Math 102
E4 (Final Exam) Preparation Ch.4, & Ch. 5, & Other v02
NO BOOK/ NO NOTES/YES CALCULATOR
Dressler Fall 2016

Name____________________________________

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

1) $4^{x} = 256$ 1) ________________

2) $3^{x} = 27$ 2) ________________

3) $2^{2x + 1} = 32$ 3) ________________

4) $4^{2x + 1} = 1024$ 4) ________________

5) $3^{3x - 1} = 243$ 5) ________________

6) $4^{3x - 1} = 16$ 6) ________________

7) $3^{x + 7} = 2$ 7) ________________

8) $4^{x + 8} = 5$ 8) ________________

9) $2^{x + 6} = 3$ 9) ________________

10) $3^{x + 6} = 8$ 10) ________________

11) $4^{7x} = 2.6$ 11) ________________

12) $7^{2x} = 4.3$ 12) ________________

13) $5^{x + 6} = 5$ 13) ________________

14) $2^{x + 6} = 5$ 14) ________________

15) $6(2)^{x} = 13$ 15) ________________

16) $4(4)^{x} = 48$ 16) ________________

17) $6(4)^{x} = 41$ 17) ________________

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

18) $e^{4x} = 8$ 18) ______________

19) $e^{3x} = 6$ 19) ______________

20) $e^{(x + 4)} = 7$ 20) ______________

21) $e^{(x + 3)} = 8$ 21) ______________

22) $\ln (6x) + \ln (7x) = 2$ 22) ______________

23) $\ln (5x) + \ln (7x) = 2$ 23) ______________

24) $-2 \ln (3x^2) + 3 \ln (2x^4) = 6$ 24) ______________

25) $2 \ln (6x^3) - 2 \ln (2x^4) = 5$ 25) ______________

26) $e^{2x - 3} \cdot e^{4x} = 115$ 26) ______________

27) $e^{2x - 1} \cdot e^{5x} = 105$ 27) ______________

28) $7e^{x} - 10 = 2e^{x} + 60$ 28) ______________

29) $7e^{x} - 14 = 3e^{x} + 40$ 29) ______________

30) $\ln(7x^{17}) - 4\ln(x^{4}) = 2$ 30) ______________

31) $\ln(7x^{9}) - 4\ln(x^{2}) = 8$ 31) ______________

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

32) $\log_{2}(8) = 3$ 32) ______________

33) $\log_{5}(25) = 2$ 33) ______________

34) $\log_{8}(2) = \frac{1}{3}$ 34) ______________

35) $\log_{125}(5) = \frac{1}{3}$ 35) ______________

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

36) $6 \ln(a) - 9 \ln(b)$ 36) ______________

37) $8 \ln(a) - 9 \ln(b)$ 37) ______________

38) $5 \ln(x - 10) - 11 \ln(x)$ 38) ______________

39) $5 \ln(x - 7) - 9 \ln(x)$ 39) ______________

40) $2 \ln(x^2) + 4 \ln(6x)$ 40) ______________

41) $4 \ln(x^2) + 4 \ln(4x)$ 41) ______________

42) $2 \ln(w^2) - \ln(6w^9)$ 42) ______________

43) $3 \ln(w^2) - \ln(7w^8)$ 43) ______________

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

44) $\log_5\left(\frac{1}{25}\right) = -2$ 44) ______________

45) $\log_2 \left(\frac{1}{4}\right) = -2$ 45) ______________

Solve the problem.

46) Let $f(x) = 3^x$. 46) ______________

i) Find $f(3)$.

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

iii) Find x when $f(x) = 9$.

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

Solve.

