

# Test Bank

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## Precalculus with Limits A Graphing Approach

**SEVENTH EDITION**

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The Pennsylvania State University,  
The Behrend College



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# Contents

## Chapter 1: Functions and Their Graphs

Test Form A .....	1
Test Form B .....	10
Test Form C .....	19
Test Form D .....	31
Test Form E.....	42
Test Form F.....	56

## Chapter 2: Polynomial and Rational Functions

Test Form A .....	71
Test Form B .....	80
Test Form C .....	89
Test Form D .....	102
Test Form E.....	113
Test Form F.....	124

## Chapter 3: Exponential and Logarithmic Functions

Test Form A .....	137
Test Form B .....	150
Test Form C .....	159
Test Form D .....	171
Test Form E.....	182
Test Form F.....	191

## Chapter 4: Trigonometric Functions

Test Form A .....	202
Test Form B .....	215
Test Form C .....	225
Test Form D .....	234
Test Form E.....	245
Test Form F.....	256

## Chapter 5: Analytic Trigonometry

Test Form A .....	265
Test Form B .....	275
Test Form C .....	284
Test Form D .....	294
Test Form E.....	304
Test Form F.....	315

## Chapter 6: Additional Topics in Trigonometry

Test Form A .....	326
Test Form B .....	338
Test Form C .....	347
Test Form D .....	356
Test Form E.....	367
Test Form F.....	378

<b>Chapter 7: Linear Systems and Matrices</b>	
Test Form A .....	389
Test Form B .....	402
Test Form C .....	415
Test Form D .....	426
Test Form E.....	437
Test Form F.....	449
<b>Chapter 8: Sequences, Series, and Probability</b>	
Test Form A .....	461
Test Form B .....	471
Test Form C .....	482
Test Form D .....	491
Test Form E.....	501
Test Form F.....	511
<b>Chapter 9: Topics in Analytic Geometry</b>	
Test Form A .....	522
Test Form B .....	536
Test Form C .....	547
Test Form D .....	561
Test Form E.....	576
Test Form F.....	589
<b>Chapter 10: Analytic Geometry in Three Dimensions</b>	
Test Form A .....	601
Test Form B .....	608
Test Form C .....	615
Test Form D .....	622
Test Form E.....	629
Test Form F.....	637
<b>Chapter 11: Limits and an Introduction to Calculus</b>	
Test Form A .....	644
Test Form B .....	653
Test Form C .....	661
Test Form D .....	670
Test Form E.....	679
Test Form F.....	690

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1. Use function notation to write  $g$  in terms of  $f(x) = x^3$ .

$$g(x) = -\frac{1}{5}(x+4)^3$$

A)  $g(x) = -\frac{1}{5}[f(x)]^3 + 4$

B)  $g(x) = -\frac{1}{5}[f(x) + 4]$

C)  $g(x) = -[f(x)]^3 + \frac{64}{5}$

D)  $g(x) = -\frac{1}{5}[f(x)]^3 + 64$

E)  $g(x) = -\frac{1}{5}[f(x+4)]$

2. Hooke's Law states that the force  $F$  required to compress or stretch a spring (within its elastic limits) is proportional to the distance  $d$  that the spring is compressed or stretched from its original length. That is,  $F = kd$ , where  $k$  is the measure of the stiffness of the spring and is called the *spring constant*. The table below shows the elongation  $d$  in centimeters of a spring when a force of  $F$  kilograms is applied.

Force, $F$	Elongation, $d$
20	3.5
40	6.3
60	10.0
80	13.3
100	16.5

Find the equation of the line that seems to best fit the data.

- A)  $F = 12.098d$   
 B)  $F = 3.024d$   
 C)  $F = 6.049d$   
 D)  $F = 4.537d$   
 E)  $F = 7.561d$

3. Find
- $(fg)(x)$
- .

$$f(x) = \sqrt{-5x} \qquad g(x) = \sqrt{-8x+6}$$

- A)  $(fg)(x) = 2x\sqrt{10} - \sqrt{30}x$   
 B)  $(fg)(x) = 2x\sqrt{10-30x}$   
 C)  $(fg)(x) = \sqrt{-13x+6}$   
 D)  $(fg)(x) = \sqrt{40x^2+6}$   
 E)  $(fg)(x) = \sqrt{40x^2-30x}$
4. If  $f$  is an even function, determine if  $g$  is even, odd, or neither.  
 $g(x) = -f(x-2)$
- A) even  
 B) odd  
 C) cannot be determined  
 D) neither
5. Given the following function,  $h(x)$ , find two functions  $f$  and  $g$  such that  
 $(f \circ g)(x) = h(x)$ .

$$h(x) = \sqrt[3]{x^2-11}$$

- A)  $f(x) = \sqrt[3]{x^2}$ ,  $g(x) = -11$   
 B)  $f(x) = \sqrt[3]{x^2}$ ,  $g(x) = x-11$   
 C)  $f(x) = \sqrt[3]{x}$ ,  $g(x) = x-11$   
 D)  $f(x) = \sqrt[3]{x-11}$ ,  $g(x) = x^2$   
 E)  $f(x) = \sqrt[3]{x-11}$ ,  $g(x) = x+11$
6. Evaluate the following function at the specified value of the independent variable and simplify.

$$f(w) = \frac{-7w^2+20}{w^2}; \quad f(0)$$

- A) 20  
 B) 0  
 C) -7  
 D) 13  
 E) undefined

7. Determine algebraically whether the following function is one-to-one.

$$|x-5|, x \leq 5$$

A)  $|a-5| = |b-5|$

$$5-a = 5-b \quad ; \text{ one-to-one}$$

$$-a = -b$$

$$a = b$$

B)  $|a-5| = |b-5|$

$$|a|-5 = |b|-5 \quad ; \text{ one-to-one}$$

$$|a| = |b|$$

$$a = b$$

C)  $|a-5| = |b-5|$

$$a+5 = 5-b \quad ; \text{ not one-to-one}$$

$$a = -b$$

D)  $|a-5| = |b-5|$

$$|-5|-a = |-5|+b \quad ; \text{ not one-to-one}$$

$$-a = b$$

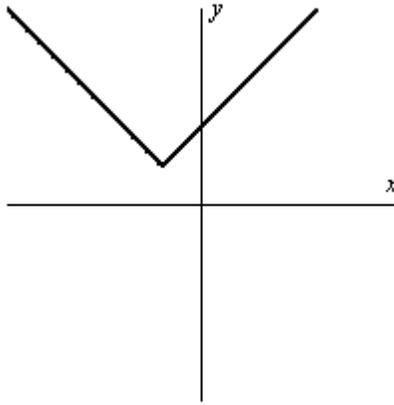
E)  $|a-5| = |b-5|$

$$|-5|-a = |-5|-b \quad ; \text{ one-to-one}$$

$$-a = -b$$

$$a = b$$

8. Determine an equation that may be represented by the graph shown below.



- A)  $f(x) = |x + 1| - 1$   
 B)  $f(x) = |x - 1| + 1$   
 C)  $f(x) = |x + 1| + 1$   
 D)  $f(x) = |x - 1| - 1$   
 E)  $f(x) = -|x - 1| + 1$
9. Determine the domain and range of the inverse function  $f^{-1}$  of the following function  $f$ .  
 $f(x) = -|x + 6| + 2$ , where  $x > -6$
- A) Domain:  $[-6, \infty)$ ; Range:  $[2, \infty)$   
 B) Domain:  $(-\infty, 2]$ ; Range:  $[-6, \infty)$   
 C) Domain:  $[-6, 2]$ ; Range:  $[-6, \infty)$   
 D) Domain:  $(-\infty, -6]$ ; Range:  $[-2, \infty)$   
 E) Domain:  $(-\infty, \infty)$ ; Range:  $(-\infty, \infty)$
10. Find the domain of the function.  
 $f(y) = \sqrt{9 - y^2}$
- A)  $-3 \leq y \leq 3$   
 B)  $y \leq -3$  or  $y \geq 3$   
 C)  $y \geq 0$   
 D)  $y \leq 3$   
 E) all real numbers

11. Find the slope-intercept form of the line passing through the points.  
 $(-1, -6), (0, -2)$
- A)  $y = 4x + 23$   
 B)  $y = 4x - 2$   
 C)  $y = \frac{1}{4}x - \frac{23}{4}$   
 D)  $y = -\frac{1}{4}x + \frac{1}{2}$   
 E)  $y = -4x - 10$
12. Write the slope-intercept form of the equation of the line through the given point perpendicular to the given line.  
 point:  $(-4, 7)$       line:  $-5x - 15y = -6$
- A)  $y = \frac{1}{5}x + \frac{39}{5}$   
 B)  $y = -\frac{1}{3}x + \frac{17}{3}$   
 C)  $y = 3x + 19$   
 D)  $y = -5x + 27$   
 E)  $y = 3x - \frac{5}{3}$
13. Compare the graph of the following function with the graph of  $f(x) = |x|$ .
- $$y = \left| \frac{4}{9}x \right|$$
- A) vertical shift of  $\frac{4}{9}$  units up  
 B) horizontal stretch of  $\frac{9}{4}$  units  
 C) vertical shrink of  $\frac{4}{9}$  units  
 D) horizontal shrink of  $\frac{4}{9}$  units  
 vertical shift of  $\frac{9}{4}$  units  
 E) horizontal shrink of  $\frac{4}{9}$  units

14. Which equation does not represent  $y$  as a function of  $x$ ?

- A)  $x = 2y + 5$
- B)  $x = 6$
- C)  $y = -5x - 7$
- D)  $y = |6 + 9x^2|$
- E)  $y = \sqrt{-8 + 4x}$

15. Evaluate the function at the specified value of the independent variable and simplify.

$$q(p) = \frac{-2p}{5p - 2}$$

$$q(x - 9)$$

- A)  $\frac{-2x + 18}{5x - 47}$
- B)  $\frac{-2x - 18}{5x - 47}$
- C)  $\frac{-2p + 18}{5p - 47}$
- D)  $\frac{18}{43}$
- E)  $-\frac{18}{47}$

16. Determine the domain of  $g(x) = \frac{1}{x^2 - 49}$ .

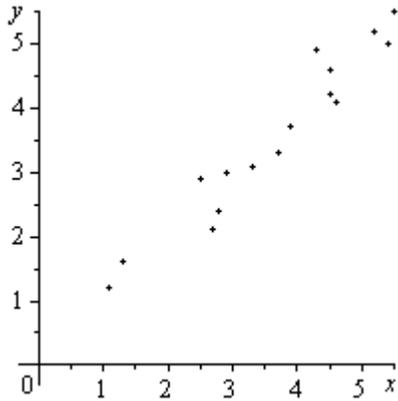
- A)  $[-7, 7]$
- B)  $(-7, 0] \cup [0, 7)$
- C)  $(-\infty, -7) \cup (-7, 7) \cup (7, \infty)$
- D)  $(-\infty, -7] \cup [7, \infty)$
- E)  $(-\infty, \infty)$

17. Find the difference quotient and simplify your answer.

$$f(w) = -9w^2 + 2w, \quad \frac{f(4+h) - f(4)}{h}, h \neq 0$$

- A)  $10 + h$
- B)  $-70 - 9w + \frac{16}{w}$
- C)  $2 - 9w + \frac{16}{w}$
- D)  $2 - 9h$
- E)  $-70 - 9h$

18. The scatter plots of different data are shown below. Determine whether there is a positive correlation, negative correlation, or no discernible correlation between the variables.



