

Study Guide and Review

Study Guide

Key Concepts

Order of Operations (Lesson 1-2)

- Evaluate expressions inside grouping symbols.
- Evaluate all powers.
- Multiply and/or divide in order from left to right.
- Add or subtract in order from left to right.

Properties of Equality (Lessons 1-3 and 1-4)

- For any numbers a , b , and c :
 - Reflexive: $a = a$
 - Symmetric: If $a = b$, then $b = a$.
 - Transitive: If $a = b$ and $b = c$, then $a = c$.
 - Substitution: If $a = b$, then a may be replaced by b in any expression.
 - Distributive: $a(b + c) = ab + ac$ and $a(b - c) = ab - ac$
 - Commutative: $a + b = b + a$ and $ab = ba$
 - Associative: $(a + b) + c = a + (b + c)$ and $(ab)c = a(bc)$

Solving Equations (Lesson 1-5)

- Apply order of operations and the properties of real numbers to solve equations.

Relations, Functions, and Interpreting Graphs of Functions (Lessons 1-6 through 1-8)

- Relations and functions can be represented by ordered pairs, a table, a mapping, or a graph.
- Use the vertical line test to determine if a relation is a function.
- End behavior describes the long-term behavior of a function on either end of its graph.
- Points where the graph of a function crosses an axis are called intercepts.
- A function is positive on a portion of its domain where its graph lies above the x -axis, and negative on a portion where its graph lies below the x -axis.

FOLDABLES StudyOrganizer

Be sure the Key Concepts are noted in your Foldable.



Key Vocabulary

algebraic expression (p. 5)	ordered pair (p. 40)
base (p. 5)	order of operations (p. 10)
coefficient (p. 28)	origin (p. 40)
coordinate system (p. 40)	power (p. 5)
dependent variable (p. 42)	range (p. 40)
domain (p. 40)	reciprocal (p. 17)
end behavior (p. 57)	relation (p. 40)
equation (p. 33)	relative maximum (p. 57)
exponent (p. 5)	relative minimum (p. 57)
function (p. 47)	replacement set (p. 33)
independent variable (p. 42)	simplest form (p. 27)
intercept (p. 56)	solution (p. 33)
like terms (p. 27)	term (p. 5)
line symmetry (p. 57)	variables (p. 5)
mapping (p. 40)	vertical line test (p. 49)

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined term to make a true sentence.

- A coordinate system is formed by two intersecting number lines.
- An exponent indicates the number of times the base is to be used as a factor.
- An expression is in simplest form when it contains like terms and parentheses.
- In an expression involving multiplication, the quantities being multiplied are called factors.
- In a function, there is exactly one output for each input.
- Order of operations tells us to perform multiplication before subtraction.
- Since the product of any number and 1 is equal to the number, 1 is called the multiplicative inverse.

Lesson-by-Lesson Review

1-1 Variables and Expressions

Write a verbal expression for each algebraic expression.

8. $h - 7$ 9. $3x^2$ 10. $5 + 6m^3$

Write an algebraic expression for each verbal expression.

11. a number increased by 9
 12. two thirds of a number d to the third power
 13. 5 less than four times a number

Evaluate each expression.

14. 2^5 15. 6^3 16. 4^4

17. **BOWLING** Fantastic Pins Bowling Alley charges \$2.50 for shoe rental plus \$3.25 for each game. Write an expression representing the cost to rent shoes and bowl g games.

Example 1

Write a verbal expression for $4x + 9$.
 nine more than four times a number x

Example 2

Write an algebraic expression for *the difference of twelve and two times a number cubed*.

Variable Let x represent the number.

Expression $12 - 2x^3$

Example 3

Evaluate 3^4 .

The base is 3 and the exponent is 4.

$$\begin{aligned} 3^4 &= 3 \cdot 3 \cdot 3 \cdot 3 && \text{Use 3 as a factor 4 times.} \\ &= 81 && \text{Multiply.} \end{aligned}$$

1-2 Order of Operations

Evaluate each expression.

