Student: _____ **Date:** _____	**Instructor:** Alfredo Alvarez **Course:** 2017 Fall 1314	**Assignment:** Practice Final - Free Response with Help99

1. Use factoring to solve the quadratic equation. Check by substitution or by using a graphing utility and identifying x-intercepts.

    $$x^2 - x - 56 = 0$$

    The solution set is $\{$ _____ $\}$.
    (Use a comma to separate answers as needed. Type repeated roots only once.)

2. Solve the equation by factoring.

    $$x^2 = 4x + 32$$

    The solution set is $\{$ _____ $\}$.
    (Use a comma to separate answers as needed.)

3. Use factoring to solve the quadratic equation. Check by substitution or by using a graphing utility and identifying x-intercepts.

    $$4x^2 = 23x + 72$$

    The solution set is $\{$ _____ $\}$.
    (Use commas to separate answers as needed. Type repeated roots only once.)

4. Use factoring to solve the quadratic equation. Check by substitution or by using a graphing utility and identifying x-intercepts.

    $$4x^2 + 12x = 0$$

    The solution set is $\{$ _____ $\}$.
    (Use a comma to separate answers as needed.)

5. Solve the quadratic equation by completing the square.

    $$x^2 + 2x = 35$$

    What is the solution set?

    $\{$ _____ $\}$ (Use a comma to separate answers as needed.)

6. Solve the following equation using the quadratic formula.

    $$x^2 + 8x + 12 = 0$$

    The solution set is $\{$ _____ $\}$.
    (Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

7. Solve the following equation using the quadratic formula.

   $2x^2 - 7x - 2 = 0$

   The solution set is $\{$ _____ $\}$.
   (Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

8. Solve for x using the quadratic formula.

   $x^2 - 10x + 29 = 0$

   The solution set is $\{$ _____ $\}$.
   (Type an exact answer, using radicals as needed. Express complex numbers in terms of i. Use a comma to separate answers as needed.)

9. Solve the equation by the method of your choice.

   $3x^2 - 11x = 20$

   The solution set is $\{$ _____ $\}$.
   (Type an exact answer, using radicals as needed. Use a comma to separate answers as needed.)

10. Solve the equation using any method.

    $3x^2 + 5 = 16x$

    The solution set is $\{$ _____ $\}$.
    (Simplify your answer. Type an exact answer, using radicals and i as needed. Use a comma to separate answers as needed.)

11. Solve the equation by the method of your choice.

    $x^2 + 4x = 11$

    The solution set is $\{$ _____ $\}$.
    (Type an exact answer, using radicals as needed. Express complex numbers in terms of i. Use a comma to separate answers as needed.)

12. Solve the equation using the method of your choice.

    $y^2 - 8y + 17 = 0$

    The solution set is $\{$ _____ $\}$.
    (Type an exact answer, using radicals as needed. Express complex numbers in terms of i. Use a comma to separate answers as needed.)

13. Solve the radical equation.

    $\sqrt{2x + 7} = x - 4$

    Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

    ○ **A.** The solution set is $\{$ _____ $\}$.
    (Use a comma to separate answers as needed.)
    ○ **B.** There is no solution.

14. Evaluate the function $f(x) = x^2 + 9x - 1$ at the given values of the independent variable and simplify.

   a. $f(-8)$ **b.** $f(x+9)$ **c.** $f(-x)$

   a. $f(-8) =$ _____ (Simplify your answer.)

   b. $f(x+9) =$ _____ (Simplify your answer.)

   c. $f(-x) =$ _____ (Simplify your answer.)

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15. Graph the given functions, f and g, in the same rectangular coordinate system. Describe how the graph of g is related to the graph of f.
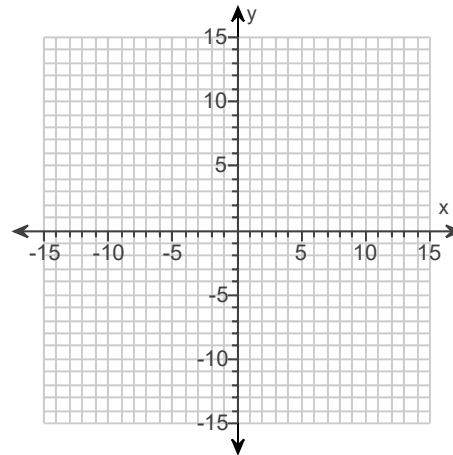
   $f(x) = |x|$

   $g(x) = |x| - 8$

   Use the graphing tool to graph the functions.

   How is the graph of g related to the graph of f?

   ○ **A.** The graph of g is the graph of f shifted 8 units vertically up.

   ○ **B.** The graph of g is the graph of f shifted 8 units horizontally left.

   ○ **C.** The graph of g is the graph of f shifted 8 units vertically down.

   ○ **D.** The graph of g is the graph of f shifted 8 units horizontally right.

16. Use the graph to determine

   a. open intervals on which the function is increasing, if any.
   b. open intervals on which the function is decreasing, if any.
   c. open intervals on which the function is constant, if any.
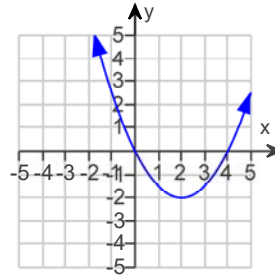
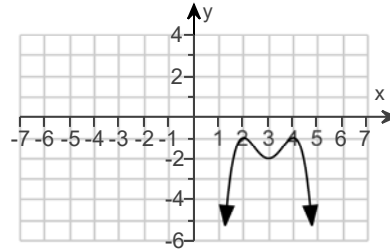**a.** Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The function is increasing on the interval(s) _____ .
   (Type your answer in interval notation. Use a comma to separate answers as needed.)
○ **B.** There is no interval on which the function is increasing.

b. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The function is decreasing on the interval(s) _____ .
   (Type your answer in interval notation. Use a comma to separate answers as needed.)
○ **B.** There is no interval on which the function is decreasing.

c. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The function is constant on the interval(s) _____ .
   (Type your answer in interval notation. Use a comma to separate answers as needed.)
○ **B.** There is no interval on which the function is constant.

17. Use the graph to determine

   (a) open intervals on which the function is increasing, if any.

   (b) open intervals on which the function is decreasing, if any.

   (c) open intervals on which the function is constant, if any.

(a) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

   ○ **A.** The function is increasing on the interval(s) _____ .
   (Type your answer in interval notation. Use a comma to separate answers as needed.)

   ○ **B.** The function is never increasing.

(b) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

   ○ **A.** The function is decreasing on the interval(s) _____ .
   (Type your answer in interval notation. Use a comma to separate answers as needed.)

   ○ **B.** The function is never decreasing.

(c) Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

   ○ **A.** The function is constant on the interval(s) _____ .
   (Type your answer in interval notation. Use a comma to separate answers as needed.)

   ○ **B.** The function is never constant.

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18. Use the graph to determine the following.

   (a) Find the numbers at which f has a relative maximum. What are these relative maxima?

   (b) Find the numbers at which f has a relative minimum. What are these relative minima?
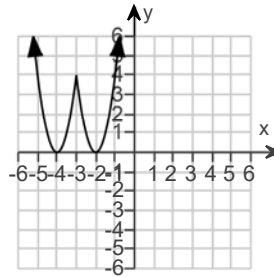
(a) The number(s) at which f has a relative maximum is/are _____ .
(Type an integer or a decimal. Use a comma to separate answers as needed.)

The relative maximum/maxima is/are _____ .
(Type an integer or a decimal. Use a comma to separate answers as needed.)

(b) The number(s) at which f has a relative minimum is/are _____ .
(Type an integer or a decimal. Use a comma to separate answers as needed.)

The relative minimum/minima is/are _____ .
(Type an integer or a decimal. Use a comma to separate answers as needed.)

19. The graph and equation of the function f are given.
    a. Use the graph to find any values at which f has a relative maximum, and use the equation to calculate the relative maximum for each value.
    b. Use the graph to find any values at which f has a relative minimum, and use the equation to calculate the relative minimum for each value.

$f(x) = 2x^3 - 3x^2 - 36x + 7$
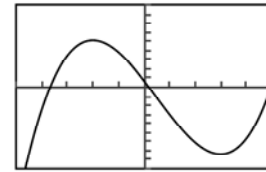
$[-5,5,1]$ by $[-90,90,10]$

a. Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

  ○ **A.** The function f has (a) relative maxima(maximum) at _____ and the relative maxima(maximum) are(is) _____ .
    (Use a comma to separate answers as needed.)
  ○ **B.** The function f has no relative maxima.

b. Select the correct choice below and, if necessary, fill in the answer boxes to complete your choice.

