

Disclaimer: The actual exam differs.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**Express the number in scientific notation.**

1) 0.0000031517

1) _____

Simplify and write the answer using scientific notation.

2) $\frac{10.4 \times 10^{-5}}{2.6 \times 10^3}$

2) _____

Calculate.

3) $\frac{[2(1+4)^3 + 3](-3 + 4 \cdot (-1))}{3^{-1}(3^{-1} + 2)}$

3) _____

Find the domain of the function.

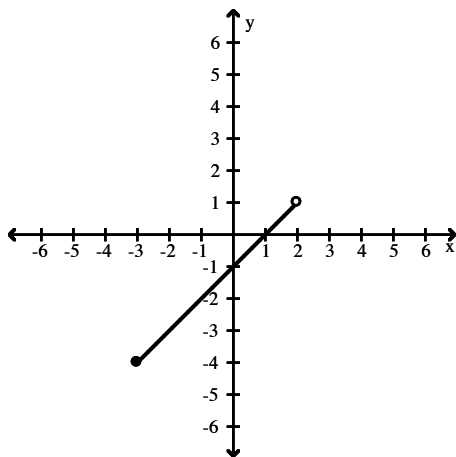
4) $f(x) = \frac{1}{x^2 + 5x - 6}$

4) _____

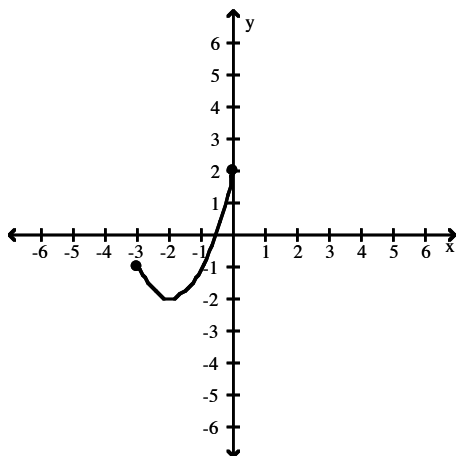
Find the domain and range of the function represented in the graph.

5)

5) _____



6)



6) _____

By graphing the function, visually estimate its domain and range.

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

7) _____

Solve the problem.

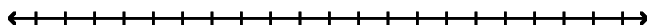
8) On average, the number of electric guitars sold in Texas each year is 105,231, which is about seven times the average number of guitars sold each year in Wyoming. How many electric guitars, on average, are sold in Wyoming?

8) _____

Solve and write interval notation for the solution set. Then graph the solution set.

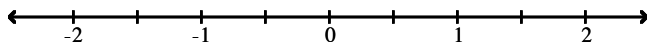
9) $17 < 5x + 2 \leq 37$

9) _____



10) $-1 < -\frac{2}{3}(3x - 1) \leq \frac{1}{6}$

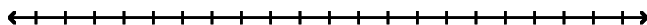
10) _____



Solve and give interval notation for the solution set. Then graph the solution set.

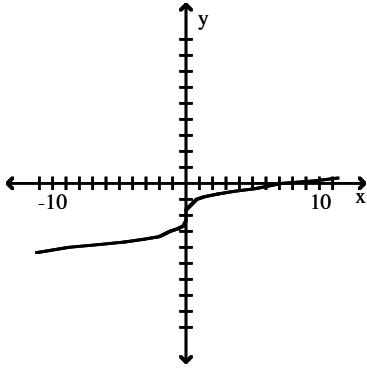
11) $3x - 6 < -1.5$ or $3x - 6 > 1.5$

11) _____



Determine the intervals on which the function is increasing, decreasing, and constant.

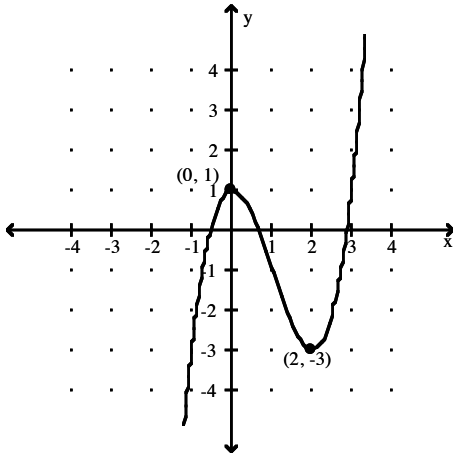
12)



12) _____

Using the graph, determine any relative maxima or minima of the function and the intervals on which the function is increasing or decreasing. Round to three decimal places when necessary.

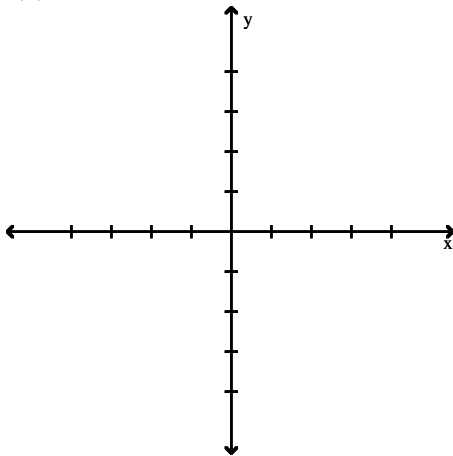
13) $f(x) = x^3 - 3x^2 + 1$



13) _____

Graph the function. Use the graph to find any relative maxima or minima.

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



14) _____

For the piecewise function, find the specified function value.

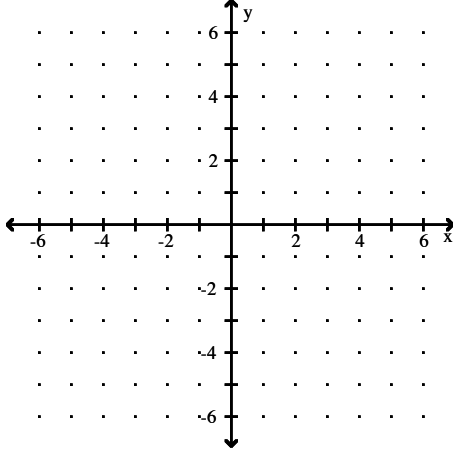
$$15) f(x) = \begin{cases} 4x+7, & \text{for } x \leq 0, \\ 6-7x, & \text{for } 0 < x < 7, \\ x, & \text{for } x \geq 7 \end{cases}$$

f(8)

15) _____

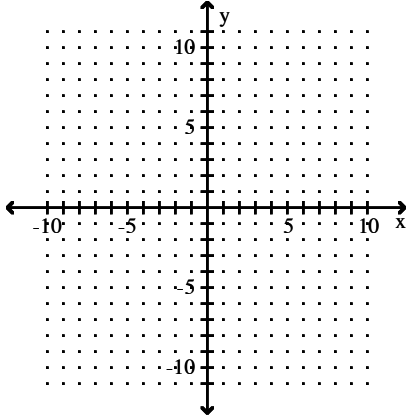
Graph the function.

$$16) f(x) = \begin{cases} x-1, & \text{for } x > 0, \\ 5, & \text{for } x \leq 0 \end{cases}$$



16) _____

$$17) f(x) = \begin{cases} x+2 & \text{for } -8 \leq x < 4 \\ -9 & \text{for } x = 4 \\ -x+5 & \text{for } x > 4 \end{cases}$$



17) _____

For the pair of functions, find the indicated sum, difference, product, or quotient.

$$18) f(x) = 7 - 6x, \quad g(x) = -2x + 6$$

Find $(f + g)(x)$.

18) _____

$$19) f(x) = 3x + 2, \quad g(x) = 6x + 6$$

Find $(fg)(x)$.

19) _____

$$20) f(x) = \frac{2}{x-7}, g(x) = \frac{1}{9+x}$$

20) _____

Find $(f/g)(x)$.

For the function f , construct and simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$.

$$21) f(x) = \frac{18}{x+13}$$

21) _____

For the pair of functions, find the indicated composition.

$$22) f(x) = 4x^2 + 3x + 6, g(x) = 3x - 7$$

22) _____

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

For the pair of functions, find the indicated domain.

$$23) f(x) = \frac{2}{x+9}, g(x) = x + 6$$

23) _____

Find the domain of $f \circ g$.

$$24) f(x) = \frac{7}{x+9}, g(x) = x + 6$$

24) _____

Find the domain of $g \circ f$.

$$25) f(x) = 2x - 5, g(x) = \sqrt{x+2}$$

25) _____

Find the domain of $g \circ f$.

