Semester 1 ~ College Algebra Final Study Guide

Name: _____

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

Evaluate the expression for x = –2, y = 3, and a = –4.

1) $\dfrac{-(x+5)^2 - 2y}{-2 - a}$

1) _____

    A) $-\dfrac{15}{2}$ B) $\dfrac{35}{2}$ C) $\dfrac{15}{2}$ D) $-\dfrac{3}{2}$

2) $\dfrac{\dfrac{6}{y} - \dfrac{a}{2}}{\dfrac{x}{2} + \dfrac{9}{y}}$

2) _____

    A) 0   B) $\dfrac{4}{3}$ C) $\dfrac{5}{2}$ D) 2

3) $\dfrac{2x + 2(3 + a)^2}{y - 1}$

3) _____

    A) 33   B) 19   C) – 1   D) 9

Simplify the expression. Assume all variables represent nonzero real numbers.

4) $(-4x^6y)(-7x^4y^5)$

4) _____

    A) $-28x^{10}y^5$ B) $28x^{24}y^5$ C) $-11x^{10}y^5$ D) $28x^{10}y^6$

Find the sum or difference.

5) $(2x^7 + 6x^9 - 7 - 7x^8) - (2 - 2x^8 + 3x^9 - 7x^7)$

5) _____

    A) $3x^9 - 9x^8 - 5x^7 - 5$ B) $9x^9 - 9x^8 - 5x^7 - 9$

    C) $3x^9 - 5x^8 + 9x^7 - 9$ D) $9x^9 - 9x^8 - 5x^7 - 5$

Find the product.

6) $2x^2(6x^6 + 4x^4)$

6) _____

    A) $12x^8 + 4x^4$ B) $12x^8 - 8x^6$ C) $12x^{12} + 8x^8$ D) $12x^8 + 8x^6$

7) $(3x - 6y)(5x + 9y + 1)$

7) _____

    A) $15x^2 - 30xy + 3x - 54y^2 - 6y$ B) $15x^2 - 3xy + 3x - 54y^2 - 6y$

    C) $15x^2 + 27xy + 3x - 54y^2$ D) $15x^2 - 3xy - 3y^2$

8) $(3k^2 + 4k - 3)(k^2 - 5k + 1)$

    A) $3k^4 - 15k^3 - 20k^2 + 19k - 3$ B) $3k^4 - 11k^3 - 20k^2 + 19k - 3$

    C) $3k^4 - 11k^3 - 17k^2 + 19k - 3$ D) $3k^4 - 15k^3 - 17k^2 + 19k - 3$

8) _____

Factor by grouping.

9) $10x^2 + 25x + 6x + 15$

    A) $(10x - 3)(x - 5)$ B) $(5x + 3)(2x + 5)$ C) $(10x + 3)(x + 5)$ D) $(5x - 3)(2x - 5)$

9) _____

10) $15x^2 + 6x - 20x - 8$

    A) $(15x - 4)(x + 2)$ B) $(3x - 4)(5x + 2)$ C) $(15x + 4)(x - 2)$ D) $(3x + 4)(5x - 2)$

10) _____

Factor the trinomial, if possible.

11) $10m^2 + 37mn + 30n^2$

    A) $(2m + 5n^2)(5m + 6)$ B) $(2m + 6n)(5m + 5n)$

    C) $(2m + 5n)(5m + 6n)$ D) $(2m - 5n)(5m - 6n)$

11) _____

12) $10x^2 + 23x + 12$

    A) $(2x + 3)(5x + 4)$ B) $(10x + 3)(x + 4)$ C) $(10x + 1)(x + 12)$ D) $(2x - 3)(5x - 4)$

12) _____

13) $15x^2 + 22x + 8$

    A) $(15x + 2)(x + 4)$ B) $(15x + 1)(x + 8)$ C) $(3x - 2)(5x - 4)$ D) $(3x + 2)(5x + 4)$

13) _____

Evaluate the expression.

14) $16^{1/4}$

    A) 2   B) 16   C) 8   D) 32

14) _____

Simplify the expression. Assume all variables represent positive real numbers.

15) $\sqrt[3]{27}$

    A) 5   B) 3   C) ±3   D) 9

15) _____

16) $\sqrt[4]{\dfrac{256}{81}}$ 16) _____

   A) $\dfrac{16}{9}$ B) $\dfrac{4}{3}$ C) $\dfrac{256}{81}$ D) $\dfrac{64}{27}$

17) $2\sqrt{3} - 9\sqrt{27}$ 17) _____
   A) $-29\sqrt{3}$ B) $25\sqrt{3}$ C) $-7\sqrt{3}$ D) $-25\sqrt{3}$

Perform the indicated operations.

18) $\dfrac{x}{x^2 - 16} - \dfrac{6}{x^2 + 5x + 4}$ 18) _____

   A) $\dfrac{x^2 - 5x + 24}{(x - 4)(x + 4)(x + 1)}$ B) $\dfrac{x^2 - 5x + 24}{(x - 4)(x + 4)}$

   C) $\dfrac{x^2 - 5}{(x - 4)(x + 4)(x + 1)}$ D) $\dfrac{x^2 + 5x + 24}{(x - 4)(x + 4)(x + 1)}$

19) $\dfrac{2ab}{a^2 - b^2} - \dfrac{b}{a - b} + 2$ 19) _____

   A) $\dfrac{2a + 3b}{a^2 - b^2}$ B) $\dfrac{2ab - b + 2}{a + b + 1}$ C) $\dfrac{2a + 3b}{a + b}$ D) $\dfrac{(a - b)(2a + 3b)}{a2 - b^2}$

Find the product or quotient.

20) $\dfrac{k^2 + 11k + 30}{k^2 + 14k + 48} \cdot \dfrac{k^2 + 8k}{k^2 + 12k + 35}$ 20) _____

   A) $\dfrac{k}{k + 7}$ B) $\dfrac{k}{k^2 + 14k + 48}$ C) $\dfrac{k^2 + 8k}{k + 7}$ D) $\dfrac{1}{k + 7}$

21) $\dfrac{4p - 4}{p} \div \dfrac{5p - 5}{2p^2}$

   A) $\dfrac{8p^3 - 8p^2}{5p^2 - 5p}$
                           B) $\dfrac{8}{5}p$

   C) $\dfrac{5}{8}p$
                           D) $\dfrac{20p^2 + 40p + 20}{2p^3}$

Write the expression in lowest terms.