  ○ **A.** The function f has (a) relative minima(minimum) at _____ and the relative minima(minimum) are(is) _____ .
    (Use a comma to separate answers as needed.)
  ○ **B.** The function f has no relative minima.

20. The domain of the piecewise function is $(-\infty,\infty)$.
    a. Graph the function.
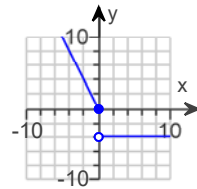   **b.** Use your graph to determine the function's range.

$f(x) = \begin{cases} -2x & \text{if } x \le 0 \\ -4 & \text{if } x > 0 \end{cases}$
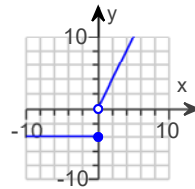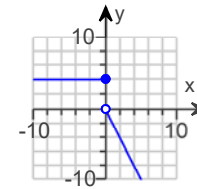
a. Choose the correct graph below.

  ○ **A.**   ○ **B.**   ○ **C.**   ○ **D.**
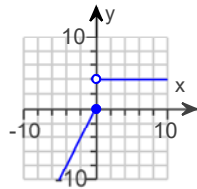
b. The range of f(x) is _____ .
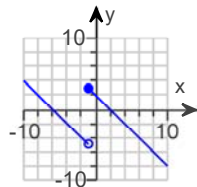(Type your answer using interval notation, set notation, and the union operator as needed.)

21. The domain of the piecewise function is $(-\infty, \infty)$.
    a. Graph the function.
    b. Use your graph to determine the function's range.

$$f(x) = \begin{cases} x + 4 \text{ if } x < -1 \\ x - 4 \text{ if } x \geq -1 \end{cases}$$

a. Choose the correct graph below.
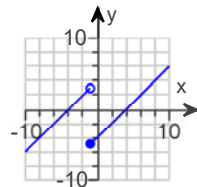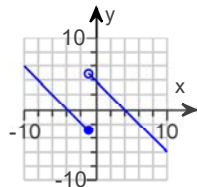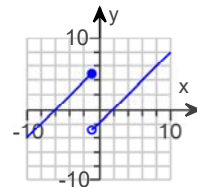
○ **A.**   ○ **B.**   ○ **C.**   ○ **D.**

b. The range of f(x) is _____ . (Type your answer in interval notation.)

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22. The domain of the piecewise function is $(-\infty, \infty)$.
    a. Graph the function.
    b. Use your graph to determine the function's range.

$$f(x) = \begin{cases} x + 2 \text{ if } x < 3 \\ x - 2 \text{ if } x \geq 3 \end{cases}$$

a. Choose the correct graph below.

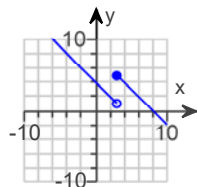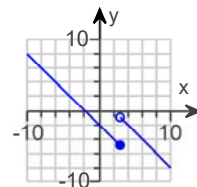○ **A.**   ○ **B.**   ○ **C.**   ○ **D.**
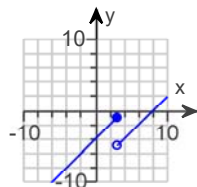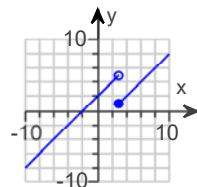

b. The range of f(x) is _____ . (Type your answer in interval notation.)

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23. Find the difference quotient of f; that is, find $\dfrac{f(x + h) - f(x)}{h}$, $h \neq 0$, for the following function. Be sure to simplify.

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

$\dfrac{f(x + h) - f(x)}{h} =$ _____ (Simplify your answer.)

24. With aging, body fat increases and muscle mass declines. The graph to the right shows the percent body fat in a group of adult women and men as they age from 25 to 75 years. Age is represented along the x-axis, and percent body fat is represented along the y-axis. State the intervals on which the graph giving the percent body fat in women is increasing and decreasing.
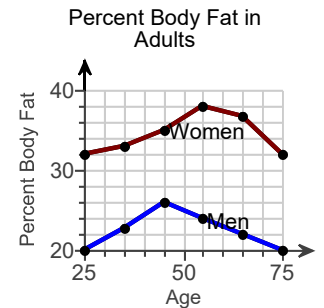
Percent Body Fat in Adults
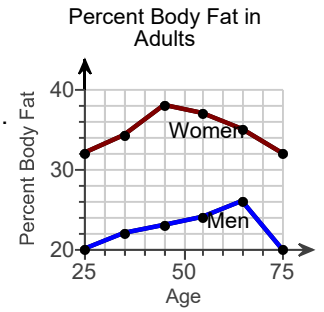
On what interval is the graph increasing?

- ○ **A.** (45,75)
- ○ **B.** (20,26)
- ○ **C.** (25,75)
- ○ **D.** (25,45)

On what interval is the graph decreasing?

- ○ **A.** (45,75)
- ○ **B.** (25,45)
- ○ **C.** (25,75)
- ○ **D.** (20,38)

25. With aging, body fat increases and muscle mass declines. The graph to the right shows the percent body fat in a group of adult women and men as they age from 25 to 75 years. Age is represented along the x-axis, and percent body fat is represented along the y-axis. For what age does the percent body fat in men reach a maximum? What is the percent body fat for that age?
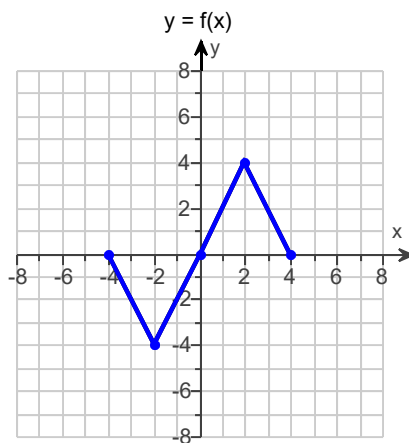
Percent Body Fat in Adults

The percent body fat in men reaches a maximum at the age of _____ years.
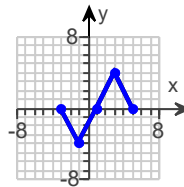
What is the percent body fat at the maximum?

_____ %

26. Use the graph of y = f(x) to graph the function g(x) = f(x) − 1.

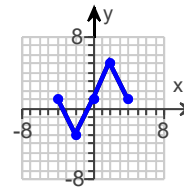

y = f(x)

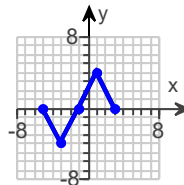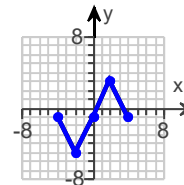Choose the correct graph of g below.

A. ○

B. ○

C. ○

D. ○

27. Use the graph of y = f(x) to graph the function g(x) = f(x + 4).

y = f(x)

Choose the correct graph of g below.

A. ○

B. ○
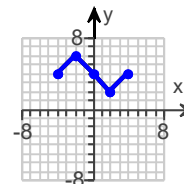
C. ○
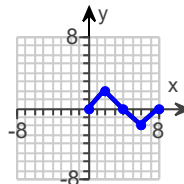
D. ○
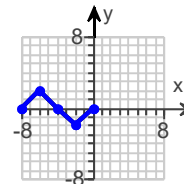
28. Use the graph of y = f(x) to graph the function
    g(x) = f(x + 2) + 3.

    y = f(x)
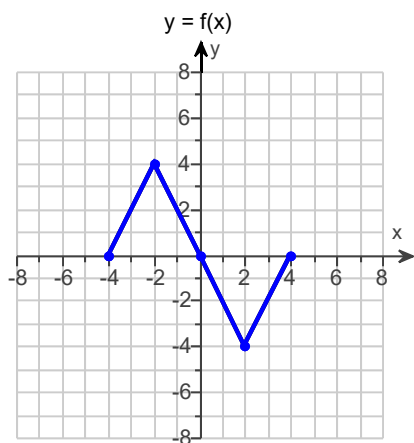
    Choose the correct graph of g below.

