

SPECTRUM[®]

Algebra

GRADES
6-8



Focused Practice for Algebra Mastery

- Equations and inequalities
- Functions and graphing
- Rational numbers
- Answer key

Table of Contents Algebra

Chapter 1 Algebra Basics

Chapter 1 Pretest	1
Lessons 1–5	3–8
Chapter 1 Posttest	9

Chapter 2 Integers and Equations

Chapter 2 Pretest	11
Lessons 1–6	13–18
Chapter 2 Posttest	19

Chapter 3 Factors and Fractions

Chapter 3 Pretest	21
Lessons 1–6	23–28
Chapter 3 Posttest	29

Chapter 4 Rational and Irrational Numbers

Chapter 4 Pretest	31
Lessons 1–6	33–38
Chapter 4 Posttest	39

Chapter 5 Proportion, Percent, and Interest

Chapter 5 Pretest	41
Lessons 1–6	43–48
Chapter 5 Posttest	49

Chapters 1–5 Mid-Test..... 51

Chapter 6 Expressions and Equations

Chapter 6 Pretest	55
Lessons 1–6	56–61
Chapter 6 Posttest	62

Chapter 7 Equations and Inequalities

Chapter 7 Pretest	64
Lessons 1–7	66–72
Chapter 7 Posttest	73

Table of Contents, continued

Chapter 8 Functions and Graphing

Chapter 8 Pretest	75
Lessons 1–14	77–90
Chapter 8 Posttest	91

Chapter 9 Systems of Equations

Chapter 9 Pretest	94
Lessons 1–4	96–101
Chapter 9 Posttest	102

Chapters 1–9 Final Test

104

Algebra Reference Chart	108
Table of Squares and Square Roots	109
Scoring Record for Posttests, Mid-Test, and Final Test	110
Answer Key	111



Check What You Know

Algebra Basics

Write each phrase as an algebraic expression.

- | a | b |
|----------------------------------|----------------------------|
| 1. three less than x _____ | n divided by seven _____ |
| 2. the product of 10 and 9 _____ | five more than a _____ |

Write each sentence as an equation or inequality. Use n for an unknown number.

3. The product of 3 and n is 12. _____ Five less than n is seven. _____
4. Two more than n is less than 10. _____ Eighteen divided by n is six. _____

Write each of the following expressions or equations in words.

5. $7 + n$ _____ $3n + 2 = 29$ _____

Write the expression for each statement.

6. the product of 4 and the difference between 8 and 3 _____
7. 4 increased by the product of 5 and 3 _____
8. the difference between 16 and the product of 4 and 2 _____
9. the quotient of 25 and 5 increased by 3 _____
10. the product of 6 and 2 decreased by 1 _____

Complete or rewrite each equation using the property indicated.

11. Commutative: $9 + 8 =$ _____ Associative: $5 \times (3 \times 4) =$ _____
12. Identity: $91 + 0 =$ _____ Property of Zero: $72 \times 0 =$ _____



Check What You Know

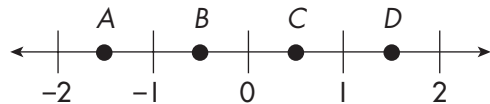
Algebra Basics

Find the value of each expression.

13. $(3 + 4) \times (6 + 1)$ _____ $3 + 2 \times 3 + 4$ _____

14. $(5 \times 3) + (4 \times 7)$ _____ $(3 + 2) \times (3 + 4)$ _____

15. Write the letter of the point that represents $\frac{-3}{2}$ _____



Solve each equation.

16. $x - 4 = 4$ _____

$x + 3 = 5$ _____

$n - 2 = 0$ _____

17. $\frac{a}{4} = 4$ _____

$a \times 4 = 4$ _____

$\frac{m}{5} = 5$ _____

18. $y \times 20 = 30$ _____

$\frac{x}{12} = 3$ _____

$b \times 7 = 21$ _____

19. $\frac{x}{5} = 20$ _____

$n \times 5 = 25$ _____

$\frac{x}{9} = 1$ _____

SHOW YOUR WORK

Solve the problems.

20. Eva spent \$48 on a shirt and a pair of pants. The pants cost twice as much as the shirt. How much did each item cost?

