

SAMPLE PAGES
FOR
C H A L L E N G E T H E H S A P
M A T H E M A T I C S

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FROM CHAPTER 2

Algebra

B. Understand relations and functions and select, convert flexibly among, and use various representations for them.

1. Gather and record data, or use data sets, to determine functional (systematic) relationships between quantities.
2. Represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities including representations involving computer algebra systems, spreadsheets, and graphing calculators.
3. Interpret situations in terms of given graphs and create situations that fit given graphs.

C. Analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes and local and global behavior.

1. Relate the solution(s) of quadratic equations to the root(s) of the quadratic functions.
2. Determine domain and range restrictions for linear and quadratic functions, given the constraints of the problem.
3. Analyze graphs of quadratic functions and write conclusions for problem situations.

T A B L E O F C O N T E N T S

HSAP MATHEMATICS INTRODUCTION

DIAGNOSTIC TEST

Chapter One: NUMBER AND OPERATIONS

Chapter Two: ALGEBRA

Chapter Three: GEOMETRY

Chapter Four: MEASUREMENT

Chapter Five: DATA ANALYSIS AND PROBABILITY

PRACTICE TEST 1

PRACTICE TEST 2

ALGEBRA

STANDARD I

Understand patterns, relations, and functions.

- B.** Understand relations and functions and select, convert flexibly among, and use various representations for them.
1. Gather and record data, or use data sets, to determine functional (systematic) relationships between quantities.
 2. Represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities, including representations involving computer algebra systems, spreadsheets, and graphing calculators.
 3. Interpret situations in terms of given graphs and create situations that fit given graphs.

HIGHLIGHTS

This section is designed to give you practice in determining whether a graph, a set of data, or a set of ordered pairs represents a function. You may also be asked to algebraically represent the function. Your teacher will maximize your learning by expanding on these skills during class.

- ⇒ **Quick Tips:**
- to determine if a graph is a function, do the vertical line test; the vertical line can only touch the graph once
 - to determine if a set of ordered pairs represents a function, make sure the "x" value does not repeat

EXAMPLE 1

Off the coastline of South Carolina, divers are constantly searching for those undiscovered treasures. They are very aware of the dangers involved in deep-sea diving. As you dive deeper and deeper into the ocean, the pressure of the water on your body steadily increases. The pressure at the surface of the water is 14.7 pounds per square inch (psi). The pressure increases at a rate of 0.445 psi for each foot you descend.

Write an equation to represent the pressure (P) as a function of the depth (d) for every 20 feet you descend until you reach a depth of 60 feet.

Algebra

Answer:

Verbal description:

Pressure at given depth = Pressure at surface + Rate of change * Diving depth

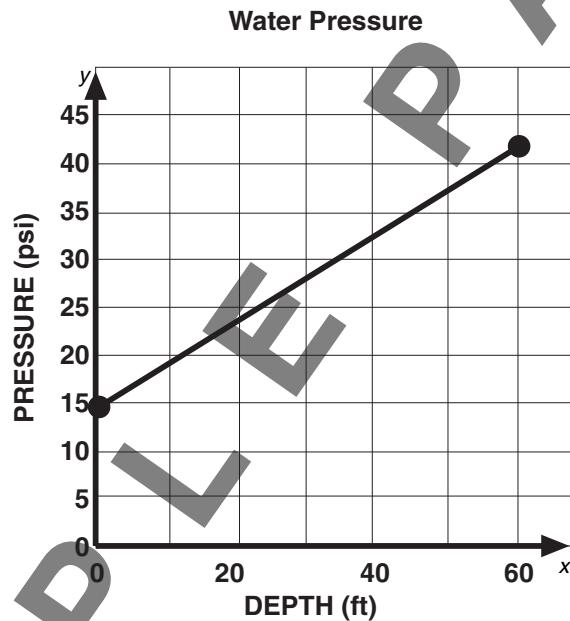
Algebraic equation:

$$P = 14.7 + 0.445d \quad \text{where } d \geq 0 \text{ and } d \leq 60$$

Table:

Input (d)	0	20	40	60
Output (P)	14.7	23.6	32.5	41.4

Graph:

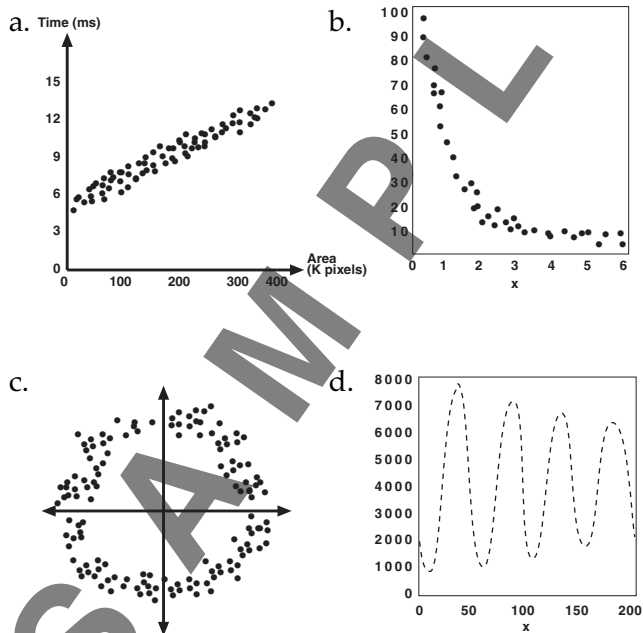


PRACTICE

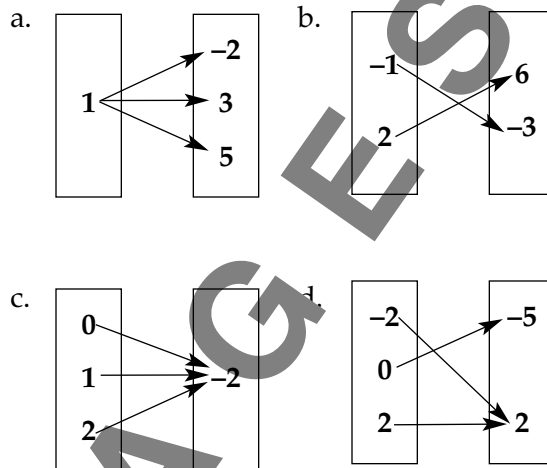
1. Which of the following mappings is not a function?

- | | Domain | Range |
|-------|--------|-------|
| a. f: | a | s |
| | b | t |
| | c | u |
| b. f: | a | s |
| | a | t |
| | a | u |
| c. f: | a | s |
| | b | s |
| | c | s |
| d. f: | a | s |
| | b | t |
| | c | t |

2. Which of the following scatterplots does not represent the possible graph of a function?



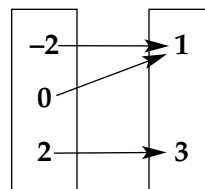
3. Which of the following is not a function?



Which set of ordered pairs, when graphed, would fail the vertical line test for functions?

- a. $\{(-2,3), (0,3), (2,4), (4,4)\}$
- b. $\{(-2,3), (-2,-3), (2,4), (2,-4)\}$
- c. $\{(0,1), (5,6), (10,8), (13,10)\}$
- d. $\{(3,2), (4,2), (5,2), (6,2)\}$

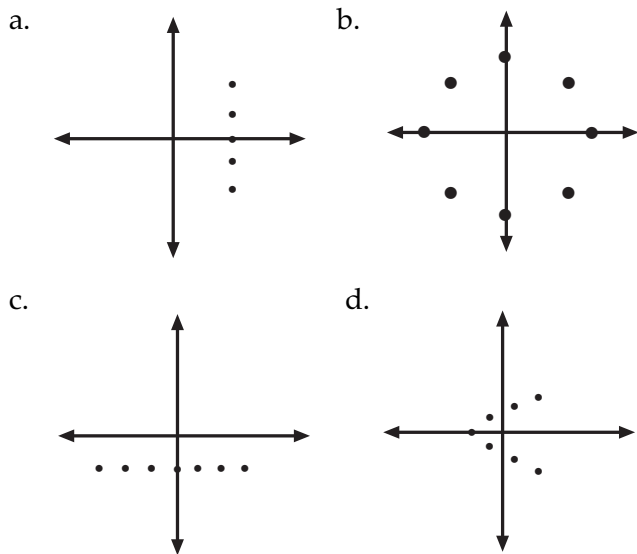
5. Which could represent the following mapping algebraically?