    ○ **A.**　　　　　　　　　　○ **B.**

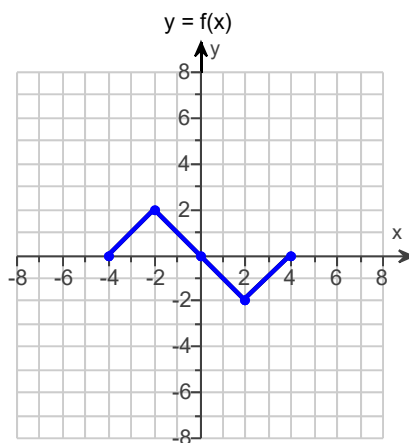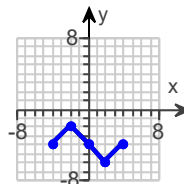   ○ **C.**　　　　　　　　　　○ **D.**

29. Use the graph of y = f(x) to graph the function
    g(x) = f(x + 4) + 4.

    y = f(x)
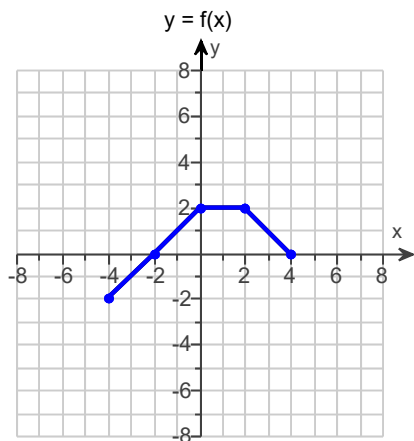
    Choose the correct graph of g below.

    ○ **A.**　　　　　　　　　　○ **B.**

    ○ **C.**　　　　　　　　　　○ **D.**

30. Use transformations of the graph of $f(x) = x^2$ to determine
    the graph of the given function.

    $g(x) = (x + 2)^2$

    Use the graphing tool to graph the function.
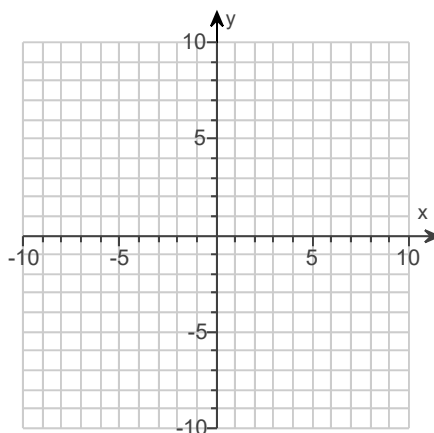
31. Find the domain of the function.

$g(x) = \sqrt{2x - 16}$

What is the domain of g?

_____ (Type your answer in interval notation.)

32. Find the domain of the function.

$f(x) = \sqrt{4 - 2x}$

What is the domain of f?

_____ (Type your answer in interval notation.)

33.

First find $f + g$, $f - g$, fg and $\dfrac{f}{g}$. Then determine the domain for each function.

$f(x) = 6x + 2$, $g(x) = x - 9$

$(f + g)(x) = $ _____ (Simplify your answer.)

What is the domain of $f + g$?

○ $(-\infty, 1) \cup (1, \infty)$
○ $(1, \infty)$
○ $(-\infty, \infty)$
○ $[0, \infty)$

$(f - g)(x) = $ _____ (Simplify your answer.)

What is the domain of $f - g$?

○ $(-\infty, \infty)$
○ $\left(-\infty, -\dfrac{11}{5}\right) \cup \left(-\dfrac{11}{5}, \infty\right)$
○ $\left(-\dfrac{11}{5}, \infty\right)$
○ $[0, \infty)$

$(fg)(x) = $ _____

What is the domain of fg?

○ $(-\infty, \infty)$
○ $\left(-\infty, -\dfrac{1}{3}\right) \cup \left(-\dfrac{1}{3}, \infty\right)$
○ $[0, \infty)$
○ $(-\infty, 9) \cup (9, \infty)$

$\left(\dfrac{f}{g}\right)(x) = $ _____

What is the domain of $\dfrac{f}{g}$?

○ $(-\infty, 9) \cup (9, \infty)$
○ $(-\infty, \infty)$
○ $(9, \infty)$
○ $[0, \infty)$

34.

First find $f + g$, $f - g$, fg and $\dfrac{f}{g}$. Then determine the domain for each function.

$f(x) = 4x^2 - 31x + 42$, $g(x) = x - 6$

$(f + g)(x) =$ _____ (Simplify your answer.)

What is the domain of $f + g$?

- $\left(\dfrac{6}{5}, \infty\right)$
- $(-\infty, \infty)$
- $\left(-\infty, \dfrac{6}{5}\right) \cup \left(\dfrac{6}{5}, \infty\right)$
- $[0, \infty)$

$(f - g)(x) =$ _____ (Simplify your answer.)

What is the domain of $f - g$?

- $\left(\dfrac{6}{5}, \infty\right)$
- $(-\infty, \infty)$
- $[0, \infty)$
- $\left(-\infty, \dfrac{42}{31}\right) \cup \left(\dfrac{42}{31}, \infty\right)$

$(fg)(x) =$ _____

What is the domain of fg?

- $(-\infty, \infty)$
- $(-\infty, 6) \cup (6, \infty)$
- $\left(\dfrac{3}{2}, \infty\right)$
- $\left(-\infty, \dfrac{3}{2}\right) \cup \left(\dfrac{3}{2}, \infty\right)$

$\left(\dfrac{f}{g}\right)(x) =$ _____ (Simplify your answer.)

What is the domain of $\dfrac{f}{g}$?

- $(-\infty, \infty)$
- $(-\infty, 6) \cup (6, \infty)$
- $[0, \infty)$
- $(6, \infty)$

35. For $f(x) = 3x$ and $g(x) = x + 1$, find the following functions.

   a. $(f \circ g)(x)$; b. $(g \circ f)(x)$; c. $(f \circ g)(3)$; d. $(g \circ f)(3)$

   a. $(f \circ g)(x) = $ _____
   (Simplify your answer.)

   b. $(g \circ f)(x) = $ _____
   (Simplify your answer.)

   c. $(f \circ g)(3) = $ _____

   d. $(g \circ f)(3) = $ _____

36. For $f(x) = 4x - 5$ and $g(x) = 5x^2 - 5$, find the following functions.

   a. $(f \circ g)(x)$; b. $(g \circ f)(x)$; c. $(f \circ g)(0)$; d. $(g \circ f)(0)$

   a. $(f \circ g)(x) = $ _____ (Simplify your answer.)

   b. $(g \circ f)(x) = $ _____ (Simplify your answer.)

   c. $(f \circ g)(0) = $ _____ (Simplify your answer.)

   d. $(g \circ f)(0) = $ _____ (Simplify your answer.)

37. For $f(x) = 1 - x$ and $g(x) = 2x^2 + x + 3$, find the following functions.

   a. $(f \circ g)(x)$; b. $(g \circ f)(x)$; c. $(f \circ g)(2)$; d. $(g \circ f)(2)$

   a. $(f \circ g)(x) = $ _____
   (Simplify your answer.)

   b. $(g \circ f)(x) = $ _____
   (Simplify your answer.)

   c. $(f \circ g)(2) = $ _____

   d. $(g \circ f)(2) = $ _____

38. Find the distance between the pair of points.

   (10,1) and (18,7)

   The distance between the points is _____ units.
   (Round to two decimal places as needed.)

39. Find the midpoint of the line segment with the given endpoints.

   (10,2) and (8,6)

   The midpoint of the segment is _____ .
   (Type an ordered pair.)

40. Give the center and radius of the circle described by the equation and graph the equation. Use the graph to identify the relation's domain and range.

$$(x - 1)^2 + (y - 2)^2 = 16$$

Use the graphing tool to graph the circle.

Use the graph to identify the domain.

The domain is _____ .
(Type your answer in interval notation.)

Use the graph to identify the range.

The range is _____ .
(Type your answer in interval notation.)
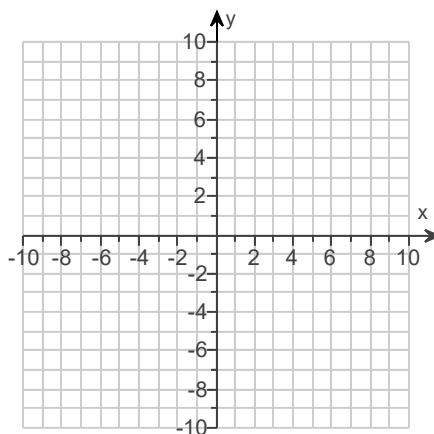
41. Complete the square and write the equation of the circle in standard form. Then determine the center and radius of the circle to graph the equation.

$$x^2 + y^2 + 8x + 6y + 21 = 0$$

The equation in standard form is _____ .
(Simplify your answer.)

