

## Written Assignment 3

2 points each except for 5, 6, 9, 15, 16, which are 4 points each as indicated.

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### 3.1

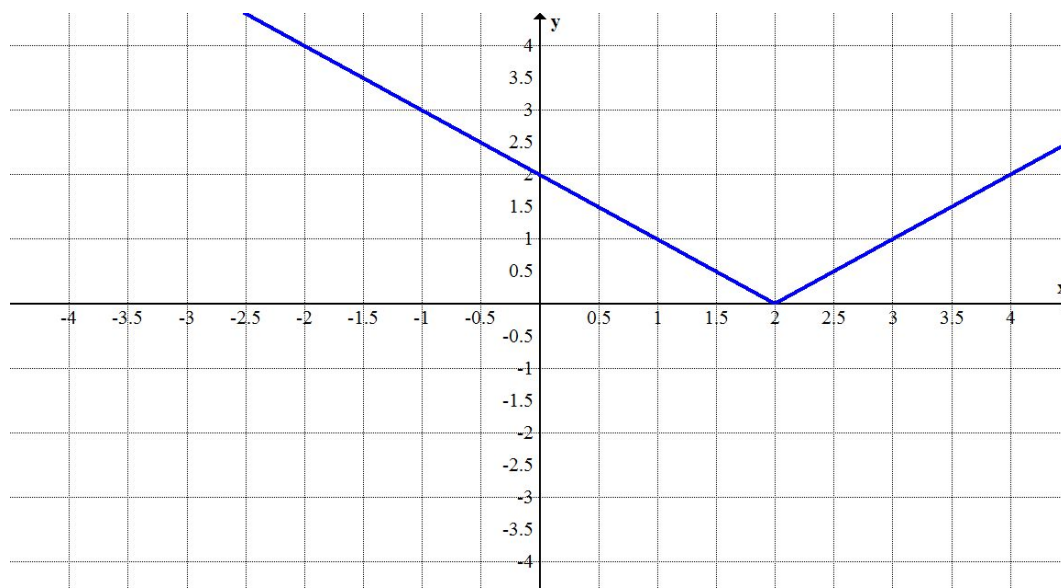
#### Algebraic

For the following exercises, determine whether the relation represents  $y$  as a function of  $x$ . If the relation represents a function then write the relation as a function of  $x$  using  $f$  as the function.

1.  $x + y^2 = 5$
2. Consider the relationship  $7n - \sqrt{5m} = 4$ .
  - a. Write the relationship as a function  $n = k(m)$ .
  - b. Evaluate  $k(5)$ .
  - c. Solve for  $k(m) = 7$ .

#### GRAPHICAL

3. Given the following graph
  - a. Evaluate  $f(4)$
  - b. Solve for  $f(x) = 4$



## Numeric

For the following exercises, determine whether the relation represents a function.

4.  $\{(0, 5), (-5, 8), (0, -8)\}$

For the following exercises, determine if the relation represented in table form represents  $y$  as a function of  $x$ .

5. For the following exercises, use the function  $f$  represented in table below. (4 points)

|        |     |     |    |   |    |     |     |
|--------|-----|-----|----|---|----|-----|-----|
| $x$    | -18 | -12 | -6 | 0 | 6  | 12  | 18  |
| $f(x)$ | 24  | 17  | 10 | 3 | -4 | -11 | -18 |

- Evaluate  $f(-6)$ .
- Solve  $f(x) = -11$
- Evaluate  $f(12)$
- Solve  $f(x) = -18$

For the following exercises, evaluate the expressions, given functions  $f$ ,  $g$ , and  $h$ :

$$f(x) = 4x + 2; \quad g(x) = 7 - 6x; \quad h(x) = 7x^2 - 3x + 6$$

6.  $f(-1) \cdot g(1) \cdot h(0)$      (4 points)

### Real-world applications

7. The number of cubic yards of compost,  $C$ , needed to cover a garden with area  $a$  square feet is given by  $C = h(a)$ .
- A garden with area 5,000 ft<sup>2</sup> requires 25 yd<sup>3</sup> of compost. Express this information in terms of the function  $h$ .
  - Explain the meaning of the statement  $h(2500) = 12.5$ .

