as the traffic intensity. What happens to the average number of vehicles waiting as traffic intensity increases? 183) \_\_\_\_\_
- 184) The resistance, in ohms, of a 25 foot piece of wire is given by the function  $R(d) = \frac{0.025}{d^2}$ , where  $d$  is the diameter of the wire in inches. What happens to the resistance of the wire as the diameter of the wire decreases? 184) \_\_\_\_\_
- 185) The concentration of a drug in the bloodstream, measured in milligrams per liter, can be modeled by the function,  $C(t) = \frac{12t + 4}{3t^2 + 2}$ , where  $t$  is the number of minutes after injection of the drug. When will the drug be at its highest concentration? Approximate your answer rounded to two decimal places. 185) \_\_\_\_\_
- 186) Economists use what is called a Leffer curve to predict the government revenue for tax rates from 0% to 100%. Economists agree that the end points of the curve generate 0 revenue, but disagree on the tax rate that produces the maximum revenue. Suppose an economist produces this rational function,  
 $R(x) = \frac{10x(100-x)}{75+x}$ , where  $R$  is revenue in millions at a tax rate of  $x$  percent. Use a graphing calculator to graph the function. What tax rate produces the maximum revenue? What is the maximum revenue? 186) \_\_\_\_\_
- 187) Economists use what is called a Leffer curve to predict the government revenue for tax rates from 0% to 100%. Economists agree that the end points of the curve generate 0 revenue, but disagree on the tax rate that produces the maximum revenue. Suppose an economist produces this rational function,  $R(x) = \frac{10x(100-x)}{15+x}$ , where  $R$  is revenue in millions at a tax rate of  $x$  percent. Use a graphing calculator to graph the function. What tax rate produces the maximum revenue? What is the maximum revenue? 187) \_\_\_\_\_



188) A company that produces inflatable rafts has costs given by the function  $C(x) = 30x + 15,000$ , where  $x$  is the number of inflatable rafts manufactured and  $C(x)$  is measured in dollars. The average cost to manufacture each inflatable raft is given by  $\bar{C}(x) = \frac{30x + 15,000}{x}$ . Find  $\bar{C}(200)$ . (Round to the nearest dollar, if necessary.)

188) \_\_\_\_\_

189) A company that produces radios has costs given by the function  $C(x) = 15x + 25,000$ , where  $x$  is the number of radios manufactured and  $C(x)$  is measured in dollars. The average cost to manufacture each radio is given by  $\bar{C}(x) = \frac{15x + 25,000}{x}$ . Find  $\bar{C}(200)$ . (Round to the nearest dollar, if necessary.)

189) \_\_\_\_\_

**Divide and write the answer in the form  $a + bi$ .**

190) Let  $z = 8 - i$  and  $w = -4 - 6i$ . Find  $\frac{z + 2i}{w}$ .

190) \_\_\_\_\_

191) Let  $z = 3 - i$  and  $w = -6 - 5i$ . Find  $\frac{z + 2i}{w}$ .

191) \_\_\_\_\_

192) Let  $z = 2 - i$  and  $w = -1 + 6i$ . Find  $\frac{z}{w}$ .

192) \_\_\_\_\_

193) Let  $z = 5 - i$  and  $w = -4 + 9i$ . Find  $\frac{z}{w}$ .

193) \_\_\_\_\_

194) Let  $z = 9 - 4i$  and  $w = 7 + 5i$ . Find  $\frac{w}{z}$ .

194) \_\_\_\_\_

195) Let  $z = 2 + 6i$  and  $w = 9 - 5i$ . Find  $\frac{w}{z + 3}$ .

195) \_\_\_\_\_

196) Let  $z = 2 + 8i$  and  $w = 7 - 3i$ . Find  $\frac{w}{z + 3}$ .

196) \_\_\_\_\_

197) Let  $z = 7 - 6i$  and  $w = 7 + 4i$ . Find  $\frac{w}{z}$ .

197) \_\_\_\_\_

**Solve the equation.**

198)  $x^2 + x + 7 = 0$

198) \_\_\_\_\_

199)  $x^2 + x + 5 = 0$

199) \_\_\_\_\_

200)  $x^2 - 8x + 25 = 0$

200) \_\_\_\_\_

201)  $x^2 + 12x + 40 = 0$

201) \_\_\_\_\_

202)  $16x^2 - 7x + 1 = 0$

202) \_\_\_\_\_

203)  $4x^2 - 3x + 1 = 0$

203) \_\_\_\_\_

204)  $4x^2 = -3x - 4$

204) \_\_\_\_\_

205)  $3x^2 = -7x - 6$

205) \_\_\_\_\_

**Provide an appropriate response.**

206) True or False: The numbers  $\frac{7 + 3i}{i}$  and  $3 - 7i$  are equivalent.