47) $\log_2 (x) = 1$ 47) ______________

48) $\log_4 (x) = 1$ 48) ______________

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

50) $\log (x) = 3$ 50) ______________

51) $\log_2 (x) = -3$ 51) ______________

52) $\log_3 (x) = -2$ 52) ______________

53) $\log_5 (x + 3) = 1$ 53) ____________

54) $\log_6 (x + 2) = 1$ 54) ____________

55) $\log_5 (x + 3) = -1$ 55) ____________

56) $\log_4 (x - 1) = -1$ 56) ____________

57) $\log_5 (x + 3) = -3$ 57) ____________

58) $\log_2 (x - 3) = -3$ 58) ____________

59) $\log_2 (-7 - 5x) = 3$ 59) ____________

60) $\log_3 (29 - 5x) = 2$ 60) ____________

61) $\log (3x - 4) = 1$ 61) ____________

62) $\log (4x + 8) = 1$ 62) ____________

63) $3\log_{729}(x) + 9 = 10$ 63) ______________

64) $4\log_{625}(x) + 4 = 5$ 64) ______________

65) $\log_2(\log_2(y)) = 1$ 65) ______________

66) $\log_3(\log_3(y)) = 2$ 66) ______________

67) $\log_6(x^2) = 4$ 67) ______________

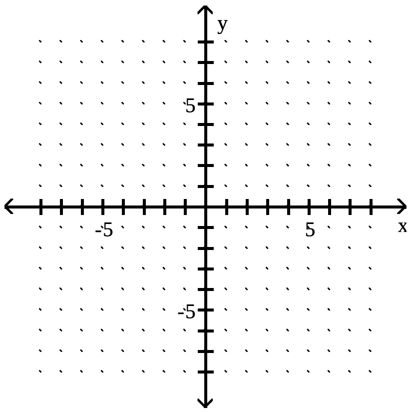
68) $\log_x(8) = 3$ 68) ______________

69) $\log_x(144) = 2$ 69) ______________

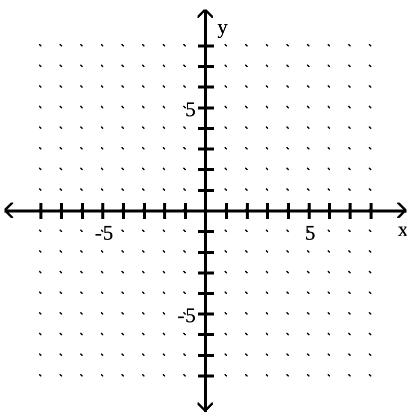
70) $\log_x(9) = 2$ 70) ______________

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.

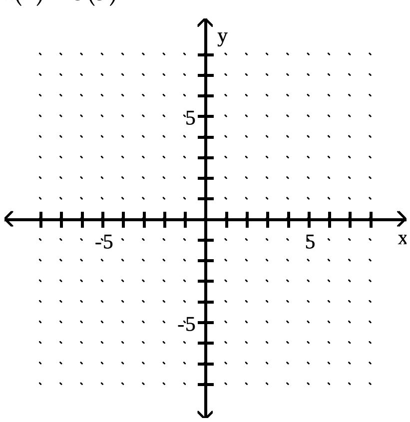
71) $f(x) = 2(9)^x$ 71) ______________



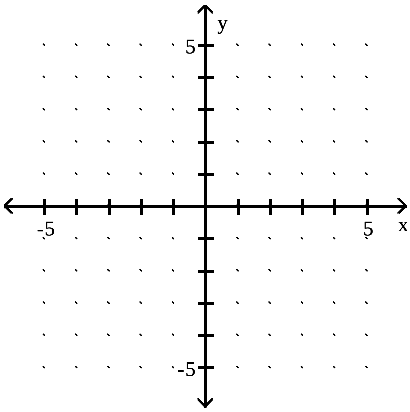
72) $f(x) = 2(5)^x$ 72) ______________



73) $f(x) = 3(5)^x$ 73) ______________

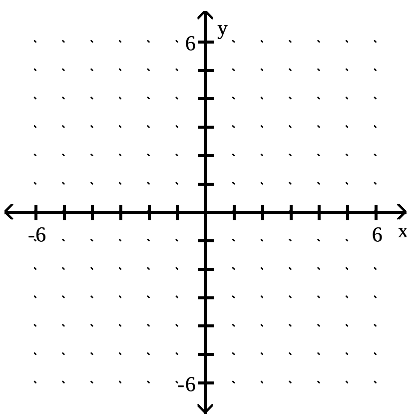


74) $f(x) = 5(\frac{1}{4})^x$ 74) ______________

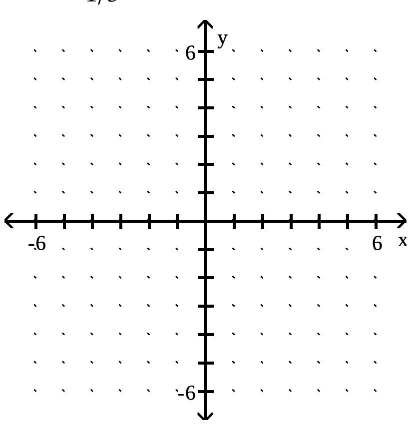


Sketch the graph of the function.