22) $\dfrac{z^2 + 7z + 6}{z^2 - 2z - 3}$

   A) $\dfrac{z + 1}{z - 1}$
           B) $\dfrac{z + 6}{z - 3}$
           C) $\dfrac{z - 6}{z + 3}$
           D) $\dfrac{z + 7}{z - 2}$

23) $\dfrac{3m^2 + 20m + 12}{2m^2 + 15m + 18}$

   A) $\dfrac{m - 2}{m - 3}$
           B) $\dfrac{m + 3}{m + 4}$
           C) $\dfrac{3m + 2}{2m + 3}$
           D) $\dfrac{3m + 6}{2m - 6}$

Find the domain of the expression.

24) $\dfrac{2x - 3}{(4x - 3)(x + 6)}$

   A) all real numbers
                        B) $\left\{ x \mid x \neq \dfrac{3}{4}, -6 \right\}$

   C) $\left\{ x \mid x \neq \dfrac{4}{3}, -6 \right\}$
                  D) $\left\{ x \mid x \neq -\dfrac{3}{4}, 6 \right\}$

25) $\dfrac{x^2 - 64}{x^2 - 6x + 8}$

   A) $\{ x \mid x \neq -8 \text{ and } x \neq +8 \}$
                      B) $\{ x \mid x \neq 0 \}$
   C) $\{ x \mid x \neq -2 \text{ and } x \neq -4 \}$
                      D) $\{ x \mid x \neq 2 \text{ and } x \neq 4 \}$

Solve the formula for the indicated variable.

26) $V = \dfrac{1}{3}Bh,$ for B

   A) $B = \dfrac{3h}{V}$
          B) $B = \dfrac{3V}{h}$
          C) $B = \dfrac{V}{3h}$
          D) $B = \dfrac{h}{3V}$

27) $A = P(1 + nr),$ for r

   A) $r = \dfrac{A}{n}$
          B) $r = \dfrac{P - A}{Pn}$
          C) $r = \dfrac{Pn}{A - P}$
          D) $r = \dfrac{A - P}{Pn}$

Find the quotient. Write the answer in standard form.

28) $\dfrac{6 + 5i}{3 + 4i}$

28) _____

    A) $-\dfrac{2}{25} - \dfrac{39}{25}i$ B) $-\dfrac{38}{7} - \dfrac{9}{7}i$ C) $\dfrac{38}{25} - \dfrac{9}{25}i$ D) $\dfrac{2}{7} - \dfrac{9}{7}i$

29) $\dfrac{7 + 3i}{6 - 9i}$

29) _____

    A) $\dfrac{23}{13} + \dfrac{15}{13}i$ B) $-\dfrac{1}{9} + \dfrac{3}{5}i$ C) $-\dfrac{23}{15} + \dfrac{3}{5}i$ D) $\dfrac{5}{39} + \dfrac{9}{13}i$

Write the number as the product of a real number and i.

30) $\sqrt{-20}$

30) _____

    A) $-2\sqrt{5}i$ B) $2\sqrt{5}i$ C) $2i\sqrt{5}$ D) $-2i\sqrt{5}$

31) $\sqrt{-44}$

31) _____

    A) $-2\sqrt{11}i$ B) $2i\sqrt{11}$ C) $2\sqrt{11}i$ D) $-2i\sqrt{11}$

Solve the equation by the square root property.

32) $(x - 7)^2 = 11$

32) _____

    A) $\{\sqrt{11} - \sqrt{-7}\}$ B) $\{7 \pm \sqrt{11}\}$

    C) $\{\sqrt{11} - 7, -\sqrt{11} - 7\}$ D) $\{7 + \sqrt{11}\}$

33) $(7x + 4)^2 = 4$

33) _____

    A) $\left\{\dfrac{0}{7}\right\}$ B) $\left\{\dfrac{2}{7}, \dfrac{6}{7}\right\}$ C) $\left\{-\dfrac{2}{7}, 0\right\}$ D) $\left\{-\dfrac{2}{7}, -\dfrac{6}{7}\right\}$

Solve the equation using the quadratic formula.

34) $2x^2 + 12x = -7$

34) _____

    A) $\left\{\dfrac{-6 \pm \sqrt{22}}{2}\right\}$ B) $\left\{\dfrac{-6 \pm \sqrt{2}}{2}\right\}$ C) $\left\{\dfrac{-12 \pm \sqrt{22}}{2}\right\}$ D) $\left\{\dfrac{-6 \pm \sqrt{22}}{4}\right\}$

Solve the equation by the zero-factor property.

35) $2x^2 - 3x - 5 = 0$ 35) _____

    A) $\left\{\dfrac{2}{5}, 0\right\}$ B) $\left\{\dfrac{2}{5}, 1\right\}$ C) $\left\{\dfrac{2}{5}, -1\right\}$ D) $\left\{\dfrac{5}{2}, -1\right\}$

Solve the equation.

36) $x = \sqrt{2x + 15}$ 36) _____

    A) $\varnothing$ B) {5}   C) {5, -3}   D) {2}

37) $x = \sqrt{3x + 18}$ 37) _____

    A) {6}   B) {3}   C) $\varnothing$ D) {6, -3}

38) $4x = \sqrt{1 - 6x}$ 38) _____

    A) $\left\{\dfrac{1}{2}\right\}$ B) $\left\{\dfrac{1}{8}\right\}$ C) $\left\{\dfrac{1}{4}\right\}$ D) $\left\{-\dfrac{1}{2}\right\}$

Solve and graph the inequality. Give answer in interval notation.

