Chapter 1 Study Guide and Review

Chapter Summary

Key Concepts

Order of Operations (Lesson 1-2)
- Evalute 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 (Lesson 1-6)
- Relations can be represent by ordered pairs, a table, a mapping, or a graph.

Functions (Lesson 1-7)
- Use the vertical line test to determine if a relation is a function.

Conditional Statements (Lesson 1-8)
- An if-then statement has a hypothesis and a conclusion.

FOLDABLES Study Organizer

Be sure the Key Concepts are noted in your Foldable.

Key Vocabulary

algebraic expression (p. 5) like terms (p. 25)

base (p. 5) mapping (p. 38)

coefficient (p. 26) ordered pair (p. 38)

conclusion (p. 54) order of operations (p. 10)

conditional statement (p. 54) origin (p. 38)

coordinate system (p. 38) power (p. 5)

counterexample (p. 56) range (p. 38)

deductive reasoning (p. 55) reciprocal (p. 17)

dependent variable (p. 40) relation (p. 38)

domain (p. 38) replacement set (p. 31)

equation (p. 31) simplest form (p. 25)

exponent (p. 5) solution (p. 31)

function (p. 45) term (p. 5)

hypothesis (p. 54) variables (p. 5)

independent variable (p. 40) vertical line test (p. 47)

Vocabulary Check

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

1. A coordinate system is formed by two intersecting number lines.

2. An exponent indicates the number of times the base is to be used as a factor.

3. An expression is in simplest form when it contains like terms and parentheses.

4. In an expression involving multiplication, the quantities being multiplied are called factors.

5. In a function, there is exactly one output for each input.

6. Order of operations tells us to perform multiplication before subtraction.

7. Since the product of any number and 1 is equal to the number, 1 is called the multiplicative inverse.

Chapter 1 Study Guide and Review
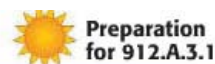
Write a verbal expression for each algebraic expression.

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.

$3^4 = 3 \cdot 3 \cdot 3 \cdot 3$ Use 3 as a factor 4 times.

$= 81$ Multiply.

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. $\left[(2^5 - 5) \div 9\right]11$ **23.** $\dfrac{11 + 4^2}{5^2 - 4^2}$

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

24. $c + 3a$

25. $5b^2 \div c$

26. $\left(a^2 + 2bc\right) \div 7$

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

$3(9 - 5)^2 \div 8 = 3(4)^2 \div 8$ Work inside parentheses.

$= 3(16) \div 8$ Evaluate 4^2.

$= 48 \div 8$ Multiply.

$= 6$ Divide.

EXAMPLE 5

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

$(5m - 2n) \div p^2$

$= (5 \cdot 8 - 2 \cdot 4) \div 2^2$ Replace m with 8, n with 4, and p with 2.

$= (40 - 8) \div 2^2$ Multiply.

$= 32 \div 2^2$ Subtract.

$= 32 \div 4$ Evaluate 2^2.

$= 8$ Divide.

Chapter 1 Study Guide and Review

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.

$6(4 \cdot 2 - 7) + 5 \cdot \frac{1}{5}$

$= 6(8 - 7) + 5 \cdot \frac{1}{5}$	Substitution
$= 6(1) + 5 \cdot \frac{1}{5}$	Substitution
$= 6 + 5 \cdot \frac{1}{5}$	Multiplicative Identity
$= 6 + 1$	Multiplicative Inverse
$= 7$	Substitution

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.

$5(3 + 8) = 5(3) + 5(8)$	Distributive Property
$= 15 + 40$	Multiply.
$= 55$	Simplify.

EXAMPLE 8

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

$6(x + 4) = 6 \cdot x + 6 \cdot 4$	Distributive Property
$= 6x + 24$	Simplify.

EXAMPLE 9

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

$(3x - 2)(-5)$

$= (3x)(-5) - (2)(-5)$	Distributive Property
$= -15x + 10$	Simplify.

Chapter 1 Study Guide and Review

912.A.3.1

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 the equation 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 $w = 6$.
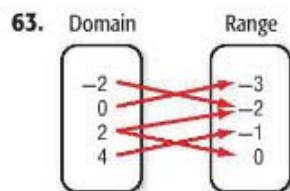

912.A.2.4
912.A.2.1

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

63.

Domain   Range

−2 → −3
0 → −2
2 → −1
4 → 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

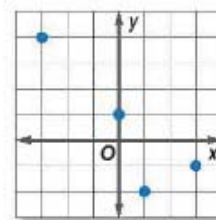Express the relation {(−3, 4), (1, −2), (0, 1), (3, −1)} as a table, a graph, and a mapping.

Table

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

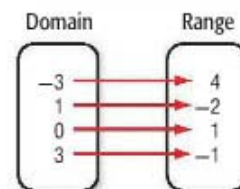| x	y
−3	4
1	−2
0	1
3	−1

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.

Domain   Range

−3 → 4
1 → −2
0 → 1
3 → −1

Chapter 1 Study Guide and Review

Determine whether each relation is a function.

65.
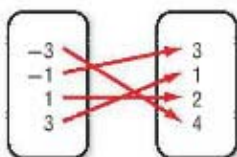
66.

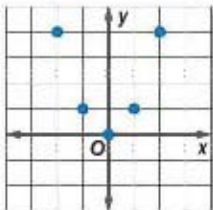| x	y
-4	3
2	0
1	-2
2	1

67.

68. {(8, 4), (6, 3), (4, 2), (2, 1), (0, 0)}

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

69. $f(-3)$ **70.** $g(2)$ **71.** $f(0)$

72. $g(-4)$ **73.** $f(m + 2)$ **74.** $g(3p)$

75. 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 the relation shown below is a function.

For each member of the domain, there is only one member of the range that corresponds to it. So this mapping represents a function. It does not matter that more than one element of the domain is paired with one element of the range.
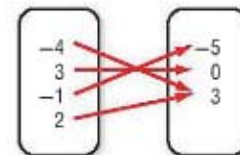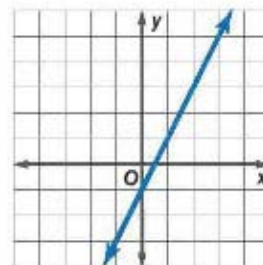

EXAMPLE 13

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.

Chapter 1 Study Guide and Review

Chapter 1 Practice Test. p.67

Write an algebraic expression for each verbal expression.

1. six more than a number

2. twelve less than the product of three and a number

3. four divided by the difference between a number and seven

Evaluate each expression.

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

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

6. **NGSSS PRACTICE** 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. $\dfrac{2}{9}[9 \div (7 - 5)]$

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, mappin or graph as a set of ordered pairs.

16.

x	y
−2	4
1	2
3	0
4	−2

17.
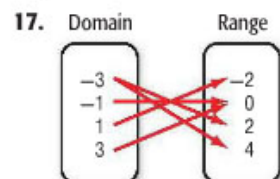
Domain   Range

18. **NGSSS PRACTICE** 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}

I. 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. $f(-6y)$

Identify the hypothesis and conclusion of each statement.

22. If the temperature goes below 32°F, it will snow outside.

23. If Ivan breaks his arm, he will need to go to the hospital.

Find a counterexample for each conditional statement.

24. If you go to the pool, you will get wet.

25. If a quadrilateral has one pair of sides that are parallel, then it is a square.