NAME _____ DATE _____ PERIOD _____

9-1 Properties (pages 333–336)

Properties are statements that are true for all values of the variables.

Distributive Property	To multiply a sum by a number, multiply each addend of the sum by the number outside the parentheses.	$3(5 + 2) = 3 \times 5 + 3 \times 2$ $a(b + c) = ab + ac$
Commutative Property	The order in which numbers are added or multiplied does not change the sum or product.	$6 + 8 = 8 + 6$ $7 \times 4 = 4 \times 7$
Associative Property	The way in which numbers are grouped when added or multiplied does not change the sum or product.	$(2 + 5) + 3 = 2 + (5 + 3)$ $(6 \times 9) \times 4 = 6 \times (9 \times 4)$
Additive Identity	The sum of any number and 0 is the number.	$4 + 0 = 4 \quad a + 0 = a$
Multiplicative Identity	The product of any number and 1 is the number.	$5 \times 1 = 5 \quad 1 \times n = n$

EXAMPLES

A Find 5×12 mentally using the Distributive Property.

$5 \times 12 = 5(10 + 2)$ Use $10 + 2$ for 12.
$= 5(10) + 5(2)$
$= 50 + 10 = 60$

B Find $8 + 11 + 2 + 9$ mentally.

$8 + 11 + 2 + 9$
$= 8 + 2 + 11 + 9$ Commutative Property
$= (8 + 2) + (11 + 9)$ Associative Property
$= 10 + 20 = 30$ Add mentally.

Try These Together

Find each product mentally. Use the Distributive Property. Then evaluate.

1. 9×17 **2.** 16×4

PRACTICE

Rewrite each expression using the Distributive Property. Then evaluate.

3. $7(60 + 8)$ **4.** $8(50 + 1)$ **5.** $52 \times 50 + 52 \times 6$

Identify the property shown by each equation.

6. $9 + 0 = 9$ **7.** $65 \times 1 = 65$ **8.** $4 + (7 + 5) = (4 + 7) + 5$

Find each sum or product mentally.

9. $5 \times 4 \times 8$ **10.** $15 + 14 + 16$ **11.** $2 \times 9 \times 50$

12. **Standardized Test Practice** Find 1.8×5 mentally.

A 0.9 **B** 5.4 **C** 9 **D** 54

Answers: **1.** 153 **2.** 64 **3.** $7 \times 60 + 7 \times 8$; 476 **4.** $8 \times 50 + 8 \times 1$; 408 **5.** $52(50 + 6)$; 2,912 **6.** Identity(+) **7.** Identity(×) **8.** Assoc.(+) **9.** 160 **10.** 45 **11.** 900 **12.** C

NAME _____ DATE _____ PERIOD _____

9-2 Solving Addition Equations (pages 339–342)

You can use models to solve addition equations. You can then use the same pattern as you solve addition equations with paper and pencil.

Solving Addition Equations	To solve an equation, you get the variable by itself on one side of the equation. To solve an addition equation • Circle the variable you will get by itself on one side of the equation. • Ask yourself, "What do I need to do to undo what has been done to this variable?" • Then do the same thing to each side of the equation. Your variable will then be by itself on one side of the equation, and your numbers will be on the other side of the equation.

EXAMPLES

A Solve $8 + y = 10$.

$8 + y = 10$	*To get y alone, you must undo adding 8.*
$8 + y = 10$	*Subtract to undo adding 8.*
$\underline{-8} \quad \underline{-8}$	*Subtract 8 from each side.*
$y = 2$	
$8 + 2 = 10$ ✓	*Check by replacing y with 2.*

B Find the value of n if $n + (-2) = 7$.

$n + (-2) = 7$	*To get n alone, you must undo adding (−2).*
$n + (-2) = 7$	*+2 is the opposite of (−2).*
$\underline{+2} \quad \underline{+2}$	*Do the same thing to each side.*
$n = 9$	
$9 + (-2) = 7$ ✓	*Check by replacing n with 9.*

Try These Together

1. Solve $-3 = b + 4$.

HINT: You can either subtract 4 or add (−4) to each side of the equation.

2. Solve $t + 5 = -14$.

HINT: Subtract 5 from each side of the equation.