75) $y = \log_2(x)$ 75) ______________



76) $y = \log_{1/5}(x)$ 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, W/m^2) and $I_0 = 10^{-12}$ W/m^2. A certain sound has intensity of 9.12×10^{-5} 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, W/m^2) and $I_0 = 10^{-12}$ W/m^2. A certain sound has intensity of 9.36×10^{-4} 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 $pH = -\log(H^+)$ where H^+ represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is 1×10^{-4}. 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 $pH = -\log(H^+)$ where H^+ represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is 1×10^{-5}. 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 $pH = -\log(H^+)$ where H^+ represents the concentration of the hydrogen ions in the solution in moles per liter. Find the pH if the hydrogen ion concentration is 6.6×10^{-9}. 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 $f(t) = 4600e^{0.064t}$. 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 $f(t) = 8100e^{0.065t}$. 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 $f(t) = 6900e^{0.061t}$. When will the account be worth $11,947? 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 $f(t) = 9300e^{0.053t}$. When will the account be worth $11,496? 85) ______________

86) The function $y = 200e^{-0.0077x}$ 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 73 pounds to remain? 86) ______________

87) The function $y = 900e^{-0.0099x}$ 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 900 pounds of the material are placed in the vault, how much time will need to pass for only 274 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) $x^3 - 5$; $x - 1$ 88) ______________

89) $3x^4 - 4x^2 - 1$; $x + \frac{1}{2}$ 89) ______________

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

91) $x^5 - 4x^4 - 14x^3 + 14x^2 - 15x + 20$; $x - 6$ 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) $x^2 + 10x + 12; x + 8$ 98) ______________

99) $x^2 + 14x + 44; x + 6$ 99) ______________

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

100) $f(x) = x^3 + 4x^2 + 2x + 2$; find $f(2)$ 100) ______________

101) $f(x) = x^3 - 3x^2 + 2x - 5$; find $f(-4)$ 101) ______________

102) $f(x) = 4x^3 + 4x^2 - 2x + 19$; find $f(2)$ 102) ______________

103) $f(x) = 3x^3 + 4x^2 + 4x + 23$; find $f(-3)$ 103) ______________

104) $f(x) = 4x^3 - 12x^2 - 9x$; find $f\left(-\frac{1}{2}\right)$ 104) ______________

105) $f(x) = 4x^3 - 8x^2 - 7x$; 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) $x - 5$; $x^3 - 8x^2 + 17x - 10$ 106) ______________

107) $x - 3$; $x^3 + 14x^2 + 39x - 54$ 107) ______________

108) $x + 5$; $x^3 - 5x^2 - 29x + 105$ 108) ______________

109) $x + 4$; $x^3 - 9x^2 + 8x + 64$ 109) ______________

110) $x - 6$; $4x^3 - 23x^2 + 40x - 21$ 110) ______________

111) $x - 5$; $2x^3 - 15x^2 + 33x - 20$ 111) ______________

112) $x + 3$; $2x^3 - 14x^2 - 18x + 126$ 112) ______________

113) $x - 6$; $4x^3 - 31x^2 + 27x + 90$ 113) ______________

114) $x - 8$; $2x^3 - 15x^2 - 29x + 168$ 114) ______________

115) $x - 7$; $3x^3 - 22x^2 - 3x + 70$ 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) $f(x) = x^3 - 6x^2 + 5x - 24$ 118) ____________

119) $f(x) = x^3 - 5x^2 + 9x - 24$ 119) ____________

120) $f(x) = 2x^3 + 5x^2 + 11x - 8$ 120) ____________

121) $f(x) = 2x^3 + 7x^2 + 15x - 8$ 121) ____________

122) $f(x) = 3x^3 + 64x^2 + 64x + 27$ 122) ____________

123) $f(x) = 3x^3 + 45x^2 + 45x + 27$ 123) ____________

124) $f(x) = 2x^3 - 5x^2 + 7x - 11$ 124) ____________

125) $f(x) = 2x^3 - 5x^2 + 7x - 23$ 125) ____________

126) $f(x) = 14x^7 + 56x^3 + 2x - 7$ 126) ____________

127) $f(x) = 10x^7 + 40x^3 + 2x - 5$ 127) ____________

Find all rational zeros.

