

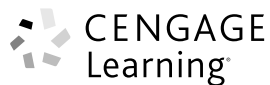
Test Bank

Precalculus with Limits A Graphing Approach

SEVENTH EDITION

Ron Larson

The Pennsylvania State University,
The Behrend College



© 2016 Cengage Learning

WCN: 01-100-101

ALL RIGHTS RESERVED. No part of this work covered by the copyright herein may be reproduced, transmitted, stored, or used in any form or by any means graphic, electronic, or mechanical, including but not limited to photocopying, recording, scanning, digitizing, taping, Web distribution, information networks, or information storage and retrieval systems, except as permitted under Section 107 or 108 of the 1976 United States Copyright Act, without the prior written permission of the publisher except as may be permitted by the license terms below.

For product information and technology assistance, contact us at
Cengage Learning Customer & Sales Support,
1-800-354-9706.

For permission to use material from this text or product, submit
all requests online at www.cengage.com/permissions
Further permissions questions can be emailed to
permissionrequest@cengage.com.

ISBN: 978-1-305-11757-0

Cengage Learning
20 Channel Center Street
Boston, MA 02210
USA

Cengage Learning is a leading provider of customized learning solutions with office locations around the globe, including Singapore, the United Kingdom, Australia, Mexico, Brazil, and Japan. Locate your local office at: www.cengage.com/global.

Cengage Learning products are represented in Canada by Nelson Education, Ltd.

To learn more about Cengage Learning Solutions, visit www.cengage.com.

Purchase any of our products at your local college store or at our preferred online store
www.cengagebrain.com.

NOTE: UNDER NO CIRCUMSTANCES MAY THIS MATERIAL OR ANY PORTION THEREOF BE SOLD, LICENSED, AUCTIONED, OR OTHERWISE REDISTRIBUTED EXCEPT AS MAY BE PERMITTED BY THE LICENSE TERMS HEREIN.

READ IMPORTANT LICENSE INFORMATION

Dear Professor or Other Supplement Recipient:

Cengage Learning has provided you with this product (the "Supplement") for your review and, to the extent that you adopt the associated textbook for use in connection with your course (the "Course"), you and your students who purchase the textbook may use the Supplement as described below. Cengage Learning has established these use limitations in response to concerns raised by authors, professors, and other users regarding the pedagogical problems stemming from unlimited distribution of Supplements.

Cengage Learning hereby grants you a nontransferable license to use the Supplement in connection with the Course, subject to the following conditions. The Supplement is for your personal, noncommercial use only and may not be reproduced, posted electronically or distributed, except that portions of the Supplement may be provided to your students IN PRINT FORM ONLY in connection with your instruction of the Course, so long as such students are advised that they may not copy or distribute

any portion of the Supplement to any third party. You may not sell, license, auction, or otherwise redistribute the Supplement in any form. We ask that you take reasonable steps to protect the Supplement from unauthorized use, reproduction, or distribution. Your use of the Supplement indicates your acceptance of the conditions set forth in this Agreement. If you do not accept these conditions, you must return the Supplement unused within 30 days of receipt.

All rights (including without limitation, copyrights, patents, and trade secrets) in the Supplement are and will remain the sole and exclusive property of Cengage Learning and/or its licensors. The Supplement is furnished by Cengage Learning on an "as is" basis without any warranties, express or implied. This Agreement will be governed by and construed pursuant to the laws of the State of New York, without regard to such State's conflict of law rules.

Thank you for your assistance in helping to safeguard the integrity of the content contained in this Supplement. We trust you find the Supplement a useful teaching tool.

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

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

Name: _____ Date: _____

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) $(fg)(x) = 2x\sqrt{10} - \sqrt{30x}$
 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) $|a-5| = |b-5|$

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

$$-a = b$$

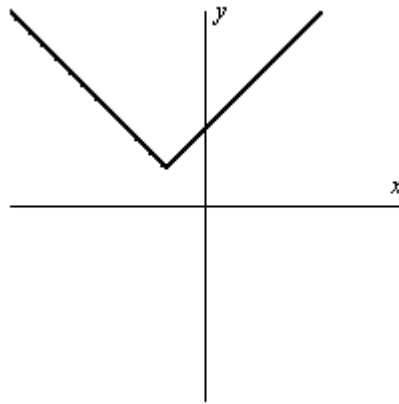
E) $|a-5| = |b-5|$

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

$$-a = -b$$

$$a = b$$

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.

$$\text{point: } (-4, 7)$$

$$\text{line: } -5x - 15y = -6$$

- 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) $-\frac{18}{47}$

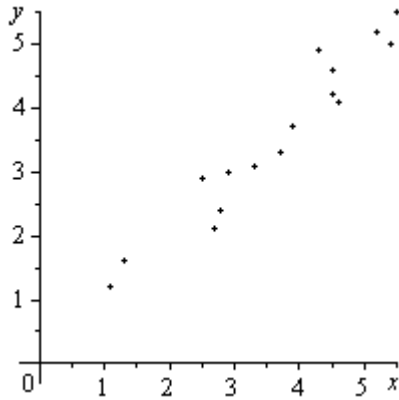
16. Determine the domain of $g(x) = \frac{1}{x^2 - 49}$.