206) \_\_\_\_\_

207) True or False: The numbers  $\frac{5 + 6i}{i}$  and  $6 - 5i$  are equivalent.

207) \_\_\_\_\_

## Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

- 1) 4
- 2) 2
- 3) 1
- 4) 1
- 5) 2
- 6) 1
- 7) -5.6781
- 8) -5.4150
- 9) -6.8867
- 10) -6.3174
- 11) 0.4526
- 12) 0.3190
- 13) -4.5350
- 14) -5.7075
- 15) 2.9386
- 16) 1.0577
- 17) 2.0437
- 18) 0.9730
- 19) 0.8959
- 20) -3.9014
- 21) 0.0794
- 22) 0.3924
- 23) 2.0304
- 24) 0.6797
- 25) 3.3362
- 26) 2.2993
- 27) 0.5852
- 28) 2.4681
- 29) 2.8449
- 30) 10.0428
- 31) 7.7997
- 32)  $4^2 = 16$
- 33)  $3^2 = 9$
- 34)  $16^{1/2} = 4$
- 35)  $25^{1/2} = 5$
- 36)  $\ln \left( \frac{a^5}{b^9} \right)$
- 37)  $\ln \left( \frac{a^4}{b^7} \right)$
- 38)  $\ln \left( \frac{(x-5)^{11}}{x^8} \right)$
- 39)  $\ln \left( \frac{(x-10)^9}{x^8} \right)$
- 40)  $\ln (256x^{12})$
- 41)  $\ln (216x^7)$

## Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

42)  $\ln \left( \frac{1}{2w^4} \right)$

43)  $\ln \left( \frac{1}{3w^4} \right)$

44)  $4^{-3} = \frac{1}{64}$

45)  $4^{-2} = \frac{1}{16}$

46) i) 27

ii) 1

iii) 2

iv) 19,683

47) 4

48) 6

49) 100

50) 10,000

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

52)  $\frac{1}{125}$

53) 212

54) 38

55)  $-\frac{7}{4}$

56)  $\frac{28}{9}$

57)  $-\frac{71}{36}$

58)  $-\frac{17}{6}$

59) 2

60) -3

61)  $\frac{5}{2}$

62)  $\frac{96}{5}$

63) 9

64) 5

65) 512

66) 27

67) 81, -81

68) 5

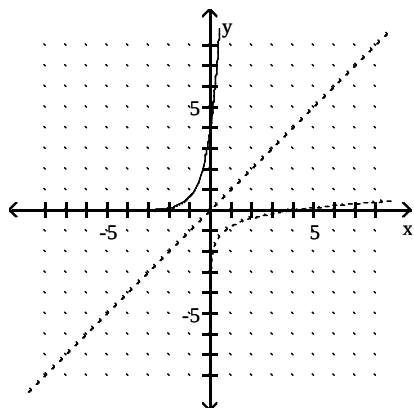
69) 5

70) 3

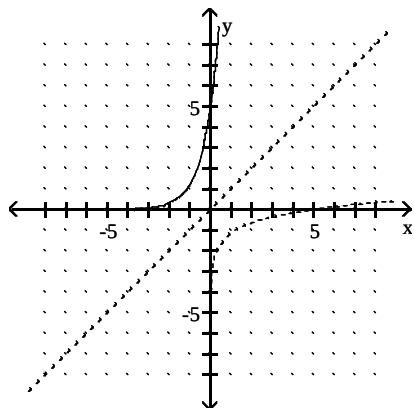
# Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

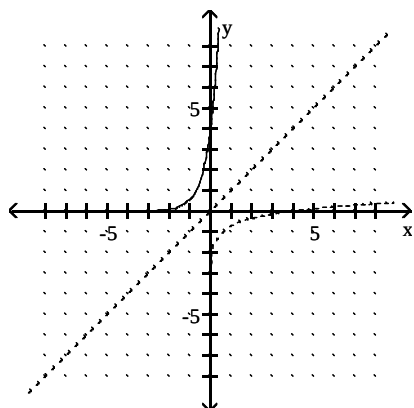
71)



72)