Determine algebraically whether the graph is symmetric with respect to the x -axis, the y -axis, and the origin.

$$26) xy = -3$$

26) _____

$$27) x^2 + y^2 = 5$$

27) _____

Determine algebraically whether the function is even, odd, or neither even nor odd.

$$28) f(x) = -5x^5 + 7x^3$$

28) _____

$$29) f(x) = 9x^4 + 7x - 4$$

29) _____

$$30) f(x) = \sqrt{x^2 + 17}$$

30) _____

Simplify. Write your answers in the form of $a+bi$, where a and b are real numbers.

$$31) (8 + 2i)(6 + 4i)$$

31) _____

$$32) (4 + \sqrt{-16})(6 + \sqrt{-64})$$

32) _____

33) $\frac{\sqrt{3+4i}}{7-6i}$

33) _____

Simplify.

34) $(-i)^{27}$

34) _____

Solve.

35) $20x^3 - 15x^2 + 12x - 9 = 0$

35) _____

Solve by completing the square to obtain exact solutions.

36) $x^2 + 12x + 15 = 0$

36) _____

Use the quadratic formula to find the exact solutions.

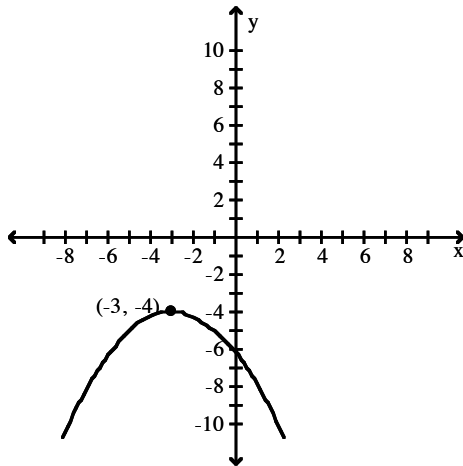
37) $x^2 = 19 + 5x$

37) _____

Use the graph to find the vertex, the axis of symmetry, and the maximum or minimum value of the function.

38)

38) _____



Find the vertex of the parabola.

39) $f(x) = -2x^2 - 20x - 54$

39) _____

Find the axis of symmetry of the given function.

40) $f(x) = -3x^2 + 2x$

40) _____

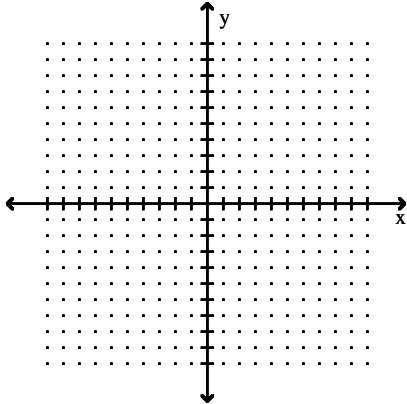
Determine whether there is a maximum or minimum value for the given function, and find that value.

41) $f(x) = x^2 + 14x + 39$

41) _____

Graph.

42) $f(x) = -x^2 + 2x - 6$



42) _____

Find the range of the given function.

43) $f(x) = -4x^2 - 40x - 104$

43) _____

Find the intervals on which the function is increasing and the intervals on which the function is decreasing.

44) $f(x) = x^2 - 4x - 12$

44) _____

Solve.

45) The length and width of a rectangle have a sum of 82. What dimensions give the maximum area?

45) _____

46) $\frac{5}{y+3} - \frac{2}{y-3} = \frac{9}{y^2-9}$

46) _____

47) $\frac{8x}{x-8} - \frac{4}{x} = \frac{32}{x^2-8x}$

47) _____

48) $\sqrt{3x+14} = x+3$

48) _____

49) $\sqrt{2x+3} - \sqrt{x+1} = 1$

49) _____

50) $x^{1/3} = -4$

50) _____

51) $\frac{1}{A} = \frac{1}{B} + \frac{1}{C}$, for A

51) _____

52) $|x-6| = 2$

52) _____

Solve and write interval notation for the solution set.

53) $\left| \frac{3x-1}{4} \right| > 4$

53) _____

Find the correct end behavior diagram for the given polynomial function.

54) $f(x) = -\frac{1}{7}x^3 + 7x^2 + 7x - 5$

54) _____

55) $f(x) = 2.51x^4 + 8x^2 + x - 2$

55) _____

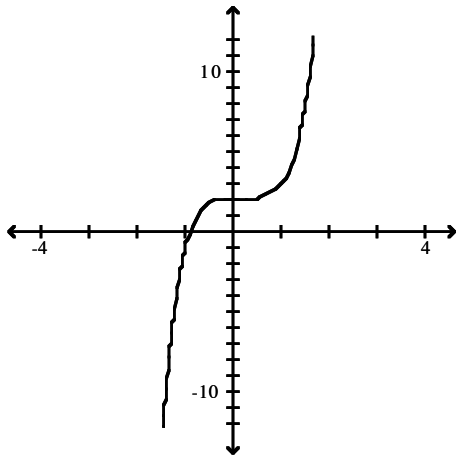
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use the leading-term test to match the function with the correct graph.

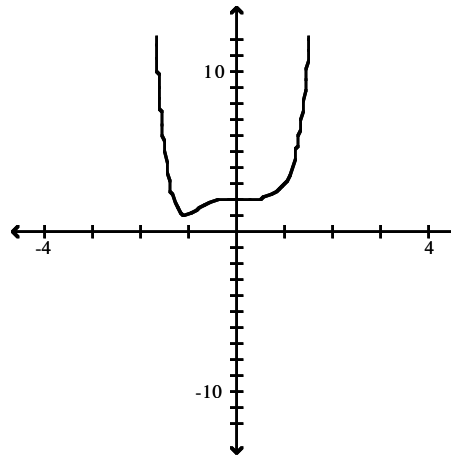
56) $f(x) = x^5 - x^4 + x^3 + 2$

56) _____

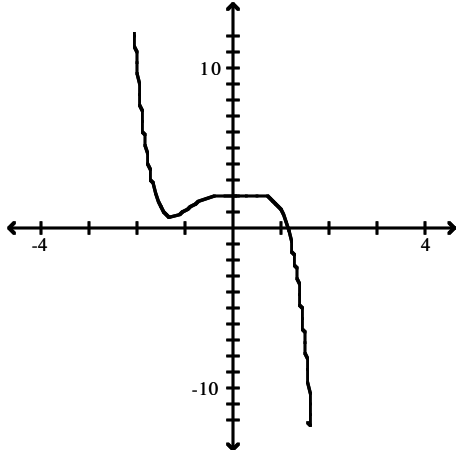
A)



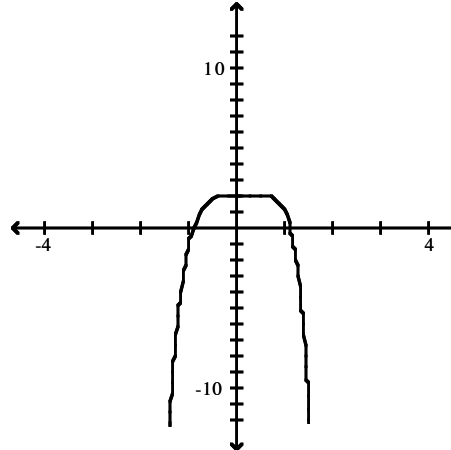
B)



C)



D)



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

Find the zeros of the polynomial function and state the multiplicity of each.

57) $f(x) = -6x^2(x - 7)(x + 1)^3$

57) _____

Solve the problem.

58) If there are x teams in a sports league and all the teams play each other twice, a total of $N(x)$ games are played, where $N(x) = x^2 - x$. A soccer league has 8 teams, each of which plays the others twice. If the league pays \$42 per game for the field and officials, how much will it cost to play the entire schedule?

58) _____

For the function find the maximum number of real zeros that the function can have, the maximum number of x-intercepts that the function can have, and the maximum number of turning points that the graph of the function can have.

59) $f(x) = 8x^2 - 9 + 0.17x - 5x^3$

59) _____

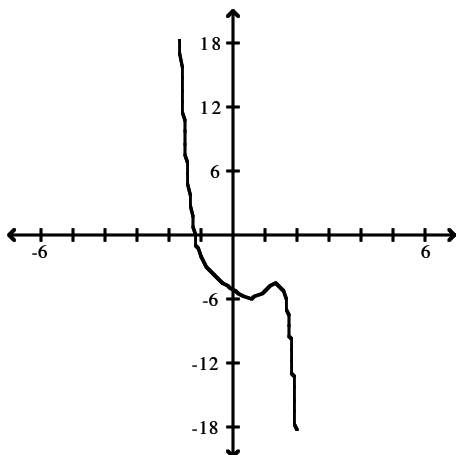
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use the leading-term test to match the function with the correct graph.