- a. $y = 3x^2 - 1$
- b. $y = |x + 1|$
- c. $y = 2(x - 3)$
- d. $y = -(x - 5)$

Algebra

6. Which of the following could be the graph of a function?



7. Use the table below to determine which of the following statements is true?

X	3	4	4	6	-2
Y	0	-3	4	7	

- a. the domain is $\{0, -3, 4, 7, 2\}$
- b. the range is $\{3, 4, 6, -2\}$
- c. the table defines a function
- d. the table defines a relation

8. Which of the following does not represent a function?

- a. $y = x$
- b. $f(x) = 3$
- c. $\{(0, 1), (1, 2), (2, -3)\}$

d.

-1	0
0	11
-2	12
	13
-3	14

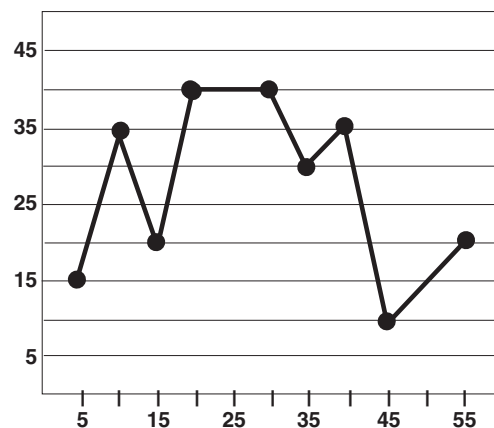
9. Matthew recorded the following data:

X	-4	-1	0	2
Y	10	-5	-	-

Which equation below shows the functional relationship between x and y ?

- a. $y = x^2 - 6$
- b. $y = 2x + 6$
- c. $y = x^2 - 6$
- d. $y = 2x^2 - 6$

10. Davis has been monitoring the fluctuations in the value of some stock he is interested in buying. He notices that the price fell drastically, but is now beginning to rise. To maximize his profits, he wants to purchase this stock when it is at its lowest. Which point on the graph would illustrate the best time for Davis to buy the stock?



- a. (5, 15)
- b. (55, 30)
- c. (45, 10)
- d. (20, 40)

11. A one-day car rental costs \$25 plus \$0.10 per mile driven. Which equation can be used to find the cost of a rental car for a given number of miles?

- a. $y = .1x$
- b. $y = .25x + 1$
- c. $y^2 = .1x + 25$
- d. $y = .1x + 25$

12. Look at the chart below. What function would give the monthly telephone charge?

Minutes	10	20	30	40
Cost	\$0.50	\$1.00	\$1.50	\$2.00
Basic Charge	\$39	\$39	\$39	\$39

- a. $f_{(x)} = 39 + .50x$
- b. $f_{(x)} = .05(39 + x)$
- c. $f_{(x)} = 39x + .50$
- d. $f_{(x)} = .05x + 39$

13. As a summer job, you start a house sitting service in your neighborhood. You agree to get the mail, pick up the newspapers, water plants, and feed pets for an initial fee of \$5, plus \$2 per day. Write an equation that shows the relationship between the number of days you housesit and the amount of money you earn for each month.

- a. amount earned = 2(number of days) + 5
- b. amount earned = 5(number of days) + 2
- c. amount earned = 5(number of days)
- d. amount earned = 2(number of days)

14. Which equation describes the function that contains all of the data points shown in the table?

Input	0	1	2	3	4	5
Output	1	2	5	10	17	26

- a. $y = x^2$
- b. $y = x^2 + 1$
- c. $y = 2x + 3$
- d. $y = x^2 - 1$

15. You have decided to save \$6 a week to buy an electric guitar costing \$150. Which expression shows how much money you still need to save after n weeks?

- a. $150 + 6n$
- b. $(150 + 6)n$
- c. $150 - 6n$
- d. $(150 - 6)n$

16. The number of students on the football team is two more than three times the number of students on the basketball team. If the basketball team has y students, how many students are on the football team?

- a. $3y - 2$
- b. $6y$
- c. $2y + 3$
- d. $2 + 3y$

Algebra

17. Which equation represents the function in the table?

Input (x)	Output (y)
0	3
1	4
2	7

- a. $y = x + 5$
- b. $y = 2x + 3$
- c. $y = x^2 + 5$
- d. $y = x^2 + 3$

18. Which of the following represents a function?

I.

Input	Output
1	4
2	4
3	6
4	6

II.