Use the graphing tool to graph the circle.
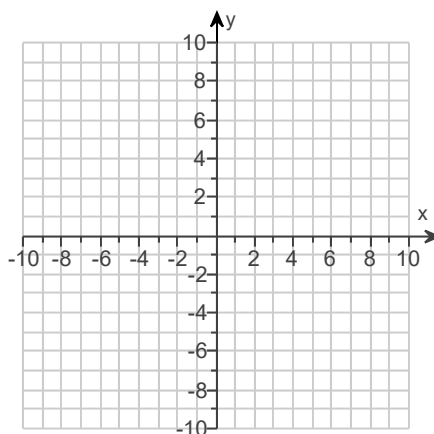
42. The graph of a quadratic function is given. Select the function's equation from the choices given.
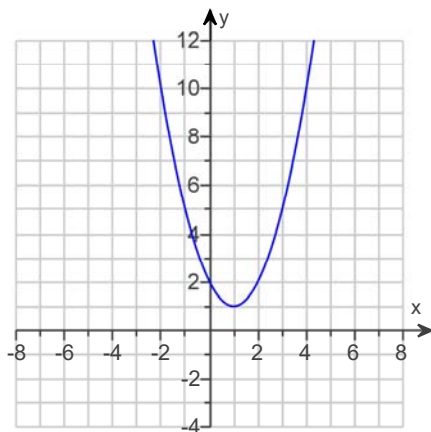
Choose the correct equation below.

- **A.** $f(x) = (x + 1)^2 - 1$
- **B.** $f(x) = (x - 1)^2 - 1$
- **C.** $f(x) = (x + 1)^2 + 1$
- **D.** $f(x) = (x - 1)^2 + 1$

43. Find the coordinates of the vertex for the parabola defined by the given quadratic function.

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

The vertex is _____ . (Type an ordered pair.)

44. Use the vertex and intercepts to sketch the graph of the quadratic function. Give the equation for the parabola's axis of symmetry. Use the parabola to identify the function's domain and range.

　　$f(x) = 2(x + 1)^2 - 4$

Use the graphing tool to graph the equation. Use the vertex and the y-intercept when drawing the graph.

The axis of symmetry is _____ .
(Type an equation. Simplify your answer)

The domain of f is _____ .
(Type your answer in interval notation.)

The range of f is _____ .
(Type your answer in interval notation.)

45. Use the vertex and intercepts to sketch the graph of the quadratic function. Give the equation of the parabola's axis of symmetry. Use the graph to determine the function's domain and range.

　　$f(x) = x^2 + 2x - 3$

Use the graphing tool to graph the equation. Use the vertex and one of the intercepts when drawing the graph.

The axis of symmetry is _____ .
(Type an equation.)

The domain of f is _____ .
(Type your answer in interval notation.)

The range of f is _____ .
(Type your answer in interval notation.)

46. Use the vertex and intercepts to sketch the graph of the quadratic function. Give the equation for the parabola's axis of symmetry. Use the parabola to identify the function's domain and range.
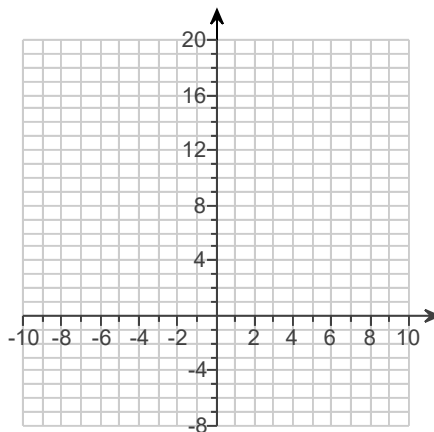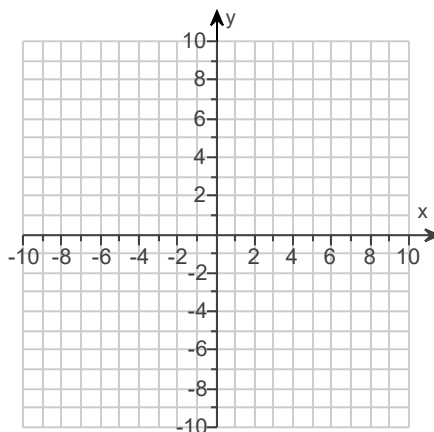
$$f(x) = x^2 + 3x - 4$$

Use the graphing tool to graph the equation. Use the vertex and one of the intercepts to graph the equation.
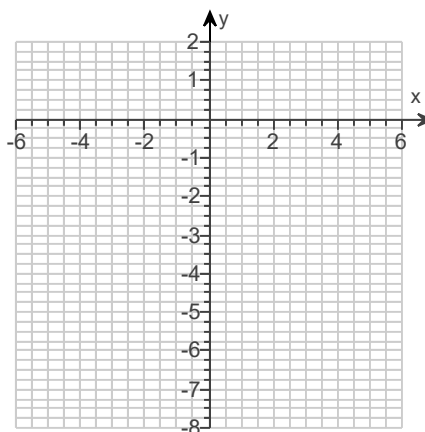
The axis of symmetry is _____ .
(Type an equation.)

Identify the function's domain.

The domain is _____ .
(Type the answer in interval notation.)

Identify the function's range.

The range is _____ .
(Type the answer in interval notation.)

47. Use the vertex and intercepts to sketch the graph of the quadratic function. Give the equation of the parabola's axis of symmetry. Use the graph to determine the domain and range of the function.

$$f(x) = 6x - x^2 - 8$$

Use the graphing tool to graph the equation. Use the vertex and one of the intercepts to draw the graph.

The axis of symmetry is _____ .
(Type an equation.)

The domain of the function is _____ .
(Type your answer in interval notation.)

The range of the function is _____ .
(Type your answer in interval notation.)
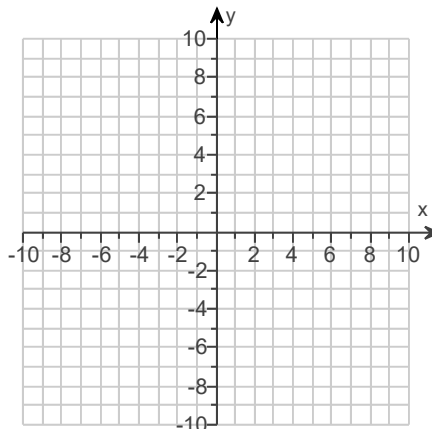
48. Solve the equation $x^3 - 13x^2 + 47x - 35 = 0$ given that 1 is a zero of $f(x) = x^3 - 13x^2 + 47x - 35$.

The solution set is { _____ }. (Use a comma to separate answers as needed.)

49. Use the Rational Zero Theorem to list all possible rational zeros for the given function.

$$f(x) = x^3 + 16x^2 + 17x - 6$$

Choose the answer below that lists all possible rational zeros.

○ **A.** $-1, 1, -6, 6$

○ **B.** $-1, 1, -\dfrac{1}{2}, \dfrac{1}{2}, -\dfrac{1}{3}, \dfrac{1}{3}, -\dfrac{1}{6}, \dfrac{1}{6}$

○ **C.** $-1, 1, -2, 2, -3, 3, -6, 6$

○ **D.** $-1, 1, -2, 2, -3, 3, -6, 6, -\dfrac{1}{2}, \dfrac{1}{2}, -\dfrac{1}{3}, \dfrac{1}{3}, -\dfrac{1}{6}, \dfrac{1}{6}$

50. The following equation is given.

    $$x^3 - 2x^2 - 25x + 50 = 0$$

    a. List all rational roots that are possible according to the Rational Zero Theorem.

    _____
    (Use a comma to separate answers as needed.)

    b. Use synthetic division to test several possible rational roots in order to identify one actual root.

    One rational root of the given equation is _____ .
    (Simplify your answer.)

    c. Use the root from part (**b.**) and solve the equation.

    The solution set of $x^3 - 2x^2 - 25x + 50 = 0$ is $\{$ _____ $\}$.
    (Simplify your answer. Type an exact answer, using radicals as needed. Use integers or fractions for any numbers in the expression. Use a comma to separate answers as needed.)

51. Answer the following questions about the equation below.

    $$12x^3 + 77x^2 - 48x + 7 = 0$$

    (a) List all rational roots that are possible according to the Rational Zero Theorem.

    - **A.** $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12, \pm \dfrac{1}{7}, \pm \dfrac{2}{7}, \pm \dfrac{3}{7}, \pm \dfrac{4}{7}, \pm \dfrac{6}{7}, \pm \dfrac{12}{7}$

    - **B.** $\pm 1, \pm 7, \pm \dfrac{1}{2}, \pm \dfrac{7}{2}, \pm \dfrac{1}{3}, \pm \dfrac{7}{3}, \pm \dfrac{1}{4}, \pm \dfrac{7}{4}, \pm \dfrac{1}{6}, \pm \dfrac{7}{6}, \pm \dfrac{1}{12}, \pm \dfrac{7}{12}$

    - **C.** $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

    - **D.** $\pm 1, \pm 7$

    (b) Use synthetic division to test several possible rational roots in order to identify one actual root.

    One rational root of the given equation is _____ .
    (Simplify your answer.)