PRACTICE

Solve each equation. Use models if necessary. Check your solution.

3. $x + 7 = 11$ **4.** $y + 2 = 6$ **5.** $10 + m = 13$

6. $2 + n = 11$ **7.** $r + (-1) = 4$ **8.** $16 + t = 26$

9. $12 + w = -2$ **10.** $4 + z = 9$ **11.** $d + (-5) = -8$

12. Find the value of a if $a + 13 = 26$.

13. What is the value of b if $9 + b = -1$?

14. **Standardized Test Practice** Find the value of x if $x + 10 = 95$.

A 25 **B** 85 **C** 95 **D** 75

Answers: **1.** −7 **2.** −19 **3.** 4 **4.** 4 **5.** 3 **6.** 9 **7.** 5 **8.** 10 **9.** −14 **10.** 5 **11.** −3 **12.** 13 **13.** −10 **14.** B

NAME _____ DATE _____ PERIOD _____

9-3 Solving Subtraction Equations (pages 344–347)

You can use models to solve subtraction equations. You can also rewrite a subtraction equation as an addition equation and solve with paper and pencil.

Solving Subtraction Equations	To solve an equation, you get the variable by itself on one side of the equation. To solve a subtraction equation • Ask yourself, "What do I need to do to undo what has been done to this variable?" • Then do the same thing to each side of the equation.

EXAMPLES

A Solve $y - 7 = 12$.

$y - 7 = 12$

$+7 \quad +7$ *Add 7 to each side.*

$y = 19$

$19 - 7 = 12$ ✓ *Check by replacing y with 19.*

B Find the value of n if $n - (-2) = 8$.

$n - (-2) = 8$ *To get n alone, you must undo subtracting (−2).*

$n + 2 = 8$ *Subtracting (−2) is the same as adding 2. The opposite of adding 2 is subtracting 2.*

$-2 \quad -2$ *Do the same thing to each side.*

$n = 6$

$6 - (-2) = 8$ ✓ *Check by replacing n with 6.*

Try These Together

1. Solve $x - 4 = -3$.
HINT: Add 4 to each side.

2. Solve $p - (-7) = -20$.
HINT: Rewrite as $p + 7 = -20$.

PRACTICE

Solve each equation. Use models if necessary. Check your solution.

3. $h - 5 = 2$ **4.** $g - 8 = 1$ **5.** $-3 = j - 5$

6. $k - (-4) = 10$ **7.** $n - (-6) = 12$ **8.** $r - (-1) = 6$

9. $t - 7 = 2$ **10.** $s - 16 = 5$ **11.** $d - 8 = -2$

12. $f - 10 = 5$ **13.** $w - 4 = -4$ **14.** $x - 9 = 3$

15. Find the value of z if $z - 3 = -2$.

16. If $q - (-1) = 4$, what is the value of q?

17. **Standardized Test Practice** Martina spent \$1 on a snack after school and had \$4 left. How much money did she have before she bought the snack?

A \$6 **B** \$4 **C** \$3 **D** \$5

Answers: 1. 1 2. −27 3. 7 4. 9 5. 2 6. 6 7. 6 8. 5 9. 9 10. 21 11. 6 12. 15 13. 0 14. 12 15. 1 16. 3 17. D

NAME _____ DATE _____ PERIOD _____

9-4 Solving Multiplication Equations (pages 350–353)

You can use models to solve multiplication equations. You can also solve an equation with paper and pencil by undoing what has been done.

Solving Multiplication Equations	• You need to get the variable by itself on one side of the equation by undoing what has been done to the variable. • Ask yourself, "What do I need to do to undo what has been done to this variable?" • Divide to undo multiplication. • Do the same to each side of the equation.

EXAMPLES

A Solve $8y = 24$.

$8y = 24$	*To get y alone, you must undo multiplying by 8.*
$8y = 24$	*Divide to undo the multiplication.*
$\frac{8y}{8} = \frac{24}{8}$	*Divide each side by 8.*
$y = 3$	
$8(3) = 24$ ✓	*Check by replacing y with 3.*

B Find the value of n if $18 = -3n$.