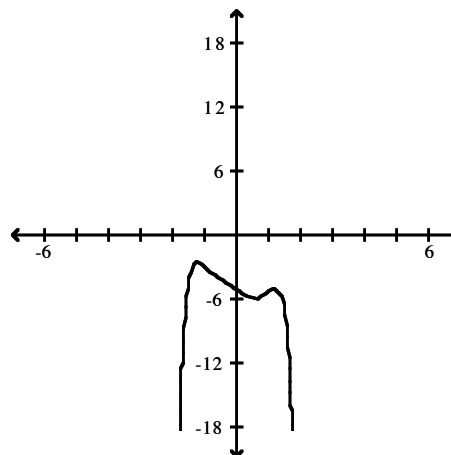
60) $f(x) = -0.3x^7 + 0.16x^6 - 0.26x^5 + x^4 + x^3 - 2x - 5$

60) _____

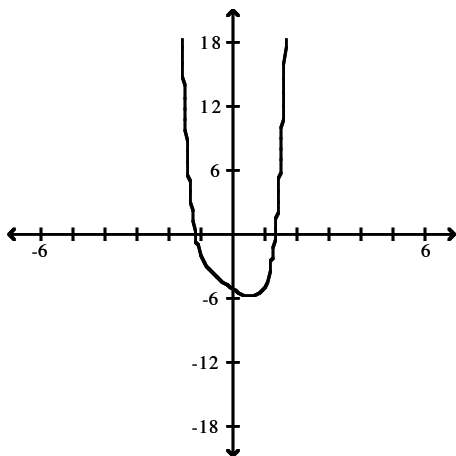
A)



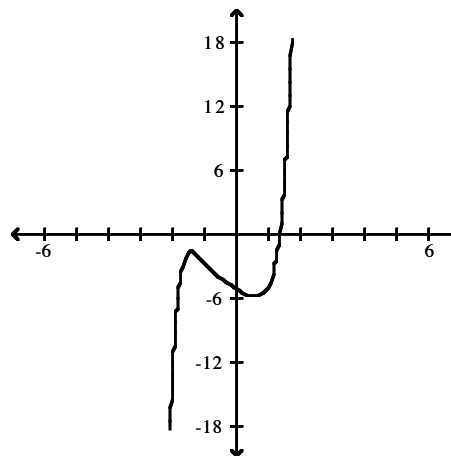
B)



C)



D)

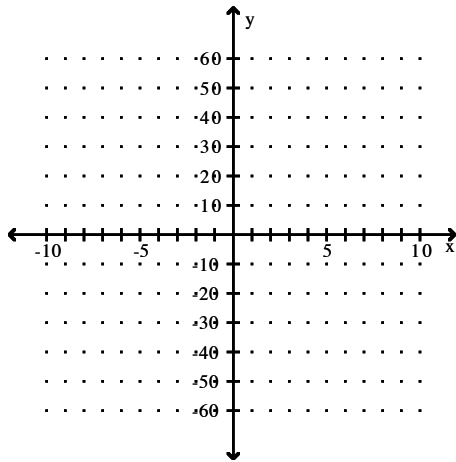


SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

Graph the function.

61) $f(x) = x(x+4)(x-2)(x+1)$

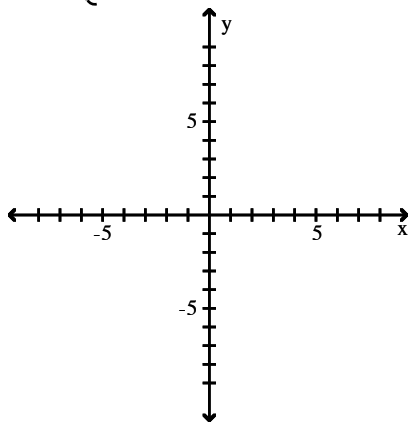
61) _____



Graph the piecewise function.

$$62) f(x) = \begin{cases} x+6, & \text{for } x < -2, \\ x^2+3, & \text{for } -2 \leq x \leq 1, \\ -\frac{1}{2}x^3, & \text{for } x > 1 \end{cases}$$

62) _____



Evaluate the function for the given values of a and b. Then use the intermediate value theorem to determine which of the statements below is true.

63) $a = -2$ and $b = -1$

63) _____

$$f(x) = 8x^5 - 9x^3 + 7x^2 + 2$$

A polynomial $P(x)$ and a divisor $d(x)$ are given. Use long division to find the quotient $Q(x)$ and the remainder $R(x)$ when $P(x)$ is divided by $d(x)$, and express $P(x)$ in the form $d(x) \cdot Q(x) + R(x)$.

64) $P(x) = 2x^4 - x^3 - 15x^2 + 3x$

64) _____

$$d(x) = x + 3$$

Use synthetic division to find the quotient and the remainder.

65) $(3x^4 - 9x^3 + 2x^2 - 6x) \div (x - 3)$

65) _____

Use synthetic division to find the function value.

66) $f(x) = x^4 + 16$; find $f(4)$.

66) _____

Factor the polynomial $f(x)$. Then solve the equation $f(x) = 0$.

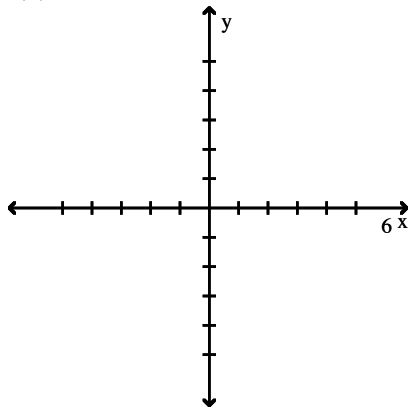
67) $f(x) = x^3 + 10x^2 + 29x + 20$

67) _____

Graph the polynomial function. Use synthetic division and the remainder theorem to find the zeros.

68) $f(x) = x^3 + 2x^2 - 15x - 36$

68) _____



Find the requested polynomial.

69) Find a polynomial of degree 4 having the following zeros:
 -2 (multiplicity 2), $\sqrt{12}$, $-\sqrt{12}$

69) _____

Provide the requested response.

70) Suppose that a polynomial function of degree 4 with rational coefficients has -2 , -6 , $-4 - i$ as zeros. Find the other zero.

70) _____

Find a polynomial function of lowest degree with rational coefficients that has the given numbers as some of its zeros.

71) $2 + i$, 2

71) _____

Given that the polynomial function has the given zero, find the other zeros.

72) $f(x) = x^4 - 8x^3 + 14x^2 - 8x + 13$; i

72) _____

73) $f(x) = x^3 + 3x^2 - 8x + 10$; $1 + i$

73) _____

74) $f(x) = x^3 - 64$; 4

74) _____

Give all possible rational zeros for the polynomial.

75) $f(x) = 3x^3 + 33x^2 + 33x + 27$

75) _____

Given the polynomial function $f(x)$, find the rational zeros, then the other zeros (that is, solve the equation $f(x) = 0$), and factor $f(x)$ into linear factors.

76) $f(x) = x^4 + 18x^3 + 71x^2 - 18x - 72$

76) _____

Find only the rational zeros.

77) $f(x) = x^6 + 81$

77) _____

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.

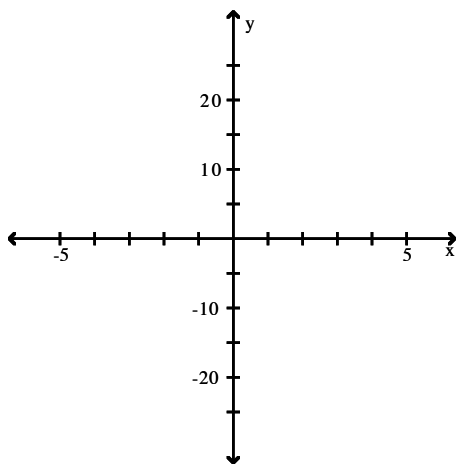
78) $F(x) = 7x^5 - 4x^4 + 2x^3 - 9$

78) _____

Sketch the graph of the polynomial function. Use the rational zeros theorem when finding the zeros.

79) $f(x) = 2x^3 + x^2 - 13x + 6$

79) _____



State the domain of the rational function.

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

80) _____

81) $f(x) = \frac{(x - 5)(x + 6)}{x^2 - 9}$

81) _____

Find the vertical asymptote(s) of the graph of the given function.

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

82) _____

Find the horizontal asymptote, if any, of the rational function.

83) $f(x) = \frac{(x - 4)(x + 3)}{x^2 - 1}$

83) _____

Find the oblique asymptote, if any, of the rational function.

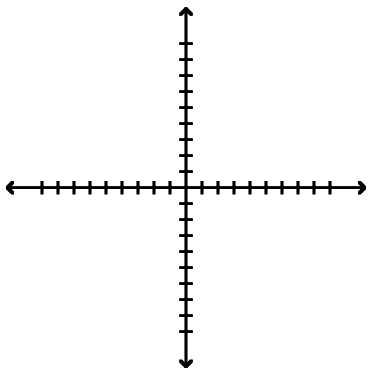
$$84) f(x) = \frac{x^2 + 2x + 2}{x + 7}$$

84) _____

Graph the function, showing all asymptotes (those that do not correspond to an axis) as dashed lines. List the x- and y-intercepts.