39) $4x + 9 \geq 3x + 13$ 39) _____

A) $(-\infty, 4]$

B) $(4, \infty)$

C) $(-\infty, 4)$

D) $[4, \infty)$
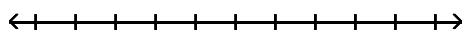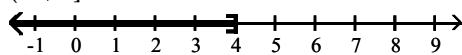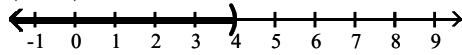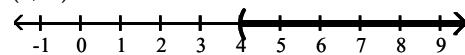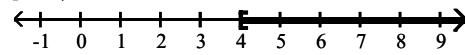
40) $-4 < 3x + 2 \le 8$ 40) _____
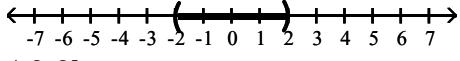
   A) $(-2, 2)$ B) $[-2, 2]$
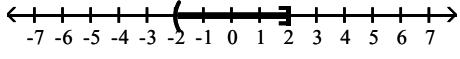

   C) $(-2, 2]$ D) $[-2, 2)$
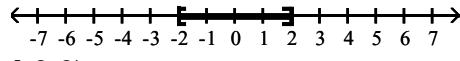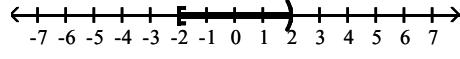
41) $5 < 4x + 5 \le 21$ 41) _____
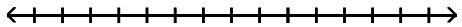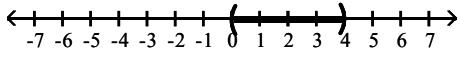
   A) $(0, 4)$ B) $[0, 4)$
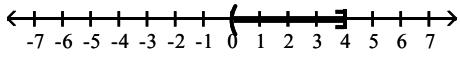
   C) $(0, 4]$ D) $[0, 4]$
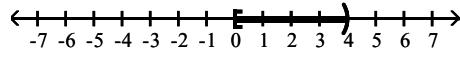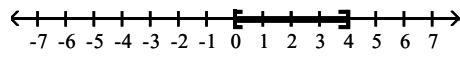


Solve the equation.

42) $|2x - 8| = 7$ 42) _____

   A) $\left\{ -\dfrac{1}{2}, -\dfrac{15}{2} \right\}$ B) $\left\{ \dfrac{15}{2} \right\}$ C) $\left\{ \dfrac{1}{2}, -\dfrac{15}{2} \right\}$ D) $\left\{ \dfrac{15}{2}, \dfrac{1}{2} \right\}$

Solve the inequality. Write the solution set in interval notation.

43) $|4x + 3| - 9 < -4$ 43) _____

   A) $\left(-2, \dfrac{1}{2} \right)$ B) $\varnothing$

   C) $\left(-\infty, -2 \right)$ D) $\left(-\infty, -2 \right) \cup \left(\dfrac{1}{2}, \infty \right)$

44) $|2x - 6| + 2 < 4$ 44) _____

   A) $\varnothing$ B) $(2, 4)$ C) $\left(-\infty, 2 \right)$ D) $\left(-\infty, 2 \right) \cup \left(4, \infty \right)$

45) $|2x + 2| + 7 \ge 15$ 45) _____

   A) $\left(\infty, -5 \right] \cup \left[3, \infty \right)$ B) $\varnothing$ C) $\left[3, \infty \right]$ D) $\left[-5, 3 \right]$

Evaluate the function.

46) Find f(4) when $f(x) = 5x^2 + 2x - 2$ 46) _____
    A) 90   B) 70   C) 22   D) 86

47) Find f(k − 1) when $f(x) = 5x^2 + 5x + 5$ 47) _____
    A) $5k^2 + 30k + 15$ B) $-5k^2 + 5k + 5$ C) $5k^2 - 5k + 5$ D) $5k^2 - 5k + 15$

48) Find f(k − 1) when $f(x) = 4x^2 - 2x + 5$ 48) _____
    A) $4k^2 + 18k + 7$ B) $4k^2 - 10k + 11$ C) $4k^2 - 10k + 7$ D) $-10k^2 + 4k + 11$

Decide whether the relation defines a function.

49) $4x = 11 - 4y$ 49) _____
    A) Not a function   B) Function

50) $y = \sqrt{7x - 4}$ 50) _____
    A) Function   B) Not a function

51) $y^2 = 4x$ 51) _____
    A) Not a function   B) Function

**The graph of y = f(x) is given. Use the graph to find the function value.**

52) Find f(−5).   52) _____
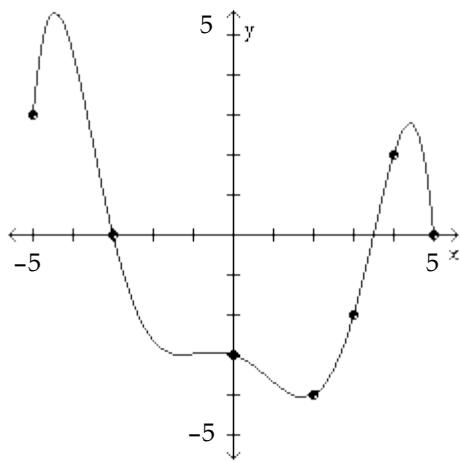
   A) −5   B) 3   C) 0   D) 8

**Determine the largest open intervals of the domain over which the function is increasing, decreasing, and constant.**
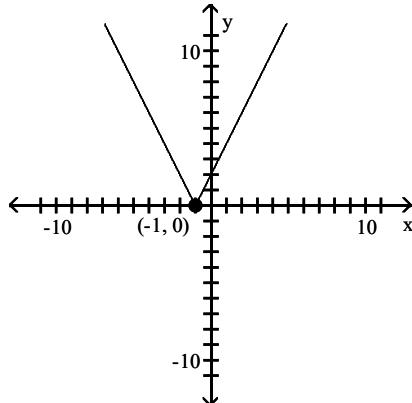
53)

A) Increasing $(-\infty, 1)$; Decreasing $(1, \infty)$
B) Increasing $(-\infty, -1)$; Decreasing $(-1, \infty)$
C) Increasing $(-1, \infty)$; Decreasing $(-\infty, -1)$
D) Increasing $(1, \infty)$; Decreasing $(-\infty, 1)$

53) _____
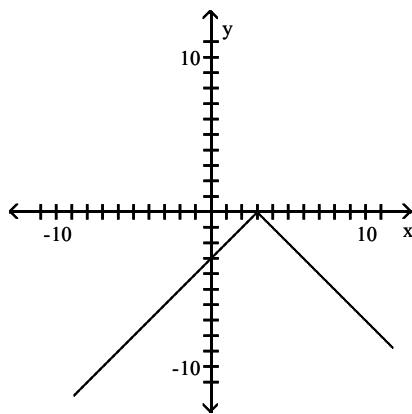
54)

A) Increasing $(-\infty, 3)$; Decreasing $(-\infty, 3)$
B) Increasing $(-\infty, 3)$; Decreasing $(3, \infty)$
C) Increasing $(3, \infty)$; Decreasing $(3 \; \infty)$
D) Increasing $(3, \infty)$; Decreasing $(-\infty, 3)$

54) _____

Solve the equation.