- A) positive correlation
- B) negative correlation
- C) no discernible correlation

19. Evaluate the following function for  $f(x) = -2x^2 + 1$  and  $g(x) = x + 4$  algebraically.

$$\left(\frac{f}{g}\right)(q-4)$$

A)  $\frac{-2q^2 + 5}{q + 8}$

B)  $\frac{-2q^2 + 8q - 31}{q}$

C)  $\frac{-2q^2 + 5}{q}$

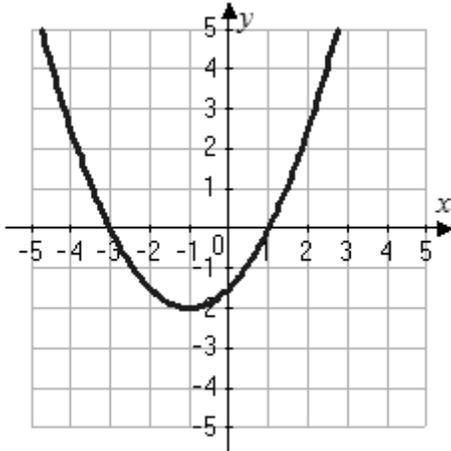
D)  $\frac{-2q^2 + 16q - 31}{q}$

E)  $\frac{-2q^2 - 3}{q}$

20. Use the graph of

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

to write an equation for the function whose graph is shown.



A)  $f(x) = (x+1)^2 - 2$

B)  $f(x) = (x-1)^2 - 2$

C)  $f(x) = (x+1)^2 + 2$

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

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

## Answer Key

1. E
2. C
3. E
4. C
5. D
6. E
7. A
8. C
9. B
10. A
11. B
12. C
13. B
14. B
15. A
16. C
17. E
18. A
19. D
20. E

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Evaluate the indicated function for
- $f(x) = x^2 - 5$
- and
- $g(x) = x + 9$
- .

$$(fg)(-1)$$

- A) -32  
 B) -48  
 C) -46  
 D) 40  
 E) -50

2. Find the value(s) of
- $x$
- for which
- $f(x) = g(x)$
- .

$$f(x) = x^2 - 7x + 3 \qquad g(x) = -3x + 8$$

- A) 3, 10,  $\frac{8}{3}$   
 B) 3, -7,  $\frac{8}{3}$   
 C) 5, -1  
 D) -5, 1  
 E) 4,  $\frac{8}{3}$

3. Find
- $(f - g)(x)$
- .

$$f(x) = -\frac{8x}{4x+7} \qquad g(x) = -\frac{4}{x}$$

- A)  $(f - g)(x) = \frac{-8x+4}{3x+7}$   
 B)  $(f - g)(x) = \frac{-8x+23}{4x+7}$   
 C)  $(f - g)(x) = \frac{-8x+9}{4x+7}$   
 D)  $(f - g)(x) = \frac{-8x^2+16x-28}{4x^2+7x}$   
 E)  $(f - g)(x) = \frac{-8x^2+16x+28}{4x^2+7x}$

4. If  $f$  is an even function, determine if  $g$  is even, odd, or neither.

$$g(x) = f(-x) + 1$$

- A) even  
 B) odd  
 C) cannot be determined  
 D) neither

5. Evaluate the function at the specified value of the independent variable and simplify.

$$f(p) = \frac{-3p}{4p - 3}$$

$$f(s + 8)$$

- A)  $\frac{-3s - 24}{4s + 29}$   
 B)  $\frac{-3s + 24}{4s + 29}$   
 C)  $\frac{-3p - 24}{4p + 29}$   
 D)  $\frac{24}{35}$   
 E)  $-\frac{24}{29}$

6. Determine the domain of  $g(x) = \frac{1}{x^2 - 81}$ .

- A)  $[-9, 9]$   
 B)  $(-9, 0] \cup [0, 9)$   
 C)  $(-\infty, -9) \cup (-9, 9) \cup (9, \infty)$   
 D)  $(-\infty, -9] \cup [9, \infty)$   
 E)  $(-\infty, \infty)$

7. Determine whether lines  $L_1$  and  $L_2$  passing through the pairs of points are parallel, perpendicular, or neither.

$$L_1: (7, -4), (-9, -1)$$

$$L_2: (4, -6), (-3, 9)$$

- A) parallel  
 B) perpendicular  
 C) neither

8. Algebraically determine whether the function below is even, odd, or neither.

$$f(q) = 2q^{3/2}$$

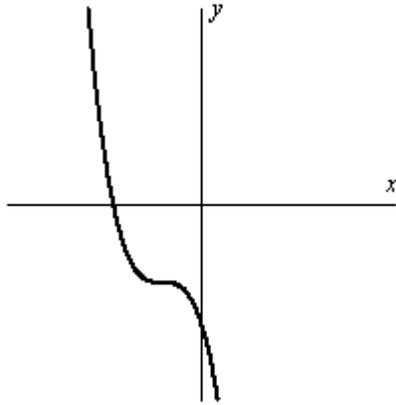
- A) even
- B) odd
- C) cannot be determined
- D) neither

9. Find  $f \circ g$ .

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

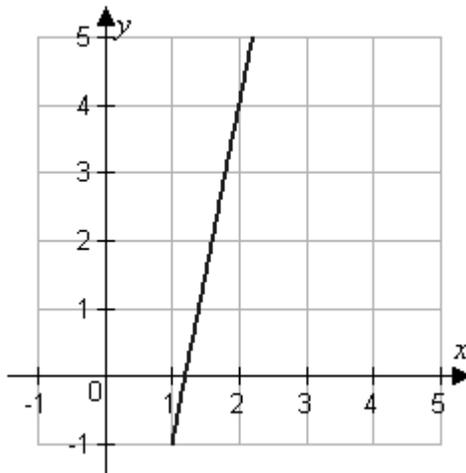
- A)  $(f \circ g)(x) = \frac{5}{x^2}$
- B)  $(f \circ g)(x) = \frac{5}{x^2 + 4x}$
- C)  $(f \circ g)(x) = \frac{2x^2 + 3}{x^2 - 4}$
- D)  $(f \circ g)(x) = \frac{7}{x^2 - 4}$
- E)  $(f \circ g)(x) = \frac{2x^2 - 3}{x^2 - 4}$

10. Determine an equation that may be represented by the graph shown below.



- A)  $f(x) = (x-1)^3 + 2$   
 B)  $f(x) = -(x-1)^3 + 2$   
 C)  $f(x) = -(x-1)^3 - 2$   
 D)  $f(x) = -(x+1)^3 - 2$   
 E)  $f(x) = -(x+1)^3 + 2$

11. Estimate the slope of the line.



- A) -5  
 B) 0  
 C) 5  
 D)  $\frac{1}{5}$   
 E)  $\frac{2}{5}$

12. Compare the graph of the following function with the graph of  $f(x) = |x|$ .

$$y = \left| \frac{1}{9}x \right|$$

- A) vertical shift of  $\frac{1}{9}$  unit up
- B) horizontal stretch of  $\frac{9}{1}$  unit
- C) vertical shrink of  $\frac{1}{9}$  unit
- D) horizontal shrink of  $\frac{1}{9}$  unit  
vertical shift of  $\frac{9}{1}$  unit
- E) horizontal shrink of  $\frac{1}{9}$  unit
13. Use a graphing utility to graph the function and visually determine the intervals over which the function is increasing, decreasing, or constant.

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

- A) decreasing on  $(0, 0)$   
increasing on  $(0, \infty)$
- B) increasing on  $(-\infty, -1)$   
decreasing on  $(-1, 0)$   
increasing on  $(0, 1)$   
decreasing on  $(1, \infty)$
- C) decreasing on  $(-\infty, -1)$   
increasing on  $(-1, 1)$   
decreasing on  $(1, \infty)$
- D) increasing on  $(-\infty, 0)$   
decreasing on  $(0, \infty)$
- E) decreasing on  $(-\infty, -1)$   
increasing on  $(-1, 0)$   
decreasing on  $(0, 1)$   
increasing on  $(1, \infty)$

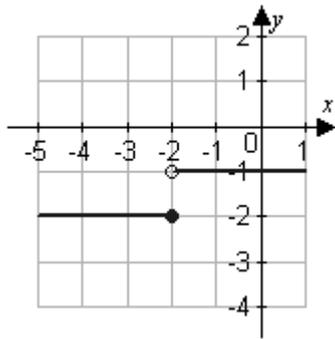
14. Hooke's Law states that the force  $F$  required to compress or stretch a spring (within its elastic limits) is proportional to the distance  $d$  that the spring is compressed or stretched from its original length. That is,  $F = kd$ , where  $k$  is the measure of the stiffness of the spring and is called the *spring constant*. The table below shows the elongation  $d$  in centimeters of a spring when a force of  $F$  kilograms is applied.

Force, $F$	Elongation, $d$
20	2.8
40	5.0
60	8.0
80	10.6
100	13.2

Find the equation of the line that seems to best fit the data. Use the model to estimate the elongation of the spring when a force of 50 kilograms is applied. Round your answer to one decimal place.

- A) 13.2 centimeters  
 B) 9.9 centimeters  
 C) 3.3 centimeters  
 D) 6.6 centimeters  
 E) 5.0 centimeters
15. Find  $f \circ g$ .
- $f(x) = 3x - 2$                        $g(x) = x - 5$
- A)  $(f \circ g)(x) = 3x - 17$   
 B)  $(f \circ g)(x) = 3x - 7$   
 C)  $(f \circ g)(x) = 3x^2 - 17x + 10$   
 D)  $(f \circ g)(x) = 2x + 3$   
 E)  $(f \circ g)(x) = 2x - 7$

16. Use the graph of the function to find the domain and range of  $f$ .



- A) domain :  $(-\infty, -2) \cup (-2, \infty)$   
 range :  $(-\infty, -2) \cup (-1, \infty)$
- B) domain :  $(-\infty, -2) \cup (-2, \infty)$   
 range :  $\{-2, -1\}$
- C) domain : all real numbers  
 range :  $\{-2, -1\}$
- D) domain :  $(-\infty, -2) \cup (-2, \infty)$   
 range :  $(-1, 1)$
- E) domain :  $\{-2, -1\}$   
 range : all real numbers

17. Find the inverse function of  $f$ .

$$f(x) = x^5 + 5$$

- A)  $f^{-1}(x) = -\sqrt[5]{x} + 5$
- B)  $f^{-1}(x) = \sqrt[5]{x} + 5$
- C)  $f^{-1}(x) = -\sqrt[5]{x+5}$
- D)  $f^{-1}(x) = \sqrt[5]{x-5}$
- E)  $f^{-1}(x) = \sqrt[5]{x} - 5$

18. Evaluate the following function at the specified value of the independent variable and simplify.

$$f(u) = \frac{4u^2 + 12}{u^2}; \quad f(0)$$

- A) 12  
 B) 0  
 C) 4  
 D) 16  
 E) undefined
19. Find  $g \circ f$ .