128) $f(x) = x^3 + 8x^2 - 16x - 128$ 128) ____________

129) $f(x) = x^3 + 6x^2 - 9x - 54$ 129) ____________

130) $f(x) = x^3 - 3x^2 - 4x + 12$ 130) ____________

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

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

133) $f(x) = 4x^3 - 12x^2 - x + 3$ 133) ______________

134) $f(x) = 12x^3 + 49x^2 + 3x - 4$ 134) ______________

135) $f(x) = 12x^3 + 61x^2 + 4x - 5$ 135) ______________

136) $f(x) = 10x^3 + 23x^2 + 5x - 2$ 136) ______________

137) $f(x) = 10x^3 + 63x^2 + 17x - 6$ 137) ______________

138) $f(x) = 8x^3 + 34x^2 - 29x + 5$ 138) ______________

139) $f(x) = 8x^3 + 10x^2 - 11x + 2$ 139) ______________

140) $f(x) = x^4 - 7x^3 + 3x^2 + 21x - 18$ 140) ______________

141) $f(x) = x^4 - 6x^3 + 2x^2 + 18x - 15$ 141) ______________

142) $f(x) = x^4 + 4x^3 + 4x^2 - 8x - 64$ 142) ______________

143) $f(x) = x^4 + 2x^3 + 2x^2 - 4x - 8$ 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) $f(x) = 4x^3 - 2x^2 + 5x + 6$ 144) ____________

145) $f(x) = 9x^8 + 2x^6 + 5x^4 + 4x^2 + 8$ 145) ____________

146) $f(x) = -9x^4 + 4x^3 - 4x^2 + 3x - 9$ 146) ____________

147) $f(x) = 9x^5 - 4x^4 + 7x^3 - 8$ 147) ____________

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

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

Find the domain of the rational function.

150) $g(x) = \dfrac{x - 5}{x + 9}$ 150) ____________

151) $g(x) = \dfrac{x - 1}{x + 2}$ 151) ____________

152) $g(x) = \frac{x - 7}{x + 4}$ 152) ______________

153) $f(x) = \frac{x - 1}{x^2 + 9}$ 153) ______________

154) $f(x) = \frac{x - 4}{x^2 + 3}$ 154) ______________

155) $f(x) = \frac{x - 1}{x^2 + 8}$ 155) ______________

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

156) $g(x) = \frac{x + 3}{x - 1}$ 156) ______________

157) $g(x) = \frac{x + 9}{x - 3}$ 157) ______________

158) $h(x) = \frac{x^2 - 100}{(x - 5)(x + 6)}$ 158) ______________

159) $h(x) = \frac{x^2 - 100}{(x - 4)(x + 8)}$ 159) ______________

160) $f(x) = \frac{x^2 + 2x}{x^2 - 5x - 14}$ 160) ______________

161) $f(x) = \frac{x^2 + 5x}{x^2 - 4x - 45}$ 161) ______________

162) $f(x) = \frac{x - 1}{x^2 + 8}$ 162) ______________

163) $f(x) = \frac{x - 9}{x^2 + 1}$ 163) ______________

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

164) $g(x) = \frac{x^2 + 7x - 5}{x - 5}$ 164) ______________

165) $g(x) = \frac{x^2 + 3x - 5}{x - 5}$ 165) ______________

166) $g(x) = \frac{x + 9}{x^2 - 3}$ 166) ______________

167) $g(x) = \frac{x + 6}{x^2 - 6}$ 167) ______________

168) $f(x) = \frac{-2x + 5}{2x + 6}$ 168) ______________

169) $g(x) = \frac{-5x + 7}{4x + 4}$ 169) ______________

170) $g(x) = \frac{9x^2 - 7x - 9}{8x^2 - 2x + 8}$ 170) ______________

171) $g(x) = \frac{2x^2 - 6x - 3}{7x^2 - 3x + 2}$ 171) ______________

172) $g(x) = \frac{x + 8}{x^2 - 7}$ 172) ______________

173) $g(x) = \frac{x + 8}{x^2 - 7}$ 173) ______________

174) $h(x) = \frac{x^2 - 16}{x + 4}$ 174) ______________

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

176) $f(x) = \frac{5x^2 + 8x - 3}{2x^3 - 4x + 8}$ 176) ______________

177) $f(x) = \frac{3x^2 + 7x - 5}{2x^3 - 2x + 10}$ 177) ______________

Solve the problem.