55) $-3x + 5 - 3(x + 1) = -(4x + 1)$

A) $\left\{ \dfrac{1}{2} \right\}$ B) $\{1\}$ C) $\left\{ \dfrac{1}{3} \right\}$ D) $\left\{ \dfrac{3}{2} \right\}$

55) _____

56) $2x - 4 + 5(x + 1) = 6x + 5$

A) $\{-2\}$ B) $\{4\}$ C) $\{2\}$ D) $\{-4\}$

56) _____

Find the slope of the line satisfying the given conditions.

57) through $(-3, -6)$ and $(7, 6)$

A) $-\dfrac{5}{6}$ B) $\dfrac{5}{6}$ C) $-\dfrac{6}{5}$ D) $\dfrac{6}{5}$

57) _____

9

Write an equation for the line described. Give your answer in standard form.

58) x–intercept (2, 0), y–intercept (0, 5) 58) _____

    A) $-5x + 2y = 10$ B) $5x - 2y = 10$ C) $5x + 2y = 10$ D) $5x + 2y = -10$

59) through (–3, 5), undefined slope 59) _____

    A) $y = -3$ B) $x = 5$ C) $y = 5$ D) $x = -3$

Write an equation for the line described. Give your answer in slope–intercept form.

60) through (–5, 2) and (0, –4) 60) _____

    A) $y = \frac{6}{5}x - 4$ B) $y = -\frac{6}{5}x - 4$ C) $y = \frac{7}{4}x - 4$ D) $y = -\frac{7}{4}x - 4$

The graph of a linear function f is shown. Write the equation that defines f. Write the equation in slope–intercept form.
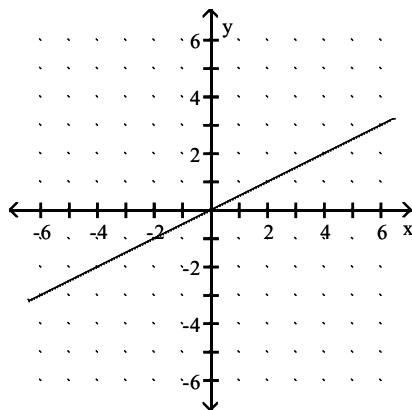
61) 61) _____

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

Write an equation for the line described. Write the equation in the form specified.

62) parallel to $y + 8x = 4$, through (4, 5); slope–intercept form 62) _____

    A) $y = -\frac{1}{8}x - \frac{37}{8}$ B) $y = 8x - 37$ C) $y = -8x + 37$ D) $y = -8x - 37$

63) perpendicular to $-2x + y = 8$, through (5, 4); slope–intercept form 63) _____

   A) $y = -\frac{1}{2}x - \frac{13}{2}$ B) $y = \frac{1}{2}x - \frac{13}{2}$ C) $y = -2x - 13$ D) $y = -\frac{1}{2}x + \frac{13}{2}$

Find the requested value.

64) $f(-3)$ for $f(x) = \begin{cases} 3x, & \text{if } x \leq -1 \\ x - 2, & \text{if } x > -1 \end{cases}$

    A) –9   B) 1   C) 9   D) –5

64) _____

65) $f(-6)$ for $f(x) = \begin{cases} 8x + 1, & \text{if } x < 6 \\ 6x, & \text{if } 6 \leq x \leq 8 \\ 6 - 7x, & \text{if } x > 8 \end{cases}$

    A) –47   B) –36   C) 48   D) 49

65) _____

Evaluate.

66) Find $(f - g)(-2)$ when $f(x) = 4x^2 - 2$ and $g(x) = x - 3$.

    A) 19   B) –12   C) 15   D) 13

66) _____

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

67) $f(x) = 4x - 7$, $g(x) = 7x - 8$
    Find $(f - g)(x)$.
    A) $11x - 15$ B) $3x - 1$ C) $-3x - 15$ D) $-3x + 1$

67) _____

68) $f(x) = 9x - 5$, $g(x) = 5x - 7$
    Find $(f - g)(x)$.
    A) $4x - 12$ B) $4x + 2$ C) $-4x - 2$ D) $14x - 12$

68) _____

69) $f(x) = 8x + 1$, $g(x) = 4x - 2$
    Find $(fg)(x)$.
    A) $12x^2 - 12x - 1$ B) $32x^2 - 12x - 2$ C) $32x^2 + 2x - 2$ D) $32x^2 - 2$

69) _____

Solve the problem.

70) Use the tables to find $(f + g)(2)$.

70) _____

x	2	3	9
f(x)	–6	3	–4

x	2	5	9
g(x)	3	5	6

    A) –3   B) 8   C) 2   D) 18

Graph the function.

71) $f(x) = \begin{cases} 5, & \text{if } x \geq 1 \\ -4 - x, & \text{if } x < 1 \end{cases}$