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

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

- A)  $(g \circ f)(x) = x^2 + 2$   
 B)  $(g \circ f)(x) = x^2 - 4$   
 C)  $(g \circ f)(x) = x^2 + 4$   
 D)  $(g \circ f)(x) = x^2 + 2x + 4$   
 E)  $(g \circ f)(x) = x^2 + 4x + 4$

20. Find all real values of  $x$  such that  $f(x) = 0$ .

$$f(x) = \frac{-3x - 2}{5}$$

- A)  $-\frac{2}{15}$   
 B)  $\pm\frac{2}{15}$   
 C)  $\pm\frac{2}{3}$   
 D)  $-\frac{2}{3}$   
 E)  $\frac{2}{3}$

## Answer Key

1. A
2. C
3. E
4. A
5. A
6. C
7. C
8. D
9. E
10. D
11. C
12. B
13. E
14. D
15. A
16. C
17. D
18. E
19. E
20. D

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Find the difference quotient and simplify your answer.

$$f(s) = -2s^2 - 2s, \quad \frac{f(4+h) - f(4)}{h}, h \neq 0$$

- A)  $6 + h$   
 B)  $-18 - 2s - \frac{16}{s}$   
 C)  $-2 - 2s - \frac{16}{s}$   
 D)  $-2 - 2h$   
 E)  $-18 - 2h$

2. Determine whether the function has an inverse function. If it does, find the inverse function.

$$f(x) = x^2 + 5$$

- A) No inverse function exists.  
 B)  $f^{-1}(x) = \sqrt{x} + 5, x \geq 0$   
 C)  $f^{-1}(x) = \sqrt{x} - 5$   
 D)  $f^{-1}(x) = \sqrt{x + 5}, x \geq -6$   
 E)  $f^{-1}(x) = \sqrt{x - 5}$

3. Which equation does not represent
- $y$
- as a function of
- $x$
- ?

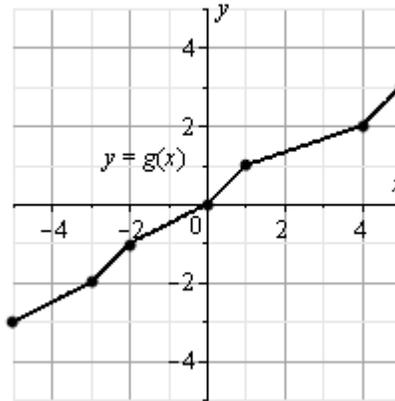
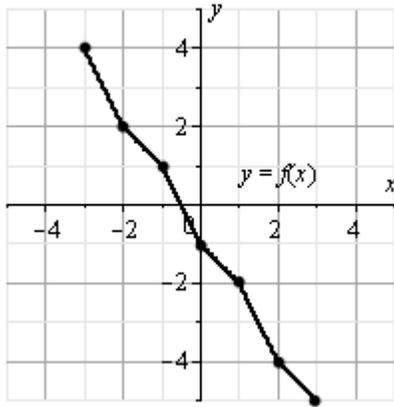
- A)  $x = -9y + 2$   
 B)  $x = -1$   
 C)  $y = 7x - 9$   
 D)  $y = |6 - x^2|$   
 E)  $y = \sqrt{-9 + 6x}$

4. Determine the domain and range of the inverse function  $f^{-1}$  of the following function  $f$ .

$$f(x) = -|x + 7| - 1, \text{ where } x > -7$$

- A) Domain:  $[-7, \infty)$ ; Range:  $[-1, \infty)$
- B) Domain:  $(-\infty, -1]$ ; Range:  $[-7, \infty)$
- C) Domain:  $[-7, -1]$ ; Range:  $[-7, \infty)$
- D) Domain:  $(-\infty, -7]$ ; Range:  $[1, \infty)$
- E) Domain:  $(-\infty, \infty)$ ; Range:  $(-\infty, \infty)$

5. Use the graphs of  $y = f(x)$  and  $y = g(x)$  to evaluate  $(g^{-1} \circ f^{-1})(-4)$ .



- A) 4
- B) 1.3
- C) 0
- D) -2
- E) -2.5

6. Compare the graph of the following function with the graph of  $f(x) = x^3$ .

$$y = [5(x + 10)]^3$$

- A) vertical shift of 10 units up  
 B) vertical shift of 10 units up  
 horizontal shrink of  $\frac{1}{5}$  units  
 C) horizontal shift of 10 units to the left  
 horizontal shrink of  $\frac{1}{125}$  units  
 D) horizontal shift of 10 units to the left  
 horizontal stretch of  $\frac{1}{5}$  units  
 E) horizontal shift of 10 units to the left  
 vertical shift of 5 units up
7. Find  $f \circ g$ .

$$f(x) = |x^2 - 6| \qquad g(x) = -9 - x$$

- A)  $(f \circ g)(x) = |x^2 + 18x + 75|$   
 B)  $(f \circ g)(x) = |x^2 + 75|$   
 C)  $(f \circ g)(x) = |-3 - x^2|$   
 D)  $(f \circ g)(x) = |-15 - x^2|$   
 E)  $(f \circ g)(x) = -9 - |x^2 - 6|$

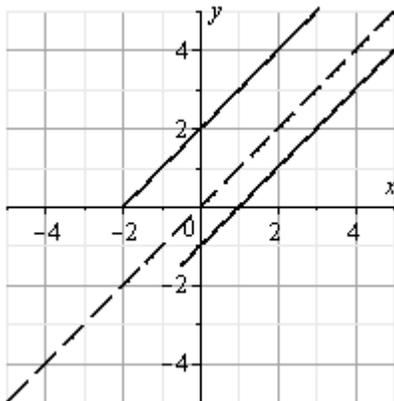
8. The average lengths  $L$  of cellular phone calls in minutes from 1999 to 2004 are shown in the table below.



Year	Average length, $L$ (in minutes)
1999	2.38
2000	2.56
2001	2.74
2002	2.73
2003	2.87
2004	3.05

Use the *regression* feature of a graphing utility to find a linear model for the data. Let  $t$  represent the year, with  $t = 9$  corresponding to 1999. Use the model to predict the average lengths of cellular phone calls for the year 2015. Round your answer to two decimal places.

- A) 4.37 minutes  
 B) 8.74 minutes  
 C) 5.37 minutes  
 D) 3.37 minutes  
 E) 2.19 minutes
9. Decide whether the two functions shown in the graph below appear to be inverse functions of each other.



- A) yes  
 B) no  
 C) not enough information

10. Use a graphing utility to graph the function and visually determine the intervals over which the function is increasing, decreasing, or constant.

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

- A) increasing on  $(-\infty, -1)$   
 decreasing on  $(-1, 1)$   
 increasing on  $(1, \infty)$
- B) decreasing on  $(-\infty, 0)$   
 increasing on  $(0, \infty)$
- C) decreasing on  $(-\infty, \infty)$
- D) increasing on  $(-\infty, \infty)$
- E) decreasing on  $(-\infty, -1)$   
 increasing on  $(-1, 1)$   
 decreasing on  $(1, \infty)$
11. Find the value(s) of  $x$  for which  $f(x) = g(x)$ .

$$f(x) = x^2 - 13x + 5 \quad g(x) = -9x + 2$$

- A) 5, 18,  $\frac{2}{9}$
- B) 5, -13,  $\frac{2}{9}$
- C) 3, 1
- D) -3, -1
- E) 8,  $\frac{2}{9}$

12. Use function notation to write  $g$  in terms of  $f(x) = x^3$ .

$$g(x) = -\frac{1}{4}(x+9)^3$$

A)  $g(x) = -\frac{1}{4}[f(x)]^3 + 9$

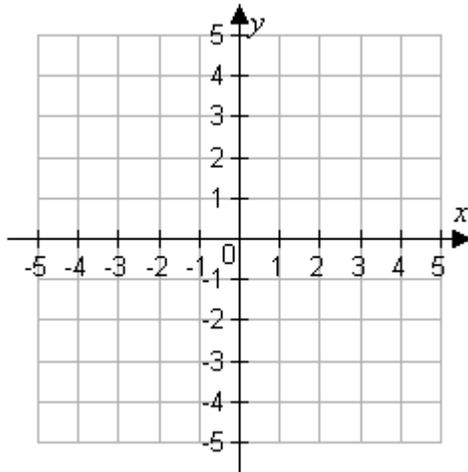
B)  $g(x) = -\frac{1}{4}[f(x) + 9]$

C)  $g(x) = -[f(x)]^3 + \frac{729}{4}$

D)  $g(x) = -\frac{1}{4}[f(x)]^3 + 729$

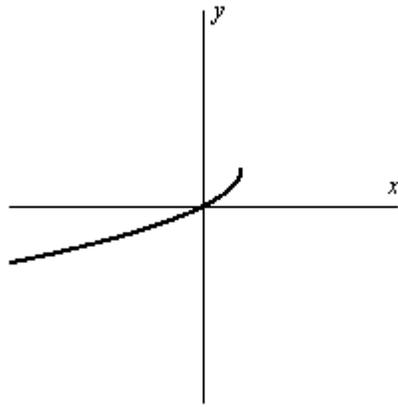
E)  $g(x) = -\frac{1}{4}[f(x+9)]$

13. Plot the points and find the slope of the line passing through the pair of points.  
(3, 4), (-2, 4)



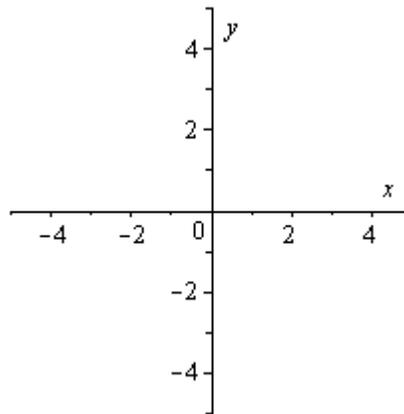
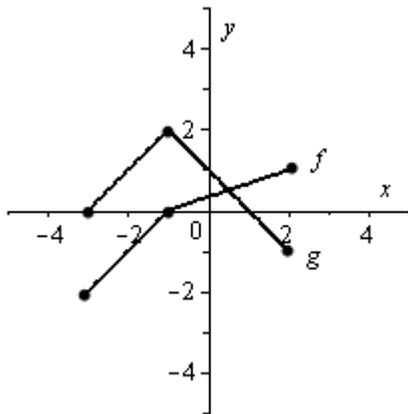
- A) slope: 0  
 B) slope: 1  
 C) slope: -5  
 D) slope:  $-\frac{1}{5}$   
 E) slope: undefined

14. Determine an equation that may be represented by the graph shown below.

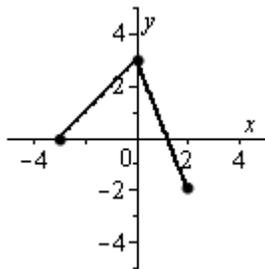


- A)  $f(x) = 1 - \sqrt{1 - x}$
- B)  $f(x) = -1 - \sqrt{1 - x}$
- C)  $f(x) = -1 + \sqrt{1 - x}$
- D)  $f(x) = -1 - \sqrt{1 + x}$
- E)  $f(x) = -1 + \sqrt{1 + x}$

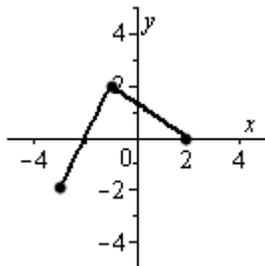
15. Use the graphs of  $f$  and  $g$ , shown below, to graph  $h(x) = (f + g)(x)$ .