Let s stand for the cost of the shirt.

Equation: _____ $s =$ _____

The shirt cost _____. The pants cost _____.

21. In Ben's office, there are 5 more women than men. There are 23 women. How many men are there?

What is the unknown number? _____

Equation: _____ $n =$ _____

There are _____ men in the office.

20.

21.

Lesson 1.1 Expressions and Variables

A **variable** is a symbol, usually a letter of the alphabet, that stands for an unknown number, or quantity. $a = \text{variable}$

An **algebraic expression** is a combination of numbers, variables, and at least one operation. $x + 13$

An **expression** is a number phrase without an equals sign.

An **algebraic expression** is a number, variable, or combination of numbers and variables, connected by a mathematical operation like addition, subtraction, multiplication, or division. For example, in the expression $x + 5$, x is the variable.

A **numerical expression** contains only numbers: $3 + 6$

A **variable expression** contains numbers and variables: $3 + b$

All expressions express an idea.

$5n$ means "five times n " or "five ns ."

$b - 3$ means " b decreased by 3" or "a number decreased by 3."

In the expression $5n$, both 5 and n are **factors**.

Translate each phrase into an algebraic expression.

- | | a | b |
|-----------|------------------------------|-----------------------|
| 1. | x increased by 2 _____ | 4 less than 11 _____ |
| 2. | the product of 9 and 8 _____ | r added to 10 _____ |
| 3. | b divided by 5 _____ | three 7s _____ |
| 4. | s decreased by 1 _____ | 6 more than 12 _____ |

Write the following expressions in words.

- 5.** $d + 2$ _____
- 6.** $3 \times n$ _____

Lesson 1.2 Equations and Inequalities

A **term** is a number, variable, product, or quotient in an algebraic expression. In $3a + 5$, $3a$ is a term and 5 also is a term.

The term $3a$ means $3 \times a$. The number 3 is the coefficient of a . A **coefficient** is a number that multiplies a variable. In the expression $x + 5$, the coefficient of x is understood to be 1 .

An **equation** is a mathematical sentence that states that two expressions are equal. It contains an equals sign.

$$2 + 5 = 7$$

An **inequality** is a mathematical sentence that states that two expressions are not equal. It shows how two numbers or expressions compare to one another.

$$2 + 5 > 6 \quad 2 + 5 < 9$$

Like expressions, equations and inequalities may contain only numerals, or they may also contain variables.

$$2 + c = 7$$

For each term below, identify the coefficient and the variable.

- | a | b |
|--|---------------------------------------|
| 1. $3x$ coefficient _____ variable _____ | $4y$ coefficient _____ variable _____ |
| 2. z coefficient _____ variable _____ | $5n$ coefficient _____ variable _____ |

Translate each sentence into an equation or inequality. Use n for an unknown number.

3. five more than n _____ the product of n and 11 _____

Translate each sentence into an equation or inequality. Use n for an unknown number.

4. The product of n and three is greater than twenty-seven. _____
5. Ten divided by n equals two. _____

Write each equation or inequality in words.

6. $x \div 3 = 12$ _____
7. $7n + 3 < 31$ _____

Lesson 1.3 Properties

The **Commutative Properties of Addition and Multiplication** state that the order in which numbers are added or multiplied does not change the result.

$$\begin{array}{l} a + b = b + a \\ 2 + 3 = 5 \\ 3 + 2 = 5 \end{array} \quad \text{and} \quad \begin{array}{l} a \times b = b \times a \\ 5 \times 2 = 10 \\ 2 \times 5 = 10 \end{array}$$

The **Associative Properties of Addition and Multiplication** state that the way in which addends and factors are grouped does not change the result.

$$\begin{array}{l} (a + b) + c = a + (b + c) \\ (2 + 3) + 4 = 2 + (3 + 4) \\ 5 + 4 = 2 + 7 \\ 9 = 9 \end{array} \quad \text{and} \quad \begin{array}{l} (a \times b) \times c = a \times (b \times c) \\ (2 \times 4) \times 5 = 2 \times (4 \times 5) \\ 8 \times 5 = 2 \times 20 \\ 40 = 40 \end{array}$$