## 3.2

### Algebraic

For the following exercises, find the domain and range of each function and state it using interval notation.

8.  $f(x) = \frac{\sqrt{9-2x}}{\sqrt{5x+13}}$

### Numeric

For the following exercises, given each function  $f$ , evaluate  $f(3)$ ,  $f(-2)$ ,  $f(1)$ , and  $f(0)$ . (4 points)

9. 
$$f(x) = \begin{cases} x-1 & x \leq 1 \\ 2x+3 & x > 1 \end{cases}$$

### Real-World Applications

10. The height  $h$  of a projectile is a function of the time  $t$  it is in the air. The height in meters for  $t$  seconds is given by the function  $h(t) = -9.8t^2 + 19.6t$ . What is the domain of the function? What does the domain mean in the context of the problem?

### 3.3

#### Algebraic

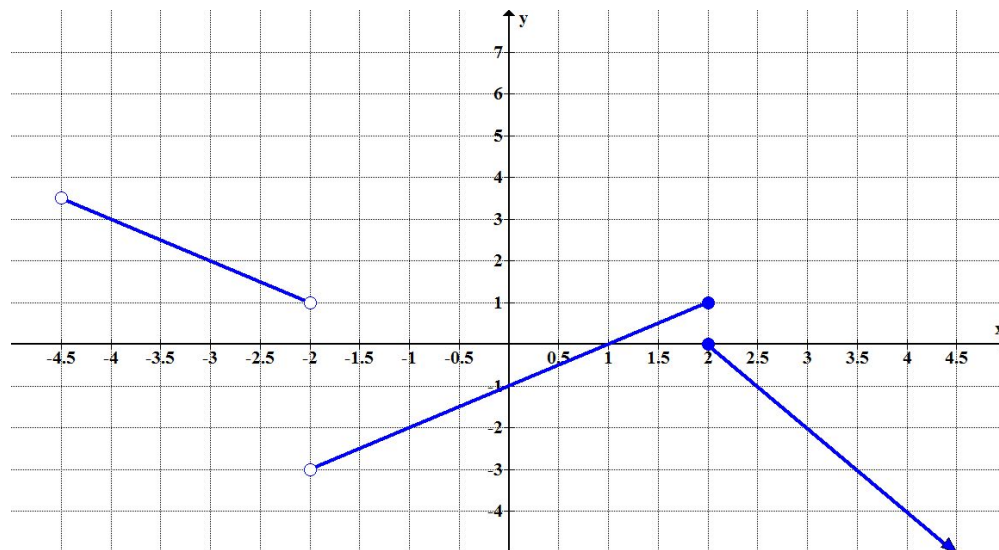
For the following exercises, find the average rate of change of each function on the interval specified for real numbers  $b$  or  $h$  in simplest form.

11.  $k(x) = \frac{2}{3x+1}$  on  $[2, 2+h]$

#### Graphical

For the following exercises, use the graph of each function to **estimate** the intervals on which the function is increasing or decreasing.

12.



For the following exercises, find the average rate of change of each function on the interval specified.

13.  $g(x) = 3x^2 - \frac{2}{3x^3}$  on  $[1, 3]$

### Real-World Applications

14. Near the surface of the moon, the distance that an object falls is a function of time. It is given by  $d(t) = 1.6t^2$ , where  $t$  is in seconds and  $d(t)$  is in meters. If an object is dropped from a certain height, find the average velocity of the object from  $t = 2$  to  $t = 5$ .

## 3.4

### Algebraic

For the following exercises, determine the domain for each function in interval notation.

(4 points)

15.  $f(x) = \sqrt{2x+5}$  and  $g(x) = |4x+9|$ , find  $f-g$ ,  $f+g$ ,  $fg$ , and  $\frac{f}{g}$

For the following exercises, use each set of functions to find  $g(f(h(x)))$ . Simplify your answers. (4 points)

16.  $f(x) = x^3 - 3$ ,  $g(x) = 6 - x$ , and  $h(x) = \sqrt{2x}$

### Numeric

For the following exercises, use the function values for  $f$  and  $g$  shown in table below to evaluate each expression.

|             |    |    |    |    |    |    |    |    |    |
|-------------|----|----|----|----|----|----|----|----|----|
| <b>x</b>    | -8 | -6 | -4 | -2 | 0  | 2  | 4  | 6  | 8  |
| <b>f(x)</b> | 15 | 8  | 9  | 6  | 3  | 0  | -3 | -6 | -8 |
| <b>g(x)</b> | -6 | -1 | 3  | 7  | 11 | 15 | -8 | 23 | 0  |

17.