178) An open-top rectangular box has a square base and it will hold 107 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 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. 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 $y = \frac{3.8x}{100 - x}$, 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 $y = \frac{7.1x}{100 - x}$, where y is the cost in thousands of dollars for removing x percent of a given pollutant. Find the cost of removing 55% 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 radios has costs given by the function $C(x) = 30x + 30{,}000$, 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 $\bar{C}(x) = \frac{30x + 30{,}000}{x}$. Find $\bar{C}(250)$. (Round to the nearest dollar, if necessary.) 188) ______

189) A company that produces scooters has costs given by the function $C(x) = 15x + 20{,}000$, where x is the number of scooters manufactured and C(x) is measured in dollars. The average cost to manufacture each scooter is given by $\bar{C}(x) = \frac{15x + 20{,}000}{x}$. Find $\bar{C}(250)$. (Round to the nearest dollar, if necessary.) 189) ______

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

190) Let $z = 3 - i$ and $w = -5 - 6i$. Find $\frac{z + 2i}{w}$. 190) ______

191) Let $z = 8 - i$ and $w = -7 - 5i$. Find $\frac{z + 2i}{w}$. 191) ______

192) Let $z = 5 - i$ and $w = -6 + 8i$. Find $\frac{z}{w}$. 192) ______

193) Let $z = 7 - i$ and $w = -2 + 6i$. Find $\frac{z}{w}$. 193) ______

194) Let $z = 5 - 3i$ and $w = 3 + 3i$. Find $\frac{w}{z}$. 194) ______

195) Let $z = 2 + 7i$ and $w = 9 - 3i$. Find $\frac{w}{z + 3}$. 195) ________

196) Let $z = 2 + 4i$ and $w = 8 - 8i$. Find $\frac{w}{z + 3}$. 196) ________

197) Let $z = 8 - 3i$ and $w = 8 + 3i$. Find $\frac{w}{z}$. 197) ________

Solve the equation.

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

199) $x^2 + x + 3 = 0$ 199) ________

200) $x^2 - 8x + 52 = 0$ 200) ________

201) $x^2 + 4x + 8 = 0$ 201) ________

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

203) $8x^2 - 5x + 1 = 0$ 203) ________

204) $8x^2 = 5x - 9$ 204) ______________

205) $6x^2 = -7x - 5$ 205) ______________

Provide an appropriate response.

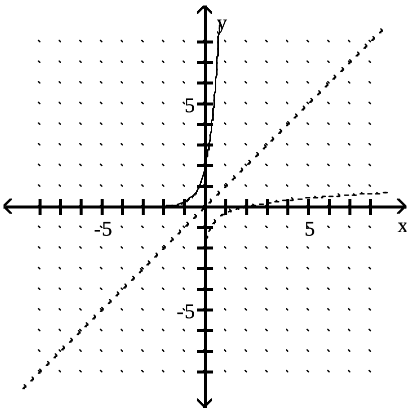
206) True or False: The numbers $\frac{3 + 2i}{i}$ and $2 - 3i$ are equivalent. 206) ______________

207) True or False: The numbers $\frac{5 + 2i}{i}$ and $2 - 5i$ are equivalent. 207) ______________

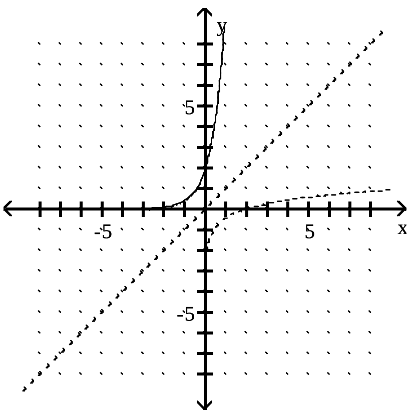
1) 4
2) 3
3) 2
4) 2
5) 2
6) 1
7) -6.3691
8) -6.8390
9) -4.4150
10) -4.1072
11) 0.0985
12) 0.3748
13) -5.0000
14) -3.6781
15) 1.1155
16) 1.7925
17) 1.3863
18) 0.5199
19) 0.5973
20) -2.0541
21) -0.9206
22) 0.4194
23) 0.4595
24) 2.1484
25) 0.2463
26) 1.2908
27) 0.8077
28) 2.6391
29) 2.6027
30) 1.0556
31) 425.8511
32) $2^3 = 8$
33) $5^2 = 25$
34) $8^{1/3} = 2$
35) $125^{1/3} = 5$
36) $\ln\left(\frac{a^6}{b^9}\right)$
37) $\ln\left(\frac{a^8}{b^9}\right)$
38) $\ln\left(\frac{(x - 10)^5}{x^{11}}\right)$
39) $\ln\left(\frac{(x - 7)^5}{x^9}\right)$
40) $\ln (1296x^8)$
41) $\ln (256x^{12})$