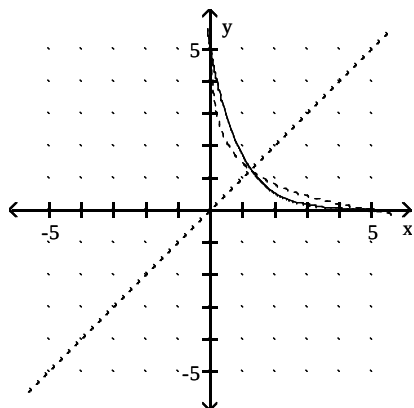
73)



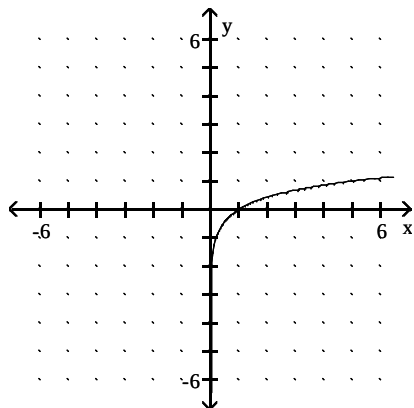
# Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

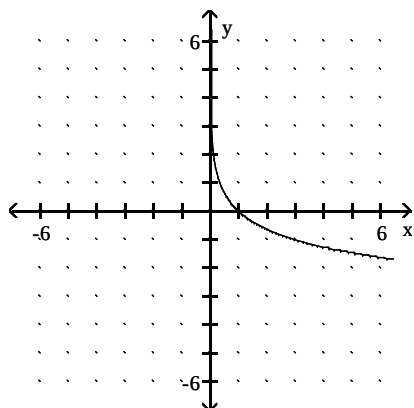
74)



75)



76)



77) 80 decibels

78) 75 decibels

79) 3

80) 6

81) 11.66

82) \$2500.00

83) \$1200.00

84) 2003

85) 2006

86) 90 years

87) 180 years

## Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

- 88) quotient:  $x^2 + x + 1$ ; remainder:  $-2$
- 89) quotient:  $2x^3 + \frac{1}{2}x^2 - \frac{31}{8}x - \frac{31}{32}$ ; remainder:  $-\frac{159}{128}$
- 90) quotient:  $2x^3 - \frac{2}{3}x^2 + \frac{29}{9}x - \frac{29}{27}$ ; remainder:  $-\frac{52}{81}$
- 91) quotient:  $x^4 + 3x^3 - 3x^2 + 2x + 2$ ; remainder:  $2$
- 92) quotient:  $6x^4 - 8x^3 + 4x^2 - 2x + 2$ ; remainder:  $-5$
- 93) quotient:  $2x^2 + x + 3$ ; remainder:  $-13$
- 94) quotient:  $2x^3 - 7x^2 + 6x - 15$ ; remainder:  $45$
- 95) quotient:  $2x^4 + x^3 + x^2 + 4x + 3$ ; remainder:  $8$
- 96) quotient:  $3x^4 - 2x^3 + 4x^2 - 6x + 12$ ; remainder:  $-25$
- 97) quotient:  $2x^4 + x^3 + x^2 + 4x + 3$ ; remainder:  $8$
- 98) quotient:  $x + 7$ ; remainder:  $-4$
- 99) quotient:  $x + 4$ ; remainder:  $-7$
- 100)  $12$
- 101)  $-49$
- 102)  $-47$
- 103)  $31$
- 104)  $0$
- 105)  $2$
- 106) Yes
- 107) No
- 108) Yes
- 109) No
- 110) No
- 111) No
- 112) No
- 113) Yes
- 114) Yes
- 115) Yes
- 116) Yes
- 117) No
- 118)  $\{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24\}$
- 119)  $\{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24\}$
- 120)  $\left\{ \pm 1, \pm \frac{1}{2}, \pm 2, \pm 4, \pm 8 \right\}$
- 121)  $\left\{ \pm 1, \pm \frac{1}{2}, \pm 2, \pm 4, \pm 8 \right\}$
- 122)  $\left\{ \pm 1, \pm \frac{1}{3}, \pm 3, \pm 9, \pm 27 \right\}$
- 123)  $\left\{ \pm 1, \pm \frac{1}{3}, \pm 3, \pm 9, \pm 27 \right\}$
- 124)  $\left\{ \pm 1, \pm 13, \pm \frac{1}{2}, \pm \frac{13}{2} \right\}$
- 125)  $\left\{ \pm 1, \pm 5, \pm \frac{1}{2}, \pm \frac{5}{2} \right\}$



## Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

126)  $\left\{ \pm 1, \pm \frac{1}{2}, \pm 11, \pm \frac{11}{2}, \pm \frac{1}{11}, \pm \frac{1}{22} \right\}$

127)  $\left\{ \pm 1, \pm \frac{1}{2}, \pm 3, \pm \frac{3}{2}, \pm \frac{1}{3}, \pm \frac{1}{6} \right\}$

128)  $\{-4, -8, 7\}$

129)  $\{-4, -8, 3\}$

130)  $\{4, 6, -1\}$

131)  $\{4, 3, -1\}$

132)  $\left\{ \frac{1}{2}, -\frac{1}{2}, 2 \right\}$

133)  $\left\{ \frac{1}{2}, -\frac{1}{2}, 5 \right\}$

134)  $\left\{ -\frac{1}{3}, \frac{1}{4}, -5 \right\}$

135)  $\left\{ -\frac{1}{3}, \frac{1}{4}, -3 \right\}$

136)  $\left\{ -\frac{1}{2}, \frac{1}{5}, -1 \right\}$

137)  $\left\{ -\frac{1}{2}, \frac{1}{5}, -4 \right\}$

138)  $\left\{ \frac{1}{2}, \frac{1}{4}, -1 \right\}$

139)  $\left\{ \frac{1}{2}, \frac{1}{4}, -3 \right\}$

140)  $\{7, 1\}$

141)  $\{8, 1\}$

142) No rational zeros

143) No rational zeros

144) 0 or 2 positive; 1 negative

145) 0 positive; 0 negative

146) 0, 2, or 4 positive; 0 negative

147) 1 or 3 positive; 0 negative

148) 1 positive; 1 or 3 negative

149) 1 or 3 positive; 0 or 2 negative

150)  $(-\infty, -2) \cup (-2, \infty)$

151)  $(-\infty, -3) \cup (-3, \infty)$

152)  $(-\infty, -3) \cup (-3, \infty)$

153)  $(-\infty, \infty)$

154)  $(-\infty, \infty)$

155)  $(-\infty, \infty)$

156)  $x = 8$

157)  $x = 9$

158)  $x = 2, x = -3$

159)  $x = 4, x = -3$

160)  $x = 8$

161)  $x = 8$

162) no vertical asymptote

163) no vertical asymptote

## Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

164) no horizontal asymptote

165) no horizontal asymptote

166)  $y = 0$

167)  $y = 0$

168)  $y = -\frac{3}{4}$

169)  $y = -\frac{5}{3}$

170)  $y = \frac{2}{7}$

171)  $y = \frac{9}{7}$

172)  $y = 0$

173)  $y = 0$

174) no horizontal asymptote

175) no horizontal asymptote

176)  $y = 0$

177)  $y = 0$

178)  $S(x) = \frac{440}{x} + x^2$

179)  $S(x) = \frac{424}{x} + x^2$

180)  $192 \text{ cm}^2$  when  $x = 8 \text{ cm}$

181) \$8100

182) \$4333

183) The average number of vehicles waiting increases.

184) The resistance increases.

185)  $t = 0.55$  minutes after the injection is given

186) 39.6%; \$209 million

187) 26.5%; \$469 million

188) \$105

189) \$140

190)  $-\frac{19}{26} + \frac{11}{13}i$

191)  $-\frac{23}{61} + \frac{9}{61}i$

192)  $-\frac{8}{37} - \frac{11}{37}i$

193)  $-\frac{29}{97} - \frac{41}{97}i$

194)  $\frac{43}{97} + \frac{73}{97}i$

195)  $\frac{15}{61} - \frac{79}{61}i$

196)  $\frac{11}{89} - \frac{71}{89}i$

## Answer Key

Testname: E4PREP\_CH4\_CH5\_OTHER\_V01

197)  $\frac{5}{17} + \frac{14}{17}i$

198)  $-\frac{1}{2} \pm i\frac{3\sqrt{3}}{2}$

199)  $-\frac{1}{2} \pm i\frac{\sqrt{19}}{2}$

200)  $4 \pm 3i$

201)  $-6 \pm 2i$

202)  $\frac{7}{32} \pm i\frac{\sqrt{15}}{32}$

203)  $\frac{3}{8} \pm i\frac{\sqrt{7}}{8}$

204)  $-\frac{3}{8} \pm i\frac{\sqrt{55}}{8}$

205)  $-\frac{7}{6} \pm i\frac{\sqrt{23}}{6}$

206) True

207) True