- 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.

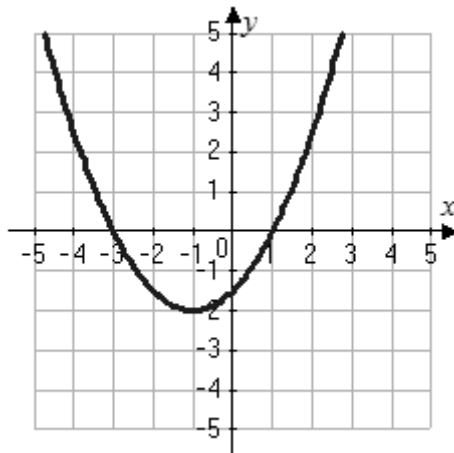
$$\left(\frac{f}{g}\right)(q-4)$$

- 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.

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

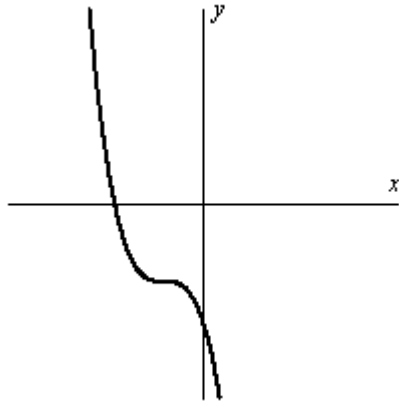
- A) even
- B) odd
- C) cannot be determined
- D) neither

9. Find $f \circ g$.

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

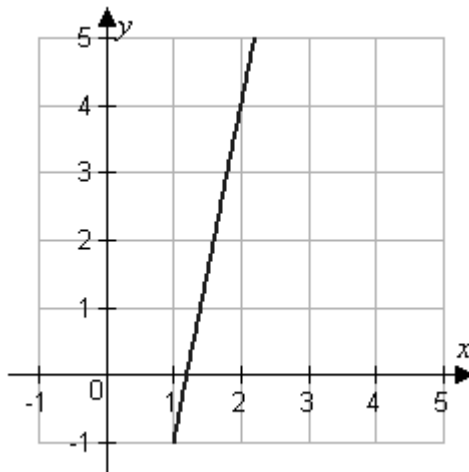
- A) $(f \circ g)(x) = \frac{5}{x^2}$
- B) $(f \circ g)(x) = \frac{5}{x^2 + 4x}$
- C) $(f \circ g)(x) = \frac{2x^2 + 3}{x^2 - 4}$
- D) $(f \circ g)(x) = \frac{7}{x^2 - 4}$
- E) $(f \circ g)(x) = \frac{2x^2 - 3}{x^2 - 4}$

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 $(1, \infty)$

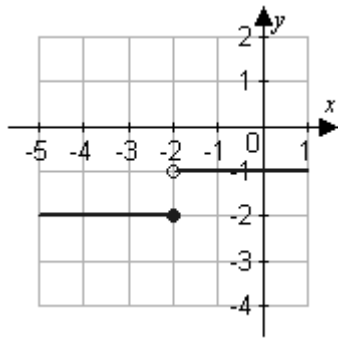
14. Hooke's Law states that the force F required to compress or stretch a spring (within its elastic limits) is proportional to the distance d that the spring is compressed or stretched from its original length. That is, $F = kd$, where k is the measure of the stiffness of the spring and is called the *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 $g \circ f$.

$$f(x) = x + 2 \qquad g(x) = x^2$$

- 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
- ?

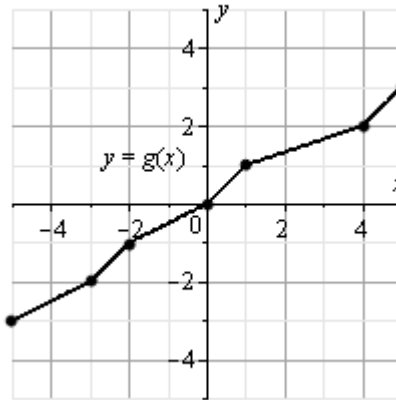
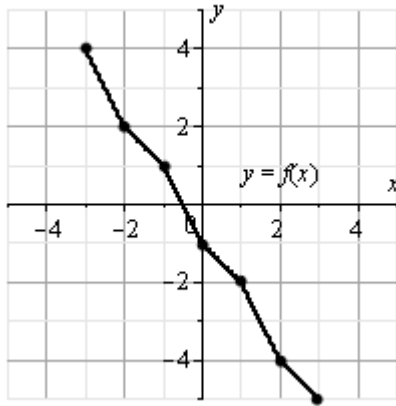
- A) $x = -9y + 2$
 B) $x = -1$
 C) $y = 7x - 9$
 D) $y = |6 - x^2|$
 E) $y = \sqrt{-9 + 6x}$