- a.  $(f \circ g)(4)$
- b.  $(f \circ g)(-8)$
- c.  $(g \circ f)(-6)$
- d.  $(g \circ f)(8)$

For the following exercises, use each pair of functions to find  $f(g(-1))$  and  $g(f(-1))$ .

18.  $f(x) = \frac{-6}{2x+5}$ ,  $g(x) = -x^2 + 7$

### Real-World Applications

19. The radius  $r$ , in inches, of a spherical balloon is related to the volume,  $V$ , by  $r = \sqrt[3]{\frac{3V}{4\pi}}$ . Air is pumped into the balloon, so the volume after  $t$  seconds is given by  $V(t) = 15 + 18t$ . Find the composite function  $r(V(t))$  and use it to answer the following questions. Round the results to the nearest hundredth of a second.

[MO3.6]

- a. At what exact time is the radius 10 inches?
- b. At what exact time is the radius 20 inches?
- c. At what exact time is the radius 30 inches?

## 3.5

### Algebraic

For the following exercises, write a formula for the function obtained when the graph is shifted as described.

20.  $g(x) = |x|$  is shifted up 3 units and to the left 1 unit.

For the following exercises, describe how the graph of the function is a transformation of the graph of the original function  $f$ .

21.  $y = f(x - 5) - 9$

For the following exercises, determine the interval(s) on which the function is increasing and decreasing.

22.  $h(x) = 6(x - 8)^2 + 7$

## GRAPHICAL

For the following exercises, sketch a graph of the function as a transformation of the graph of one of the toolkit (basic) functions. State the transformation in words.

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

## Numeric

For the following exercises, determine whether the function is odd, even, or neither.

24.  $f(x) = (x + 4)^2$

For the following exercises, write a formula for the function  $f$  that results when the graph of a given toolkit function is transformed as described.

25. The graph of  $f(x) = |x|$  is reflected over the  $x$ -axis, shifted vertically up 1 unit, horizontally compressed by a factor of  $\frac{3}{7}$ .

### 3.6

#### Algebraic

26. Describe the situation in which the distance that point  $x$  is from 18 is at least 13 units. Express this using absolute value notation.

For the following exercises, find the  $x$ - and  $y$ -intercepts of the graphs of each function.

27.  $f(x) = |x + 9| - 11$

#### Real-World Applications

28. A machinist must produce a circular metal brace that is within 0.001 inches of the correct diameter of 6.5 inches. Using  $x$  as the diameter of the circular metal brace, write this statement using absolute value notation.

### 3.7

#### Algebraic

For the following exercises, find  $f^{-1}(x)$  for each function.

29.  $f(x) = -2x - 13$

For the following exercises, find a domain on which each function  $f$  is one-to-one and non-decreasing. Write the domain in interval notation. Then find the inverse of  $f$  restricted to that domain.

30.  $f(x) = (x + 11)^2 - 14$

### Graphical

For the following exercises, use a graphing utility to determine whether each function is one-to-one.

31.  $f(x) = (x - 3)^2 + 6$

### Numeric

For the following exercises, evaluate or solve, assuming that the function  $f$  is one-to-one.

32. If  $f\left(\frac{2}{3}\right) = \frac{3}{2}$ , find  $f^{-1}\left(\frac{3}{2}\right)$ .

### Real-World Applications

33. The area  $A$  of a circle is a function of its radius given by  $A(r) = \pi r^2$ . Express the radius of a circle as a function of its area. Call this function  $r(A)$ . Find  $r(64\pi)$  and interpret its meaning.

## 4.1

### Algebraic

For the following exercises, determine whether the equation of the curve can be written as a linear function.

34.  $x + 6 = 4y - 2$

For the following exercises, find the slope of the line that passes through the two given points.

35.  $(-3, 5)$  and  $(6, -11)$

For the following exercises, given each set of information, find a linear equation satisfying the conditions, if possible.