71) _____
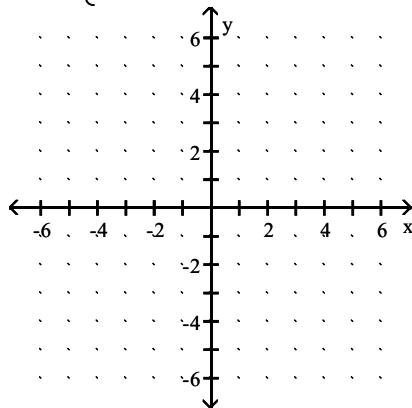
A)
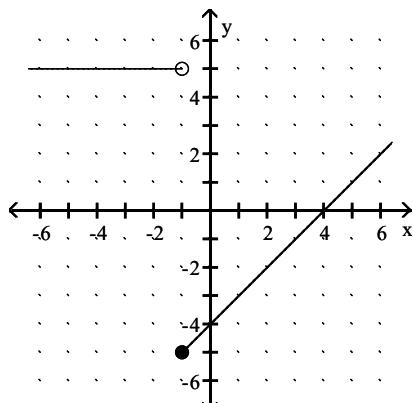
B)
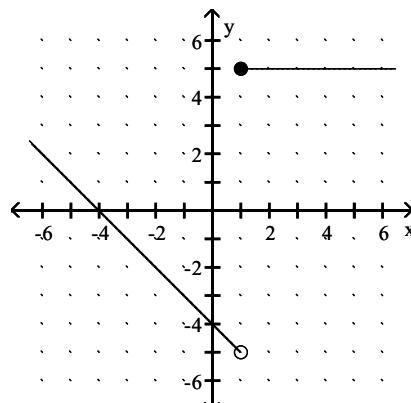
C)
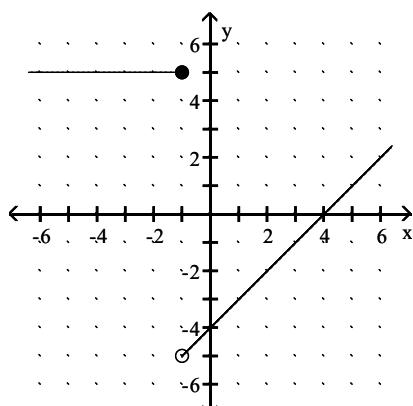
D)
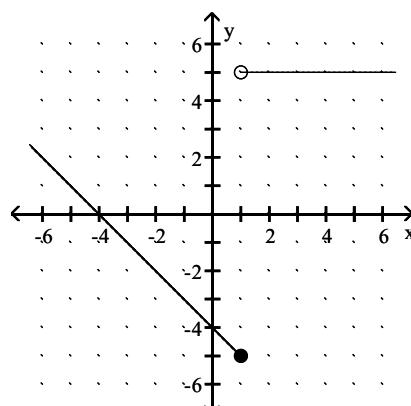
Find the requested function value.

72) Find $(f \circ g)(3)$ when $f(x) = -8x + 5$ and $g(x) = -3x^2 - 7x + 5$.

A) 349   B) -945   C) 205   D) 195

72) _____

For the given functions f and g , find the indicated composition.

73) $f(x) = 7x + 12$, $g(x) = 3x - 1$

$(f \circ g)(x)$

A) $21x + 35$ B) $21x + 11$ C) $21x + 5$ D) $21x + 19$

73) _____

74) $f(x) = \dfrac{x-2}{3}$, $g(x) = 3x + 2$

(g∘f)(x)

    A) 3x + 4   B) $x - \dfrac{2}{3}$ C) x + 4   D) x

Describe how the graph of the equation relates to the graph of $y = x^2$.

75) $f(x) = x^2 + 7$

    A) a translation 7 units down   B) a translation 7 units up
    C) a translation 7 units to the right   D) a translation 7 units to the left

76) $f(x) = (x - 7)^2 + 9$

    A) a translation 7 units to the right and 9 units up
    B) a translation 7 units to the left and 9 units down
    C) a translation 7 units to the left and 9 units up
    D) a translation 9 units to the right and 7 units up

Solve the problem.

77) Select the equation that describes the graph shown.
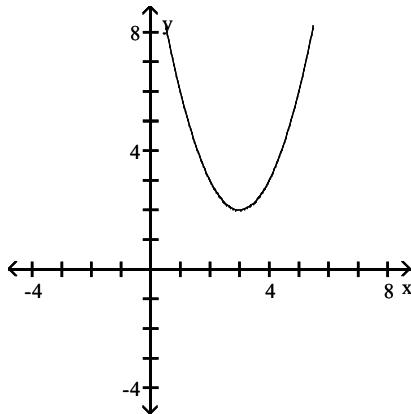
    A) $y = (x + 2)^2 - 3$ B) $y = x^2 - 3$ C) $y = (x + 3)^2 + 2$ D) $y = (x - 3)^2 + 2$

Describe the transformations and give the equation for the graph.
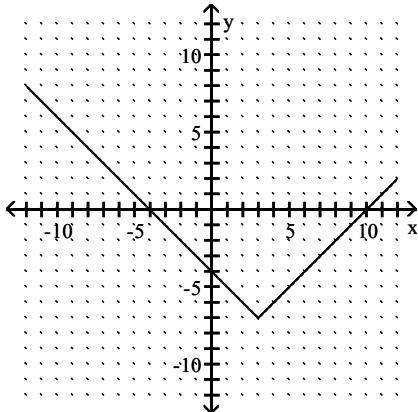
78)

A) It is the graph of $f(x) = |x|$ translated 3 units to the right and 7 units down. The equation is $y = |x + 3| - 7$

B) It is the graph of $f(x) = |x|$ translated 3 units to the right and 7 units down. The equation is $y = |x - 3| - 7$

C) It is the graph of $f(x) = |x|$ translated 3 units to the right and 7 units down. The equation is $y = |x - 3| + 7$

D) It is the graph of $f(x) = |x|$ translated 3 units to the right and 7 units down. The equation is $y = |x + 3| + 7$

Find the domain and range of the function.

79) $y = (x + 7)^2 + 2$

A) Domain: $[-7, \infty)$; Range: $[-\infty, 7)$ B) Domain: $[2, \infty)$; Range: $[-\infty, 2)$
C) Domain: $(-\infty, \infty)$; Range: $[2, \infty)$ D) Domain: $(-\infty, \infty)$; Range: $[-7, \infty)$

80) $f(x) = 4x^2 - 64x + 266$

A) Domain: $(-\infty, \infty)$; Range: $[0, \infty)$ B) Domain: $(-\infty, \infty)$; Range: $(-\infty, 0]$
C) Domain: $(-\infty, \infty)$; Range: $[10, \infty)$ D) Domain: $(-\infty, \infty)$; Range: $(-\infty, 8]$

Identify the vertex of the parabola.

81) $y = 3x^2 - 6x + 0$

A) $(-3, 1)$ B) $(1, -3)$ C) $(3, -1)$ D) $(-1, 3)$

Use the equation and the corresponding graph for the quadratic function to find what is requested.