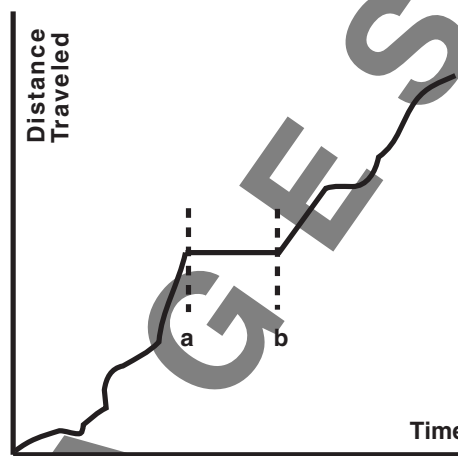
Input	Output
1	3
2	3
3	4
4	4

III.

Input	Output
1	3
1	-3
2	4
3	5

- a. All
- b. I and II
- c. I and III
- d. II and III

19. The graph below represents Jane's car trip from Newberry to Spartanburg.



Which of the following is most likely to have happened between time a and time b?

- a. Jane stopped for a meal.
- b. Jane's car was moving slowly.
- c. Jane stopped her car several times at traffic signals.
- d. Jane was driving fast on the interstate.

3. In South Carolina the percent of 18-to-24-year-olds that attend various arts activities at least once a year are represented in the table below.

Art Activities Attended by 18-to-24-year-olds

Jazz	Musical Play	Non-musical Play	Art Museum	Historic Park
15%	26%	20%	38%	46%

- a. Make a bar graph of the data.

- b. What conclusions can you draw from the bar graph.

4. If you can save \$5.25 a week, how many weeks must you save to buy a CD that costs \$15.75?

- a. Write a verbal and algebraic model to find how many bottles of juice you can buy.

- b. Solve the equation.

5. Make a line graph of the following data.

**Percent of Voting-Age Population that Voted in
Gubernatorial Elections in South Carolina**

Year	1980	1984	1988	1992	1996	2000
Percent	53.5	52.8	53.3	50.3	55.1	48.9

- a. Make a line graph of the data.
- b. What can you conclude from the line graph?

STANDARD I-C-1, 2, 3

ALGEBRA

STANDARD I

Understand patterns, relations, and functions.

- C. Analyze functions of one variable by investigating rates of change, intercepts, zeros, asymptotes and local and global behavior.
1. Relate the solution(s) of quadratic equations to the root(s) of the quadratic functions.
 2. Determine domain and range restrictions for linear and quadratic functions, given the constraints of the problem.
 3. Analyze graphs of quadratic functions and write conclusions for problem situations.

HIGHLIGHTS

This section is designed to give you practice finding the domain and range for problem situations and graphs and also determining the x-intercepts (roots or zeros) of quadratic equations. Your teacher will maximize your learning by expanding on these skills during class.

⇒ **Don't forget:** domain – the “x” values
range – the “y” values
x-intercept(s) – where the graph crosses the “x” axis

EXAMPLE 1

Terrance earns \$6.75 per hour working up to 4 hours each day after school. His weekly earnings are a function of the number of hours he works. Identify a reasonable domain and range for this situation.

Answer: The domain contains the number of hours Terrance works each week. Since he works up to 4 hours each weekday, he works up to $5 * 4$ or 20 hours a week. Therefore, a reasonable domain would be values from 0 to 20 hours. The range contains his weekly earnings from \$0 to $20 * \$6.75$ or \$135. Thus, a reasonable range is \$0 to \$135.

EXAMPLE 2

The path of Joe's golf ball after it is hit is represented by the equation:

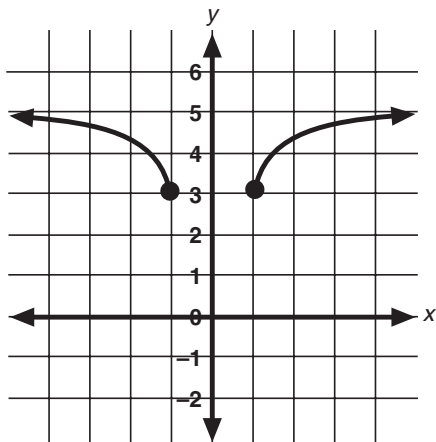
$y = -0.005x^2 + 0.3x$, where y and x are in yards. Using this equation, how far from the starting point will her ball be when it hits the ground ?