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

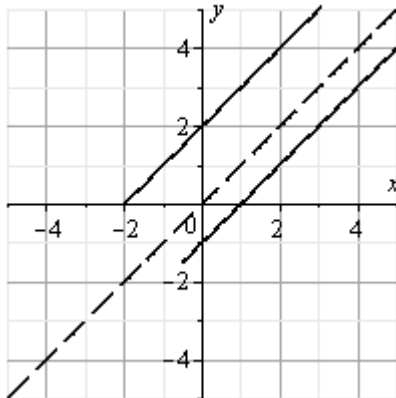
8. The average lengths L of cellular phone calls in minutes from 1999 to 2004 are shown in the table below.



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 $f(x) = g(x)$.

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

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

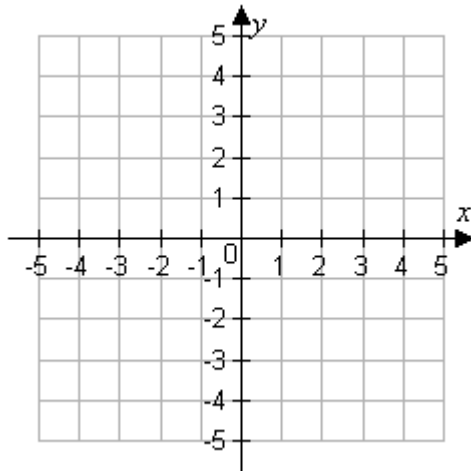
B) $g(x) = -\frac{1}{4}[f(x) + 9]$

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

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

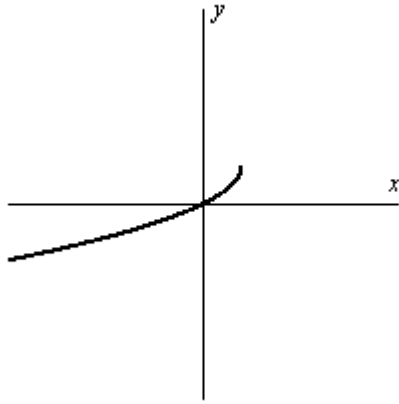
E) $g(x) = -\frac{1}{4}[f(x+9)]$

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



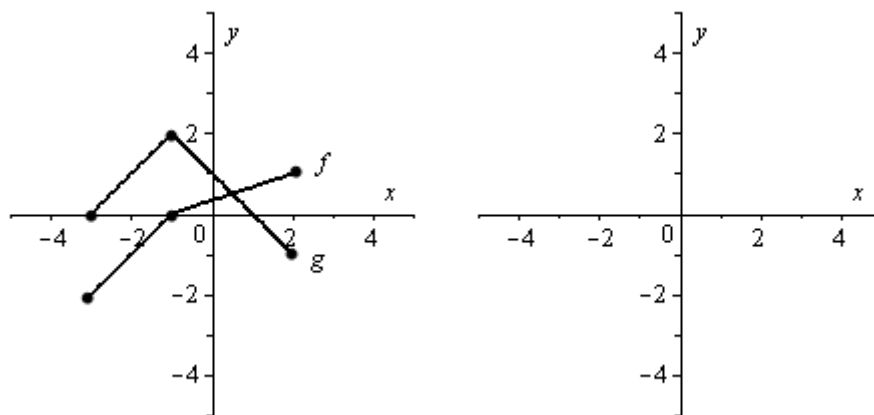
- A) slope: 0
B) slope: 1
C) slope: -5
D) slope: $-\frac{1}{5}$
E) slope: undefined

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

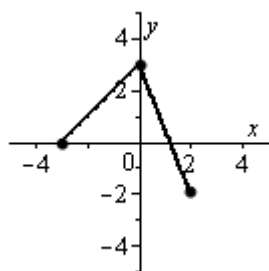


- A) $f(x) = 1 - \sqrt{1 - x}$
- B) $f(x) = -1 - \sqrt{1 - x}$
- C) $f(x) = -1 + \sqrt{1 - x}$
- D) $f(x) = -1 - \sqrt{1 + x}$
- E) $f(x) = -1 + \sqrt{1 + x}$

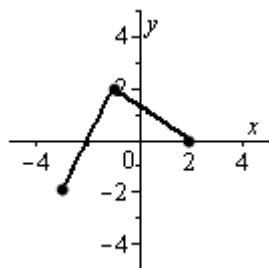
15. Use the graphs of f and g , shown below, to graph $h(x) = (f + g)(x)$.