36. x-intercept at  $(2, 0)$  and y-intercept at  $(0, 3)$

For the following exercises, determine whether the lines given by the equations below are parallel, perpendicular, or neither.

37.  $3x + 8y = 12$  and  $15 - 8y = 3x$

For the following exercises, find the x- and y-intercepts of each equation.

38.  $\frac{3x}{5} + \frac{7y}{9} = \frac{2}{3}$

For the following exercises, use the descriptions of each pair of lines given below to find the slopes of Line 1 and Line 2. Is each pair of lines parallel, perpendicular, or neither?

39. Line 1: Passes through  $(2, 3)$  and  $(4, -1)$  Line 2: Passes through  $(6, 3)$  and  $(12, 6)$

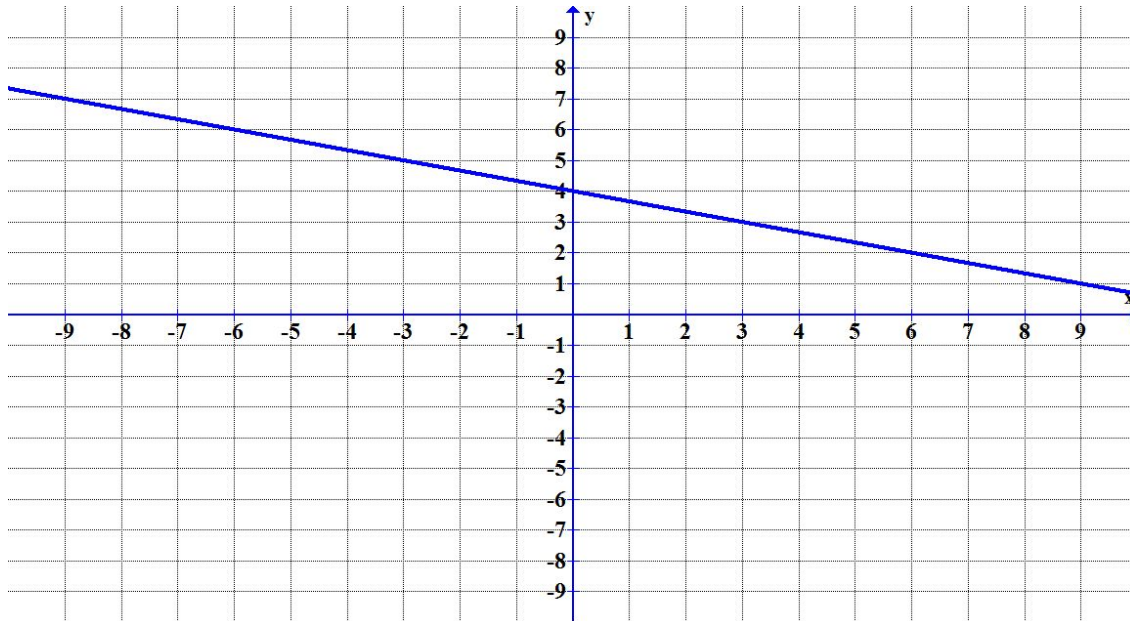
For the following exercises, write an equation for the line described.

40. Write an equation for a line perpendicular to  $p(t) = -11t + 14$  and passing through the point  $(-3, -1)$ .

## Graphical

For the following exercises, find the slope of the lines graphed.

41.



For

the following exercises, sketch a line with the given features.

42. An y-intercept of  $(0, -7)$  and slope  $\frac{3}{5}$

For the following exercises, sketch the graph of each equation.

43.  $g(x) = \frac{2x}{3} - \frac{1}{2}$

## Real-World Applications

44. At noon, a waitress notices that she has \$12 in her tip jar. If she makes an average of \$2.25 from each customer, how much will she have in her tip jar if she serves  $n$  more customers during her shift?

## 4.2

### Algebraic

For the following exercises, consider this scenario:

45. The weight of a newborn is 7.25 pounds. The baby gained three-eighths pound a month for its first year.
- Find the linear function that models the baby's weight,  $W$ , as a function of the age of the baby, in months,  $t$ .
  - When did the baby weight 9.875 pounds?
  - What is the baby's weight after 10.5 months?