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

82) _____
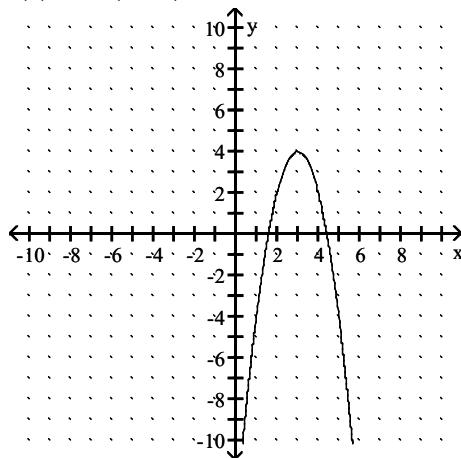
Find the coordinates of the vertex.

    A) (4, 3)   B) (3, 4)   C) (3, -4)   D) (-3, 4)

Solve the problem.

83) The number of mosquitoes M(x), in millions, in a certain area depends on the June rainfall x, in inches: $M(x) = 10x - x^2$. What rainfall produces the maximum number of mosquitoes?

83) _____

    A) 0 in.   B) 5 in.   C) 10 in.   D) 100 in.

84) A ball is thrown downward from a window in a tall building. Its position at time t in seconds is $s(t) = 16t^2 + 32t$, where s(t) is in feet. How long (to the nearest tenth) will it take the ball to fall 246 feet?

84) _____

    A) 9.0 sec   B) 3.0 sec   C) 2.8 sec   D) 3.9 sec

Use synthetic division to perform the division.

85) $\dfrac{x^3 - x^2 + 7}{x + 2}$

85) _____

    A) $x^2 - 3x + 6 + \dfrac{6}{x + 2}$ B) $x^2 + 3x + 6 + \dfrac{-5}{x + 2}$

    C) $x^2 - 3x + 6 + \dfrac{-5}{x + 2}$ D) $x^2 - 2x + 6 + \dfrac{6}{x + 2}$

86) $\dfrac{x^5 - 3x^4 - 7x^3 - 13x^2 - 12x + 13}{x - 5}$

A) $x^4 + 2x^3 + 3x^2 + 2x - 2 + \dfrac{3}{x - 5}$

B) $x^4 + 2x^3 + 3x^2 + 2x + 3$

C) $x^3 + 2x^2 + 3x + 2 + \dfrac{3}{x - 5}$

D) $x^4 + 2x^3 + 3x^2 + 2x + 2 + \dfrac{5}{x - 5}$

Use the remainder theorem and synthetic division to find f(k).

87) $k = -3$; $f(x) = 2x^4 + 4x^3 + 6x^2 - 3x + 55$

    A) 152   B) 132   C) 172   D) −260

Factor f(x) into linear factors given that k is a zero of f(x).

88) $f(x) = 4x^3 + 16x^2 + 9x - 9$; $k = \dfrac{1}{2}$

    A) $(2x + 1)(2x + 1)(x - 9)$ B) $(2x - 1)(2x - 3)(x - 3)$
    C) $(2x + 1)(2x + 3)(x - 3)$ D) $(2x - 1)(2x + 3)(x + 3)$

For the polynomial, one zero is given. Find all others.

89) $P(x) = x^3 - 5x^2 + 11x - 15$; 3

    A) $1 + 2i,\ 1 - 2i$ B) $1 + \sqrt{5}i,\ 1 - \sqrt{5}i$ C) $1 + \sqrt{5},\ 1 - \sqrt{5}$ D) $-1 + 2i,\ -1 - 2i$

Find all rational zeros and factor f(x).

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

    A) $-5, -4, 1$; $f(x) = (x + 5)(x + 4)(x - 1)$ B) $5, 4, -1$; $f(x) = (x - 5)(x - 4)(x + 1)$
    C) $4, 3, -1$; $f(x) = (x - 4)(x - 3)(x + 1)$ D) $-4, -3, 1$; $f(x) = (x + 4)(x + 3)(x - 1)$

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

91) $f(x) = 4x(x - 8)(x + 10)$

    A) −10 (multiplicity 1), 10 (multiplicity 1), 8 (multiplicity 1)
    B) −10 (multiplicity 1), 0 (multiplicity 1), 8 (multiplicity 1)
    C) −10 (multiplicity 1) 8 (multiplicity 2)
   D) −10 (multiplicity 1), 8 (multiplicity 1)

92) $f(x) = 5x(x + 6)(x^2 - 1)^3$

    A) 0 (multiplicity 1), 6 (multiplicity 1), ±1 (multiplicity 3)
    B) 0 (multiplicity 1), –6 (multiplicity 1), ±1 (multiplicity 1)
    C) 0 (multiplicity 1), –6 (multiplicity 1), – 1 (multiplicity 3)
    D) 0 (multiplicity 1), –6 (multiplicity 1), ±1 (multiplicity 3)

**Find a polynomial function f(x) of least possible degree having the graph shown.**
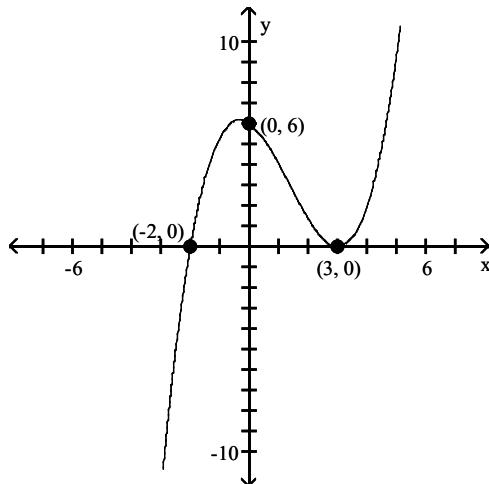
93)

    A) $f(x) = \dfrac{1}{3}(x - 2)(x + 3)$
                                   B) $f(x) = \dfrac{1}{3}(x - 2)(x + 3)^2$

    C) $f(x) = \dfrac{1}{3}(x + 2)(x - 3)$
                                     D) $f(x) = \dfrac{1}{3}(x + 2)(x - 3)^2$

94)
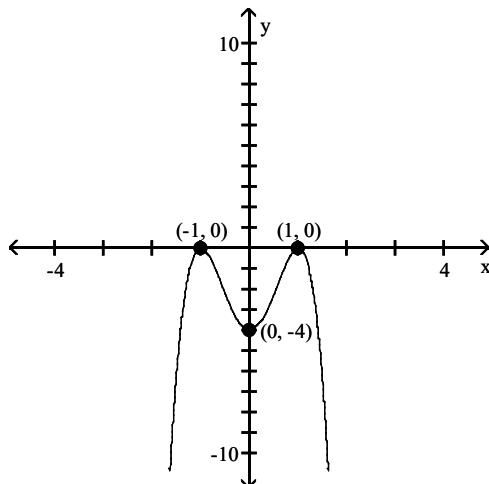
    A) $f(x) = 4(x + 1)^2(x - 1)^2$
                                     B) $f(x) = -4(x + 1)(x - 1)$
    C) $f(x) = -4(x + 1)^2(x - 1)^2$
                                     D) $f(x) = 4(x + 1)(x - 1)$

Find a polynomial of degree 3 with real coefficients that satisfies the given conditions.