$18 = -3n$	*To get n alone, you must undo multiplying by −3.*
$\frac{18}{-3} = \frac{-3n}{-3}$	*Divide each side by −3.*
$-6 = n$	
$18 = -3(-6)$ ✓	*Check by replacing n with −6.*

Try These Together

1. Solve $2.7p = -10.8$.
HINT: Divide each side by 2.7.

2. Solve $4q = 36$.
HINT: Divide each side by 4.

PRACTICE

Solve each equation. Use models if necessary.

3. $3b = 9$ **4.** $2g = -10$ **5.** $16 = 2x$ **6.** $-5q = 25$

7. $54 = 6r$ **8.** $15 = 1p$ **9.** $-24 = 8k$ **10.** $10t = 40$

11. $-12 = 4a$ **12.** $7m = 63$ **13** $48 = -6d$ **14.** $9c = -45$

15. **Standardized Test Practice** Jalisa has to take 3 teaspoons of medicine for her cold every day until the medicine is gone. If there are 33 teaspoons of medicine in the bottle, how many days will she have to take medicine?

A 11 **B** 9 **C** 10 **D** 12

Answers: 1. −4 2. 9 3. 3 4. −5 5. 8 6. −5 7. 9 8. 15 9. −3 10. 4 11. −3 12. 9 13. −8 14. −5 15. A

NAME _____ DATE _____ PERIOD _____

9-5 Solving Two-Step Equations (pages 355–357)

A two-step equation involves two different operations such as addition and multiplication. To solve a two-step equation, you work backward, reversing the order of operations.

Solving Two-Step Equations	To get the variable alone on one side of the equation • First, undo the number that is added or subtracted. • Second, undo the number that multiplies or divides the variable.

EXAMPLES

A Solve $3x + 7 = -5$.

$3x + 7 = -5$	*To get x alone, undo adding 7 first.*
$3x = -12$	*Subtract 7 from each side.*
$3x = -12$	*Second, undo multiplying by 3.*
$\frac{3x}{3} = -\frac{12}{3}$	*Divide each side by 3.*
$x = -4$	
$3(-4) + 7 = -5$ ✓	*Check by replacing x with −4.*

B Solve $4 - 5p = 14$.

$4 - 5p = 14$	*To get p alone, undo adding 4 first.*
$-5p = 10$	*Subtract 4 from each side.*
$-5p = 10$	*Second, undo multiplying by −5.*
$\frac{-5p}{-5} = \frac{10}{-5}$	*Divide each side by −5.*
$p = -2$	
$4 - 5(-2) = 14$ ✓	*Check by replacing p with −2.*

Try These Together

1. Solve $3q - 4 = 8$.

HINT: Add 4 to each side and then divide by 3.

2. Solve $7 = 3y + 1$.

HINT: First subtract 1 from each side and then divide each side by 3.

PRACTICE

Solve each equation.

3. $2x + 4 = 8$ **4.** $10y + 5 = 45$ **5.** $4z + 2 = 14$ **6.** $5k + 10 = 50$

7. $6t - 9 = 9$ **8.** $5m + 10 = 70$ **9.** $8s - 4 = 28$ **10.** $9h - 5 = 40$

11. $15 = -3p + 9$ **12.** $14 = -5q - 1$ **13.** $26 = 3j + 2$ **14.** $40 = 2d + 20$

15. Five more than twice a number is 37. Find the number.

16. Eight less than three times a number is nineteen. What is the number?

17. **Standardized Test Practice** Devin spent $34 at the music store. He bought two CDs for the same price each and a case for $10. How much did each CD cost?

A $15 **B** $5 **C** $12 **D** $17

Answers: 1. 4 2. 2 3. 2 4. 4 5. 3 6. 8 7. 3 8. 12 9. 4 10. 5 11. −2 12. −3 13. 8 14. 10 15. 16 16. 9 17. C

NAME _____ DATE _____ PERIOD _____

9-6 Functions (pages 362–365)

When you say "y is a **function** of x," this means that the value of y depends on the value of x. If you know the input value for x and the function rule, you can find the output value for y. A **function table** shows you the input (x) and output (y) values for a certain function rule.

Making Function Tables and Finding Function Rules	• To find the output values for a function table, substitute the input values for the variable in the function rule. • To find the function rule when you have the function table, study the relationship between each input and output.