18. $24 - 4 \cdot 5$ 19. $15 + 3^2 - 6$
 20. $7 + 2(9 - 3)$ 21. $8 \cdot 4 - 6 \cdot 5$
 22. $[(2^5 - 5) \div 9]11$ 23. $\frac{11 + 4^2}{5^2 - 4^2}$

Evaluate each expression if $a = 4$, $b = 3$, and $c = 9$.

24. $c + 3a$
 25. $5b^2 \div c$
 26. $(a^2 + 2bc) \div 7$

27. **ICE CREAM** The cost of a one-scoop sundae is \$2.75, and the cost of a two-scoop sundae is \$4.25. Write and evaluate an expression to find the total cost of 3 one-scoop sundaes and 2 two-scoop sundaes.

Example 4

Evaluate the expression $3(9 - 5)^2 \div 8$.

$$\begin{aligned} 3(9 - 5)^2 \div 8 &= 3(4)^2 \div 8 && \text{Work inside parentheses.} \\ &= 3(16) \div 8 && \text{Evaluate } 4^2. \\ &= 48 \div 8 && \text{Multiply.} \\ &= 6 && \text{Divide.} \end{aligned}$$

Example 5

Evaluate the expression $(5m - 2n) \div p^2$ if $m = 8$, $n = 4$, $p = 2$.

$$\begin{aligned} (5m - 2n) \div p^2 &= (5 \cdot 8 - 2 \cdot 4) \div 2^2 && \text{Replace } m \text{ with 8, } n \text{ with 4, and } p \text{ with 2.} \\ &= (40 - 8) \div 2^2 && \text{Multiply.} \\ &= 32 \div 2^2 && \text{Subtract.} \\ &= 32 \div 4 && \text{Evaluate } 2^2. \\ &= 8 && \text{Divide.} \end{aligned}$$



Study Guide and Review *Continued*

1-3 Properties of Numbers

Evaluate each expression using properties of numbers. Name the property used in each step.

28. $18 \cdot 3(1 \div 3)$ 29. $[5 \div (8 - 6)] \frac{2}{5}$
 30. $(16 - 4^2) + 9$ 31. $2 \cdot \frac{1}{2} + 4(4 \cdot 2 - 7)$
 32. $18 + 41 + 32 + 9$ 33. $7\frac{2}{5} + 5 + 2\frac{3}{5}$
 34. $8 \cdot 0.5 \cdot 5$ 35. $5.3 + 2.8 + 3.7 + 6.2$

36. **SCHOOL SUPPLIES** Monica needs to purchase a binder, a textbook, a calculator, and a workbook for her algebra class. The binder costs \$9.25, the textbook \$32.50, the calculator \$18.75, and the workbook \$15.00. Find the total cost for Monica's algebra supplies.

Example 6

Evaluate $6(4 \cdot 2 - 7) + 5 \cdot \frac{1}{5}$. Name the property used in each step.

$$\begin{aligned} 6(4 \cdot 2 - 7) + 5 \cdot \frac{1}{5} & \\ = 6(8 - 7) + 5 \cdot \frac{1}{5} & \quad \text{Substitution} \\ = 6(1) + 5 \cdot \frac{1}{5} & \quad \text{Substitution} \\ = 6 + 5 \cdot \frac{1}{5} & \quad \text{Multiplicative Identity} \\ = 6 + 1 & \quad \text{Multiplicative Inverse} \\ = 7 & \quad \text{Substitution} \end{aligned}$$

1-4 The Distributive Property

Use the Distributive Property to rewrite each expression. Then evaluate.

37. $(2 + 3)6$ 38. $5(18 + 12)$
 39. $8(6 - 2)$ 40. $(11 - 4)3$
 41. $-2(5 - 3)$ 42. $(8 - 3)4$

Rewrite each expression using the Distributive Property. Then simplify.