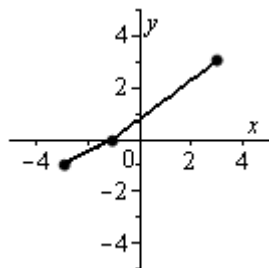
A)



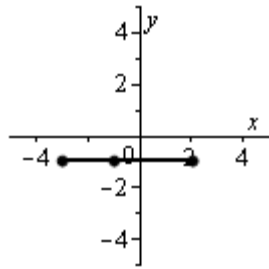
B)



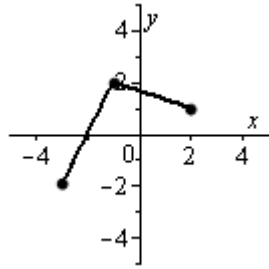
C)



D)



E)



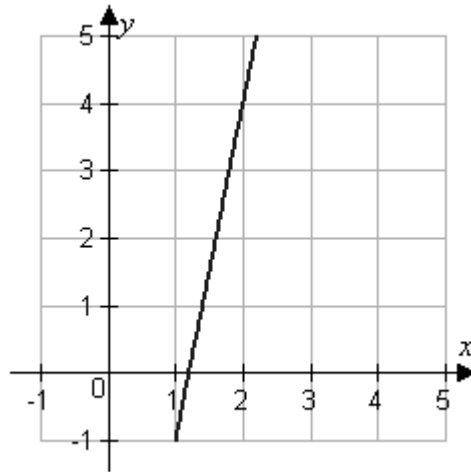
16. Evaluate the function at the specified value of the independent variable and simplify.

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

$$f(-1.4)$$

- 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) $(f \circ g)^{-1} = 5\sqrt[3]{x+5}$

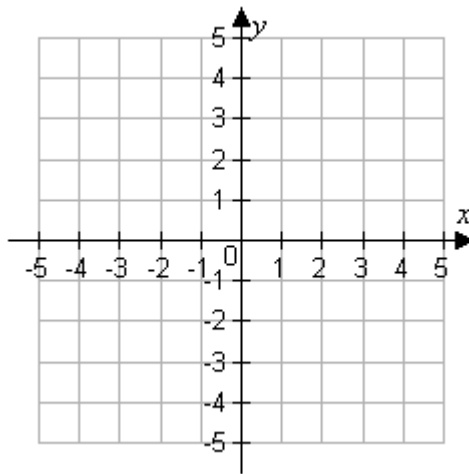
19. Find all real values of x such that $f(x) = 0$.

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

- 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 $f(x) \geq 0$.

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



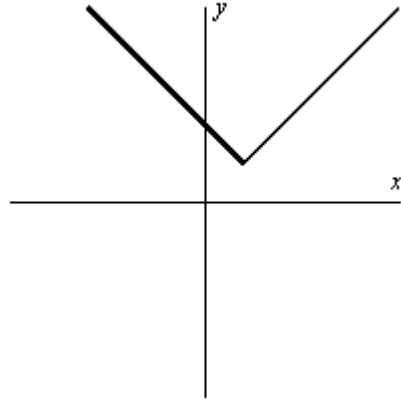
- A) $(-\infty, 0] \cup [4, \infty)$
- B) $[0, 4]$
- C) $(0, 4)$
- D) $(-\infty, 0) \cup (4, \infty)$
- E) $\{4\}$

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 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 .

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

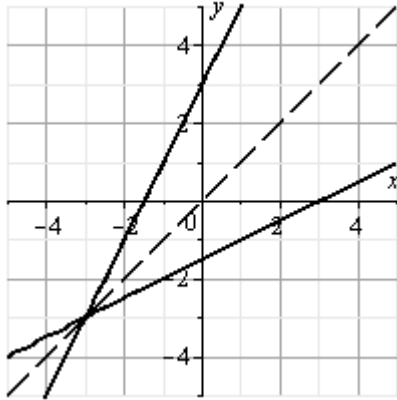
- A) $f^{-1}(x) = -\sqrt[5]{x} - 1$
- B) $f^{-1}(x) = \sqrt[5]{x} - 1$
- C) $f^{-1}(x) = -\sqrt[5]{x - 1}$
- D) $f^{-1}(x) = \sqrt[5]{x + 1}$
- E) $f^{-1}(x) = \sqrt[5]{x} + 1$

3. Find the domain of the function.

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

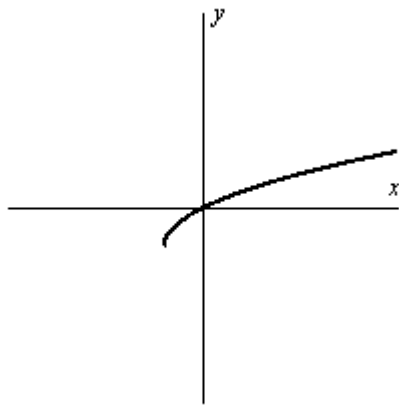
- A) all real numbers $w \neq -9$
- B) all real numbers $w \neq -9, w \neq 0$
- C) all real numbers
- D) $w = -9, w = 0$
- E) $w = -9$

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 $f \circ g$.