EXAMPLES

A Complete the function table.

input (x)	output ($x + 2$)
-1	
0	
2	

$-1 + 2 =$ ***1***
$0 + 2 =$ ***2***
$2 + 2 =$ ***4***

B Find the rule for the function table.

input (x)	output (?)
1	2
2	5
3	8

Notice that the output is 1 less than three times x.
The rule is ***3x − 1****.*

Try These Together

1. If the input values are 3, 5, and 6, and the corresponding output values are 7, 11, and 13, what is the function rule?
HINT: Notice that 7 is 1 more than twice 3.

2. If the function rule is $5x + 2$, what is the output for an input of 0?
HINT: Substitute 0 for x in the rule and simplify.

PRACTICE

Complete each function table.

3.

input (x)	output ($x - 2$)
2	
4	
8	

4.

input (x)	output ($x + 3$)
1	
3	
5	

5. What is the output for an input of 7 if the function rule is $4x$?

6. If the output is 4 and the function rule is $x + 3$, what is the input?

7. **Standardized Test Practice** If the function rule is $3x - 4$, what is the output for an input of 3?

A 12 **B** 9 **C** 4 **D** 5

Answers: **1.** $2x + 1$ **2.** 2 **3.** 0, 2, 6 **4.** 4, 6, 8 **5.** 28 **6.** 1 **7.** D

NAME _____ DATE _____ PERIOD _____

9-7 Graphing Functions (pages 366–369)

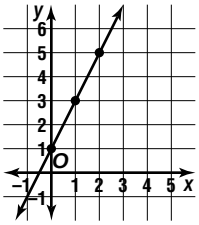
You can graph a function rule or equation on a coordinate plane.

Graphing Functions	When you have a function table, graph the function with these steps. • Write ordered pairs (input, output) from the function table. • Graph each ordered pair on the coordinate plane. • Join the graphed points with a line. When you have a function rule, make a function table for 3 or 4 input values and then graph that table with the steps above.

EXAMPLE

Graph $y = 2x + 1$.

input (x)	function rule ($2x + 1$)	output (y)	ordered pairs (x, y)
0	2(0) + 1	1	(0, 1)
1	2(1) + 1	3	(1, 3)
2	2(2) + 1	5	(2, 5)



PRACTICE

Graph the functions represented by each function table.

1.

input	output
1	−1
3	1
5	3

2.

input	output
−4	−1
0	3
4	7

Complete each function table. Then graph the function.

3.

x	$x - 1$
2	
4	
6	

4.

x	$x + 4$
−1	
−2	
−3	

5. Fitness Jakira is training for a triathlon. She runs 3 miles every day. What is the function rule that you could use to determine how far Jakira runs if the input is the number of days?

6. Standardized Test Practice What is y (the output) for the function rule $4x$ if $x = 10$?

A 6 **B** 40 **C** 80 **D** 4

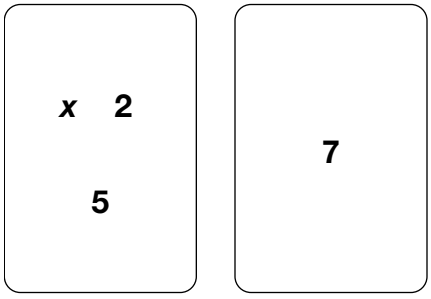
Answers: **1–2.** See Answer Key. **3–4.** See Answer Key for graphs. **3.** 1, 3, 5 **4.** 3, 2, 1 **5.** $3n$ **6.** B

NAME _____ DATE _____ PERIOD _____

9 Chapter 9 Review

Function Flash

You and your parent can use index cards or slips of paper to help you study functions. You can put a function rule and an input value on the front and the output value on the back. Fill in the table below to show what pieces of information you might put on various cards.



Front Back

	Rule	Input	Output
1.	$x - 4$	2	
2.	$3x$		9
3.	$x + 3$		5.3
4.	$2x - 1$	$1\frac{1}{2}$	
5.	$2x + 1$		3

6. You can also make cards with input and output values on the front and the function rule on the back. What rule would go on the back of the card shown?

Input	Output
0	4
2	6
4	8

Answers are located on p. 106.