

BRIGHT SCHOLARS

MATH SERIES • BOOK 1

MASTERING
PRE-ALGEBRA

BOOK 1 Grades 6–8

A Complete Practice Workbook for Number Sense, Integers, Fractions and
Percents, Ratios, Expressions, Equations, Inequalities, Functions, and Linear
Graphs

Learn it. Practice it. Prove it.

NUMBER SENSE • RATIOS • EXPRESSIONS • EQUATIONS • INEQUALITIES • GRAPHS

THIS BOOK BELONGS TO

Name _____

Class / Period _____

Teacher _____

School Year _____

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Coordinate Plane, Slope, and Linear Graphs

? BIG QUESTION

A taxi ride costs a starting fee plus the same amount for every mile. How can one straight line on a graph show both of those numbers at a glance?

BY THE END OF THIS UNIT, I CAN

- ☐ plot and interpret points on the coordinate plane.
- ☐ calculate slope from points, tables, and graphs.
- ☐ use $y = mx + b$ to identify slope and y-intercept.
- ☐ write and interpret equations of linear relationships.

UNIT ROADMAP

10.1 The Coordinate Plane	p. 173
10.2 Slope as Rate of Change.....	p. 174
10.3 Slope-Intercept Form	p. 177
10.4 Graphing Linear Relationships.....	p. 178

Suggested time: 1 week

Standards: 6.NS.C.6b; 6.NS.C.8; 8.EE.B.5; 8.EE.B.6;
8.F.A.3; 8.F.B.4

KEY VOCABULARY

coordinate plane	ordered pair	origin
x-axis	y-axis	quadrant
slope	rise	run
y-intercept	slope-intercept form	

The Coordinate Plane

KEY TERMS coordinate plane • ordered pair • origin • x-axis • y-axis • quadrant

The **coordinate plane** is formed by two number lines that cross at right angles. The horizontal one is the **x-axis**, the vertical one is the **y-axis**, and they cross at the **origin**, $(0, 0)$. An **ordered pair** (x, y) locates a point: x tells how far to move left or right from the origin, and y tells how far to move up or down. Order matters: $(2, 5)$ and $(5, 2)$ are different points.

The axes split the plane into four **quadrants**, numbered I to IV counterclockwise starting at the upper right. The signs of the coordinates tell you the quadrant. A point with a 0 coordinate lies on an axis, not in a quadrant: $(0, b)$ is on the y -axis and $(a, 0)$ is on the x -axis.

QUADRANT SIGNS

Quadrant	Signs (x, y)	Example
I	$(+, +)$	$(3, 2)$
II	$(-, +)$	$(-3, 2)$
III	$(-, -)$	$(-3, -2)$
IV	$(+, -)$	$(3, -2)$

EXAMPLE 1 Plot $P(-2, 5)$ and $Q(4, -3)$ and name the quadrant of each

STEP 1 For P , start at the origin, move 2 left ($x = -2$), then 5 up ($y = 5$). The signs are $(-, +)$, so P is in Quadrant II.

STEP 2 For Q , move 4 right ($x = 4$), then 3 down ($y = -3$). The signs are $(+, -)$, so Q is in Quadrant IV.

ANSWER P is in Quadrant II; Q is in Quadrant IV.

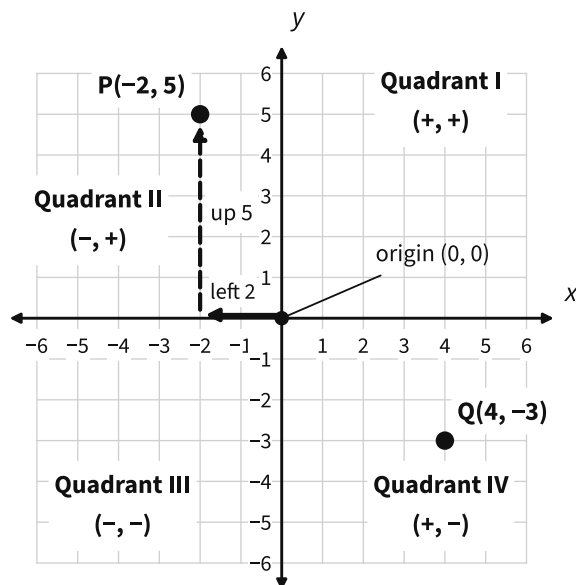


FIGURE 10.1 The four quadrants and their sign patterns.
To plot $P(-2, 5)$, start at the origin, move 2 units left, then 5 units up.