    (c) Use the root from part (b) to solve the equation.

    The solution set is $\{$ _____ $\}$.
    (Simplify your answer. Type an exact answer, using radicals as needed. Use integers or fractions for any numbers in the expression. Use a comma to separate answers as needed.)

52. Find all zeros of the polynomial function. Use the Rational Zero Theorem, Descartes's Rule of Signs, and possibly the graph of the polynomial function shown by a graphing utility as an aid in obtaining the first zero or the first root.

 $$f(x) = x^4 - 8x^3 + 15x^2 + 58x + 34$$

    Find the zeros of the polynomial function.

    _____
    (Simplify your answer. Type an exact answer, using radicals and i as needed. Use a comma to separate answers as needed. Type each answer only once.)
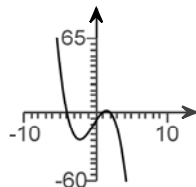
53. An incomplete graph of the polynomial function $f(x) = -x^3 - x^2 + 10x - 8$ is shown on the right.

   a. Find all zeros of the function.

   b. Without using a graphing utility, draw a complete graph of the function.
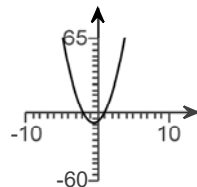

[-5, 0, 1] by [-30, 35, 5]
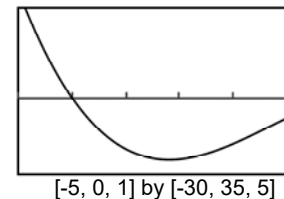
a. The zeros are _____ .
(Use a comma to separate answers as needed.)

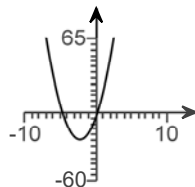b. Choose the correct graph of the function below. The scale for each graph is $[-10, 10, 1]$ by $[-60, 65, 5]$.

   ○ A.   ○ B.   ○ C.   ○ D.
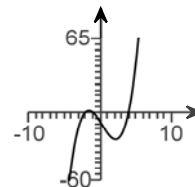
54. Use the vertex and intercepts to sketch the graph of the quadratic function. Give the equation of the parabola's axis of symmetry. Use the graph to determine the domain and range of the function.

$f(x) = (x - 4)^2 - 9$

Use the graphing tool to graph the function. Use the vertex and one of the intercepts when drawing the graph.

The axis of symmetry is _____ .
(Type an equation. Simplify your answer.)
The domain of the function is _____ .
(Type your answer in interval notation.)
The range of the function is _____ .
(Type your answer in interval notation.)
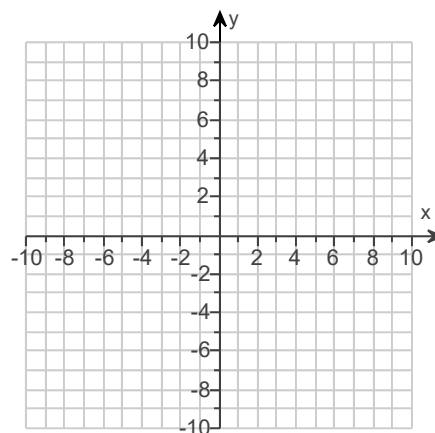
55. Use the vertex and intercepts to sketch the graph of the quadratic function. Give the equation of the parabola's axis of symmetry. Use the graph to determine the domain and range of the function.

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

Use the graphing tool to graph the equation. Use the vertex and one of the intercepts to draw the graph.

The axis of symmetry is _____ .
(Type an equation.)

The domain of the function is _____ .
(Type your answer in interval notation.)

The range of the function is _____ .
(Type your answer in interval notation.)

56. Fill in the blanks so that the resulting statement is true.

If the graph of a function f approaches b as x increases or decreases without bound, then the line $y = b$ is a

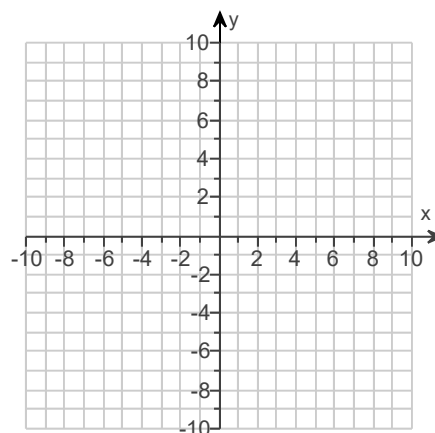(1) _____ of the graph of f. The equation of such a line for the graph of $y = \dfrac{x - 10}{3x^2 + x + 1}$ is (2) _____

(1)   ○
   ○ horizontal asymptote
   ○ vertical asymptote

(2) ○ $x = 0$.
     ○ $y = 0$.

57. Fill in the blank so that the resulting statement is true.

Based on the synthetic division shown below, the equation of the slant asymptote of $f(x) = \dfrac{4x^2 - 2x + 2}{x - 2}$ is _____.

```
2|  4   -2    2
        8    12
    _____
    4    6    14
```

Based on the synthetic division shown, the equation of the slant asymptote of $f(x) = \dfrac{4x^2 - 2x + 2}{x - 2}$ is _____. (Type an equation.)

58. Find the vertical asymptotes, if any, and the values of x corresponding to holes, if any, of the graph of the rational function.

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

Select the correct choice below and, if necessary, fill in the answer box to complete your choice. (Type an equation. Use commas to separate answers as needed.)

○ **A.** The vertical asymptote(s) is(are) _____ and hole(s) corresponding to _____ .

○ **B.** The vertical asymptote(s) is(are) _____ . There are no holes.

○ **C.** There are no vertical asymptotes but there is(are) hole(s) corresponding to _____ .

○ **D.** There are no discontinuities.

59. Find the vertical asymptotes, if any, and the values of x corresponding to holes, if any, of the graph of the rational function.

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

Select the correct choice below and, if necessary, fill in the answer box to complete your choice. (Type an equation. Use commas to separate answers as needed.)

○ **A.** The vertical asymptote(s) is(are) _____ and hole(s) corresponding to _____ .

○ **B.** The vertical asymptote(s) is(are) _____ . There are no holes.

○ **C.** There are no vertical asymptotes but there is(are) hole(s) corresponding to _____ .

○ **D.** There are no discontinuities.

60. Find the vertical asymptotes, if any, and the values of x corresponding to holes, if any, of the graph of the rational function.

$$h(x) = \frac{x+3}{x(x-6)}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice. (Type an equation. Use a comma to separate answers as needed.)

- ○ **A.** The vertical asymptote(s) is(are) _____ and hole(s) corresponding to _____ .
- ○ **B.** There are no vertical asymptotes but there is(are) hole(s) corresponding to _____ .
- ○ **C.** The vertical asymptote(s) is(are) _____ . There are no holes.
- ○ **D.** There are no discontinuities.

61. Find the vertical asymptotes, if any, and the values of x corresponding to holes, if any, of the graph of the rational function.

$$f(x) = \frac{x-8}{x^2 - 10x + 16}$$

Select the correct choice below and, if necessary, fill in the answer box(es) to complete your choice. (Type an integer or a fraction. Use a comma to separate answers as needed.)

- ○ **A.** Vertical asymptote(s) at x = _____
- ○ **B.** Vertical asymptote(s) at x = _____ and hole(s) at x = _____
- ○ **C.** Hole(s) at x = _____
- ○ **D.** There are no discontinuities.

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

$$f(x) = \frac{14x}{7x^2 + 5}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ○ **A.** The horizontal asymptote is _____ . (Type an equation.)
- ○ **B.** There is no horizontal asymptote.

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

$$g(x) = \frac{28x^2}{7x^2 + 6}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- ○ **A.** The horizontal asymptote is _____ . (Type an equation.)
- ○ **B.** There is no horizontal asymptote.

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

$$g(x) = \frac{14x^2}{7x^2 + 1}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.**   The horizontal asymptote is _____ .   (Type an equation.)

○ **B.**   There is no horizontal asymptote.

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

$$f(x) = \frac{-7x + 4}{3x + 4}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.**   The horizontal asymptote is _____ .
      (Type an equation. Simplify your answer. Use integers or fractions for any numbers in the
       equation.)

○ **B.**   There is no horizontal asymptote.

66. Find the domain of the logarithmic function.

$$f(x) = \log (13 - x)$$

The domain of $f(x) = \log (13 - x)$ is _____ .
(Type your answer in interval notation.)

67. Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a calculator if possible.

$$\log_b \left(\frac{x^3 y}{z^2} \right)$$

$$\log_b \left(\frac{x^3 y}{z^2} \right) = \underline{\hspace{2cm}}$$

68. Use properties of logarithms to expand the logarithmic expression below as much as possible.

$$\log_f \frac{\sqrt{a}\, b^8}{c^2}$$

$$\log_f \frac{\sqrt{a}\, b^8}{c^2} = \underline{\hspace{2cm}}$$ (Simplify your answer.)