43. $3(x + 2)$ 44. $(m + 8)4$
 45. $6(d - 3)$ 46. $-4(5 - 2t)$
 47. $(9y - 6)(-3)$ 48. $-6(4z + 3)$

49. **TUTORING** Write and evaluate an expression for the number of tutoring lessons Mrs. Green gives in 4 weeks.

Tutoring Schedule	
Day	Students
Monday	3
Tuesday	5
Wednesday	4

Example 7

Use the Distributive Property to rewrite the expression $5(3 + 8)$. Then evaluate.

$$\begin{aligned} 5(3 + 8) &= 5(3) + 5(8) && \text{Distributive Property} \\ &= 15 + 40 && \text{Multiply} \\ &= 55 && \text{Simplify} \end{aligned}$$

Example 8

Rewrite the expression $6(x + 4)$ using the Distributive Property. Then simplify.

$$\begin{aligned} 6(x + 4) &= 6 \cdot x + 6 \cdot 4 && \text{Distributive Property} \\ &= 6x + 24 && \text{Simplify} \end{aligned}$$

Example 9

Rewrite the expression $(3x - 2)(-5)$ using the Distributive Property. Then simplify.

$$\begin{aligned} (3x - 2)(-5) & \\ = (3x)(-5) - (2)(-5) & \quad \text{Distributive Property} \\ = -15x + 10 & \quad \text{Simplify} \end{aligned}$$

1-5 Equations

Find the solution of each equation if the replacement sets are $x: \{1, 3, 5, 7, 9\}$ and $y: \{6, 8, 10, 12, 14\}$.

50. $y - 9 = 3$ 51. $14 + x = 21$
 52. $4y = 32$ 53. $3x - 11 = 16$
 54. $\frac{42}{y} = 7$ 55. $2(x - 1) = 8$

Solve each equation.

56. $a = 24 - 7(3)$
 57. $z = 63 \div (3^2 - 2)$

58. **AGE** Shandra's age is four more than three times Sherita's age. Write an equation for Shandra's age. Solve if Sherita is 3 years old.

Example 10

Solve the equation $5w - 19 = 11$ if the replacement set is $w: \{2, 4, 6, 8, 10\}$.

Replace w in $5w - 19 = 11$ with each value in the replacement set.

w	$5w - 19 = 11$	True or False?
2	$5(2) - 19 = 11$	false
4	$5(4) - 19 = 11$	false
6	$5(6) - 19 = 11$	true
8	$5(8) - 19 = 11$	false
10	$5(10) - 19 = 11$	false

Since the equation is true when $w = 6$, the solution of $5w - 19 = 11$ is $w = 6$.

1-6 Relations

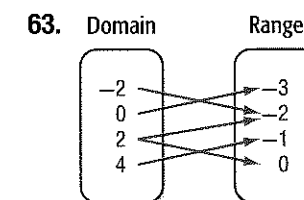
Express each relation as a table, a graph, and a mapping. Then determine the domain and range.

59. $\{(1, 3), (2, 4), (3, 5), (4, 6)\}$
 60. $\{(-1, 1), (0, -2), (3, 1), (4, -1)\}$
 61. $\{(-2, 4), (-1, 3), (0, 2), (-1, 2)\}$

Express the relation shown in each table, mapping, or graph as a set of ordered pairs.

62.

x	y
5	3
3	-1
1	2
-1	0



64. **GARDENING** On average, 7 plants grow for every 10 seeds of a certain type planted. Make a table to show the relation between seeds planted and plants growing for 50, 100, 150, and 200 seeds. Then state the domain and range and graph the relation.

Example 11

Express the relation $\{(-3, 4), (1, -2), (0, 1), (3, -1)\}$ as a table, a graph, and a mapping.

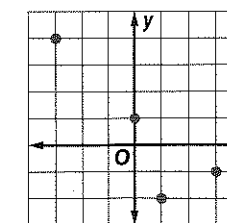
Table

Place the x -coordinates into the first column. Place the corresponding y -coordinates in the second column.

x	y
-3	4
1	-2
0	1
3	-1

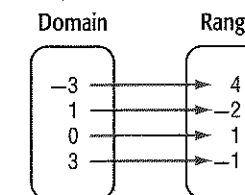
Graph

Graph each ordered pair on a coordinate plane.