95) Zeros of 1, –2, 3 and P(2) = 8

95) _____

    A) $P(x) = 2x^3 + 8x^2 - 10x + 12$ B) $P(x) = -2x^3 - 8x^2 + 10x - 12$

    C) $P(x) = -2x^3 + 4x^2 + 10x - 12$ D) $P(x) = 2x^3 - 4x^2 - 10x + 12$

Find a polynomial of least degree with only real coefficients and having the given zeros.

96) 5 + 2i and 5 – 2i

96) _____

    A) $f(x) = x^2 + 29$ B) $f(x) = x^2 - 10x + 29$

    C) $f(x) = x^2 + 10x + 29$ D) $f(x) = x^2 - 10x + 21$

Use the graph to answer the question.

97) Find the domain and range of the rational function graphed below.

97) _____
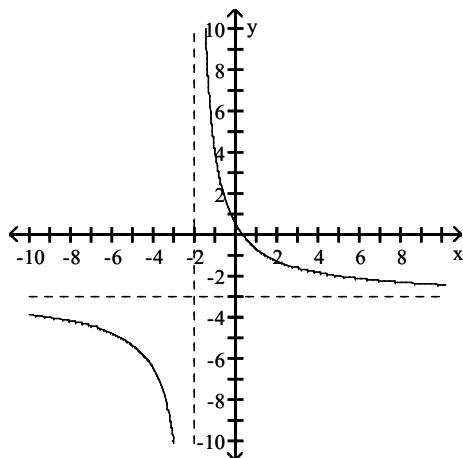
    A) Domain: $(-\infty, -2) \cup (-2, \infty)$; Range: $(-\infty, -3) \cup (-3, \infty)$
    B) Domain: $(-\infty, -3) \cup (-3, \infty)$; Range: $(-\infty, -2) \cup (-2, \infty)$
    C) Domain: $(-\infty, -2) \cup (-2, \infty)$; Range: $(-\infty, \infty)$
    D) Domain: $(-\infty, \infty)$; Range: $(-\infty, -3) \cup (-3, \infty)$

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

98) $P(x) = -2x^3 + 2x^2 + 6x - 3$

98) _____

    A) ↖↘   B) ↖↗   C) ↙↘   D) ↙↗

99) $P(x) = 6x^6 - x^5 + 8x^2 - 3$

99) _____

   A) ↖↗   B) ↙↘   C) ↙↗   D) ↖↘

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

Graph the polynomial function. Factor first if the expression is not in factored form.

100) $f(x) = x^3 + 4x^2 - x - 4$ 100) _____
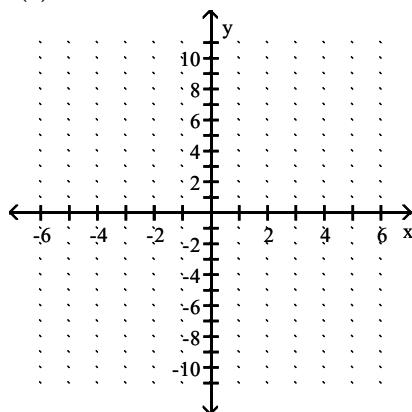
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Determine which of the rational functions given below has the following feature(s).

101) The horizontal asymptote is $y = 5$ 101) _____

A) $f(x) = \dfrac{x + 5}{x + 9}$ 　　　B) $f(x) = \dfrac{5x - 1}{x + 9}$ 　　　C) $f(x) = \dfrac{5}{x - 5}$ 　　　D) $f(x) = \dfrac{5x^2 - 1}{x + 9}$

Answer the question

102) How can the graph of $f(x) = \dfrac{6}{x + 14}$ be obtained from the graph of $y = \dfrac{1}{x}$?   102) _____

A) By making a horizontal shift of 6 units to the right and a vertical shift of 14 units down
B) By making a horizontal shift of 14 units to the left and stretching vertically by a factor of 6
C) By making a horizontal shift of 14 units to the right and stretching vertically by a factor of 6
D) By making a horizontal shift of 14 units to the left and a vertical shift of 6 units up

103) How can the graph of $f(x) = \dfrac{4}{(x + 2)^2}$ by obtained from the graph of $y = \dfrac{1}{x^2}$?   103) _____

A) By making a horizontal shift of 2 units to the left and stretching vertically by a factor of 4
B) By making a horizontal shift of 2 units to the right and stretching vertically by a factor of 4
C) By making a horizontal shift of 4 units to the right and a vertical shift of 2 units up
D) By making a horizontal shift of 2 units to the left and a vertical shift of 4 units down

Give the equations of any vertical asymptotes.

104) $f(x) = \dfrac{x - 1}{x^2 - 9}$

    A) $x = 1$ B) $x = 3$ C) $x = -3$ D) $x = 3,\ x = -3$

104) _____

105) $f(x) = \dfrac{x - 4}{x^2 + 2x}$

    A) $x = 2$ B) $x = 0,\ x = -2$ C) $x = 4$ D) $x = -2$

105) _____

106) $h(x) = \dfrac{(x - 6)(x + 5)}{x^2 - 1}$

    A) none   B) $x = 6,\ x = -5$ C) $x = 1,\ x = -1$ D) $x = -6,\ x = 5$

106) _____

Give the equations of any horizontal asymptotes.

107) $g(x) = \dfrac{x^2 + 8x - 1}{x - 1}$

    A) $y = -1$ B) none   C) $y = 8$ D) $y = 0$

107) _____

108) $g(x) = \dfrac{x + 3}{x^2 - 2}$

    A) $y = 0$ B) $y = 2$ C) $y = 1$ D) none

108) _____

109) $h(x) = \dfrac{27x^2}{9x^2 - 8}$

    A) $y = 3$ B) $y = \sqrt{8}$ C) none   D) $y = 8$

109) _____

Identify any vertical, horizontal, or oblique asymptotes in the graph of y = f(x). State the domain of f.