69. Use properties of logarithms to expand the logarithmic expression as much as possible. Evaluate logarithmic expressions without using a calculator if possible.

$$\ln\left[\frac{x^3\sqrt{x^2+4}}{(x+4)^7}\right]$$

$\ln\left[\dfrac{x^3\sqrt{x^2+4}}{(x+4)^7}\right] = $ _____

70. Use properties of logarithms to expand the logarithmic expression as much as possible. Where possible, evaluate logarithmic expressions without using a calculator.

$$\log\left[\frac{10x^5\sqrt[3]{7-x}}{3(x+4)^2}\right]$$

$\log\left[\dfrac{10x^5\sqrt[3]{7-x}}{3(x+4)^2}\right] = $ _____

71. Solve the exponential equation by expressing each side as a power of the same base and then equating exponents.

$$5^x = 25$$

The solution set is $\{$ _____ $\}$.

72. Solve for x.

$$3^{2x-2} = 9$$

The solution set is $\{$ _____ $\}$.

73. Solve the following exponential equation by expressing each side as a power of the same base and then equating exponents.

$$25^{x+5} = 625^{x-1}$$

The solution set is $\{$ _____ $\}$.

74. Solve the exponential equation. Express the solution set in terms of natural logarithms. Then use a calculator to obtain a decimal approximation, correct to two decimal places, for the solution.

$$3\,e^{\,x} = 13$$

What is the solution in terms of natural logarithms?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Simplify your answer. Use integers or fractions for any numbers in the expression.)

What is the decimal approximation for the solution?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Round to two decimal places as needed.)

75. Solve the following exponential equation by taking the natural logarithm on both sides. Express the solution in terms of natural logarithms. Then, use a calculator to obtain a decimal approximation for the solution.

$$2\,e^{3x} = 1606$$

What is the solution in terms of natural logarithms?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Simplify your answer. Use integers or fractions for any numbers in the expression.)

What is the decimal approximation for the solution?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Round to two decimal places as needed.)

76. Solve the following exponential equation by taking the natural logarithm on both sides. Express the solution in terms of natural logarithms. Then, use a calculator to obtain a decimal approximation for the solution.

$$e^{2-8x} = 538$$

What is the solution in terms of natural logarithms?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Simplify your answer. Use integers or fractions for any numbers in the expression.)

What is the decimal approximation for the solution?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Round to two decimal places as needed.)

77. Solve the exponential equation. Express the solution in terms of natural logarithms. Then use a calculator to obtain a decimal approximation for the solution.

$$8^{(x+3)} = 297$$

What is the solution in terms of natural logarithms?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Simplify your answer. Use integers or fractions for any numbers in the expression.)

What is the decimal approximation for the solution?

The solution set is $\{$ _____ $\}$.
(Use a comma to separate answers as needed. Round to two decimal places as needed.)

78. Solve the logarithmic equation. Be sure to reject any value of x that is not in the domain of the original logarithmic expressions. Give an exact answer.

$$\log_{12} x + \log_{12}(11x - 1) = 1$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

○ **A.** The solution set is $\{$ _____ $\}$. (Type an exact answer in simplified form.)
○ **B.** There is no solution.

79. Solve the logarithmic equation. Be sure to reject any value of x that is not in the domain of the original logarithmic expressions. Give the exact answer.

$\log_4(x + 7) + \log_4(x + 55) = 5$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- A. The solution set is $\{$ _____ $\}$.
  (Simplify your answer. Use a comma to separate answers as needed.)
- B. There is no solution.

80. Solve the logarithmic equation. Be sure to reject any value of x that is not in the domain of the original logarithmic expressions. Give the exact answer.

$\log_4(x + 10) - \log_4(x - 5) = 2$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- A. The solution set is $\{$ _____ $\}$.
  (Simplify your answer. Use a comma to separate answers as needed.)
- B. There is no solution.

81. Solve the logarithmic equation. Be sure to reject any value of x that is not in the domain of the original logarithmic expressions. Give the exact answer.

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

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- A. The solution set is $\{$ _____ $\}$.
  (Simplify your answer. Use a comma to separate answers as needed.)
- B. There is no solution.

82. The formula $A = 23.1\,e^{0.0153t}$ models the population of a US state, A, in millions, t years after 2000.

a. What was the population of the state in 2000?
b. When will the population of the state reach 28.3 million?

a. In 2000, the population of the state was _____ million.

b. The population of the state will reach 28.3 million in the year _____ .
(Round down to the nearest year.)

83. The function $f(x) = 21(0.955)^x$ models the percentage of surface sunlight, $f(x)$, that reaches a depth of x feet beneath the surface of the ocean. The figure shows the graph of this function. Use the function to determine at what depth, to the nearest foot, there is 1% of surface sunlight. How is this shown on the graph of f?
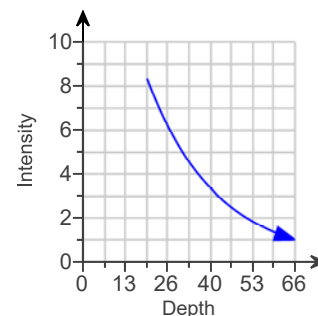
At what depth is there only 1% of surface sunlight?

_____ feet

(Do not round until the final answer. Then round to the nearest whole number as needed.)
What point on the graph represents this?

_____

(Type an ordered pair. Round to the nearest whole number as needed.)

---

84. Complete the table for a savings account subject to 4 compoundings yearly.

$$\left[A = P\left(1 + \frac{r}{n}\right)^{nt} \right]$$

Amounted Invested	Number of Compounding Periods	Annual Interest Rate	Accumulated Amount	Time t in Years
$12,000	4	5.75%	$20,000	?

Let A represent the accumulated amount, P the amount invested, n the number of compounding periods, r the annual interest rate, and t the time. Find the time, t.

t = _____ years

(Do not round until the final answer. Then round to one decimal place as needed.)

---

85. Complete the table for a savings account subject to continuous compounding.

$$\left(A = P\,e^{rt} \right)$$

Amount Invested	Annual Interest Rate	Accumulated Amount	Time t in years
$7500	12%	$15,000	?

Let A represent the accumulated amount, P the amount invested, r the annual interest rate, and t the time. Find the time, t.

t ≈ _____ years

(Round to one decimal place as needed.)

---

86. The exponential model $A = 758\,e^{0.032t}$ describes the population, A, of a country in millions, t years after 2003. Use the model to determine when the population of the country will be 1044 million.

The population of the country will be 1044 million in _____ .

(Round to the nearest year as needed.)

87. An artifact originally had 16 grams of carbon-14 present. The decay model $A = 16\,e^{-0.000121t}$ describes the amount of carbon-14 present after t years. Use the model to determine how many grams of carbon-14 will be present in 7424 years.

    The amount of carbon-14 present in 7424 years will be approximately _____ grams.
    (Round to the nearest whole number.)

88. Prehistoric cave paintings were discovered in a cave in France. The paint contained 17% of the original carbon-14. Use the exponential decay model for carbon-14, $A = A_0\,e^{-0.000121t}$, to estimate the age of the paintings.

    The paintings are approximately _____ years old. (Round to the nearest integer.)

89. Use the formula $t = \dfrac{\ln 2}{k}$ that gives the time for a population, with a growth rate k, to double, to answer the following questions.

    The growth model $A = 3\,e^{0.003t}$ describes the population, A, of a country in millions, t years after 2003.

    a. What is the country's growth rate?

    _____ %

    b. How long will it take the country to double its population?

    _____ years (Round to the nearest whole number.)

90. Solve the system by the addition method.

    $x + y = 3$
    $x - y = 5$

    Select the correct choice below and fill in any answer boxes present in your choice.

    ○ **A.** The solution set is { _____ }. (Simplify your answer. Type an ordered pair.)
    ○ **B.** There are infinitely many solutions.
    ○ **C.** There is no solution.

91. Solve the given system of equations.

    $x + y + 5z = 2$
    $x + y + 3z = 4$
    $x + 2y - 3z = 13$

    Select the correct choice below and fill in any answer boxes within your choice.

    ○ **A.** There is one solution. The solution set is { (_____ , _____ , _____) }.
       (Simplify your answers.)
    ○ **B.** There are infinitely many solutions.
    ○ **C.** There is no solution.