$$f(x) = x + 3$$

$$g(x) = \frac{4}{x^2 - 9}$$

$$\text{A)} \quad (f \circ g)(x) = \frac{4}{x^2}$$

$$\text{B)} \quad (f \circ g)(x) = \frac{4}{x^2 + 6x}$$

$$\text{C)} \quad (f \circ g)(x) = \frac{3x^2 + 1}{x^2 - 9}$$

$$\text{D)} \quad (f \circ g)(x) = \frac{7}{x^2 - 9}$$

$$\text{E)} \quad (f \circ g)(x) = \frac{3x^2 - 23}{x^2 - 9}$$

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

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

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

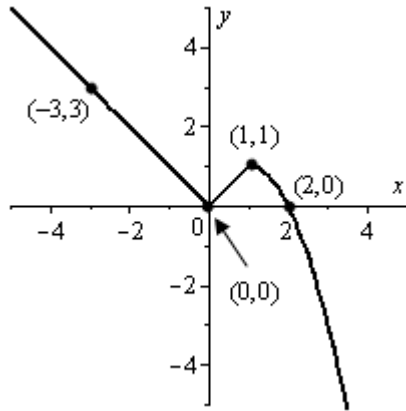
B) $g(x) = -\frac{1}{3}f(x) - 1$

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

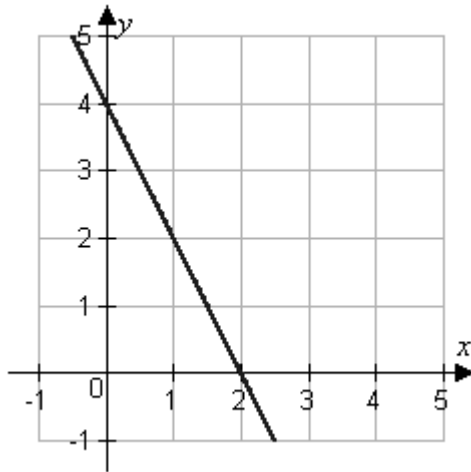
B) $f(x) = \begin{cases} |x|, & x \leq 0 \\ -(x-1)^2 + 1, & x \leq 0 \end{cases}$

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.

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

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

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

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

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

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

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) $-8, 4$

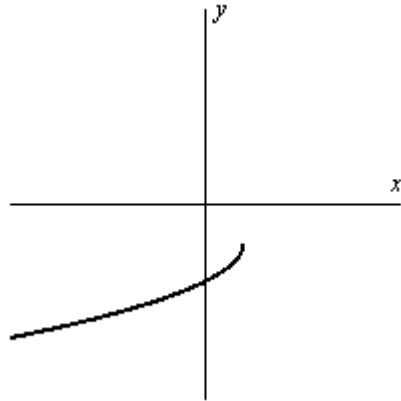
E) $47, -\frac{4}{7}$

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

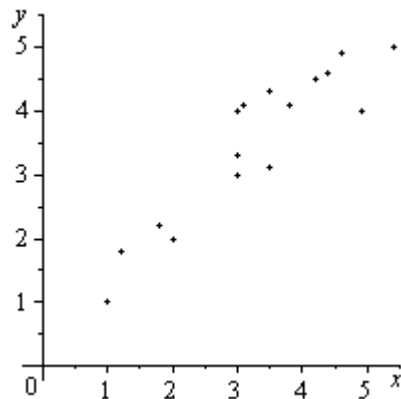
Name: _____ Date: _____

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 $g(x) = x - 6$.

$$(fg)(-2)$$

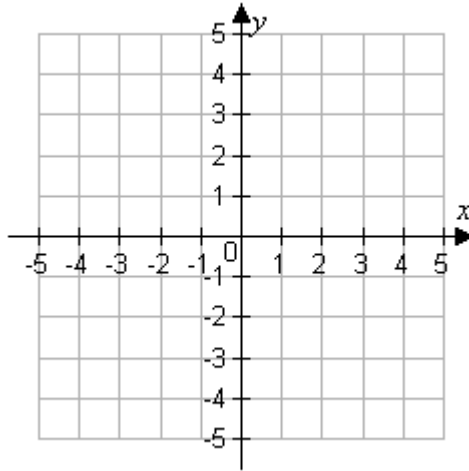
- A) -24
 B) 40
 C) -2
 D) 12
 E) 24

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) $y = 3x + 2$

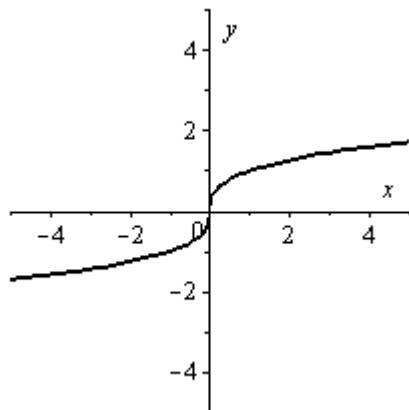
B) $y = 3x + 10$

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

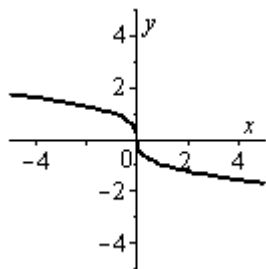
D) $y = -\frac{1}{3}x - \frac{10}{3}$

E) $y = -3x - 14$

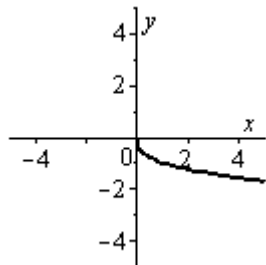
12. Match the graph of the function shown below with the graph of its inverse function