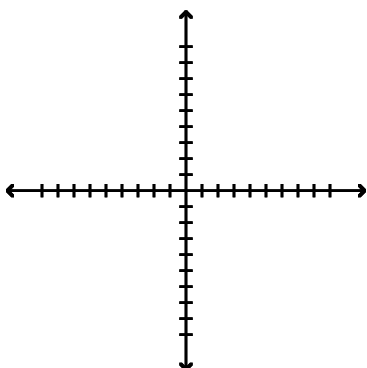
$$85) f(x) = \frac{1}{x - 2}$$

85) _____



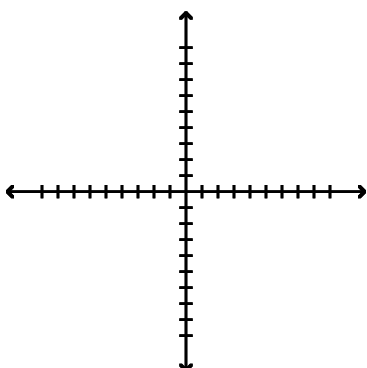
$$86) f(x) = \frac{x^2 - 16}{x - 4}$$

86) _____

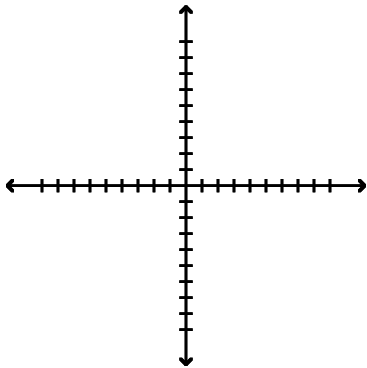


$$87) f(x) = \frac{x + 4}{2x^2 - 7x - 4}$$

87) _____

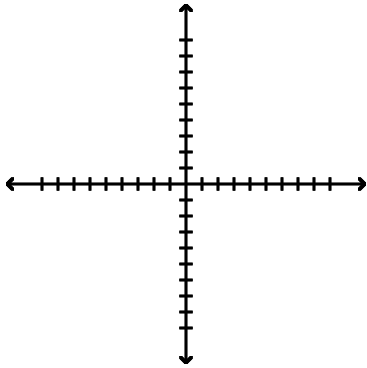


$$88) f(x) = \frac{2x}{x^2 + 7x + 6}$$



88) _____

$$89) f(x) = \frac{x+3}{(x-2)^3}$$



89) _____

Solve.

$$90) x^3 + 5x^2 - 4x - 20 \geq 0$$

90) _____

List the critical values of the related function. Then solve the inequality.

$$91) \frac{x}{x-6} < 3$$

91) _____

$$92) \frac{x-5}{x+4} - \frac{x+3}{x-2} \leq 0$$

92) _____

$$93) \frac{3}{x^2 - 9} \leq \frac{4}{x^2 + 7x + 12}$$

93) _____

Find the inverse of the function.

$$94) f(x) = \sqrt[3]{x-1}$$

94) _____

Solve the exponential equation. Round to three decimal places when necessary.

$$95) e^{-t} = 0.03$$

95) _____

Solve the logarithmic equation.

96) $\log_3(x+2) + \log_3(x-2) = 2$

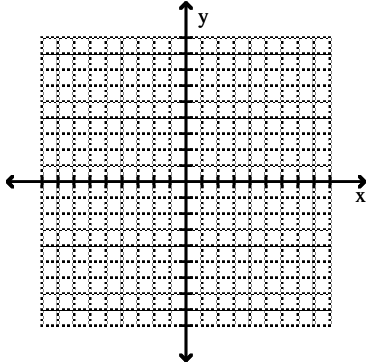
96) _____

Solve graphically.

97) $3x + 4y = -7$

$5x - 2y = -29$

97) _____



Solve using the substitution method. Use a graphing calculator to check your answer.

98) $x - 5y = -56$

$y = 28 + 3x$

98) _____

Solve using the elimination method. Use a graphing calculator to check your answer.

99) $\frac{3}{2}x - \frac{1}{3}y = -18$

$\frac{3}{4}x + \frac{2}{9}y = -9$

99) _____

Determine whether the system is consistent or inconsistent and whether the equations are dependent or independent.

100) $3x + 4y = 81$

$6x + 8y = 162$

100) _____

Solve.

101) Re grind, Inc. regrinds used typewriter platens. The variable cost per platen is \$1.40. The total cost to regrind 80 platens is \$500. Find the linear cost function to regrind platens. If reground platens sell for \$9.20 each, how many must be reground and sold to break even?

101) _____

102) A canoeist paddled 6 miles upstream in 6 hours and returned to his starting point downstream in 45 minutes. What was the speed of the current?

102) _____

103) The owner of Nuts2U Snack Shack mixes cashews worth \$5.75 a pound with peanuts worth \$2.10 a pound to get a half-pound mixed nut bag worth \$1.80. How much of each kind of nut is included in the mixed bag?

103) _____

Solve the system.

104) $4x + 3y + z = -19$
 $4x - 3y - z = -21$
 $4x + y + 4z = -5$

104) _____

105) $x - y + 4z = 1$
 $5x + z = 0$
 $x + 4y + z = -4$

105) _____

Solve the problem.

106) A \$134,000 trust is to be invested in bonds paying 8%, CDs paying 7%, and mortgages paying 9%. The bond and CD investment must equal the mortgage investment. To earn a \$10,990 annual income from the investments, how much should the bank invest in bonds?

106) _____

107) The following table shows the number of resistors, in thousands, produced by Allied Electronics in 3 recent years.

107) _____

Year, x	Number of resistors (in thousands)
2003, 0	12
2006, 3	69
2008, 5	137

Fit a quadratic function $f(x) = ax^2 + bx + c$ to the data. What is the value of b?

Perform the matrix operation.

108) Given $A = \begin{bmatrix} 2 & 3 \\ 2 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 4 \\ -1 & 6 \end{bmatrix}$, find $3A + B$.

108) _____

Find the product, if possible.

109) $\begin{bmatrix} 1 & 3 & -2 \\ 3 & 0 & 5 \end{bmatrix} \begin{bmatrix} 3 & 0 \\ -2 & 1 \\ 0 & 5 \end{bmatrix}$

109) _____

Use the Gauss-Jordan method to find A^{-1} , if it exists.

110) $A = \begin{bmatrix} 2 & 4 \\ 1 & -5 \end{bmatrix}$

110) _____

Solve the system using the inverse of the coefficient matrix of the equivalent matrix equation.

111) $3x + 5y = -10$
 $-2x - 4y = 6$

111) _____

112) $-4x - 7y - z = -22$
 $x + 2y - 8z = -19$
 $-9x + y + z = -23$

112) _____

Evaluate the determinant.

$$113) \begin{vmatrix} 7 & 5 & 2 \\ 9 & 6 & 7 \\ 3 & 2 & 7 \end{vmatrix}$$

113) _____

Solve using Cramer's rule.

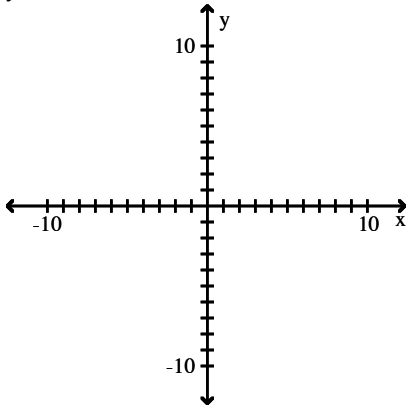
$$114) \begin{cases} x - 5y = 37 \\ 5x - 6y = 71 \end{cases}$$

114) _____

Graph.

$$115) y < |x|$$

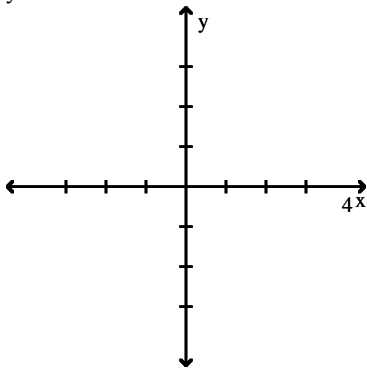
115) _____



Graph the system of inequalities, and find the coordinates of the vertices.

$$116) \begin{cases} y \leq 4 - 2x \\ y \leq 1 \end{cases}$$

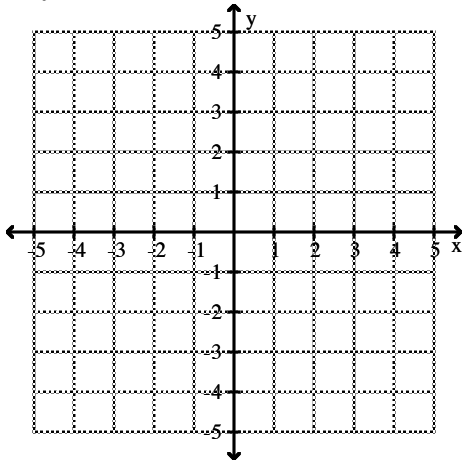
116) _____



Graph the system of inequalities.