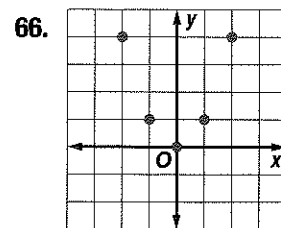
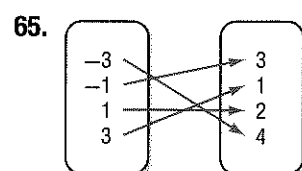
Mapping

List the x -values in the domain and the y -values in the range. Draw arrows from the x -values in set X to the corresponding y -values in set Y .



1-7 Functions

Determine whether each relation is a function.



67. $\{(8, 4), (6, 3), (4, 2), (2, 1), (6, 0)\}$

If $f(x) = 2x + 4$ and $g(x) = x^2 - 3$, find each value.

68. $f(-3)$ 69. $g(2)$ 70. $f(0)$

71. $g(-4)$ 72. $f(m + 2)$ 73. $g(3p)$

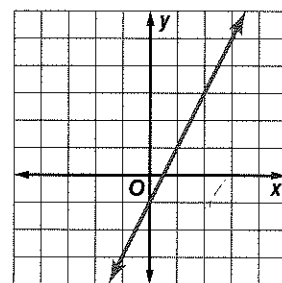
74. **GRADES** A teacher claims that the relationship between number of hours studied for a test and test score can be described by $g(x) = 45 + 9x$, where x represents the number of hours studied. Graph this function.

Example 12

Determine whether $2x - y = 1$ represents a function.

First make a table of values. Then graph the equation.

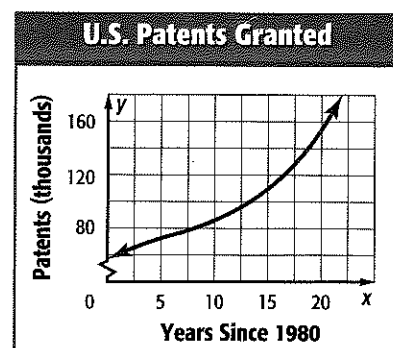
x	y
-1	-3
0	-1
1	1
2	3
3	5



Using the vertical line test, it can be shown that $2x - y = 1$ does represent a function.

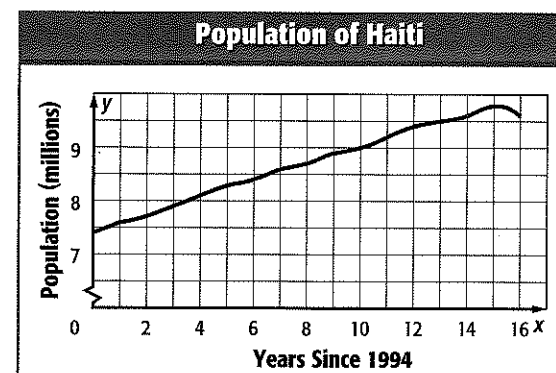
1-8 Interpreting Graphs of Functions

75. Identify the function graphed as *linear* or *nonlinear*. Then estimate and interpret the intercepts of the graph, any symmetry, where the function is positive, negative, increasing, and decreasing, the x -coordinate of any relative extrema, and the end behavior of the graph.



Example 13

POPULATION The population of Haiti from 1994 to 2010 can be modeled by the function graphed below. Estimate and interpret where the function is increasing, and decreasing, the x -coordinates of any relative extrema, and the end behavior of the graph.



The population increased from 1994 to 2009 and decreased from 2009 to 2010. The relative maximum of the graph indicates that the population peaked in 2009.

As x increases or decreases, y decreases. The end behavior indicates a decline in population from 2009 to 2010.

Write an algebraic expression for each verbal expression.

- six more than a number
- twelve less than the product of three and a number
- four divided by the difference between a number and seven

Evaluate each expression.