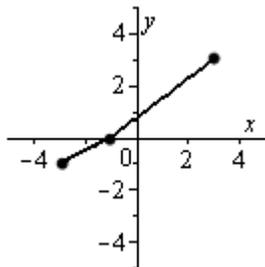
A)



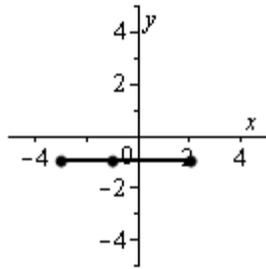
B)



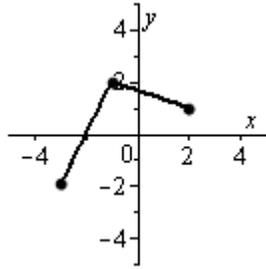
C)



D)



E)



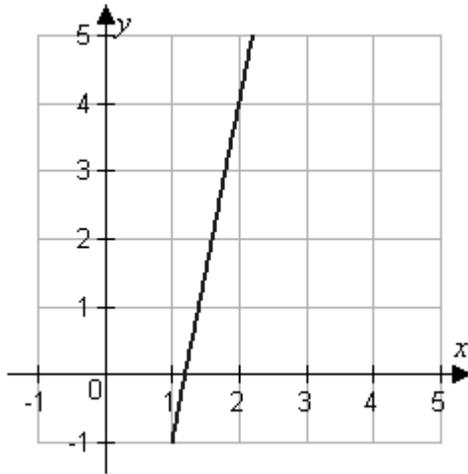
16. Evaluate the function at the specified value of the independent variable and simplify.

$$f(y) = 2y + 7$$

$$f(-1.4)$$

- A)  $-2.8y + 14$
- B)  $-9.8$
- C)  $4.2$
- D)  $-1.4y + 7$
- E)  $-1.4y - 7$

17. Estimate the slope of the line.



- A)  $-5$
- B)  $0$
- C)  $5$
- D)  $\frac{1}{5}$
- E)  $\frac{2}{5}$

18. Use the functions  $f(x) = \frac{1}{125}x - 5$  and  $g(x) = x^3$  to find  $(f \circ g)^{-1}$ .

- A)  $(f \circ g)^{-1} = \frac{x^3 + 5}{5}$
- B)  $(f \circ g)^{-1} = \frac{x^3 - 625}{125}$
- C)  $(f \circ g)^{-1} = \frac{\sqrt[3]{x+5}}{5}$
- D)  $(f \circ g)^{-1} = 5x + 5$
- E)  $(f \circ g)^{-1} = 5\sqrt[3]{x+5}$

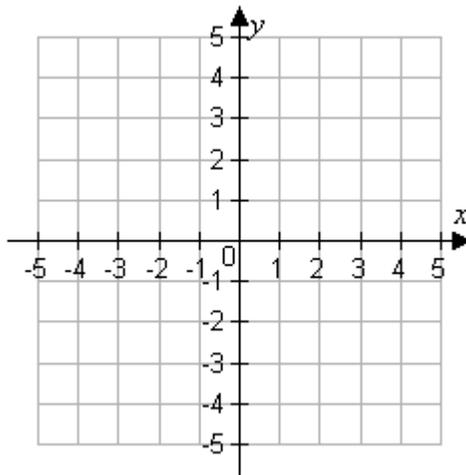
19. Find all real values of  $x$  such that  $f(x) = 0$ .

$$f(x) = \frac{7x - 5}{7}$$

- A)  $\frac{5}{49}$   
 B)  $\pm \frac{5}{49}$   
 C)  $\pm \frac{5}{7}$   
 D)  $\frac{5}{7}$   
 E)  $-\frac{5}{7}$

20. Graph the function and determine the interval(s) for which  $f(x) \geq 0$ .

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



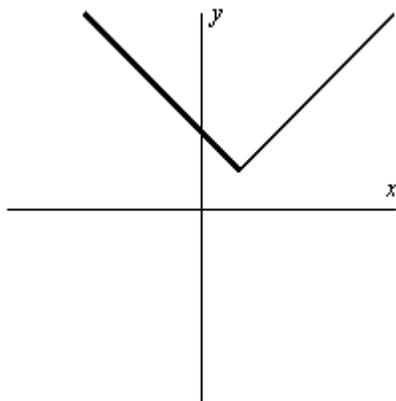
- A)  $(-\infty, 0] \cup [4, \infty)$   
 B)  $[0, 4]$   
 C)  $(0, 4)$   
 D)  $(-\infty, 0) \cup (4, \infty)$   
 E)  $\{4\}$

## Answer Key

1. E
2. A
3. B
4. B
5. A
6. C
7. A
8. A
9. B
10. E
11. C
12. E
13. A
14. A
15. B
16. C
17. C
18. E
19. D
20. B

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Determine an equation that may be represented by the graph shown below.



- A)  $f(x) = |x - 1| - 1$   
 B)  $f(x) = -|x - 1| + 1$   
 C)  $f(x) = |x - 1| + 1$   
 D)  $f(x) = |x + 1| + 1$   
 E)  $f(x) = |x + 1| - 1$

2. Find the inverse function of
- $f$
- .

$$f(x) = x^5 - 1$$

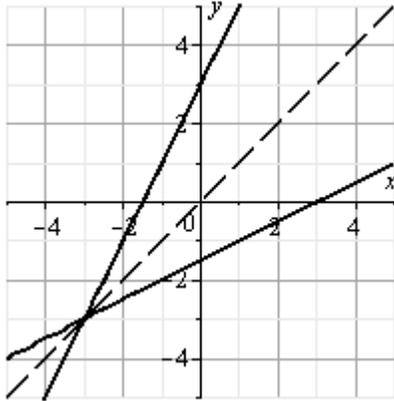
- A)  $f^{-1}(x) = -\sqrt[5]{x} - 1$   
 B)  $f^{-1}(x) = \sqrt[5]{x} - 1$   
 C)  $f^{-1}(x) = -\sqrt[5]{x-1}$   
 D)  $f^{-1}(x) = \sqrt[5]{x+1}$   
 E)  $f^{-1}(x) = \sqrt[5]{x} + 1$

3. Find the domain of the function.

$$g(w) = \frac{4w}{w+9}$$

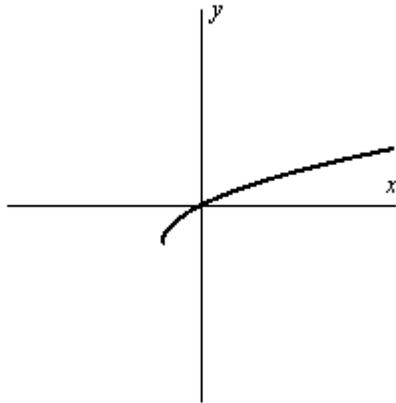
- A) all real numbers  $w \neq -9$   
 B) all real numbers  $w \neq -9, w \neq 0$   
 C) all real numbers  
 D)  $w = -9, w = 0$   
 E)  $w = -9$

4. Decide whether the two functions shown in the graph below appear to be inverse functions of each other.



- A) no  
 B) yes  
 C) not enough information

5. Determine an equation that may be represented by the graph shown below.



- A)  $f(x) = -1 + \sqrt{1+x}$   
 B)  $f(x) = 1 - \sqrt{1-x}$   
 C)  $f(x) = -1 - \sqrt{1-x}$   
 D)  $f(x) = -1 + \sqrt{1-x}$   
 E)  $f(x) = -1 - \sqrt{1+x}$

6. Which equation does not represent  $y$  as a function of  $x$ ?

- A)  $x = 6y - 9$
- B)  $x = -5$
- C)  $y = x + 5$
- D)  $y = |-1 - x^2|$
- E)  $y = \sqrt{-5 + 4x}$

7. Determine algebraically whether the following function is one-to-one.

$$f(x) = \frac{5x^2}{3x^2 + 6}, \text{ where } x > 0$$

$$\begin{aligned} \text{A) } \frac{5a^2}{3a^2 + 6} &= \frac{5b^2}{3b^2 + 6} \\ \frac{5a^2}{3a^2} + \frac{5a^2}{6} &= \frac{5b^2}{3b^2} + \frac{5b^2}{6} \\ \frac{5}{3} + \frac{5a^2}{6} &= \frac{5}{3} + \frac{5b^2}{6} \\ \frac{30 + 5a^2}{18} &= \frac{30 + 5b^2}{18} \quad ; \text{ not one-to-one} \\ 30 + 5a^2 &= 30 + 5b^2 \\ 5a^2 &= 5b^2 \\ a^2 &= b^2 \\ \pm a &= \pm b \end{aligned}$$

$$\begin{aligned} \text{B) } \frac{5a^2}{3a^2 + 6} &= \frac{5b^2}{3b^2 + 6} \\ \frac{5}{3+6} &= \frac{5}{3+6} \quad ; \text{ one-to-one} \\ \frac{5}{6} &= \frac{3}{6} \\ a &= b \end{aligned}$$

$$\begin{aligned} \text{C) } \frac{5a^2}{3a^2 + 6} &= \frac{5b^2}{3b^2 + 6} \\ \frac{5a^2}{3a^2} &= \frac{5b^2}{3b^2} \quad ; \text{ one-to-one} \\ \frac{5}{3} &= \frac{5}{3} \\ a &= b \end{aligned}$$

$$\begin{aligned}
 \text{D)} \quad \frac{5a^2}{3a^2+6} &= \frac{5b^2}{3b^2+6} \\
 \frac{5a^2}{9a^2} &= \frac{5b^2}{9b^2} && \text{; one-to-one} \\
 \frac{5a}{9} &= \frac{5b}{9} \\
 5a &= 5b \\
 a &= b
 \end{aligned}$$

$$\begin{aligned}
 \text{E)} \quad \frac{5a^2}{3a^2+6} &= \frac{5b^2}{3b^2+6} \\
 \frac{5a^2}{3a^2} + \frac{5a^2}{6} &= \frac{5b^2}{3b^2} + \frac{5b^2}{6} \\
 \frac{5}{3} + \frac{5a^2}{6} &= \frac{5}{3} + \frac{5b^2}{6} && \text{; one-to-one} \\
 \frac{30+5a^2}{18} &= \frac{30+5b^2}{18} \\
 30+5a^2 &= 30+5b^2 \\
 5a^2 &= 5b^2 \\
 a^2 &= b^2 \\
 a &= b
 \end{aligned}$$