110)
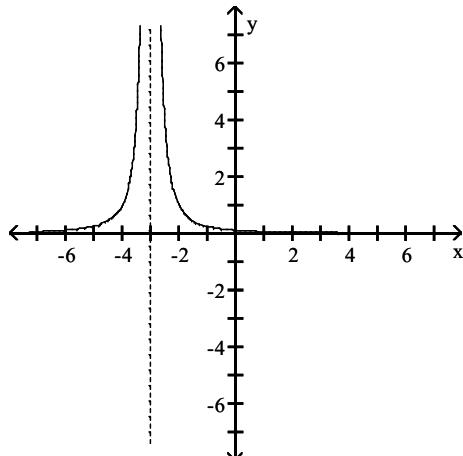
110) _____

    A) Vertical: x = –3; horizontal: y = 0; (–∞, 0) ∪ (0, ∞)

    B) Vertical: x = –3; horizontal: y = 0; (–∞, –3) ∪ (–3, ∞)

    C) Vertical: x = 0; horizontal: y = –3; (–∞, 0) ∪ (0, ∞)

    D) Vertical: x = 0; horizontal: y = –3; (–∞, –3) ∪ (–3, ∞)

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

Sketch the graph of the rational function.

111) $f(x) = \dfrac{x - 2}{x + 3}$

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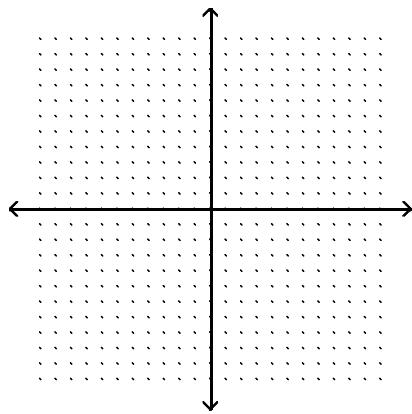
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Find an equation for the rational function graph.

112)
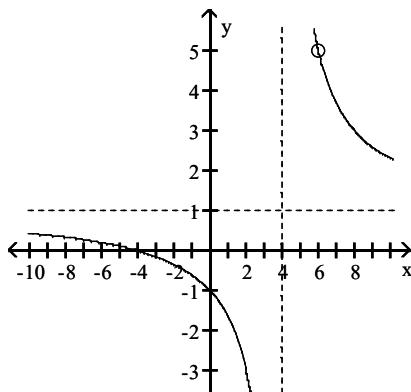
A) $f(x) = \dfrac{(x - 4)(x + 6)}{(x + 4)(x + 6)}$

B) $f(x) = \dfrac{(x + 4)(x - 6)}{(x - 4)(x - 6)}$

C) $f(x) = \dfrac{x + 4}{x - 4}$

D) $f(x) = \dfrac{(x - 4)(x - 6)}{(x + 4)(x - 6)}$

113)
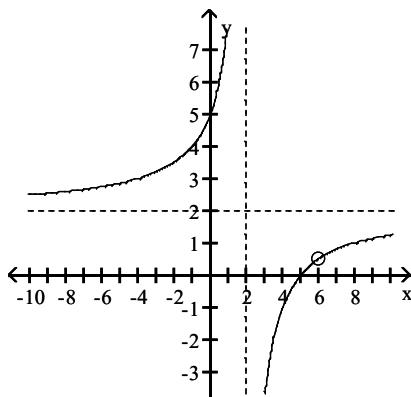
A) $f(x) = \dfrac{2(x - 2)(x - 6)}{(x - 5)(x - 6)}$

B) $f(x) = \dfrac{2(x - 5)}{x - 2}$

C) $f(x) = \dfrac{2(x + 5)(x + 6)}{(x + 2)(x + 6)}$

D) $f(x) = \dfrac{2(x - 5)(x - 6)}{(x - 2)(x - 6)}$

114)
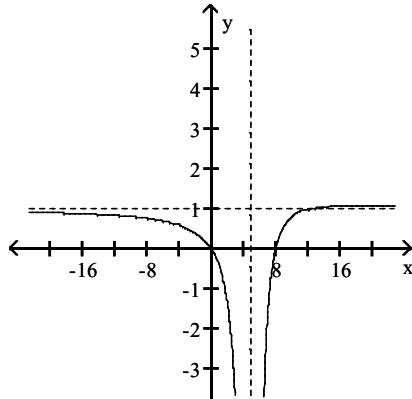
A) $f(x) = \dfrac{(x + 8)(x - 8)}{x - 5}$

B) $f(x) = \dfrac{x(x - 8)}{x - 5}$

C) $f(x) = \dfrac{x(x + 8)}{(x + 5)^2}$

D) $f(x) = \dfrac{x(x - 8)}{(x - 5)^2}$

Provide an appropriate response.

115) Explain the behavior of the graph of f(x) as it approaches its vertical asymptote.

$f(x) = \dfrac{1}{x - 9}$

A) Approaches ∞ from the left, approaches –∞ from the right
B) Approaches –∞ from the left and the right
C) Approaches –∞ from the left, approaches ∞ from the right
D) Approaches ∞ from the left and the right

23

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

51) A
52) B
53) C
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55) D
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58) C
59) D
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82) B
83) B
84) B
85) C
86) A
87) C
88) D
89) A
90) C
91) B
92) D
93) D
94) C
95) C
96) B
97) A
98) A
99) A

100)
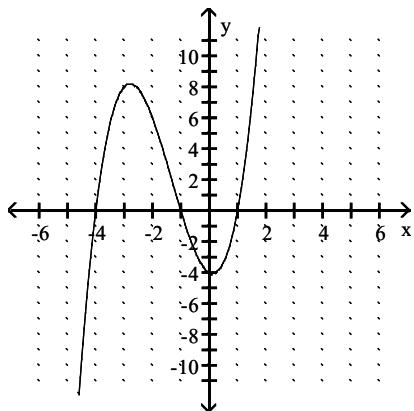
101) B
102) B
103) A
104) D
105) B
106) C
107) B
108) A
109) A
110) B
111)

112) B
113) D
114) D
115) C