Answer: When solving this quadratic equation for its roots, we find two solutions. They are 0 and 200. The root of 0 represents the ball's original location. The second root of 200 tells us that the ball will hit the ground 200 yards from its original location.

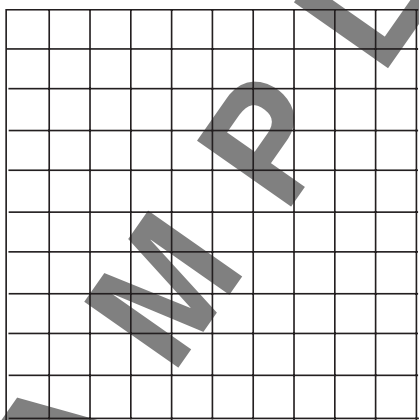
Therefore, Joe's golf ball will hit the ground 200 yards from where she originally hit the ball.

PRACTICE

1. Describe the domain of the function represented by the graph.



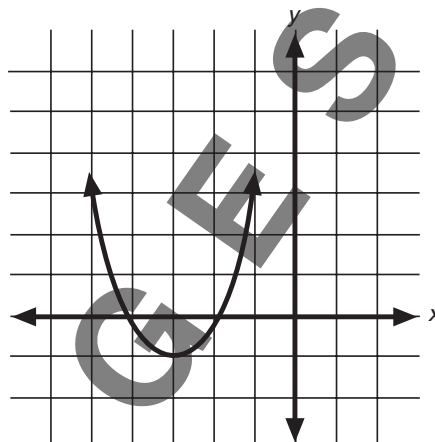
- a. all real numbers
 b. all real numbers x such that $x \leq -1$ or $x \geq 1$
 c. all real numbers y such that $y \geq 3$
 d. all real numbers x such that $-1 \leq x \leq 1$
2. Use the grid below to graph the function, $f(x) = (x + 1)^2$, for the domain $\{-3, -2, -1, 0, 1, 2, 3\}$.



What is the minimum value of the range as shown by the graph?

- a. 0
 b. 1
 c. -1
 d. ± 1

3. This is a graph of the function $f(x): x^2 + 6x + 8$



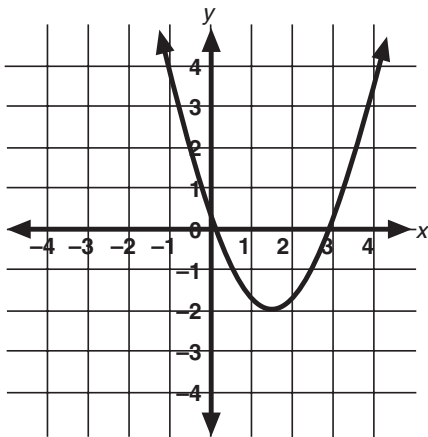
The roots of $f(x)$ appear to approximately be:

- a. $\{-4, 8, -2\}$
 b. $\{-3/4\}$
 c. $\{-2, 4\}$
 d. $\{-2, -4\}$
4. Determine whether the following equation has two real solutions, one real solution, or two complex solutions. $7x^2 + 21x + 6 = 0$
- a. two real solutions
 b. cannot be determined
 c. one real solution
 d. two complex solutions
5. If $f(x) = x^2 + 3$ and the domain = $\{-1, 0, 1\}$, determine the range.

- a. $\{\pm 4, 3\}$
 b. $\{4, 3\}$
 c. $\{4, \pm 3\}$
 d. $\{4, -3\}$

Algebra

6. Describe the range of the function shown by the graph.



- a. all real numbers
 b. all real numbers between -1 and 4
 c. all real numbers greater than or equal to -2
 d. all positive real numbers

7. Find the zero of the function: $f(x) = (1/3)x - 2$

- a. $(0,6)$
 b. $(6,0)$
 c. $(0,-6)$
 d. $(-6,0)$

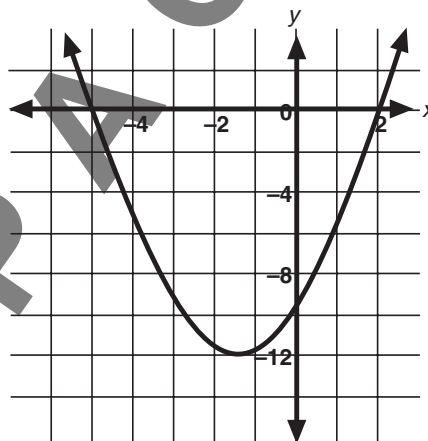
8. Which of the following does not represent the zero of a function?