8. Find  $f \circ g$ .

$$f(x) = x + 3 \qquad g(x) = \frac{4}{x^2 - 9}$$

$$\begin{aligned}
 \text{A)} \quad (f \circ g)(x) &= \frac{4}{x^2} \\
 \text{B)} \quad (f \circ g)(x) &= \frac{4}{x^2 + 6x} \\
 \text{C)} \quad (f \circ g)(x) &= \frac{3x^2 + 1}{x^2 - 9} \\
 \text{D)} \quad (f \circ g)(x) &= \frac{7}{x^2 - 9} \\
 \text{E)} \quad (f \circ g)(x) &= \frac{3x^2 - 23}{x^2 - 9}
 \end{aligned}$$

9. Use function notation to write  $g$  in terms of  $f(x) = \sqrt{x}$ .

$$g(x) = -\frac{1}{3}\sqrt{x-8} + 7$$

A)  $g(x) = -f(x-8) + 6$

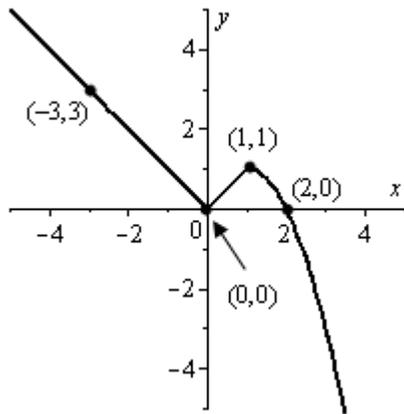
B)  $g(x) = -\frac{1}{3}f(x) - 1$

C)  $g(x) = -\frac{1}{3}f(x-8) + 7$

D)  $g(x) = f(x) + 7$

E)  $g(x) = f(x-8) - \frac{7}{3}$

10. Determine a piecewise-defined function for the graph shown below.



A)  $f(x) = \begin{cases} |x|, & x \leq 1 \\ -(x-1)^2 + 1, & x > 1 \end{cases}$

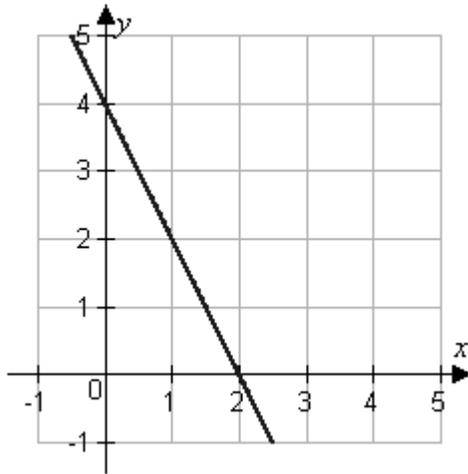
B)  $f(x) = \begin{cases} |x|, & x \leq 0 \\ -(x-1)^2 + 1, & x \leq 0 \end{cases}$

C)  $f(x) = \begin{cases} |x|, & x \geq 1 \\ -x^2, & x \leq 1 \end{cases}$

D)  $f(x) = \begin{cases} |x|, & x \geq 0 \\ -x^2, & x \leq 1 \end{cases}$

E)  $f(x) = \begin{cases} |x|, & x \leq 1 \\ -(x-1)^2, & x > 1 \end{cases}$

11. Estimate the slope of the line.



- A)  $-\frac{1}{2}$
- B) 2
- C) -2
- D)  $\frac{1}{2}$
- E) -3

12. Determine whether the function is even, odd, or neither.

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

- A) neither
- B) even
- C) odd

13. Find the slope and y-intercept of the equation of the line.

$$y = -2x + 3$$

- A) slope:  $-\frac{1}{2}$ ; y-intercept: 3
- B) slope:  $\frac{1}{3}$ ; y-intercept: -2
- C) slope: -2; y-intercept: 3
- D) slope: 3; y-intercept: -2
- E) slope: -2; y-intercept: -3

14. Determine whether lines  $L_1$  and  $L_2$  passing through the pairs of points are parallel, perpendicular, or neither.

$$L_1: (-1, 1), (-1, -6)$$

$$L_2: (3, -8), (24, -8)$$

- A) parallel  
 B) perpendicular  
 C) neither

15. Show algebraically that the functions  $f$  and  $g$  shown below are inverse functions.

$$f(x) = \sqrt[3]{8x-7}, \quad g(x) = \frac{x^3+7}{8}$$

$$\begin{aligned} \text{A) } f(g(x)) &= \sqrt[3]{8\left(\frac{x^3+7}{8}\right)-7} & g(f(x)) &= \frac{(\sqrt[3]{8x-7})^3+7}{8} \\ &= \sqrt[3]{(x^3+56)-56} & &= \frac{8x-7^3+7^3}{8} \\ &= \sqrt[3]{x^3+56-56} & &= \frac{8x}{8} \\ &= \sqrt[3]{x^3} & &= x \\ &= x \end{aligned}$$

$$\begin{aligned} \text{B) } f(g(x)) &= \sqrt[3]{8\left(\frac{x^3+7}{8}\right)-7} & g(f(x)) &= \frac{(\sqrt[3]{8x-7})^3+7}{8} \\ &= \sqrt[3]{(x^3+7)-7} & &= \frac{8x-7+7}{8} \\ &= \sqrt[3]{x^3+7-7} & &= \frac{8x}{8} \\ &= \sqrt[3]{x^3} & &= x \\ &= x \end{aligned}$$

$$\begin{aligned} \text{C) } f(g(x)) &= \sqrt[3]{8\left(\frac{x^3+7}{8}\right)-7} & g(f(x)) &= \frac{(\sqrt[3]{8x-7})^3+7}{8} \\ &= \sqrt[3]{\left(\frac{8x^3+7}{8}\right)-7} & &= \frac{8^3x-7+7}{8^3} \\ &= \sqrt[3]{x^3+7-7} & &= \frac{8^3x}{8^3} \\ &= \sqrt[3]{x^3} & &= x \\ &= x \end{aligned}$$

$$\begin{aligned}
 \text{D) } f(g(x)) &= \sqrt[3]{8\left(\frac{x^3+7}{8}\right)-7} & g(f(x)) &= \frac{(\sqrt[3]{8x-7})^3+7}{8} \\
 &= \sqrt[3]{(8x^3+56)-56} & &= \frac{8^3x-7^3+7^3}{8^3} \\
 &= \sqrt[3]{8x^3+56-56} & &= \frac{8^3x}{8^3} \\
 &= \sqrt[3]{8x^3} & &= x \\
 &= x
 \end{aligned}$$

$$\begin{aligned}
 \text{E) } f(g(x)) &= \sqrt[3]{8\left(\frac{x^3+7}{8}\right)-7} & g(f(x)) &= \frac{(\sqrt[3]{8x-7})^3+7}{8} \\
 &= \sqrt[3]{\left(x^3+\frac{7}{8}\right)-7} & &= \frac{24x-21+21}{24} \\
 &= \sqrt[3]{x^3+\frac{0}{8}} & &= \frac{24x}{24} \\
 &= \sqrt[3]{x^3} & &= x \\
 &= x
 \end{aligned}$$

16. Find all real values of  $x$  such that  $f(x) = 0$ .

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

- A)  $\frac{1}{2}$
- B)  $\pm\frac{1}{2}$
- C)  $\pm\frac{5}{2}$
- D)  $\frac{5}{2}$
- E)  $-\frac{5}{2}$

17. Compare the graph of the following function with the graph of  $f(x) = |x|$ .

$$y = \left| \frac{3}{4}x \right|$$

- A) vertical shift of  $\frac{3}{4}$  units up  
 B) horizontal stretch of  $\frac{4}{3}$  units  
 C) vertical shrink of  $\frac{3}{4}$  units  
 D) horizontal shrink of  $\frac{3}{4}$  units  
     vertical shift of  $\frac{4}{3}$  units  
 E) horizontal shrink of  $\frac{3}{4}$  units
18. Find the domain of the function.

$$g(x) = \sqrt{25 - x^2}$$

- A)  $-5 \leq x \leq 5$   
 B)  $x \leq -5$  or  $x \geq 5$   
 C)  $x \geq 0$   
 D)  $x \leq 5$   
 E) all real numbers
19. Use the functions  $f(x) = x + 4$  and  $g(x) = 5x - 7$  to find  $(g \circ f)^{-1}$ .

A)  $(g \circ f)^{-1} = \frac{5x + 11}{4}$

B)  $(g \circ f)^{-1} = 5x - 42$

C)  $(g \circ f)^{-1} = \frac{x - 13}{5}$

D)  $(g \circ f)^{-1} = \frac{-7x - 7}{5}$

E)  $(g \circ f)^{-1} = 5x + 13$

20. Find the value(s) of  $x$  for which  $f(x) = g(x)$ .

$$f(x) = x^2 - 11x - 36$$

$$g(x) = -7x - 4$$

A)  $-36, -25, -\frac{4}{7}$

B)  $-36, -11, -\frac{4}{7}$

C)  $8, -4$

D)  $-8, 4$

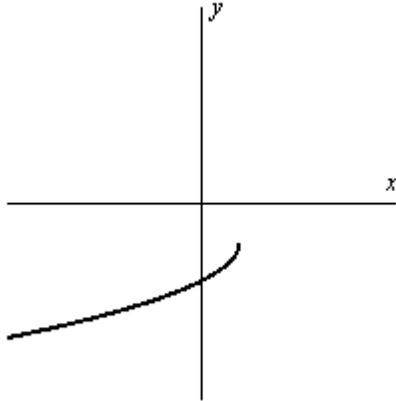
E)  $47, -\frac{4}{7}$

**Answer Key**

1. C
2. D
3. A
4. B
5. A
6. B
7. E
8. E
9. C
10. A
11. C
12. C
13. C
14. B
15. B
16. D
17. B
18. A
19. C
20. C

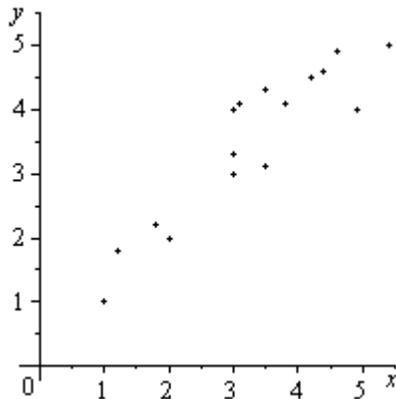
Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Determine an equation that may be represented by the graph shown below.