42) $\ln\left(\frac{1}{6w^5}\right)$
43) $\ln\left(\frac{1}{7w^2}\right)$
44) $5^{-2} = \frac{1}{25}$
45) $2^{-2} = \frac{1}{4}$
46) i) 27
ii) 1
iii) 2
iv) 19,683
47) 2
48) 4
49) 100
50) 1000
51) $\frac{1}{8}$
52) $\frac{1}{9}$
53) 2
54) 4
55) $-\frac{14}{5}$
56) $\frac{5}{4}$
57) $-\frac{374}{125}$
58) $\frac{25}{8}$
59) -3
60) 4
61) $\frac{14}{3}$
62) $\frac{1}{2}$
63) 9
64) 5
65) 4
66) 19,683
67) 36, -36
68) 2
69) 12
70) 3

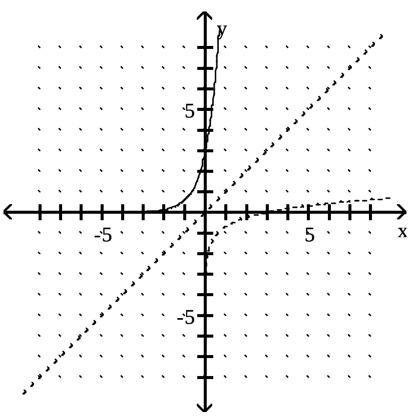
71)



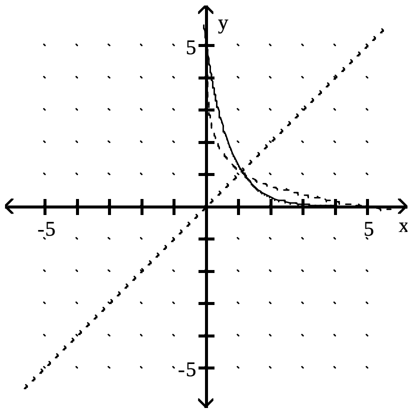
72)



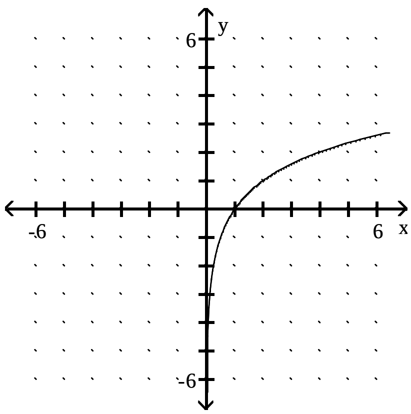
73)



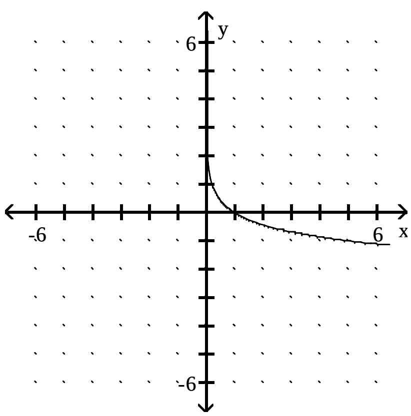
74)



75)



76)



77) 80 decibels
78) 90 decibels
79) 4
80) 5
81) 8.18
82) $4600.00
83) $8100.00
84) 2009
85) 2004
86) 131 years
87) 120 years