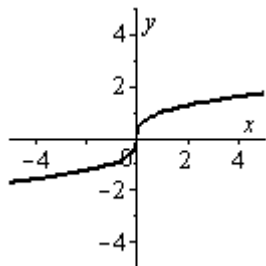
A)



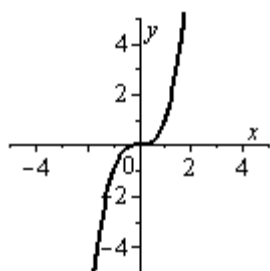
B)



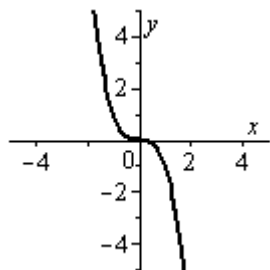
C)



D)

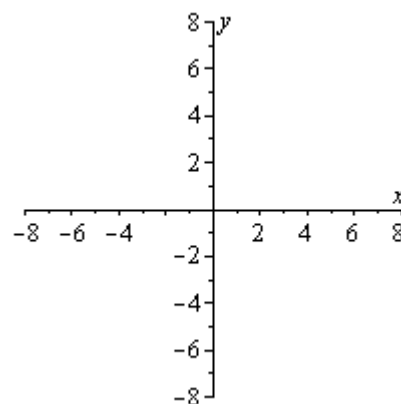
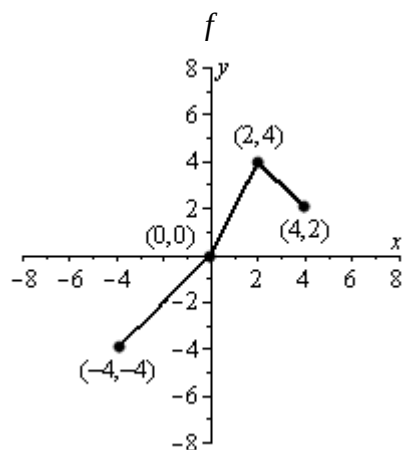


E)

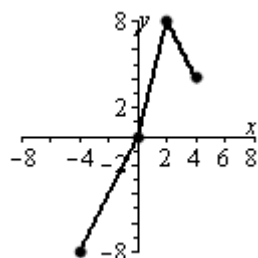


13. Use the graph of f to sketch the graph of the function indicated below.

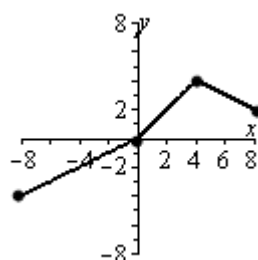
$$y = \frac{1}{2}f(x)$$



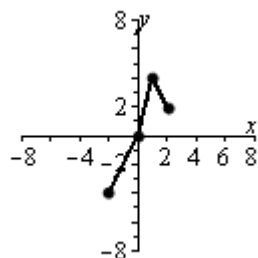
A)



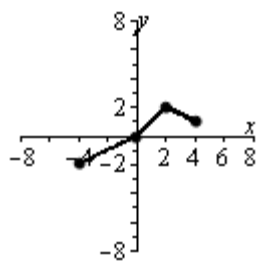
B)



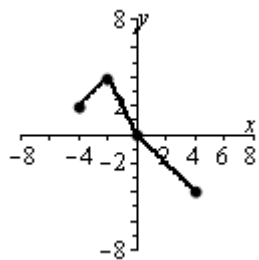
C)



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.

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

$$\begin{array}{ll} \text{A) } f(g(x)) &= -\frac{5}{7}\left(\frac{7x+21}{5}\right) - 3 & g(f(x)) &= -\frac{7\left(-\frac{5}{7}x - 3\right) + 21}{5} \\ &= \left(\frac{7x+21}{7}\right) - 3 & &= -\frac{(-5x-21)+21}{5} \\ &= (x+3) - 3 & &= \frac{-5x-21+21}{5} \\ &= x+3-3 & &= \frac{5x}{5} \\ &= x & &= x \\ \\ \text{B) } f(g(x)) &= -\frac{5}{7}\left(-\frac{7x+21}{5}\right) - 21 & g(f(x)) &= -\frac{7\left(-\frac{5}{7}x - 3\right) + 21}{5} \\ &= \left(\frac{35x+21}{35}\right) - 21 & &= -\frac{(-5x-3)+21}{5} \\ &= (x+21) - 21 & &= \frac{5x+3-21}{5} \\ &= x+21-21 & &= \frac{5x}{5} \\ &= x & &= x \\ \\ \text{C) } f(g(x)) &= -\frac{5}{7}\left(-\frac{7x+3}{5}\right) - 3 & g(f(x)) &= -\frac{7\left(-\frac{5}{7}x - 3\right) + 21}{5} \\ &= \left(\frac{35x+3}{35}\right) - 3 & &= -\frac{(-5x-3)+3}{5} \\ &= (x+3) - 3 & &= \frac{5x+3-3}{5} \\ &= x+3-3 & &= \frac{5x}{5} \\ &= x & &= x \end{array}$$