4. $32 \div 4 + 2^3 - 3$

5. $\frac{(2 \cdot 4)^2}{7 + 3^2}$

6. **MULTIPLE CHOICE** Find the value of the expression $a^2 + 2ab + b^2$ if $a = 6$ and $b = 4$.

- A 68
B 92
C 100
D 121

Evaluate each expression. Name the property used in each step.

7. $13 + (16 - 4^2)$

8. $\frac{2}{9}[9 \div (7 - 5)]$

9. $37 + 29 + 13 + 21$

Rewrite each expression using the Distributive Property. Then simplify.

10. $4(x + 3)$

11. $(5p - 2)(-3)$

12. **MOVIE TICKETS** A company operates three movie theaters. The chart shows the typical number of tickets sold each week at the three locations. Write and evaluate an expression for the total typical number of tickets sold by all three locations in four weeks.

Location	Tickets Sold
A	438
B	374
C	512

Find the solution of each equation if the replacement sets are $x: \{1, 3, 5, 7, 9\}$ and $y: \{2, 4, 6, 8, 10\}$.

13. $3x - 9 = 12$

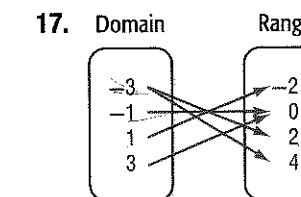
14. $y^2 - 5y - 11 = 13$

15. **CELL PHONES** The ABC Cell Phone Company offers a plan that includes a flat fee of \$29 per month plus a \$0.12 charge per minute. Write an equation to find C , the total monthly cost for m minutes. Then solve the equation for $m = 50$.

Express the relation shown in each table, mapping, or graph as a set of ordered pairs.

16.

x	y
-2	4
1	2
3	0
4	-2



18. **MULTIPLE CHOICE** Determine the domain and range for the relation $\{(2, 5), (-1, 3), (0, -1), (3, 3), (-4, -2)\}$.

F D: $\{2, -1, 0, 3, -4\}$, R: $\{5, 3, -1, 3, -2\}$

G D: $\{5, 3, -1, 3, -2\}$, R: $\{2, -1, 0, 3, 4\}$

H D: $\{0, 1, 2, 3, 4\}$, R: $\{-4, -3, -2, -1, 0\}$

J D: $\{2, -1, 0, 3, -4\}$, R: $\{2, -1, 0, 3, 4\}$

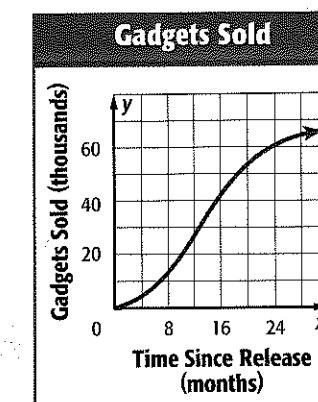
19. Determine whether the relation $\{(2, 3), (-1, 3), (0, 4), (3, 2), (-2, 3)\}$ is a function.

If $f(x) = 5 - 2x$ and $g(x) = x^2 + 7x$, find each value.

20. $g(3)$

21. $f(-6y)$

22. Identify the function graphed as *linear* or *nonlinear*. Then estimate and interpret the intercepts of the graph, any symmetry, where the function is positive, negative, increasing, and decreasing, the x -coordinate of any relative extrema, and the end behavior of the graph.



Preparing for Standardized Tests

Eliminate Unreasonable Answers

You can eliminate unreasonable answers to help you find the correct one when solving multiple choice test items. Doing so will save you time by narrowing down the list of possible correct answers.

Strategies for Eliminating Unreasonable Answers

Step 1

Read the problem statement carefully to determine exactly what you are being asked to find.

Ask yourself:

- What am I being asked to solve?
- What format (i.e., fraction, number, decimal, percent, type of graph) will the correct answer be?
- What units (if any) will the correct answer have?

Step 2

Carefully look over each possible answer choice and evaluate for reasonableness.