92. Solve the system of equations using matrices. Use Gaussian elimination with back-substitution or Gauss-Jordan elimination.

$$
\begin{aligned}
4x + 4y + 8z &= 16 \\
4x + 3y + 5z &= 14 \\
4x + 6y + 6z &= 28
\end{aligned}
$$

The solution set is $\left\{ \left(\underline{\hspace{2cm}}, \underline{\hspace{2cm}}, \underline{\hspace{2cm}} \right) \right\}$. (Simplify your answers. Type an ordered triple.)

93. Solve the system using matrices. Use Gaussian elimination with back-substitution or Gauss-Jordan elimination.

$$
\begin{aligned}
x + y - z &= -4 \\
4x - y + z &= -1 \\
-x + 3y - 2z &= 1
\end{aligned}
$$

The solution set is $\left\{ \left(\underline{\hspace{2cm}}, \underline{\hspace{2cm}}, \underline{\hspace{2cm}} \right) \right\}$. (Simplify your answers. Type an ordered triple.)

94. Find the indicated sum.

$$
\sum_{i=1}^{4} i(i+4)
$$

$\displaystyle\sum_{i=1}^{4} i(i+4) = \underline{\hspace{2cm}}$ (Simplify your answer.)

95. Write out the first three terms and the last term. Then use the formula for the sum of the first n terms of an arithmetic sequence to find the indicated sum.

$$
\sum_{i=1}^{30} (-8i + 1)
$$

Find the first three terms and the last term.

$\displaystyle\sum_{i=1}^{30} (-8i + 1) = \left(\underline{\hspace{2cm}} \right) + \left(\underline{\hspace{2cm}} \right) + \left(\underline{\hspace{2cm}} \right) + \ldots + \left(\underline{\hspace{2cm}} \right)$

Find the sum of the sequence.

$\displaystyle\sum_{i=1}^{30} (-8i + 1) = \underline{\hspace{2cm}}$

96. Use the Binomial Theorem to expand the expression.

$$
(x + 7)^3
$$

$(x + 7)^3 = \underline{\hspace{2cm}}$ (Simplify your answer.)

97. Use the Binomial Theorem to expand the binomial and express the result in simplified form.

$$(8x + y)^3$$

$(8x + y)^3 = $ _____

98. Use the binomial theorem to expand the binomial.

$$(3x - 2)^3$$

$(3x - 2)^3 = $ _____ (Simplify your answer.)

99. Write the first three terms of the binomial expansion, expressing the result in simplified form.

$$(x + 5)^7$$

The first three terms of the binomial expansion are _____ .
(Simplify your answer.)

1. $-7,8$

2. $8,-4$

3. $-\dfrac{9}{4},8$

4. $0,-3$

5. $5,-7$

6. $-6,-2$

7. $\dfrac{7+\sqrt{65}}{4},\dfrac{7-\sqrt{65}}{4}$

8. $5+2i,5-2i$

9. $5,-\dfrac{4}{3}$

10. $5,\dfrac{1}{3}$

11. $-2+\sqrt{15},-2-\sqrt{15}$

12. $4+i,4-i$

13. A. The solution set is $\left\{\quad\textbf{9}\quad\right\}$.(Use a comma to separate answers as needed.)

14. -9

$x^2+27x+161$

x^2-9x-1

15.
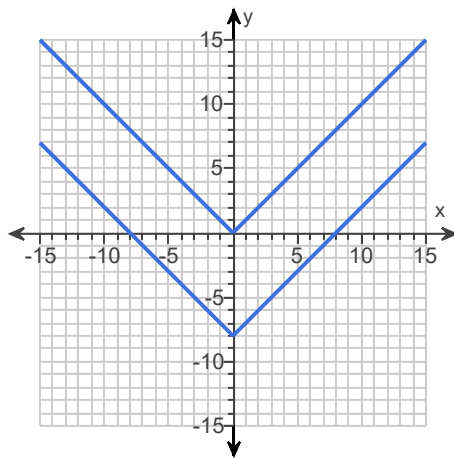
C. The graph of g is the graph of f shifted 8 units vertically down.

---

16. A. The function is increasing on the interval(s) ___(2,∞)___ .

(Type your answer in interval notation. Use a comma to separate answers as needed.)

A. The function is decreasing on the interval(s) ___(− ∞,2)___ .

(Type your answer in interval notation. Use a comma to separate answers as needed.)

B. There is no interval on which the function is constant.

---

17. A. The function is increasing on the interval(s) __(− ∞, 2),(3, 4)__ .

(Type your answer in interval notation. Use a comma to separate answers as needed.)

A. The function is decreasing on the interval(s) __(2, 3),(4, ∞)__ .

(Type your answer in interval notation. Use a comma to separate answers as needed.)

B. The function is never constant.

---

18. − 3

4

− 4, − 2

0,0

---

19. A.
The function f has (a) relative maxima(maximum) at ___− 2___ and the relative maxima(maximum) are(is)
___51___ .
(Use a comma to separate answers as needed.)

A.
The function f has (a) relative minima(minimum) at ___3___ and the relative minima(minimum) are(is)
___− 74___ .
(Use a comma to separate answers as needed.)

20.
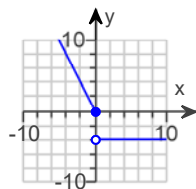
B.

$\{-4\}\cup[0,\infty)$

21.
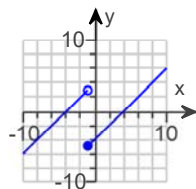
B.

$(-\infty,\infty)$

22.
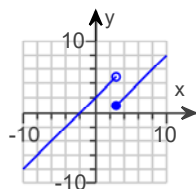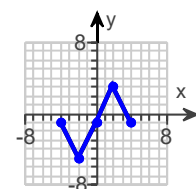

B.

$(-\infty,\infty)$

---

23. $2x + h - 2$
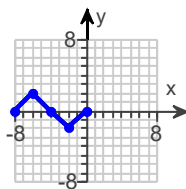
---

24. D. (25,45)

A. (45,75)

---

25. 45

26
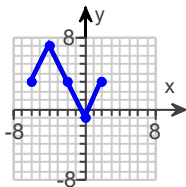

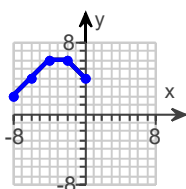26.

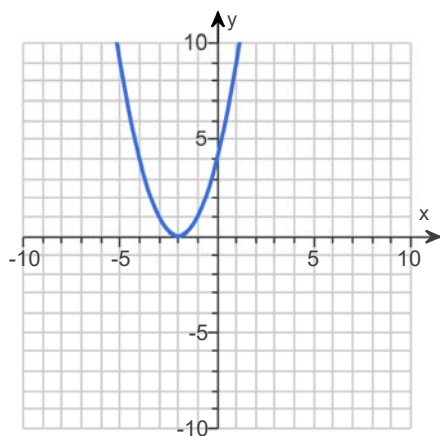D.

27.

    D.

28.

    B.

29.

    B.

30.

31. $[8,\infty)$

32. $(-\infty,2]$

33. $7x - 7$

   $(-\infty,\infty)$

   $5x + 11$

   $(-\infty,\infty)$

   $6x^2 - 52x - 18$

   $(-\infty,\infty)$

   $\dfrac{6x + 2}{x - 9}$

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

---

34. $4x^2 - 30x + 36$

   $(-\infty,\infty)$

   $4x^2 - 32x + 48$

   $(-\infty,\infty)$

   $4x^3 - 55x^2 + 228x - 252$

   $(-\infty,\infty)$

   $4x - 7$

   $(-\infty,6)\cup(6,\infty)$

---

35. $3x + 3$

   $3x + 1$

   12

   10

---

36. $20x^2 - 25$

   $80x^2 - 200x + 120$

   -25

   120

---

37. $-2x^2 - x - 2$

   $2x^2 - 5x + 6$

   -12

   4

---

38. 10

---

39. (9,4)

40.
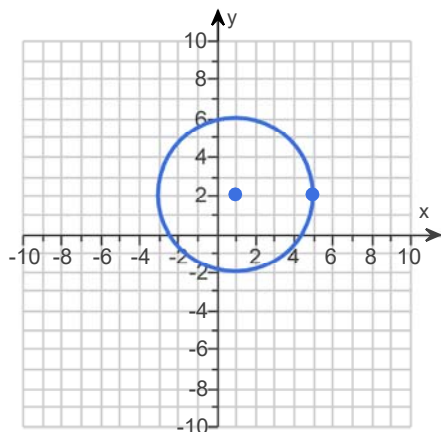
[−3,5]

[−2,6]