The **Identity Property of Addition** states that the sum of an addend and 0 is the addend.

$$a + 0 = a \qquad 5 + 0 = 5$$

The **Identity Property of Multiplication** states that the product of a factor and 1 is the factor.

$$a \times 1 = a \qquad 4 \times 1 = 4$$

The **Properties of Zero** state that the product of a factor and 0 is 0. They also state that the quotient of zero and any non-zero divisor is 0.

$$a \times 0 = 0 \quad 5 \times 0 = 0 \qquad \text{and} \qquad 0 \div a = 0 \quad 0 \div 5 = 0$$

Name the property shown by each statement.

- | | a | b |
|----|---|------------------------|
| 1. | $63 \times 1 = 63$ _____ | $0 \times b = 0$ _____ |
| 2. | $3 \times (5 \times 7) = (3 \times 5) \times 7$ _____ | $91 + 0 = 91$ _____ |
| 3. | $9 \times 8 = 8 \times 9$ _____ | $0 \div 2 = 0$ _____ |

Complete or rewrite each equation using the property indicated.

- | | a | b |
|----|------------------------------------|--|
| 4. | Identity: $0 + y =$ _____ | Associative: $6 \times (7 \times 8) =$ _____ |
| 5. | Commutative: $5 + 4 =$ _____ | Properties of Zero: $0 \times 10 =$ _____ |
| 6. | Associative: $7 + (b + 9) =$ _____ | Commutative: $10 \times 3 =$ _____ |

Lesson 1.4 Order of Operations

If an expression contains two or more operations, they must be completed in a specified order. The **order of operations** is as follows:

1. Do all operations within parentheses and/or brackets (innermost first).
2. Do all multiplications and divisions, in order from left to right.
3. Do all additions and subtractions, in order from left to right.

$$3 \times (4 + 5) + 6 \div 3 \quad \text{Do the operation within the parentheses first.}$$

$$3 \times 9 + 6 \div 3 \quad \text{Multiply and divide from left to right.}$$

$$27 + 2 \quad \text{Add.}$$

$$29$$

Describe the steps necessary to find the value of the expression.

1. $2[5 + 6 \div 2 - (4 + 3)]$

Find the value of each expression.

2. $(8 - 3) \times 2$ **a** _____

b $8 - (3 \times 2)$ _____

3. $10 - (5 + 2)$ _____

$10 - 5 + 2$ _____

4. $(2 + 3) \times (4 + 5)$ _____

$2 + 3 \times 4 + 5$ _____

5. $(9 \times 3) + (9 \times 2)$ _____

$[9 \times (6 - 3)] \times 2$ _____

Find the value of each expression if $a = 2$ and $b = 3$.

6. $5a + 2 - 1$ _____

$(b + 6) \times 4$ _____

7. $(4a + 3b) - 2$ _____

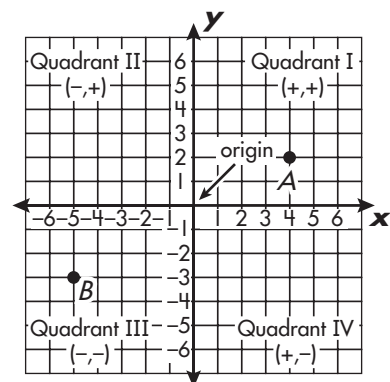
$(3a + 3) \div b$ _____

Lesson 1.5 Coordinate Systems, Ordered Pairs, and Relations

A coordinate plane is formed by two intersecting number lines. The horizontal line is called the x -axis. The vertical line is called the y -axis. This two-axis system is called the **coordinate system**.

The coordinates of a point are represented by the ordered pair (x, y) . This shows the distance the point is from the origin $(0, 0)$, in the **domain** (the set of x coordinates) and the **range** (the set of y coordinates). A set of ordered pairs is called a **relation**.