117) $y \leq -x^2$
 $x + y \geq -2$

117) _____



Decompose into partial fractions.

118) $\frac{4x^2 + 2x + 42}{(x^2 - 49)(x - 1)}$

118) _____

119) $\frac{35x - 98}{6x^2 - 35x + 49}$

119) _____

120) $\frac{2x^3 - 4x^2 - 5x + 11}{(x - 1)^3(x + 3)}$

120) _____

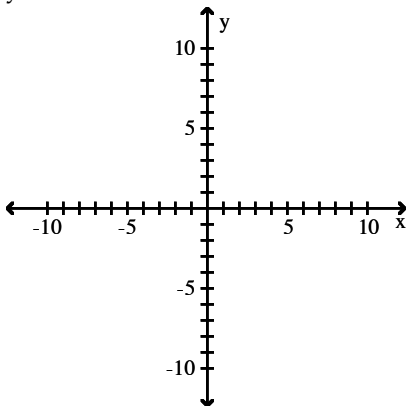
121) $\frac{14x^2 - 31x + 20}{(x - 4)(x^2 + 4)}$

121) _____

Graph the parabola and its vertex, focus, and directrix.

122) $y^2 = -8x$

122) _____



Find an equation of a parabola satisfying the given conditions.

123) Focus $\left(0, \frac{3}{4}\right)$, directrix $y = -\frac{3}{4}$

123) _____

Find the vertex, the focus, and the directrix of the parabola.

124) $(y - 7)^2 = -4(x + 2)$

124) _____

125) $(x + 4)^2 = 8(y - 2)$

125) _____

126) $x^2 + 10x + 8y + 57 = 0$

126) _____

Find the vertices and the foci of the given ellipse.

127) $\frac{x^2}{400} + \frac{y^2}{625} = 1$

127) _____

Find an equation of an ellipse satisfying the given conditions.

128) Foci: $(0, -5)$ and $(0, 5)$; length of major axis: 12

128) _____

Find the vertices of the ellipse.

129) $\frac{(x - 3)^2}{16} + \frac{(y + 1)^2}{9} = 1$

129) _____

Find the foci of the ellipse.

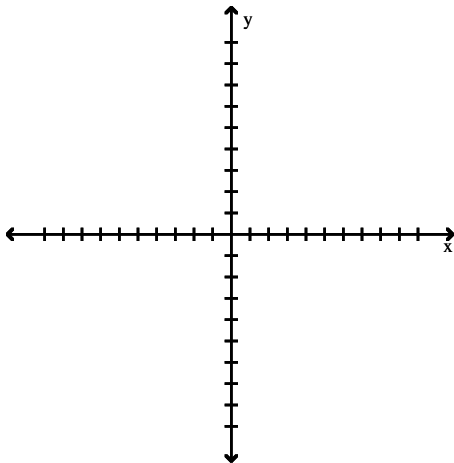
130) $36(x - 3)^2 + 9(y + 1)^2 = 324$

130) _____

Graph the ellipse.

131) $\frac{x^2}{25} + \frac{y^2}{64} = 1$

131) _____



Find the equation of the hyperbola satisfying the given conditions.

132) Center at $(0, 0)$; focus at $(0, 10)$; vertex at $(0, 8)$

132) _____

133) Vertices at (0, 8) and (0, -8); asymptotes $y = \frac{4}{7}x$ and $y = -\frac{4}{7}x$

133) _____

Find the foci of the given hyperbola.

134) $\frac{x^2}{144} - \frac{y^2}{4} = 1$

134) _____

Find the asymptotes of the hyperbola.

135) $\frac{y^2}{9} - \frac{x^2}{16} = 1$

135) _____

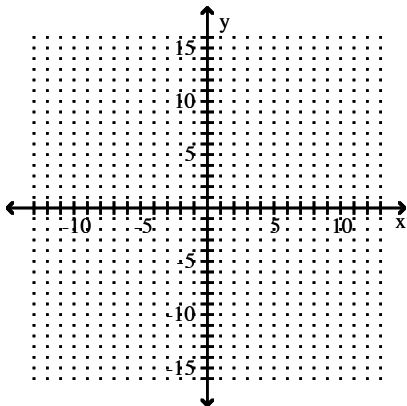
136) $9x^2 - y^2 = 9$

136) _____

Graph.

137) $\frac{(x+2)^2}{36} - \frac{(y-1)^2}{25} = 1$

137) _____



Solve.

138) $x^2 + y^2 = 113$
 $x - y = 1$

138) _____

139) $x^2 - 49y^2 = 49$
 $x + 7y = 2$

139) _____

140) $x^2 + y^2 = 80$
 $x^2 - y^2 = -48$

140) _____

141) $4x^2 - 5y^2 = -64$
 $5x^2 + 2y^2 = 52$

141) _____

The nth term of a sequence is given. Find the first 4 terms.

142) $a_n = \left(\frac{1}{9}\right)^{n-1}$

142) _____

$$143) a_n = 3 + \frac{(-4)^{n+1}}{4n}$$

143) _____

Find the indicated term of the sequence.

$$144) a_n = 16 - \frac{1200}{n}; a_{154}$$

144) _____

Predict the general, or nth term, a_n , of the sequence.

$$145) 3, 9, 27, 81, 243, \dots$$

145) _____

$$146) 0, \log 10, \log 100, \log 1000, \log 10,000, \dots$$

146) _____

$$147) -3, 3, 9, 15, 21, \dots$$

147) _____

Find the indicated partial sum for the sequence.

$$148) 3, 11, 19, 27, 35, \dots; S_5$$

148) _____

Evaluate the sum.

$$149) \sum_{i=1}^4 (i^2 - 3)$$

149) _____

Write sigma notation.

$$150) 9 + 18 + 27 + 36 + 45 + \dots$$

150) _____

Find the first 4 terms of the recursively defined sequence.

$$151) a_1 = 4, a_2 = 2, a_{n+1} = a_n - a_{n-1}$$

151) _____

Find the first term and the common difference.

$$152) \frac{7}{12}, \frac{1}{4}, -\frac{1}{12}, -\frac{5}{12}, \dots$$

152) _____

Find the indicated term of the arithmetic sequence.

$$153) 3.51, 3.68, 3.85, \dots; 16\text{th term}$$

153) _____

What term of the arithmetic sequence is the given number?

$$154) 6.3, 6.1, 5.9, \dots; 1.9$$

154) _____

$$155) 802, 777, 752, \dots; -423$$

155) _____

Find the indicated quantity.

$$156) a_{17}, \text{ when } a_1 = -6 \text{ and } d = \frac{1}{4}$$

156) _____

157) a_{11} , when $a_1 = 1$ and $d = \frac{1}{2}$

157) _____

Solve.

158) Find the sum of the first 108 positive multiples of 6.

158) _____

159) Find the sum of all multiples of 10 that are between 90 and 270, inclusive.

159) _____

For the given arithmetic series, what is S_n ?

160) $a_1 = 10$, $d = 6$, and $n = 95$

160) _____

Find the sum.

161) $\sum_{i=3}^6 (4i - 3)$

161) _____

162) $\sum_{k=1}^{38} (600 - 6k)$

162) _____

Find the common ratio.

163) $\frac{4}{3}, \frac{16}{3}, \frac{64}{3}, \frac{256}{3}, \frac{1024}{3}, \dots$

163) _____

164) $\frac{1}{x}, \frac{2}{x^2}, \frac{4}{x^3}, \frac{8}{x^4}, \dots$

164) _____

Find the indicated term.

165) $\frac{1}{4}, \frac{1}{12}, \frac{1}{36}, \dots$; the 5th term

165) _____

166) $5, 5\sqrt{2}, 10, \dots$; the 9th term.

166) _____

Find the nth, or general, term.

167) $49, 7, 1, \dots$

167) _____

Find the indicated sum.

168) Find the sum of the first 13 terms of the geometric sequence: $\frac{1}{7}, \frac{2}{7}, \frac{4}{7}, \frac{8}{7}, \frac{16}{7}, \dots$

168) _____

169) Find the sum of the first 10 terms of the geometric sequence: $\frac{1}{3}, -1, 3, -9, 27, \dots$

169) _____

Find the sum, if it exists.