- A)  $f(x) = -1 - \sqrt{1-x}$
- B)  $f(x) = -1 + \sqrt{1-x}$
- C)  $f(x) = -1 - \sqrt{1+x}$
- D)  $f(x) = -1 + \sqrt{1+x}$
- E)  $f(x) = 1 - \sqrt{1-x}$

2. The scatter plots of different data are shown below. Determine whether there is a positive correlation, negative correlation, or no discernible correlation between the variables.



- A) positive correlation
- B) negative correlation
- C) no discernible correlation

3. Does the table describe a function?

Input value	-6	-3	0	3	6
Output value	11	11	11	11	11

- A) yes  
B) no

4. Find the domain of the function.

$$g(w) = \frac{-7w}{w-5}$$

- A) all real numbers  $w \neq 5$   
 B) all real numbers  $w \neq 5, w \neq 0$   
 C) all real numbers  
 D)  $w = 5, w = 0$   
 E)  $w = 5$

5. Determine the domain and range of the inverse function  $f^{-1}$  of the following function  $f$ .

$$f(x) = -|x+8| - 3, \text{ where } x > -8$$

- A) Domain:  $[-8, \infty)$ ; Range:  $[-3, \infty)$   
 B) Domain:  $(-\infty, -3]$ ; Range:  $[-8, \infty)$   
 C) Domain:  $[-8, -3]$ ; Range:  $[-8, \infty)$   
 D) Domain:  $(-\infty, -8]$ ; Range:  $[3, \infty)$   
 E) Domain:  $(-\infty, \infty)$ ; Range:  $(-\infty, \infty)$

6. Use function notation to write  $g$  in terms of  $f(x) = x^3$ .

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

A)  $g(x) = -\frac{1}{2}[f(x)]^3 + 9$

B)  $g(x) = -\frac{1}{2}[f(x) + 9]$

C)  $g(x) = -[f(x)]^3 + \frac{729}{2}$

D)  $g(x) = -\frac{1}{2}[f(x)]^3 + 729$

E)  $g(x) = -\frac{1}{2}[f(x+9)]$

7. Evaluate the indicated function for  $f(x) = x^2 - 1$  and  $g(x) = x - 6$ .

$$(fg)(-2)$$

A) -24

B) 40

C) -2

D) 12

E) 24

8. If  $f$  is an even function, determine if  $g$  is even, odd, or neither.

$$g(x) = f(x+4)$$

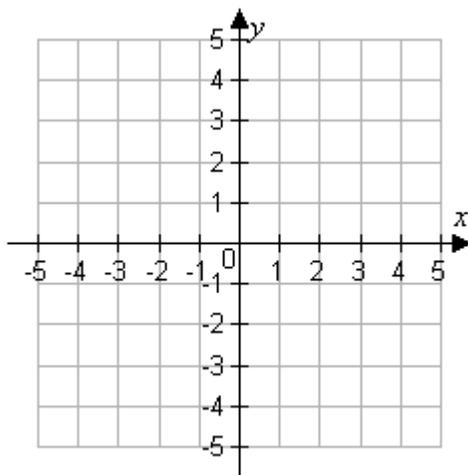
A) even

B) odd

C) cannot be determined

D) neither

9. Plot the points and find the slope of the line passing through the pair of points.  
 $(1, 0), (5, 3)$



- A) slope:  $\frac{4}{3}$   
 B) slope:  $-\frac{4}{3}$   
 C) slope:  $\frac{1}{2}$   
 D) slope:  $\frac{3}{4}$   
 E) slope:  $-\frac{3}{4}$
10. Compare the graph of the following function with the graph of  $f(x) = x^3$ .

$$y = [5(x - 2)]^3$$

- A) vertical shift of 2 units down  
 B) vertical shift of 2 units down  
 horizontal shrink of  $\frac{1}{5}$  units  
 C) horizontal shift of 2 units to the right  
 horizontal shrink of  $\frac{1}{125}$  units  
 D) horizontal shift of 2 units to the right  
 horizontal stretch of  $\frac{1}{5}$  units  
 E) horizontal shift of 2 units to the right  
 vertical shift of 5 units down

11. Find the slope-intercept form of the line passing through the points.

$$(-4, -2), (-1, 7)$$

A)  $y = 3x + 2$

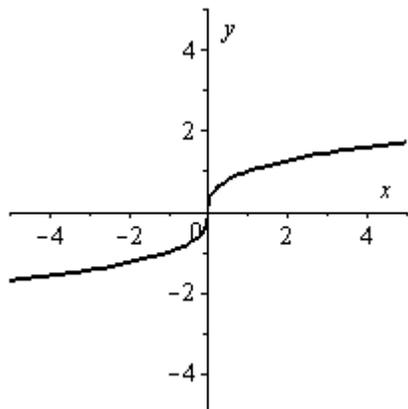
B)  $y = 3x + 10$

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

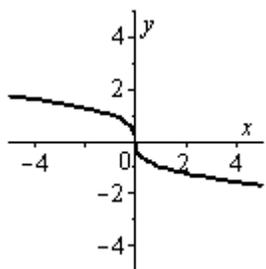
D)  $y = -\frac{1}{3}x - \frac{10}{3}$

E)  $y = -3x - 14$

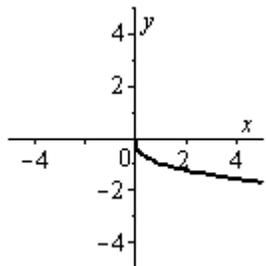
12. Match the graph of the function shown below with the graph of its inverse function



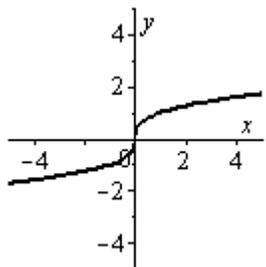
A)



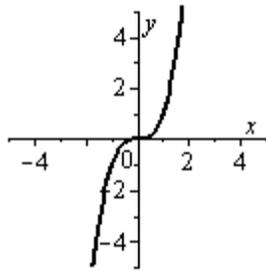
B)



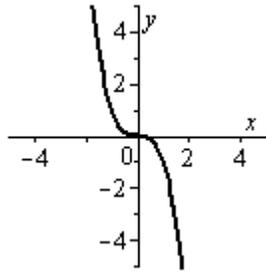
C)



D)

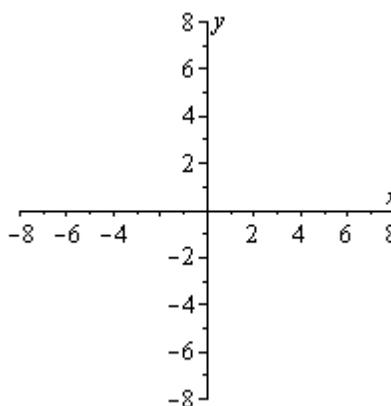
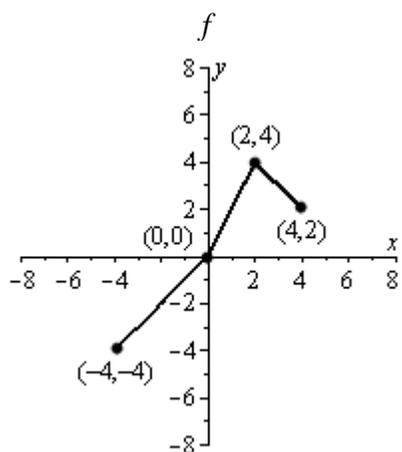


E)

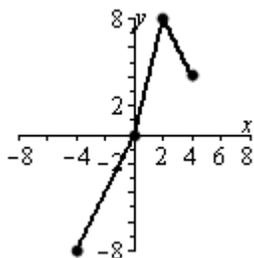


13. Use the graph of  $f$  to sketch the graph of the function indicated below.

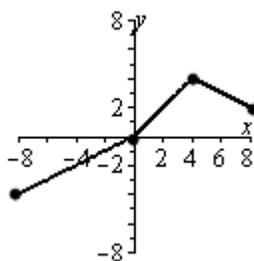
$$y = \frac{1}{2}f(x)$$



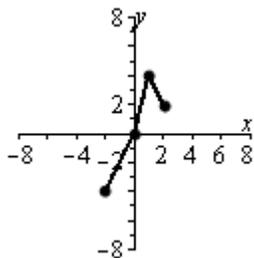
A)



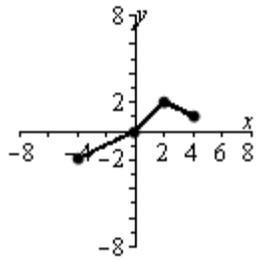
B)



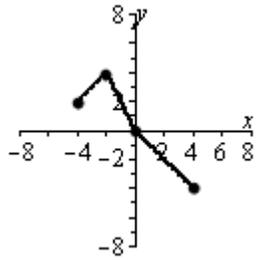
C)



D)



E)



14. Compare the graph of the following function with the graph of  $f(x) = |x|$ .

$$y = \left| \frac{7}{9}x \right|$$

- A) vertical shift of  $\frac{7}{9}$  units up
- B) horizontal stretch of  $\frac{9}{7}$  units
- C) vertical shrink of  $\frac{7}{9}$  units
- D) horizontal shrink of  $\frac{7}{9}$  units
- vertical shift of  $\frac{9}{7}$  units
- E) horizontal shrink of  $\frac{7}{9}$  units
15. Write the slope-intercept form of the equation of the line through the given point parallel to the given line.
- point: (3, -4)                      line:  $28x + 7y = -4$
- A)  $y = -\frac{1}{28}x - \frac{109}{28}$
- B)  $y = \frac{1}{4}x - \frac{19}{4}$
- C)  $y = 28x + 80$
- D)  $y = -4x + 8$
- E)  $y = -4x - 13$
16. Does the table describe a function?