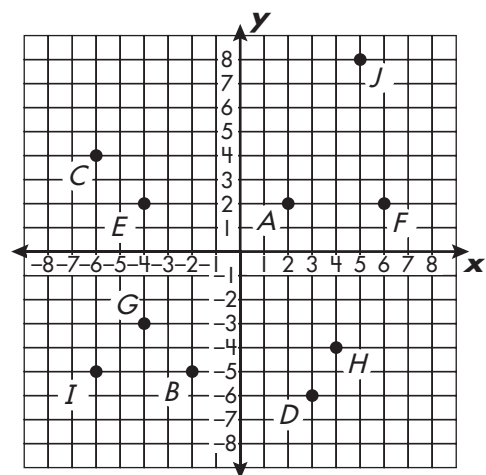
In the graph at right, Point A is located at $(4, 2)$. Point B is located at $(-5, -3)$.



When two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. The coordinates of Point C differ from the coordinates of Point B by only the sign of the x -coordinate. So Point C, located at $(5, -3)$, is a reflection of Point B across the y -axis.

Write the ordered pair for each lettered point on the grid.

1. A _____ B _____
2. C _____ D _____
3. G _____ H _____

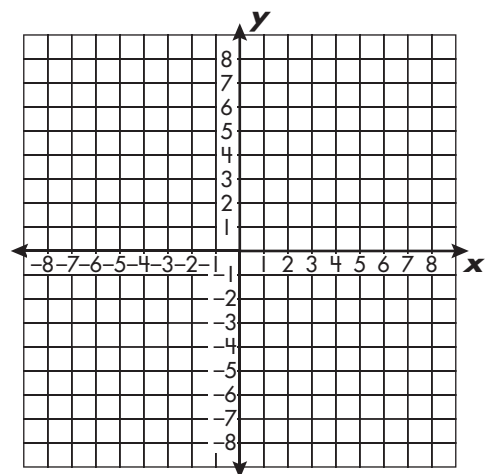


Write the ordered pair for Point I and Point J if they are reflected across the x -axis.

4. I _____ J _____

Plot each ordered pair on the grid. Label the points.

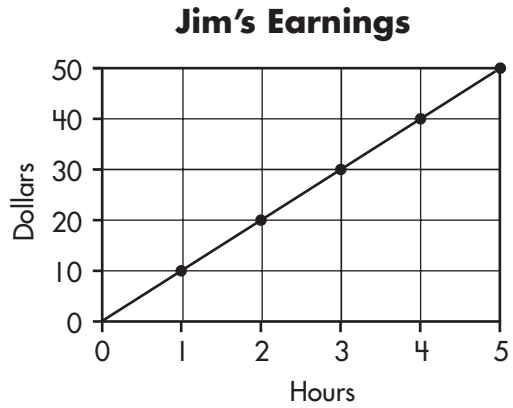
5. K $(2, 1)$ L $(2, -5)$
- M $(-2, -7)$ N $(-6, 6)$
- O $(4, 6)$ P $(3, -2)$
- Q $(-4, -6)$ R $(-7, 8)$
- S $(5, 8)$ T $(-3, 2)$



Lesson 1.5 Coordinate Systems, Ordered Pairs, and Relations

You can graph data using ordered pairs. For example, Jim has a summer job mowing lawns. He is paid \$10 per hour. The amount he can earn in five hours is shown in the table below and in the graph to the right. Hours are shown on the x -axis, and dollars are shown on the y -axis.

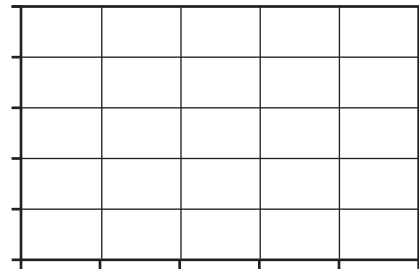
Hours (x values)	Dollars (y values)
1	10
2	20
3	30
4	40
5	50



- An 8th-grade class is selling tubs of cookie dough. They earn a \$5 profit from each tub sold. Make a table and graph to show how much profit they will earn if they sell 100, 200, 300, and 400 tubs of cookie dough. Be sure to label the x and y axes in your graph.

Tubs (x values)	Dollars (y values)

**Profit from
Cookie Dough Sales**



- Refer to the data for cookie dough sales in problem 1. How many tubs will they need to sell to earn \$3,000? Represent your answer with a point on the number line. Label all values.