- Identify any answer choices that are clearly incorrect and eliminate them.
- Eliminate any answer choices that are not in the proper format.
- Eliminate any answer choices that do not have the correct units.

Step 3

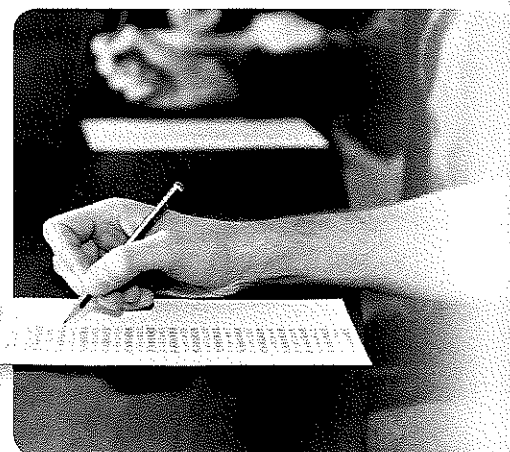
Solve the problem and choose the correct answer from those remaining. Check your answer.

Standardized Test Example

Read each problem. Eliminate any unreasonable answers. Then use the information in the problem to solve.

Jason earns 8.5% commission on his weekly sales at an electronics retail store. Last week he had \$4200 in sales. What was his commission for the week?

- | | |
|---------|---------|
| A \$332 | C \$425 |
| B \$357 | D \$441 |



Using mental math, you know that 10% of \$4200 is \$420. Since 8.5% is less than 10%, you know that Jason earned less than \$420 in commission for his weekly sales. So, answer choices C and D can be eliminated because they are greater than \$420. The correct answer is either A or B.

$$\$4200 \times 0.085 = \$357$$

So, the correct answer is B.

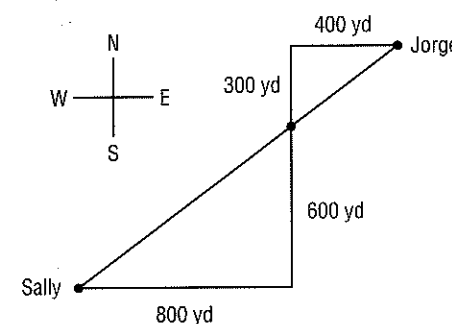
Exercises

Read each problem. Eliminate any unreasonable answers. Then use the information in the problem to solve.

1. Coach Roberts expects 35% of the student body to turn out for a pep rally. If there are 560 students, how many does Coach Roberts expect to attend the pep rally?

- A 184
B 196
C 214
D 390

2. Jorge and Sally leave school at the same time. Jorge walks 300 yards north and then 400 yards east. Sally rides her bike 600 yards south and then 800 yards west. What is the distance between the two students?



- F 500 yd
G 750 yd
H 1,200 yd
J 1,500 yd

3. What is the range of the relation below?

$\{(1, 2), (3, 4), (5, 6), (7, 8)\}$

- A all real numbers
B all even numbers
C $\{2, 4, 6, 8\}$
D $\{1, 3, 5, 7\}$

4. The expression $3n + 1$ gives the total number of squares needed to make each figure of the pattern where n is the figure number. How many squares will be needed to make Figure 9?



Figure 1

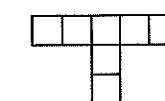


Figure 2

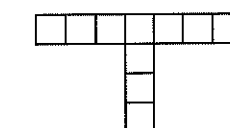


Figure 3

- F 28 squares
G 32.5 squares
H 56 squares
J 88.5 squares

5. The expression $3x - (2x + 4x - 6)$ is equivalent to

- | | |
|-------------|------------|
| A $-3x - 6$ | C $3x + 6$ |
| B $-3x + 6$ | D $3x - 6$ |

Standardized Test Practice

Chapter 1

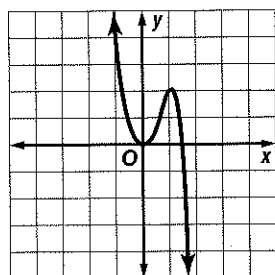
Multiple Choice

Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

1. Evaluate the expression 2^6 .

A 12
B 32
C 64
D 128

2. Which sentence best describes the end behavior of the function shown?



F As x increases, y increases, and as x decreases, y increases.
G As x increases, y increases, and as x decreases, y decreases.
H As x increases, y decreases, and as x decreases, y increases.
J As x increases, y decreases, and as x decreases, y decreases.