170) $-39 - \frac{39}{8} - \frac{39}{64} - \frac{39}{512} - \dots$

170) _____

171) $-46 + 207 - \frac{1863}{2} + \frac{16767}{4} + \dots$

171) _____

172) $0.35 + 0.0035 + 0.000035 + \dots$

172) _____

173) $\sum_{k=1}^{\infty} \left(\frac{5}{7}\right)^k$

173) _____

Find fraction notation.

174) $9.39393 \dots$

174) _____

175) $0.0150150150 \dots$

175) _____

Use mathematical induction to prove the following.

176) $6 + 12 + 18 + \dots + 6n = 3n(n+1)$

176) _____

177) $1^2 + 4^2 + 7^2 + \dots + (3n-2)^2 = \frac{n(6n^2 - 3n - 1)}{2}$

177) _____

178) $1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$

178) _____

Expand.

179) $\left(\frac{1}{3}x + 5\right)^3$

179) _____

180) $(2x + 4)^5$

180) _____

181) $\left(\frac{1}{x} - 3x\right)^3$

181) _____

Find the indicated term of the binomial expansion.

182) 3rd term; $(4x + 2)^3$

182) _____

183) 8th term; $(x + 2y)^9$

183) _____

184) 3rd term; $(4x + 2)^3$

184) _____

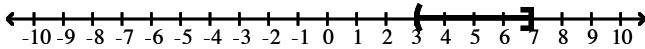
185) 6th term; $\left(\frac{5}{m^3} + \frac{m^2}{10}\right)^8$

185) _____

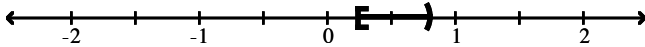
Answer Key

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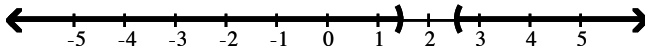
- 1) 3.1517×10^{-6}
- 2) 4×10^{-8}
- 3) -2277
- 4) $\{x \mid x \neq -6 \text{ and } x \neq 1\}$, or $(-\infty, -6) \cup (-6, 1) \cup (1, \infty)$
- 5) Domain: $[-3, 2)$; Range: $[-4, 1)$
- 6) Domain: $[-3, 0]$; Range: $[-2, 2]$
- 7) Domain: $[4, \infty)$; range: $(0, \infty)$
- 8) 15,033 guitars
- 9) $(3, 7]$



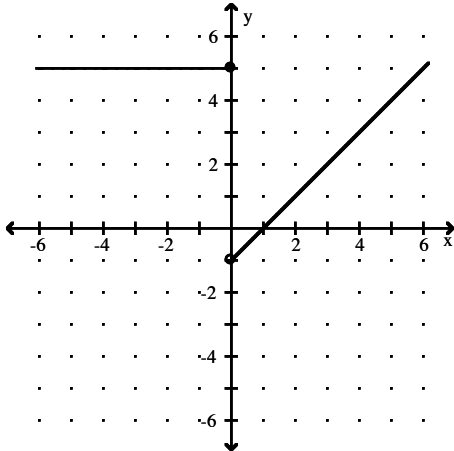
10) $\left[\frac{1}{4}, \frac{5}{6}\right)$



11) $(-\infty, 1.5) \cup (2.5, \infty)$



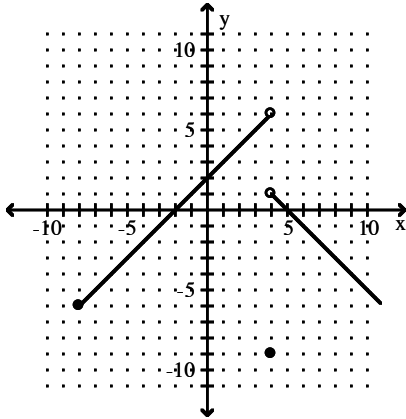
- 12) Increasing on $(-\infty, \infty)$
- 13) relative maximum: 1 at $x = 0$; relative minimum: -3 at $x = 2$; increasing $(-\infty, 0)$, $(2, \infty)$; decreasing $(0, 2)$
- 14) Relative maximum of 3 at $x = 0$
- 15) 8
- 16)



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17)



18) $-8x + 13$

19) $18x^2 + 30x + 12$

20) $\frac{2(9+x)}{x-7}$

21) $-\frac{18}{(x+h+13)(x+13)}$

22) $12x^2 + 9x + 11$

23) $(-\infty, -15) \cup (-15, \infty)$

24) $(-\infty, -9) \cup (-9, \infty)$

25) $[1.5, \infty)$

26) Origin only

27) x-axis, y-axis, origin

28) Odd

29) Neither

30) Even

31) $40 + 44i$

32) $-8 + 56i$

33) $\frac{-24 + 7\sqrt{3}}{85} + \frac{28 + 6\sqrt{3}}{85}i$

34) i

35) $\frac{3}{4}$

36) $-6 \pm \sqrt{21}$

37) $\frac{5 \pm \sqrt{101}}{2}$

38) $(-3, -4)$; $x = -3$; maximum: -4

39) $(-5, -4)$

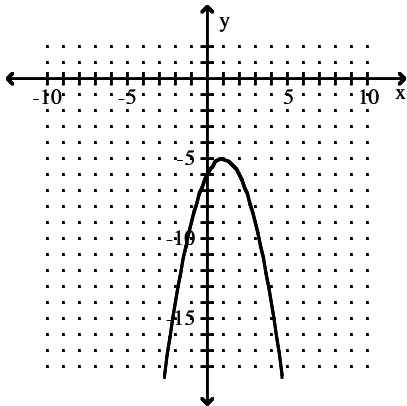
40) $x = \frac{1}{3}$

41) Minimum: -10

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42)



43) $(-\infty, -4]$

44) Increasing on $(2, \infty)$; decreasing on $(-\infty, 2)$

45) Length 41 and width 41

46) 10

47) $\frac{1}{2}$

48) $\frac{-3 + \sqrt{29}}{2}$

49) 3, -1

50) -64

51) $A = \frac{BC}{B+C}$

52) 8, 4

53) $(-\infty, -5) \cup \left(\frac{17}{3}, \infty\right)$

54) $\leftarrow \rightarrow$

55) $\leftarrow \rightarrow$

56) A

57) -1, multiplicity 3; 0, multiplicity 2; 7, multiplicity 1

58) \$2352

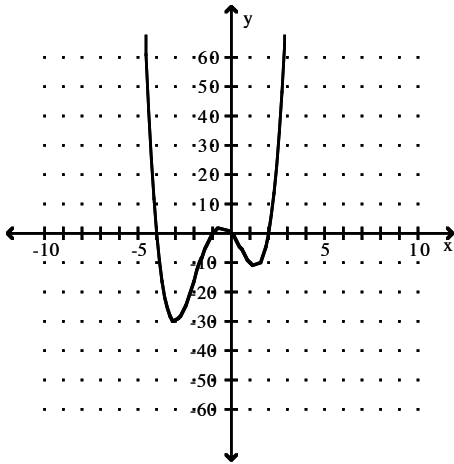
59) 3; 3; 2

60) A

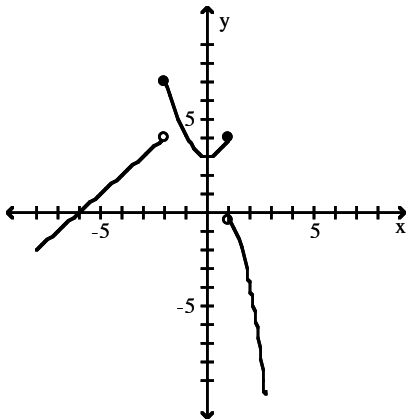
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61)



62)



63) $f(-2)$ and $f(-1)$ have opposite signs, therefore the function f has a real zero between -2 and -1 .