Algebra Answers

Chapter 1

Check What You Know, page 1

- | | a | b |
|-----|------------------------|---|
| 1. | $x - 3$ | $n \div 7$ |
| 2. | 10×9 | $a + 5$ |
| 3. | $3 \times n = 12$ | $n - 5 = 7$ |
| 4. | $n + 2 < 10$ | $18 \div n = 6$ |
| 5. | seven increased by n | Three times n , plus two, is twenty-nine. |
| 6. | $4 \times (8 - 3)$ | |
| 7. | $4 + (5 \times 3)$ | |
| 8. | $16 - (4 \times 2)$ | |
| 9. | $25 \div (5 + 3)$ | |
| 10. | $6 \times (2 - 1)$ | |
| 11. | $8 + 9$ | $(5 \times 3) \times 4$ |
| 12. | 91 | 0 |

Check What You Know, page 2

- | | a | b |
|-----|----|----|
| 13. | 49 | 13 |
| 14. | 43 | 35 |
| 15. | A | |
-
- | | a | b | c |
|-----|----------------|----|----|
| 16. | 8 | 2 | 2 |
| 17. | 16 | 1 | 25 |
| 18. | $1\frac{1}{2}$ | 36 | 3 |
| 19. | 100 | 5 | 9 |
20. $3s = 48$; \$16; \$16, \$32
21. the number of men; $23 - n = 5$ or $n + 5 = 23$; 18; 18

Lesson 1.1, page 3

- | | a | b |
|----|--|--------------|
| 1. | $x + 2$ | $11 - 4$ |
| 2. | 9×8 | $10 + r$ |
| 3. | $b \div 5$ | 3×7 |
| 4. | $s - 1$ | $12 + 6$ |
| 5. | two more than d , or two added to d , or d increased by two, or a number increased by two | |
| 6. | three times n , or three n s, or the product of three and n , or the product of three and a number | |

Lesson 1.2, page 4

- | | a | b |
|----|--|---------------|
| 1. | 3; x | 4; y |
| 2. | 1; z | 5; n |
| 3. | $n + 5$ | $11 \times n$ |
| 4. | $n \times 3 > 27$ | |
| 5. | $10 \div n = 2$ | |
| 6. | x divided by three is twelve, or a number divided by three is twelve. | |
| 7. | Seven times n , plus three, is less than thirty-one; or seven times a number, plus three, is less than thirty-one. | |

Lesson 1.3, page 5

- | | | |
|----|---------------|-------------------------|
| 1. | identity | property of zero |
| 2. | associative | identity |
| 3. | commutative | property of zero |
| 4. | y | $(6 \times 7) \times 8$ |
| 5. | $4 + 5$ | 0 |
| 6. | $(7 + b) + 9$ | 3×10 |

Lesson 1.4, page 6

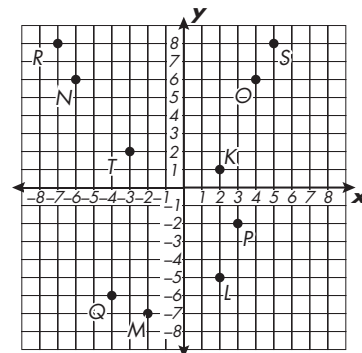
1. Perform the operation inside parentheses first, $2[5 + 6 \div 2 - (7)]$. Then, perform division, $2[5 + 3 - 7]$. Then, perform addition and subtraction from left to right, $2[8 - 7]$. Finally, multiply the difference by the factor of 2, $2[1] = 2$.

- | | a | b |
|----|----|----|
| 2. | 10 | 2 |
| 3. | 3 | 7 |
| 4. | 45 | 19 |
| 5. | 45 | 54 |
| 6. | 11 | 36 |
| 7. | 15 | 3 |

Lesson 1.5, page 7

- $A(2, 2)$; $B(-2, -5)$
- $C(-6, 4)$; $D(3, -6)$
- $G(-4, -3)$; $H(4, -4)$
- $I(-6, 5)$; $J(5, -8)$

Grid 1



Lesson 1.5, page 8

1.

Tubs (x values)	Dollars (y values)
100	500
200	1,000
300	1,500
400	2,000