41. $(x+4)^2 + (y+3)^2 = 4$
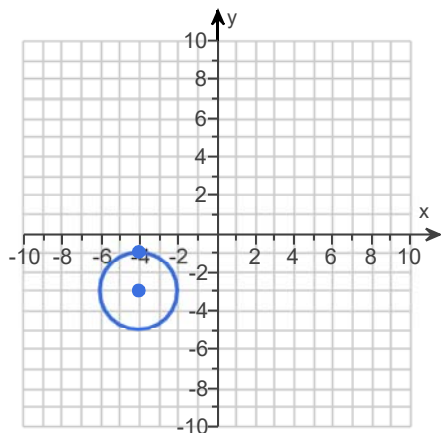
42. D. $f(x) = (x-1)^2 + 1$

43. (−2,8)

44.
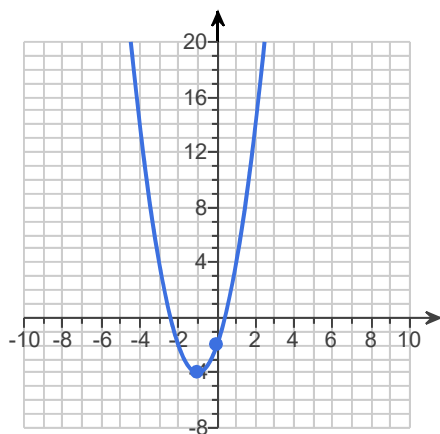
x = − 1

(− ∞,∞)

[− 4,∞)

45.
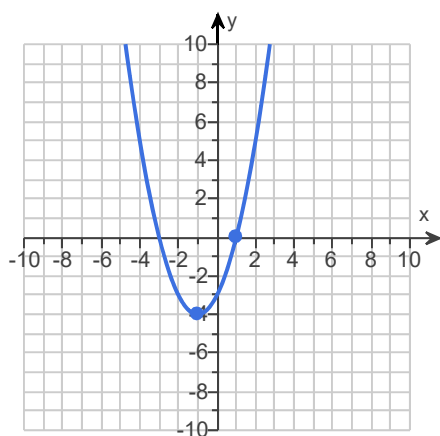
x = − 1

(− ∞,∞)

[− 4,∞)

46.
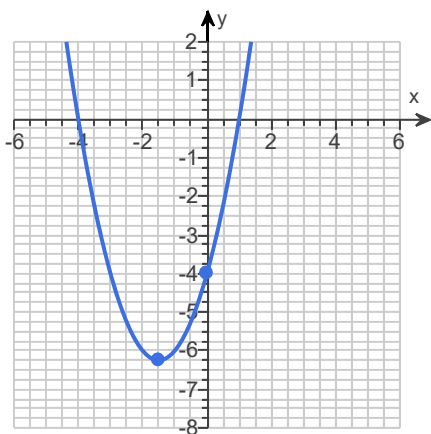
x = − 1.5

(− ∞,∞)

[− 6.25,∞)

47.
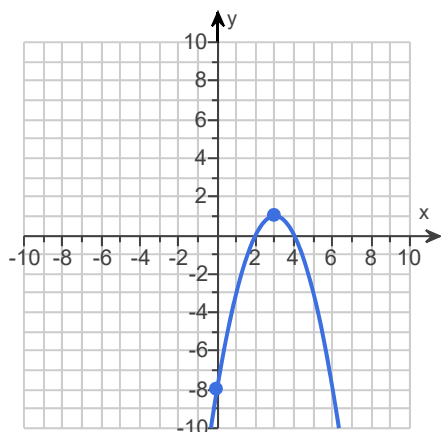
x = 3

(− ∞,∞)

(− ∞,1]

48. 1,7,5

49. C. − 1,1, − 2,2, − 3,3, − 6,6

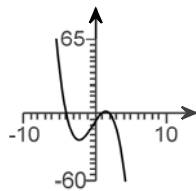50. 1, − 1,5, − 5,50, − 50,2, − 2,10, − 10,25, − 25

2

2,5, − 5

51.

B. $\pm 1, \pm 7, \pm \dfrac{1}{2}, \pm \dfrac{7}{2}, \pm \dfrac{1}{3}, \pm \dfrac{7}{3}, \pm \dfrac{1}{4}, \pm \dfrac{7}{4}, \pm \dfrac{1}{6}, \pm \dfrac{7}{6}, \pm \dfrac{1}{12}, \pm \dfrac{7}{12}$
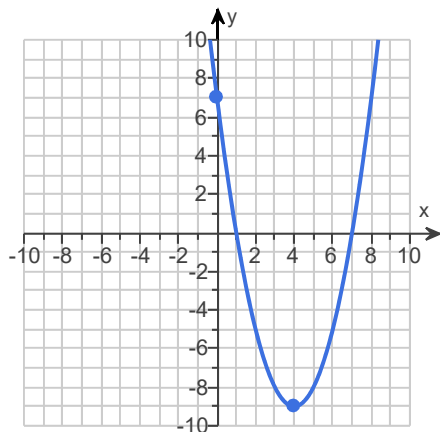
-7

$-7, \dfrac{1}{4}, \dfrac{1}{3}$

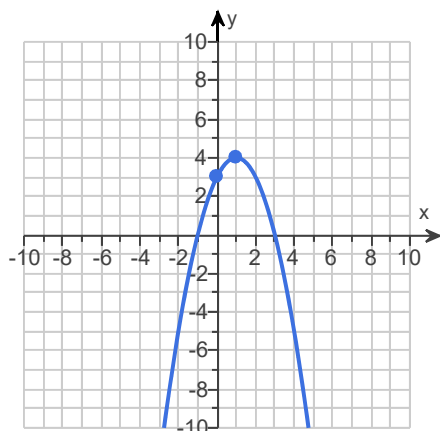52. $-1, 5+3i, 5-3i$

---

53. $-4, 1, 2$

A.

54.

$x = 4$

$(-\infty, \infty)$

$[-9, \infty)$

55.

x = 1

$(-\infty, \infty)$

$(-\infty, 4]$

56. (1) horizontal asymptote

    (2) y = 0.

57. y = 4x + 6

58. B. The vertical asymptote(s) is(are) ___**x = 6**___ . There are no holes.

59. B. The vertical asymptote(s) is(are) ___**x = − 4**___ . There are no holes.

60. C. The vertical asymptote(s) is(are) ___**x = 6, x = 0**___ . There are no holes.

61. B. Vertical asymptote(s) at x = ___**2**___ and hole(s) at x = ___**8**___

62. A. The horizontal asymptote is ___**y = 0**___ . (Type an equation.)

63. A. The horizontal asymptote is ___**y = 4**___ . (Type an equation.)

64. A. The horizontal asymptote is ___**y = 2**___ . (Type an equation.)

65. A. The horizontal asymptote is ___**$y = -\dfrac{7}{3}$**___ .

    (Type an equation. Simplify your answer. Use integers or fractions for any numbers in the equation.)

66. $(-\infty, 13)$

---

67. $3\log_b x + \log_b y - 2\log_b z$

---

68. $\dfrac{1}{2}\log_f a + 8\log_f b - 2\log_f c$

---

69. $3\ln x + \dfrac{1}{2}\ln\left(x^2 + 4\right) - 7\ln(x + 4)$

---

70. $1 + 5\log x + \dfrac{1}{3}\log(7 - x) - \log 3 - 2\log(x + 4)$

---

71. 2

---

72. 2

---

73. 7

---

74. $\ln \dfrac{13}{3}$

1.47

---

75. $\dfrac{\ln 803}{3}$

2.23

---

76. $\dfrac{2 - \ln 538}{8}$

-0.54

---

77. $\dfrac{\ln 297}{\ln 8} - 3$

-0.26

---

78. A. The solution set is $\left\{ \dfrac{12}{11} \right\}$. (Type an exact answer in simplified form.)

---

79. A. The solution set is { **9** }.(Simplify your answer. Use a comma to separate answers as needed.)

80. A. The solution set is { **6** }.(Simplify your answer. Use a comma to separate answers as needed.)

81. A. The solution set is { **1** }.(Simplify your answer. Use a comma to separate answers as needed.)

82. 23.1

    2013

83. 66

    (66,1)

84. 8.9

85. 5.8

86. 2013

87. 7

88. 14,644

89. 0.3

    231

90. A. The solution set is { **(4, − 1)** }. (Simplify your answer. Type an ordered pair.)

91. A.
    There is one solution. The solution set is {(**4** , **3** , **− 1**)}. (Simplify your answers.)

92. 1

    5

    − 1

93. -1

    6

    9

---

94. 70

---

95. -7

    -15

    -23

    -239

    $-3,690$

---

96. $x^3 + 21x^2 + 147x + 343$

---

97. $512x^3 + 192x^2y + 24xy^2 + y^3$

---

98. $27x^3 - 54x^2 + 36x - 8$

---

99. $x^7 + 35x^6 + 525x^5$