Input value	5	10	13	10	5
Output value	-13	-9	0	9	13

- A) yes
- B) no

17. Show algebraically that the functions  $f$  and  $g$  shown below are inverse functions.

$$f(x) = -\frac{5}{7}x - 3, \quad g(x) = -\frac{7x+21}{5}$$

<p>A) <math>f(g(x)) = -\frac{5}{7}\left(\frac{7x+21}{5}\right) - 3</math></p> $= \left(\frac{7x+21}{7}\right) - 3$ $= (x+3) - 3$ $= x+3-3$ $= x$	<p><math>g(f(x)) = -\frac{7\left(-\frac{5}{7}x-3\right)+21}{5}</math></p> $= -\frac{(-5x-21)+21}{5}$ $= \frac{-5x-21+21}{5}$ $= \frac{5x}{5}$ $= x$
<p>B) <math>f(g(x)) = -\frac{5}{7}\left(-\frac{7x+21}{5}\right) - 21</math></p> $= \left(\frac{35x+21}{35}\right) - 21$ $= (x+21) - 21$ $= x+21-21$ $= x$	<p><math>g(f(x)) = -\frac{7\left(-\frac{5}{7}x-3\right)+21}{5}</math></p> $= -\frac{(-5x-3)+21}{5}$ $= \frac{5x+3-21}{5}$ $= \frac{5x}{5}$ $= x$
<p>C) <math>f(g(x)) = -\frac{5}{7}\left(-\frac{7x+3}{5}\right) - 3</math></p> $= \left(\frac{35x+3}{35}\right) - 3$ $= (x+3) - 3$ $= x+3-3$ $= x$	<p><math>g(f(x)) = -\frac{7\left(-\frac{5}{7}x-3\right)+21}{5}</math></p> $= -\frac{(-5x-3)+3}{5}$ $= \frac{5x+3-3}{5}$ $= \frac{5x}{5}$ $= x$

$$\begin{aligned}
 \text{D) } f(g(x)) &= -\frac{5}{7}\left(-\frac{7x+21}{5}\right)-3 & g(f(x)) &= \frac{7\left(-\frac{5}{7}x-3\right)+21}{5} \\
 &= \left(\frac{7x+21}{7}\right)-3 & &= \frac{(-5x-21)+21}{5} \\
 &= (x+3)-3 & &= \frac{5x+21-21}{5} \\
 &= x+3-3 & &= \frac{5x}{5} \\
 &= x & &= x \\
 \\
 \text{E) } f(g(x)) &= -\frac{7}{5}\left(-\frac{5x+15}{7}\right)-3 & g(f(x)) &= \frac{7\left(-\frac{5}{7}x-3\right)+21}{5} \\
 &= \left(\frac{5x+15}{5}\right)-3 & &= \frac{(-5x-3)+21}{35} \\
 &= (x+3)-3 & &= \frac{5x+3-21}{35} \\
 &= x+3-3 & &= \frac{35x}{35} \\
 &= x & &= x
 \end{aligned}$$

18. Find the domain of the function.

$$f(t) = \sqrt{64 - t^2}$$

- A)  $-8 \leq t \leq 8$
- B)  $t \leq -8$  or  $t \geq 8$
- C)  $t \geq 0$
- D)  $t \leq 8$
- E) all real numbers

19. Find the inverse function of  $f$ .

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

A)  $f^{-1}(x) = -\sqrt[9]{x} - 2$

B)  $f^{-1}(x) = \sqrt[9]{x} - 2$

C)  $f^{-1}(x) = -\sqrt[9]{x-2}$

D)  $f^{-1}(x) = \sqrt[9]{x+2}$

E)  $f^{-1}(x) = \sqrt[9]{x} + 2$

20. Find  $f \circ g$ .

$$f(x) = -4x + 3 \qquad g(x) = x + 7$$

A)  $(f \circ g)(x) = -4x - 25$

B)  $(f \circ g)(x) = -4x + 10$

C)  $(f \circ g)(x) = -4x^2 - 25x + 21$

D)  $(f \circ g)(x) = -5x - 4$

E)  $(f \circ g)(x) = -5x + 10$

## Answer Key

1. A
2. A
3. A
4. A
5. B
6. E
7. A
8. C
9. D
10. C
11. B
12. D
13. D
14. B
15. D
16. B
17. D
18. A
19. D
20. A

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Hooke's Law states that the force  $F$  required to compress or stretch a spring (within its elastic limits) is proportional to the distance  $d$  that the spring is compressed or stretched from its original length. That is,  $F = kd$ , where  $k$  is the measure of the stiffness of the spring and is called the *spring constant*. The table below shows the elongation  $d$  in centimeters of a spring when a force of  $F$  kilograms is applied.

Force, $F$	Elongation, $d$
20	1.4
40	2.5
60	4.0
80	5.3
100	6.6

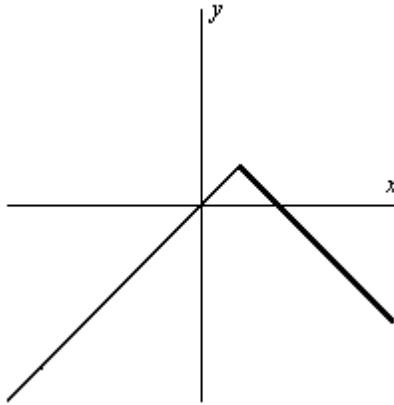
Find the equation of the line that seems to best fit the data. Use the model to estimate the elongation of the spring when a force of 55 kilograms is applied. Round your answer to one decimal place.

- A) 7.2 centimeters  
B) 5.4 centimeters  
C) 1.8 centimeters  
D) 3.6 centimeters  
E) 2.7 centimeters
2. If  $f$  is an even function, determine if  $g$  is even, odd, or neither.  
 $g(x) = -f(x + 3)$
- A) even  
B) odd  
C) cannot be determined  
D) neither

3. Given  $f(x) = \frac{10}{x^2 - 9}$  and  $g(x) = x + 3$  determine the domain of  $f \circ g$ .

- A)  $(-\infty, -3) \cup (3, \infty)$
- B)  $(-\infty, -6) \cup (-6, 0) \cup (0, \infty)$
- C)  $\left(-\infty, -\frac{10}{3}\right) \cup \left(\frac{10}{3}, \infty\right)$
- D)  $(-\infty, -3) \cup (-3, 3) \cup (3, \infty)$
- E)  $(-\infty, \infty)$

4. Determine an equation that may be represented by the graph shown below.



- A)  $f(x) = |x + 1| + 1$
- B)  $f(x) = |x + 1| - 1$
- C)  $f(x) = -|x - 1| + 1$
- D)  $f(x) = |x - 1| + 1$
- E)  $f(x) = |x - 1| - 1$

5. Find all real values of  $x$  such that  $f(x) = 0$ .

$$f(x) = 49x^2 - 64$$

- A)  $\pm \frac{7}{8}$   
 B)  $\pm \frac{8}{7}$   
 C)  $\pm \frac{64}{49}$   
 D)  $-\frac{64}{49}$   
 E)  $\frac{8}{7}$
6. Find  $(f + g)(x)$ .

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

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

- A)  $(f + g)(x) = -12x^4 - 2x^2 - 6$   
 B)  $(f + g)(x) = -4x^4 + 12x^2 + 2$   
 C)  $(f + g)(x) = -12x^2 - 2x - 6$   
 D)  $(f + g)(x) = -4x^2 + 12x + 2$   
 E)  $(f + g)(x) = 4x^2 - 12x - 2$

7. Find  $f \circ g$ .

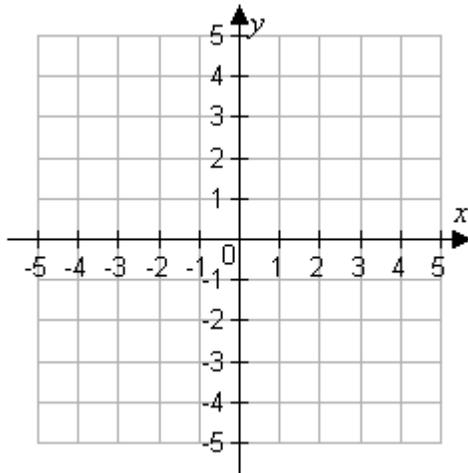
$$f(x) = x + 4$$

$$g(x) = \frac{3}{x^2 - 16}$$

- A)  $(f \circ g)(x) = \frac{3}{x^2}$   
 B)  $(f \circ g)(x) = \frac{3}{x^2 + 8x}$   
 C)  $(f \circ g)(x) = \frac{4x^2 - 1}{x^2 - 16}$   
 D)  $(f \circ g)(x) = \frac{7}{x^2 - 16}$   
 E)  $(f \circ g)(x) = \frac{4x^2 - 61}{x^2 - 16}$

8. Graph the function and determine the interval(s) for which  $f(x) \geq 0$ .

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

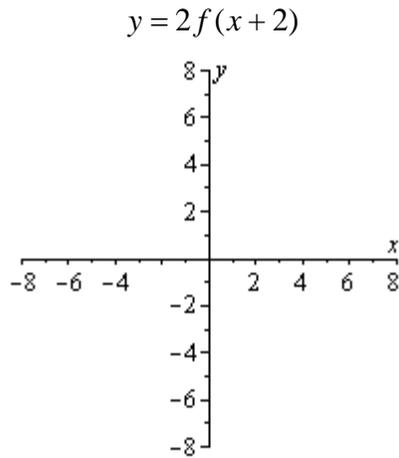
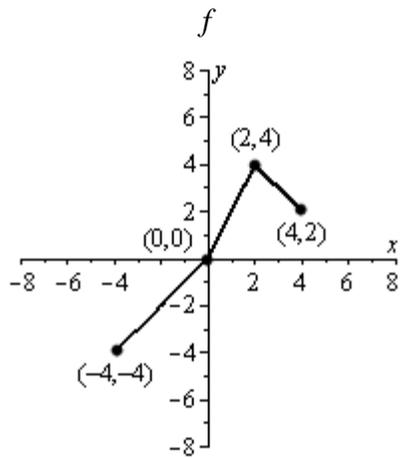


- A)  $(-\infty, 0] \cup [4, \infty)$   
 B)  $[0, 4]$   
 C)  $(0, 4)$   
 D)  $(-\infty, 0) \cup (4, \infty)$   
 E)  $\{4\}$
9. Restrict the domain of the following function  $f$  so that the function is one-to-one and has an inverse function.

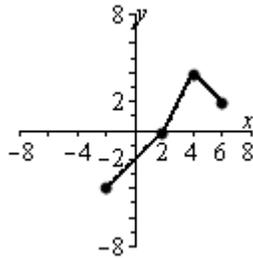
$$f(x) = -|x - 4| + 2$$

- A)  $[-4, \infty)$   
 B)  $[2, 4]$   
 C)  $[4, \infty)$   
 D)  $[-2, 4]$   
 E)  $(-\infty, 2]$

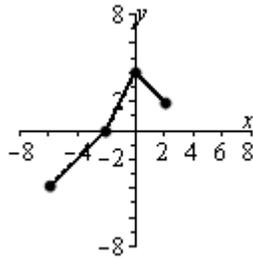
10. Use the graph of  $f$  to sketch the graph of the function indicated below.