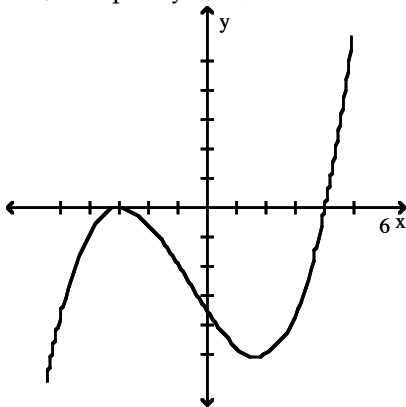
64) $(x+3)(2x^3 - 7x^2 + 6x - 15) + 45$

65) $Q(x) = (3x^3 + 2x)$; $R(x) = 0$

66) 272

67) $(x+1)(x+4)(x+5)$; $-1, -4, -5$

68) -3 (multiplicity 2), 4 ;



69) $f(x) = x^4 + 4x^3 - 8x^2 - 48x - 48$

70) $-4 + i$

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71) $f(x) = x^3 - 6x^2 + 13x - 10$

72) $-i, 4 + \sqrt{3}, 4 - \sqrt{3}$

73) $1 - i, -5$

74) $-2 + 2\sqrt{3}i, -2 - 2\sqrt{3}i$

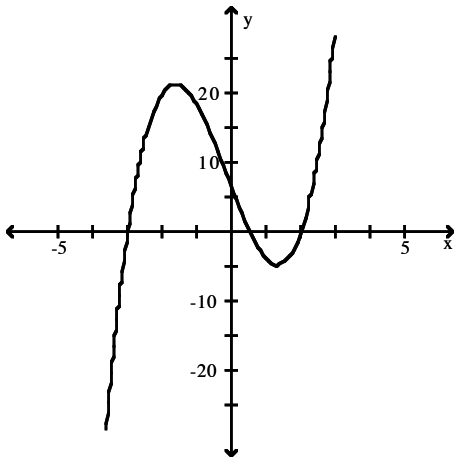
75) $\pm 1, \pm \frac{1}{3}, \pm 3, \pm 9, \pm 27$

76) $-12, -6, -1, 1; f(x) = (x + 12)(x + 6)(x + 1)(x - 1)$

77) No rational zeros

78) 1 or 3 positive; 0 negative

79)



80) $(-\infty, \infty)$

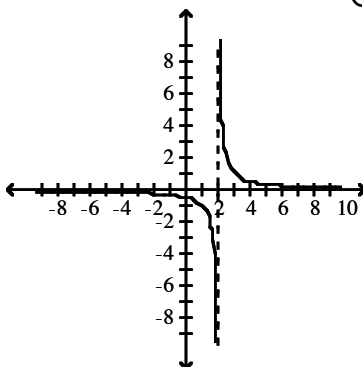
81) $(-\infty, -3) \cup (-3, 3) \cup (3, \infty)$

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

83) $y = 1$

84) $y = x - 5$

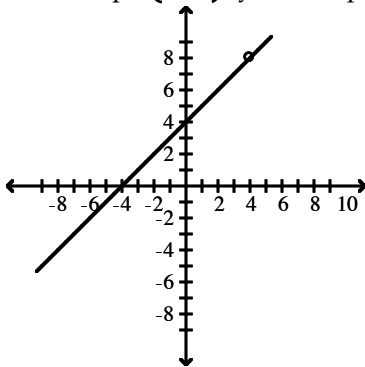
85) No x-intercepts, y-intercept: $\left(0, -\frac{1}{2}\right)$;



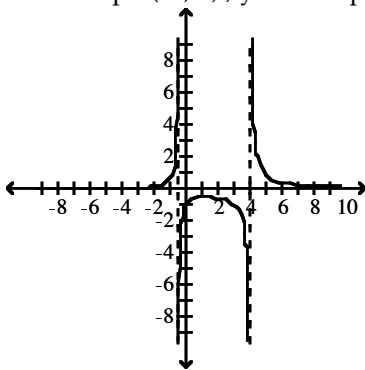
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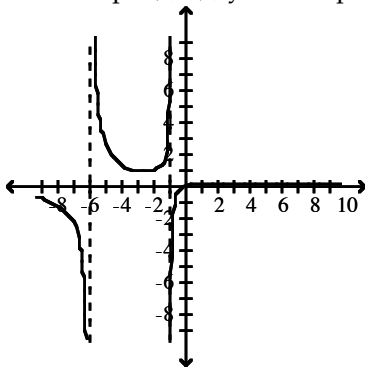
86) x-intercept: $(-4, 0)$, y-intercept: $(0, 4)$;



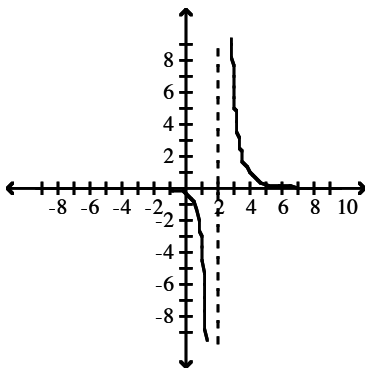
87) x-intercept: $(-4, 0)$, y-intercept: $(0, -1)$;



88) x-intercept: $(0, 0)$, y-intercept: $(0, 0)$;



89) x-intercept: $(-3, 0)$, y-intercept: $(0, -\frac{3}{8})$;



90) $[-5, -2] \cup [2, \infty)$

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91) $6, 9; (-\infty, 6) \cup (9, \infty)$

92) $-4, -\frac{1}{7}, 2; \left[-4, -\frac{1}{7}\right] \cup (2, \infty)$

93) $-4, -3, 3, 24; (-\infty, -4) \cup (-3, 3) \cup [24, \infty)$

94) $f^{-1}(x) = x^3 + 1$

95) 3.507

96) $\sqrt{13}$

97) $(-5, 2)$

98) $(-6, 10)$

99) $(-12, 0)$

100) Consistent; dependent

101) $C(x) = 1.40x + 388$; 50 platens

102) 3.5 mph

103) 0.21 lb of cashews and 0.29 lb of peanuts

104) $(-5, -1, 4)$

105) $(0, -1, 0)$

106) \$27,000

107) 10

108)

$$\begin{bmatrix} 6 & 13 \\ 5 & 24 \end{bmatrix}$$

109)

$$\begin{bmatrix} -3 & -7 \\ 9 & 25 \end{bmatrix}$$

110)

$$\begin{bmatrix} \frac{5}{14} & \frac{2}{7} \\ \frac{1}{14} & -\frac{1}{7} \end{bmatrix}$$

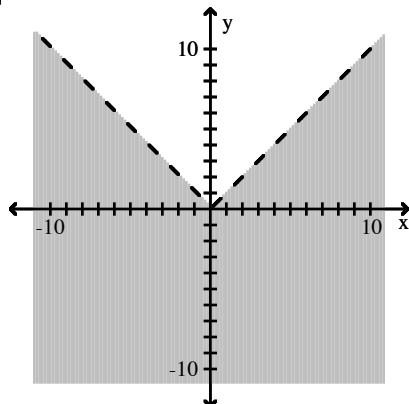
111) $(-5, 1)$

112) $(3, 1, 3)$

113) -14

114) $(7, -6)$

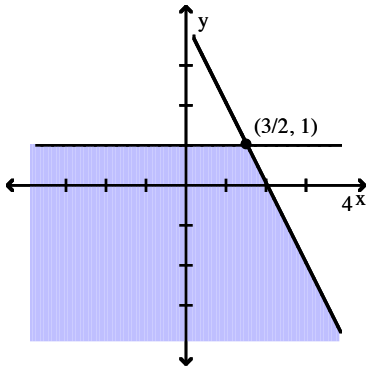
115)



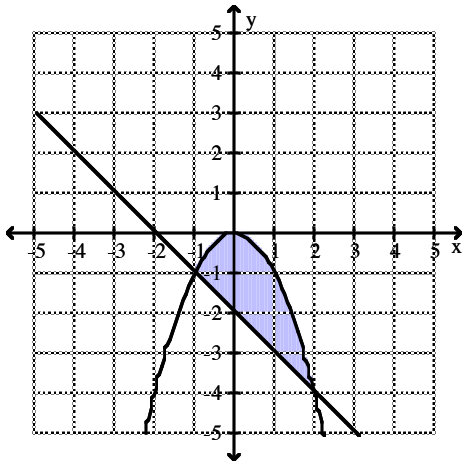
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116)



117)



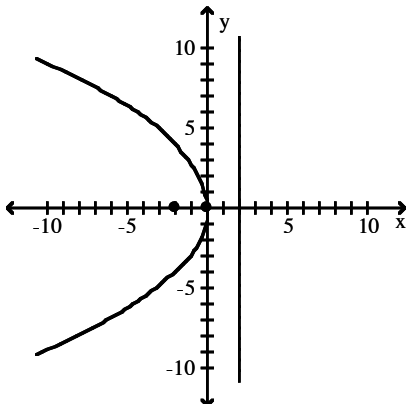
118) $\frac{3}{x-7} + \frac{2}{x+7} - \frac{1}{x-1}$

119) $\frac{7}{2x-7} + \frac{7}{3x-7}$

120) $\frac{1}{x-1} - \frac{2}{(x-1)^2} + \frac{1}{(x-1)^3} + \frac{1}{x+3}$

121) $\frac{8x+1}{x^2+4} + \frac{6}{x-4}$

122)