3. Let y represent the number of yards. Which algebraic expression represents the number of feet in y ?

A $y - 3$
B $y + 3$
C $3y$
D $\frac{3}{y}$

4. What is the domain of the following relation?

$\{(1, 3), (-6, 4), (8, 5)\}$

F $\{3, 4, 5\}$
G $\{-6, 1, 8\}$
H $\{-6, 1, 3, 4, 5, 8\}$
J $\{1, 3, 4, 5, 8\}$

5. The table shows the number of some of the items sold at the concession stand at the first day of a soccer tournament. Estimate how many items were sold from the concession stand throughout the four days of the tournament.

Concession Sales Day 1 Results	
Item	Number Sold
Popcorn	78
Hot Dogs	80
Chip	48
Sodas	51
Bottled Water	92

A 1350 items
B 1400 items
C 1450 items
D 1500 items

6. There are 24 more cars than twice the number of trucks for sale at a dealership. If there are 100 cars for sale, how many trucks are there for sale at the dealership?

F 28
G 32
H 34
J 38

7. Refer to the relation in the table below. Which of the following values would result in the relation not being a function?

x	-6	-2	0	?	3	5
y	-1	8	3	-3	4	0

A -1
B 3
C 7
D 8

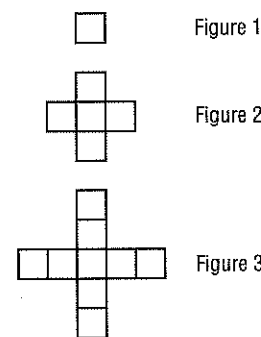
Test-Taking Tip

Question 7 A function is a relation in which each element of the domain is paired with *exactly* one element of the range.

Short Response/Gridded Response

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

8. The edge of each box below is 1 unit long.



- a. Make a table showing the perimeters of the first 3 figures in the pattern.
b. Look for a pattern in the perimeters of the shapes. Write an algebraic expression for the perimeter of Figure n .
c. What would be the perimeter of Figure 10 in the pattern?

9. The table shows the costs of certain items at a corner hardware store.

Item	Cost
box of nails	\$3.80
box of screws	\$5.25
claw hammer	\$12.95
electric drill	\$42.50

- a. Write two expressions to represent the total cost of 3 boxes of nails, 2 boxes of screws, 2 hammers, and 1 electric drill.
b. What is the total cost of the items purchased?

Need ExtraHelp?

If you missed Question...	1	2	3	4	5	6	7	8	9	10	11	12
Go to Lesson...	1-2	1-8	1-1	1-6	1-4	1-5	1-7	1-5	1-3	1-2	1-4	1-1

10. GRIDDED RESPONSE Evaluate the expression below.

$$\frac{5^3 \cdot 4^2 - 5^2 \cdot 4^3}{5 \cdot 4}$$

11. Use the equation $y = 2(4 + x)$ to answer each question.

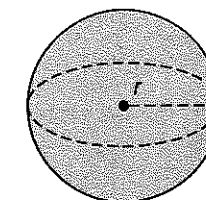
- a. Complete the table for each value of x .
b. Plot the points from the table on a coordinate grid. What do you notice about the points?
c. Make a conjecture about the relationship between the change in x and the change in y .

x	y
1	
2	
3	
4	
5	
6	

Extended Response

Record your answers on a sheet of paper. Show your work.

12. The volume of a sphere is four-thirds the product of π and the radius cubed.



- a. Write an expression for the volume of a sphere with radius r .
b. Find the volume of a sphere with a radius of 6 centimeters. Describe how you found your answer.