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

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

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 $f \circ g$.

$$f(x) = -4x + 3$$

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

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

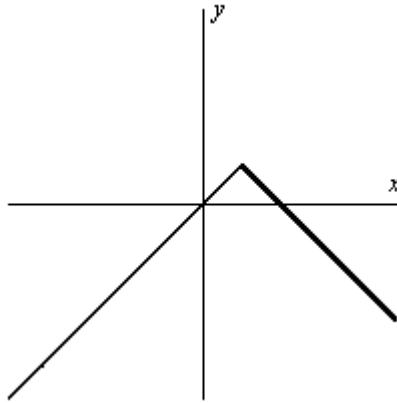
Find the equation of the line that seems to best fit the data. Use the model to estimate the elongation of the spring when a force of 55 kilograms is applied. Round your answer to one decimal place.

- 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) $(f \circ g)(x) = \frac{3}{x^2 + 8x}$

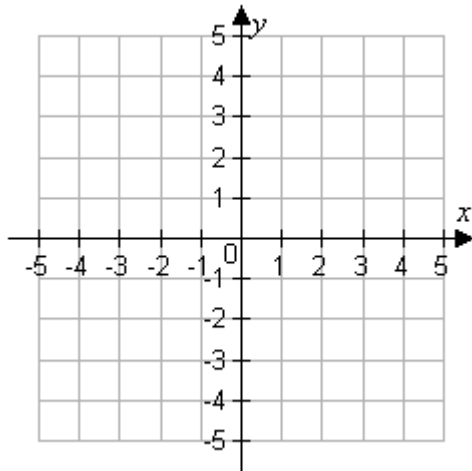
C) $(f \circ g)(x) = \frac{4x^2 - 1}{x^2 - 16}$

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 $f(x) \geq 0$.

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



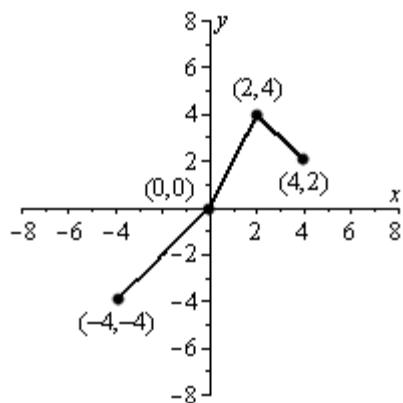
- A) $(-\infty, 0] \cup [4, \infty)$
 B) $[0, 4]$
 C) $(0, 4)$
 D) $(-\infty, 0) \cup (4, \infty)$
 E) $\{4\}$
9. Restrict the domain of the following function f so that the function is one-to-one and has an inverse function.

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

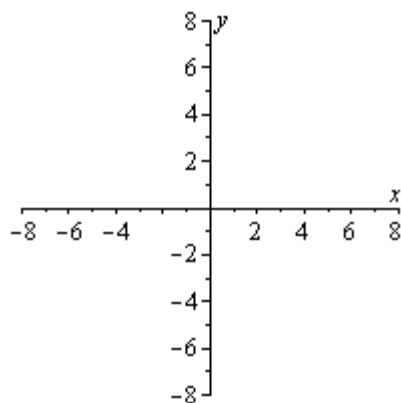
- A) $[-4, \infty)$
 B) $[2, 4]$
 C) $[4, \infty)$
 D) $[-2, 4]$
 E) $(-\infty, 2]$

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

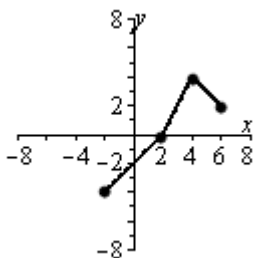
f



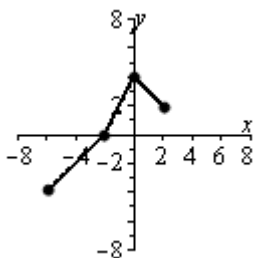
$y = 2f(x + 2)$



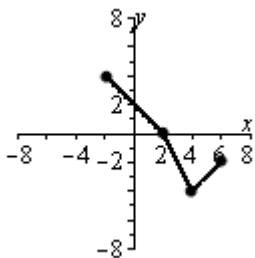
A)



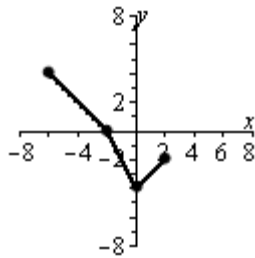
B)