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123) $x^2 = 3y$

124) V: $(-2, 7)$; F: $(-3, 7)$; D: $x = -1$

125) V: $(-4, 2)$; F: $(-4, 4)$; D: $y = 0$

126) V: $(5, -4)$; F: $(-5, -6)$; D: $y = -2$

127) V: $(0, -25), (0, 25)$;

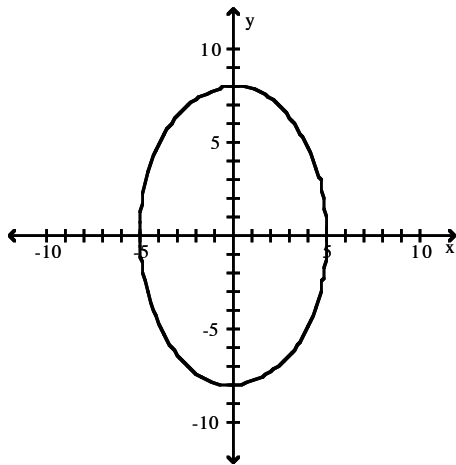
F: $(0, -15), (0, 15)$

128) $\frac{x^2}{11} + \frac{y^2}{36}$

129) $(-1, -1), (7, -1)$

130) $(3, -1 - 3\sqrt{3}), (3, -1 + 3\sqrt{3})$

131)



132) $\frac{y^2}{64} - \frac{x^2}{36} = 1$

133) $\frac{y^2}{64} - \frac{x^2}{196} = 1$

134) $(-2\sqrt{37}, 0), (2\sqrt{37}, 0)$

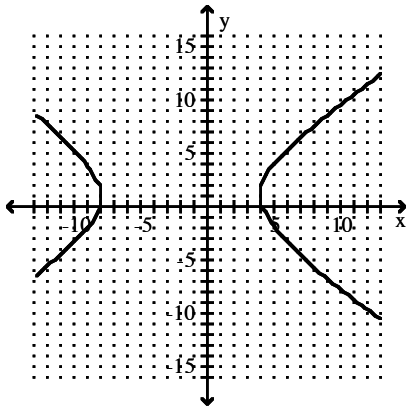
135) $y = \frac{3}{4}x, y = -\frac{3}{4}x$

136) $y = 3x, y = -3x$

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137)



138) $(-7, -8), (8, 7)$

139) $\left(\frac{53}{4}, -\frac{45}{28}\right)$

140) $(4, 8), (-4, 8), (4, -8), (-4, -8)$

141) $(2, 4), (-2, 4), (2, -4), (-2, -4)$

142) $1, \frac{1}{9}, \frac{1}{81}, \frac{1}{729}$

143) $7, -1, 7, -1$

144) $\frac{632}{77}$

145) 3^n

146) $\log 10^{n-1}$, or $n - 1$

147) $6n - 9$

148) 95

149) 18

150) $\sum_{i=1}^{\infty} 9i$

151) $4, 2, -2, -4$

152) $a_1 = \frac{7}{12}, d = -\frac{1}{3}$

153) 6.06

154) 23

155) 50

156) -2

157) 6

158) 35,316

159) 3420

160) 27,740

161) 60

162) 18,354

163) 4

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164) $\frac{2}{x}$

165) $\frac{1}{324}$

166) 80

167) 7^{3-n}

168) $\frac{8191}{7}$

169) $-\frac{14762}{3}$

170) $-\frac{312}{7}$

171) Does not exist

172) $\frac{35}{99}$

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

174) $\frac{310}{33}$

175) $\frac{5}{333}$

176) Answers may vary. One possibility:

$$S_n: 6 + 12 + 18 + \dots + 6n = 3n(n + 1)$$

$$S_1: 6 = 3 \cdot 1 \cdot (1 + 1)$$

$$S_k: 6 + 12 + 18 + \dots + 6k = 3k(k + 1)$$

$$S_{k+1}: 6 + 12 + 18 + \dots + 6k + 6(k + 1) = 3(k + 1)(k + 2)$$

1. Basis step: Since $3 \cdot 1 \cdot (1 + 1) = 3 \cdot 2 = 6$, S_1 is true.

2. Induction step: Let k be any natural number. Assume S_k . Deduce S_{k+1} .

$$6 + 12 + 18 + \dots + 6k = 3k(k + 1) \quad \text{By } S_k$$

$$6 + 12 + 18 + \dots + 6k + 6(k + 1) = 3k(k + 1) + 6(k + 1) \quad \text{Adding } 6(k + 1)$$

$$6 + 12 + 18 + \dots + 6k + 6(k + 1) = (3k + 6)(k + 1) \quad \text{Distributive law}$$

$$6 + 12 + 18 + \dots + 6k + 6(k + 1) = 3(k + 2)(k + 1)$$

$$6 + 12 + 18 + \dots + 6k + 6(k + 1) = 3(k + 1)(k + 2).$$

177) Answers may vary. One possibility:

$$S_n: 1^2 + 4^2 + 7^2 + \dots + (3n - 2)^2 = \frac{n(6n^2 - 3n - 1)}{2}$$

$$S_1: 1^2 = \frac{1 \cdot (6 \cdot 1^2 - 3 \cdot 1 - 1)}{2}$$

$$S_k: 1^2 + 4^2 + 7^2 + \dots + (3k - 2)^2 = \frac{k(6k^2 - 3k - 1)}{2}$$

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$$S_{k+1}: 1^2 + 4^2 + 7^2 + \dots + (3k-2)^2 + [3(k+1)-2]^2 = \frac{(k+1)[6(k+1)^2 - 3(k+1) - 1]}{2}$$

1. Basis step: Since $\frac{1 \cdot (6 \cdot 1^2 - 3 \cdot 1 - 1)}{2} = \frac{1 \cdot (6 - 3 - 1)}{2} = \frac{1 \cdot 2}{2} = 1 = 1^2$, S_1 is true.

2. Induction step: Let k be any natural number. Assume S_k . Deduce S_{k+1} .

$$1^2 + 4^2 + 7^2 + \dots + (3k-2)^2 = \frac{k(6k^2 - 3k - 1)}{2}$$

$$1^2 + 4^2 + 7^2 + \dots + (3k-2)^2 + [3(k+1)-2]^2 = \frac{k(6k^2 - 3k - 1)}{2} + [3(k+1)-2]^2$$

$$= \frac{6k^3 - 3k^2 - k}{2} + (3k+1)^2$$

$$= \frac{6k^3 - 3k^2 - k}{2} + (9k^2 + 6k + 1)$$

$$= \frac{6k^3 - 3k^2 - k}{2} + \frac{18k^2 + 12k + 2}{2}$$

$$= \frac{6k^3 + 15k^2 + 11k + 2}{2}$$

$$= \frac{(k+1)(6k^2 + 9k + 2)}{2}$$

$$= \frac{(k+1)[(6k^2 + 12k + 6) - (3k + 4)]}{2}$$

$$= \frac{(k+1)[6(k^2 + 2k + 1) - (3k + 4)]}{2}$$

$$= \frac{(k+1)[6(k+1)^2 - 3(k+1) - 1]}{2}$$

Answer Key

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178) Answers may vary. One possibility:

$$S_n: 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$$

$$S_1: 1 \cdot 2 = \frac{1 \cdot (1+1) \cdot (1+2)}{3}$$

$$S_k: 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + k(k+1) = \frac{k(k+1)(k+2)}{3}$$

$$S_{k+1}: 1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + k(k+1) + (k+1)(k+2) = \frac{(k+1)(k+2)(k+3)}{3}$$

1. Basis step: Since $\frac{1 \cdot (1+1) \cdot (1+2)}{3} = \frac{1 \cdot 2 \cdot 3}{3} = 1 \cdot 2$, S_1 is true.

2. Induction step: Let k be any natural number. Assume S_k . Deduce S_{k+1} .

$$1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + k(k+1) = \frac{k(k+1)(k+2)}{3}$$

$$1 \cdot 2 + 2 \cdot 3 + 3 \cdot 4 + \dots + k(k+1) + (k+1)(k+2) = \frac{k(k+1)(k+2)}{3} + (k+1)(k+2)$$

$$= \frac{k(k+1)(k+2)}{3} + \frac{3(k+1)(k+2)}{3}$$

$$= \frac{(k+3)(k+1)(k+2)}{3}$$

$$= \frac{(k+1)(k+2)(k+3)}{3}$$

179) $\frac{1}{27}x^3 + \frac{5}{3}x^2 + 25x + 125$

180) $32x^5 + 320x^4 + 1280x^3 + 2560x^2 + 2560x + 1024$

181) $\frac{1}{x^3} - \frac{9}{x} + 27x - 27x^3$

182) $48x$

183) $4608x^2y^7$

184) $48x$

185) $\frac{175}{m^9}$