- a. x-intercept
 b. $(x, 0)$
 c. $f(x) = 0$
 d. $f(0)$

9. Given $f: x \rightarrow 3x - 6$, find the zero of the function.

- a. $x = -2$
 b. $x = 1/2$
 c. $x = -1/2$
 d. $x = 2$

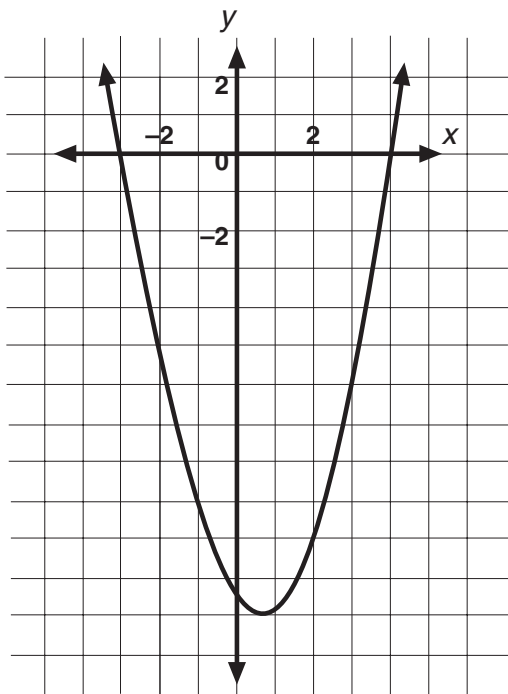
10. Find the zero of the function represented in the graph below.



11. Find the zeros of the function: $f(x) = x^2 - 5x - 24$.

- a. $x = 4$ and $x = -6$
 b. $x = 3$ and $x = -8$
 c. $x = -4$ and $x = 6$
 d. $x = -3$ and $x = 8$

12. Name the roots of the function represented in the graph below.



- a. $x = -4$ and $x = 3$
 b. $x = 4$ and $x = -3$
 c. $x = 0$ and $x = -12$
 d. there are no roots of the function
13. Determine the roots of the function:
 $f(r) = r^2 + 4r - 12$
- a. $r = 2$ and $r = -6$
 b. $r = -2$ and $r = 6$
 c. $r = 4$ and $r = -3$
 d. $r = -4$ and $r = 3$
14. Determine the roots of the function: $16x^2 - 9$.

- a. $x = \pm 3$
 b. $x = \pm 4$
 c. $x = \pm 3/4$
 d. $x = \pm 4/3$

15. Determine which statement is true with regards to: $f_{(0)} = 0$.

- a. The graph of the function goes through the origin
 b. The graph of the function has exactly one zero
 c. The function is linear
 d. The equation of the function is $y = x$

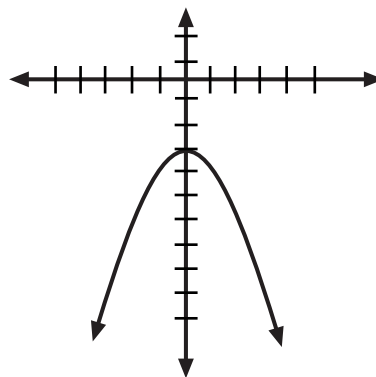
16. Which of the following does not describe the range of a function?

- a. dependent variable
 b. second coordinate in an ordered pair
 c. x-values
 d. y-values

17. List the range for the following: $\{(1,-1), (0,3), (-1,-5), (-2,-9)\}$

- a. $\{1, 0, -1, -2\}$
 b. $\{-1, 0, -5, -9\}$
 c. $\{-3, -9, -1, -2\}$
 d. $\{-1, -3, -5, -9\}$

18. What is the domain of this relation:



- a. all real numbers
 b. $\{y: y < -3\}$
 c. $\{x: x > -3\}$
 d. $\{x: x < -3\}$

2. Suppose the function $-0.005d^2 + 0.22d = h$ is used to simulate the path of a football at the kickoff of a computer football game. In this equation, h is the height of the football and d is the horizontal distance in yards. What is the horizontal distance the ball will travel before it hits the ground? Show your work.

SAMPLE

PAGES