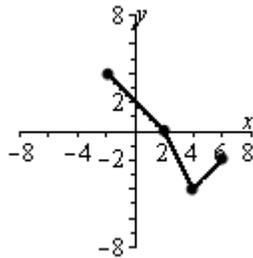
A)



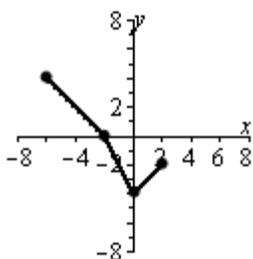
B)



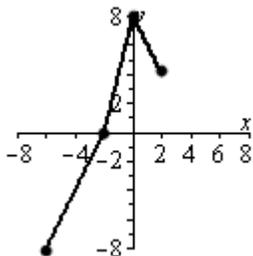
C)



D)



E)



11. Algebraically determine whether the function below is even, odd, or neither.

$$f(s) = 8s^{7/6}$$

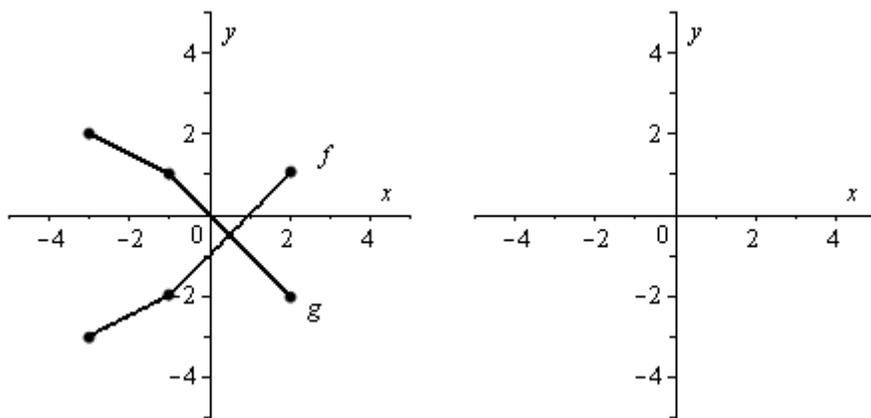
- A) even  
 B) odd  
 C) cannot be determined  
 D) neither
12. Compare the graph of the following function with the graph of  $f(x) = \sqrt{x}$ .
- $$y = \sqrt{-x + 4}$$
- A) First a vertical shift of 4 units up then a reflection in the y-axis.  
 B) First a horizontal shift of 4 units to the left then a reflection in the y-axis.  
 C) First a vertical shift of 4 units up then a reflection in the x-axis.  
 D) First a horizontal shift of 4 units to the left, then a vertical shift of 4 units up and then a reflection in the y-axis.  
 E) First a horizontal shift of 4 units to the left then a reflection in the x-axis.

13. Find the domain of the function.

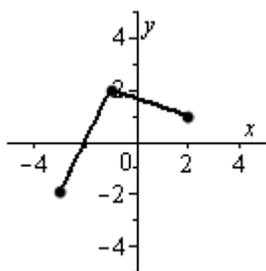
$$g(p) = \sqrt{4 - p^2}$$

- A)  $-2 \leq p \leq 2$
- B)  $p \leq -2$  or  $p \geq 2$
- C)  $p \geq 0$
- D)  $p \leq 2$
- E) all real numbers

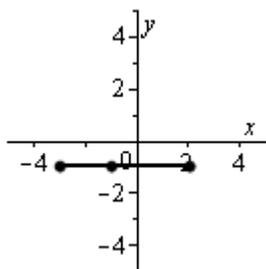
14. Use the graphs of  $f$  and  $g$ , shown below, to graph  $h(x) = (f + g)(x)$ .



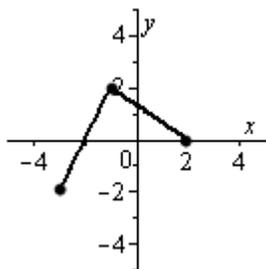
A)



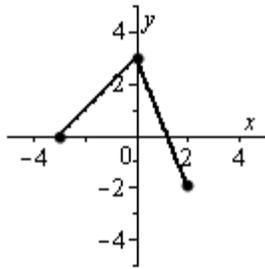
B)



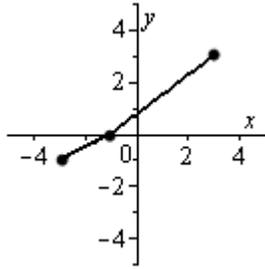
C)



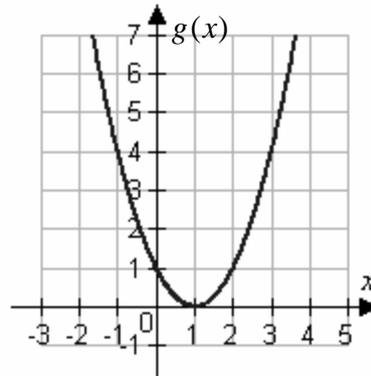
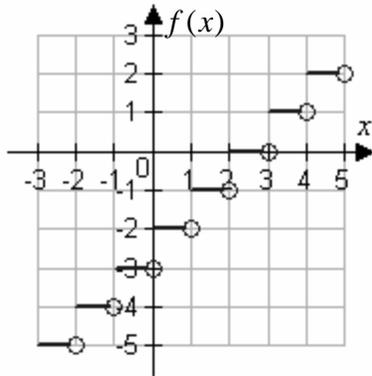
D)



E)



15. Use the graphs of  $f$  and  $g$  to evaluate the function.



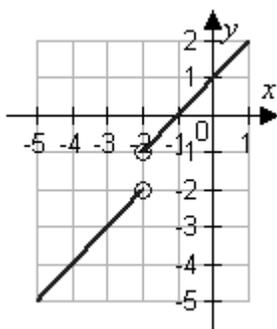
$(f \circ g)(1)$

- A) 9
- B) -1
- C) 0
- D) -4
- E) -2

16. Find the slope and y-intercept of the equation of the line.

$$y = -2x - 9$$

- A) slope:  $-\frac{1}{2}$ ; y-intercept:  $-9$   
 B) slope:  $-\frac{1}{9}$ ; y-intercept:  $-2$   
 C) slope:  $-2$ ; y-intercept:  $-9$   
 D) slope:  $-9$ ; y-intercept:  $-2$   
 E) slope:  $-2$ ; y-intercept:  $9$
17. Use the graph of the function to find the domain and range of  $f$ .



- A) domain : all real numbers  
range :  $(-\infty, -2) \cup (-1, \infty)$   
 B) domain : all real numbers  
range : all real numbers  
 C) domain :  $(-\infty, -2) \cup (-2, \infty)$   
range :  $(-\infty, -2) \cup (-1, \infty)$   
 D) domain :  $(-\infty, -2) \cup (-1, \infty)$   
range :  $(-\infty, -2) \cup (-2, \infty)$   
 E) Domain: all real numbers  
Range:  $(-\infty, -2] \cup [-1, \infty)$

18. Given that  $f(x) = \sqrt[4]{x-4}$  and  $g(x) = x^4 + 4$  determine the value of the following (if possible).

$$(f \circ g)(0)$$

- A) 0
  - B) 2
  - C) 4
  - D)  $x^4 - 16$
  - E) not possible
19. Find the inverse function of  $f(x) = 8x + 3$

A)  $g(x) = \frac{x-3}{8}$

B)  $g(x) = 3x + 8$

C)  $g(x) = \frac{x+3}{8}$

D)  $g(x) = \frac{x}{3}$

E)  $g(x) = \frac{1}{8}x - 3$

20. Show algebraically that the functions  $f$  and  $g$  shown below are inverse functions.

$$f(x) = \frac{2}{2+x}, x \geq 0, \quad g(x) = \frac{2-2x}{x}, 0 < x \leq 1$$

$$\begin{aligned} \text{A) } f(g(x)) &= \frac{2}{2 + \left(\frac{2-2x}{x}\right)} & g(f(x)) &= \frac{2-2\left(\frac{2}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\ &= \frac{2}{2 + \left(\frac{1}{x}\right)} & &= \frac{0 - \left(\frac{2}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\ &= \frac{1}{\left(\frac{1}{x}\right)} & &= \frac{-2}{\frac{2}{2+x}} \\ &= 1 \cdot \frac{x}{1} & &= \frac{2x+2}{2+x} \\ &= x & &= x \end{aligned}$$

$$\begin{aligned} \text{B) } f(g(x)) &= \frac{2}{2 + \left(\frac{2-2x}{x}\right)} & g(f(x)) &= \frac{2-2\left(\frac{2}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\ &= \frac{1}{1 + \frac{2-2x}{x}} & &= \frac{2 - \left(\frac{4}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\ &= \frac{1}{\left(\frac{0}{x}\right)} & &= \frac{4+2x-4}{\frac{2+x}{\left(\frac{2}{2+x}\right)}} \\ &= x & &= \frac{2x}{\frac{2+x}{\left(\frac{x}{2+x}\right)}} \\ & & &= \frac{2x}{x} \\ & & &= x \end{aligned}$$

$$\begin{aligned}
 \text{C) } f(g(x)) &= \frac{2}{2 + \left(\frac{2-2x}{x}\right)} \\
 &= \frac{4}{\frac{2-2x}{x}} \\
 &= \frac{2}{\left(\frac{2x}{x}\right)} \\
 &= 2 \cdot \frac{x}{2} \\
 &= x
 \end{aligned}
 \qquad
 \begin{aligned}
 g(f(x)) &= \frac{2-2\left(\frac{2}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\
 &= \frac{\left(\frac{2}{2+2x}\right)}{\left(\frac{2}{2+x}\right)} \\
 &= \left(\frac{2}{2+2x}\right)\left(\frac{2+x}{2}\right) \\
 &= \frac{2+x}{2+2x} \\
 &= \frac{x}{2x} \\
 &= x
 \end{aligned}$$

$$\begin{aligned}
 \text{D) } f(g(x)) &= \frac{2}{2 + \left(\frac{2-2x}{x}\right)} \\
 &= \frac{2}{\frac{2x+2-2x}{x}} \\
 &= \frac{2-2x}{\left(\frac{2}{x}\right)} \\
 &= \frac{1-x}{1} \\
 &= x
 \end{aligned}
 \qquad
 \begin{aligned}
 g(f(x)) &= \frac{2-2\left(\frac{2}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\
 &= \frac{\left(\frac{4}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\
 &= \left(\frac{4}{2+x}\right)\left(\frac{2+x}{2}\right) \\
 &= \frac{2(2+x)}{2+x} \\
 &= \frac{2x}{2} \\
 &= x
 \end{aligned}$$

$$\begin{aligned}
 \text{E) } f(g(x)) &= \frac{2}{2 + \left(\frac{2-2x}{x}\right)} \\
 &= \frac{2}{\frac{2x+2-2x}{x}} \\
 &= \frac{2}{\left(\frac{2}{x}\right)} \\
 &= 2 \cdot \frac{x}{2} \\
 &= x
 \end{aligned}$$

$$\begin{aligned}
 g(f(x)) &= \frac{2 - 2\left(\frac{2}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\
 &= \frac{2 - \left(\frac{4}{2+x}\right)}{\left(\frac{2}{2+x}\right)} \\
 &= \frac{4 + 2x - 4}{\left(\frac{2}{2+x}\right)} \\
 &= \frac{2x}{\left(\frac{2}{2+x}\right)} \\
 &= \frac{2x}{2} \\
 &= x
 \end{aligned}$$

## Answer Key

1. D
2. C
3. B
4. C
5. B
6. D
7. E
8. B
9. C
10. E
11. D
12. B
13. A
14. B
15. E
16. C
17. C
18. A
19. A
20. E