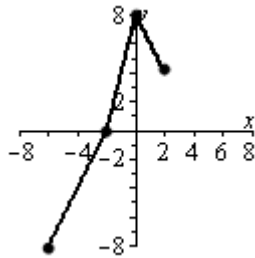
C)



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 $f(x) = \sqrt{x}$.

$$y = \sqrt{-x + 4}$$

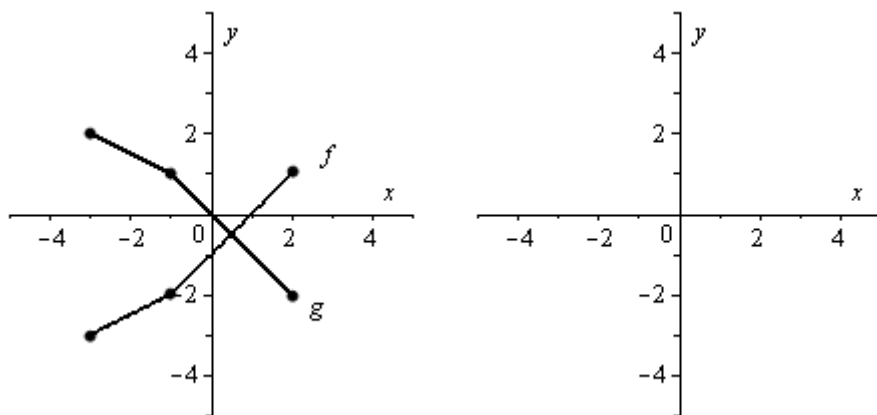
- A) First a vertical shift of 4 units up then a reflection in the y-axis.
- B) First a horizontal shift of 4 units to the left then a reflection in the y-axis.
- C) First a vertical shift of 4 units up then a reflection in the x-axis.
- D) First a horizontal shift of 4 units to the left, then a vertical 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.

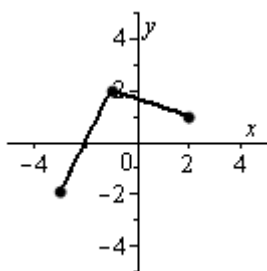
$$g(p) = \sqrt{4 - p^2}$$

- 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

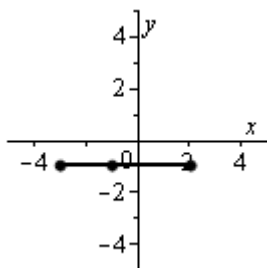
14. Use the graphs of f and g , shown below, to graph $h(x) = (f + g)(x)$.



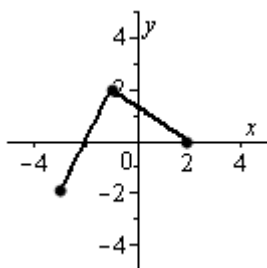
A)



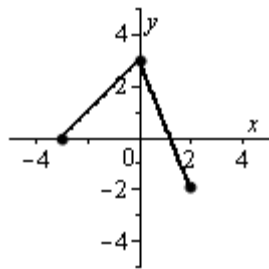
B)



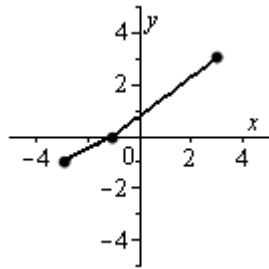
C)



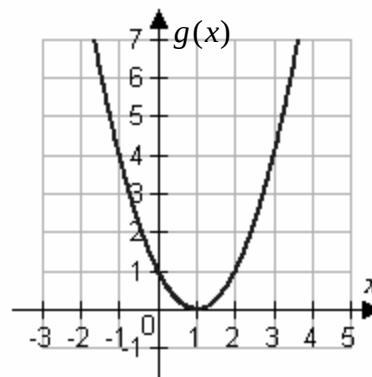
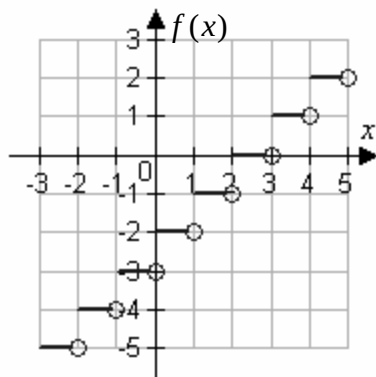
D)



E)



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



$$(f \circ g)(1)$$

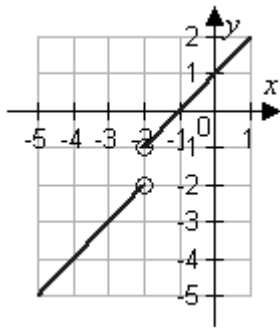
- A) 9
- B) -1
- C) 0
- D) -4
- E) -2

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.

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

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

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

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

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

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

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

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

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