88) quotient: $x^2 + x + 1$; remainder: -4
89) quotient: $3x^3 - \frac{3}{2}x^2 - \frac{13}{4}x + \frac{13}{8}$; remainder: $-\frac{29}{16}$
90) quotient: $3x^3 - \frac{3}{4}x^2 + \frac{35}{16}x - \frac{35}{64}$; remainder: $-\frac{221}{256}$
91) quotient: $x^4 + 2x^3 - 2x^2 + 2x - 3$; 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: $x + 2$; remainder: -4
99) quotient: $x + 8$; remainder: -4
100) 30
101) -125
102) 63
103) -34
104) 1
105) 1
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) $\{\pm1, \pm2, \pm3, \pm4, \pm6, \pm8, \pm12, \pm24\}$
119) $\{\pm1, \pm2, \pm3, \pm4, \pm6, \pm8, \pm12, \pm24\}$
120) $\left\{\pm1, \pm\frac{1}{2}, \pm2, \pm4, \pm8\right\}$
121) $\left\{\pm1, \pm\frac{1}{2}, \pm2, \pm4, \pm8\right\}$
122) $\left\{\pm1, \pm\frac{1}{3}, \pm3, \pm9, \pm27\right\}$
123) $\left\{\pm1, \pm\frac{1}{3}, \pm3, \pm9, \pm27\right\}$
124) $\left\{\pm1, \pm11, \pm\frac{1}{2}, \pm\frac{11}{2}\right\}$
125) $\left\{\pm1, \pm23, \pm\frac{1}{2}, \pm\frac{23}{2}\right\}$

126) $\left\{\pm 1, \pm \frac{1}{2}, \pm 7, \pm \frac{7}{2}, \pm \frac{1}{7}, \pm \frac{1}{14}\right\}$
127) $\left\{\pm 1, \pm \frac{1}{2}, \pm 5, \pm \frac{5}{2}, \pm \frac{1}{5}, \pm \frac{1}{10}\right\}$
128) $\{-4, -8, 4\}$
129) $\{-3, -6, 3\}$
130) $\{2, 3, -2\}$
131) $\{3, 4, -1\}$
132) $\left\{\frac{1}{2}, -\frac{1}{2}, 2\right\}$
133) $\left\{\frac{1}{2}, -\frac{1}{2}, 3\right\}$
134) $\left\{-\frac{1}{3}, \frac{1}{4}, -4\right\}$
135) $\left\{-\frac{1}{3}, \frac{1}{4}, -5\right\}$
136) $\left\{-\frac{1}{2}, \frac{1}{5}, -2\right\}$
137) $\left\{-\frac{1}{2}, \frac{1}{5}, -6\right\}$
138) $\left\{\frac{1}{2}, \frac{1}{4}, -5\right\}$
139) $\left\{\frac{1}{2}, \frac{1}{4}, -2\right\}$
140) $\{6, 1\}$
141) $\{5, 1\}$
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) $(-\infty, -9) \cup (-9, \infty)$
151) $(-\infty, -2) \cup (-2, \infty)$
152) $(-\infty, -4) \cup (-4, \infty)$
153) $(-\infty, \infty)$
154) $(-\infty, \infty)$
155) $(-\infty, \infty)$
156) $x = 1$
157) $x = 3$
158) $x = 5, x = -6$
159) $x = 4, x = -8$
160) $x = 7$
161) $x = 9$
162) no vertical asymptote
163) no vertical asymptote

164) no horizontal asymptote
165) no horizontal asymptote
166) $y = 0$
167) $y = 0$
168) $y = -1$
169) $y = -\frac{5}{4}$
170) $y = \frac{9}{8}$
171) $y = \frac{2}{7}$
172) $y = 0$
173) $y = 0$
174) no horizontal asymptote
175) no horizontal asymptote
176) $y = 0$
177) $y = 0$
178) $S(x) = \frac{428}{x} + x^2$
179) $S(x) = \frac{440}{x} + x^2$
180) 192 cm^2 when $x = 8$ cm
181) $11,400
182) $8677
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) $150
189) $95
190) $-\frac{21}{61} + \frac{13}{61} i$
191) $-\frac{61}{74} + \frac{33}{74} i$
192) $-\frac{19}{50} - \frac{17}{50} i$
193) $-\frac{1}{2} - 1 i$
194) $\frac{3}{17} + \frac{12}{17} i$
195) $\frac{12}{37} - \frac{39}{37} i$
196) $\frac{8}{41} - \frac{72}{41} i$
197) $\frac{55}{73} + \frac{48}{73} i$

198) $-\frac{1}{2} \pm i\frac{\sqrt{7}}{2}$

199) $-\frac{1}{2} \pm i\frac{\sqrt{11}}{2}$

200) $4 \pm 6i$

201) $-2 \pm 2i$

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

203) $\frac{5}{16} \pm i\frac{\sqrt{7}}{16}$

204) $\frac{5}{16} \pm i\frac{\sqrt{263}}{16}$

205) $-\frac{7}{12} \pm i\frac{\sqrt{71}}{12}$

206) True

207) True