✓ **QUICK CHECK**

1 Which quadrant contains $(-4, 3)$? Sign of x : _____ Sign of y : _____ Quadrant: _____

2 Where is the point $(6, 0)$ located?

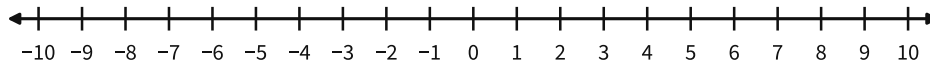
UNIT 10 | LESSON 10.2

Slope as Rate of Change

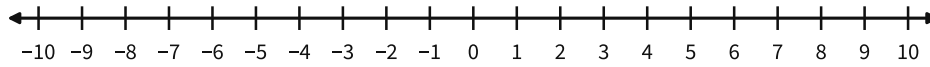
KEY TERMS slope • rise • run • rate of change

The **slope** of a line measures how steep it is. Slope is the vertical change (the **rise**) divided by the horizontal change (the **run**) between any two points on the line. Because a line is straight, every pair of points gives the same slope. Slope is the line's rate of change: how much y changes for each increase of 1 in x .

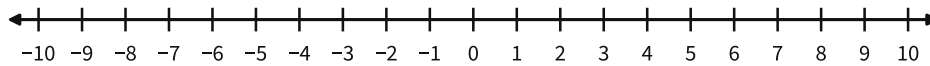
5 $\frac{x+3}{4} > 2$



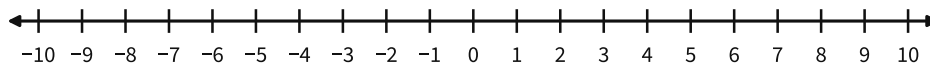
6 $4(y+1) < 12$



7 $6n - 7 > 4n + 3$



8 $2(3x - 1) \leq 4x + 8$



TRANSLATING AND TESTING SOLUTIONS

1 Which of these values satisfy $x - 3 < 4$? Circle each one: 5, 6, 7, 8, 9

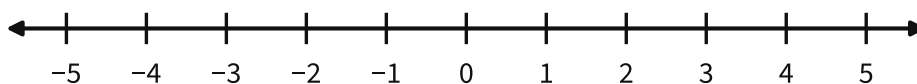
2 Write an inequality: a number n increased by 3 is at most 10.

3 Write an inequality: a car's speed s is less than 65 mph.

INEQUALITY GRAPHING LAB

Solve, graph, and translate inequalities. Use an open circle for $<$ or $>$ and a closed circle for $\leq$ or $\geq$.

1 Graph $x > 2$ on the number line.



Error Analysis

Common Mistake	Do This Instead
MISTAKE Not flipping when dividing by a negative: $-5x < 15$ becomes $x < -3$.	FIX Dividing by -5 reverses the symbol: $x > -3$. Check: $x = 0$ works, since $0 < 15$.
MISTAKE Flipping because a negative appears: $2x > -10$ becomes $x < -5$.	FIX You divide by positive 2, so the symbol stays: $x > -5$.
MISTAKE Using a closed circle for $<$ or $>$.	FIX Strict symbols leave out the boundary: $x < 5$ gets an open circle at 5. Only $\leq$ and $\geq$ get closed circles.
MISTAKE Writing "at least 18" as $a > 18$.	FIX "At least" includes 18, so $a \geq 18$.
MISTAKE Rounding up under an "at most" limit: $15t \leq 50$ gives $t \leq 3.33\dots$, so "4 tickets."	FIX Four \$15 tickets cost \$60, over the \$50 budget. Round down: at most 3 tickets.

Each box shows a student's incorrect work. Describe the error in words, then write the correct solution.

! STUDENT WORK Solve $-2x > 8$

STEP 1 Divide both sides by -2 .

STEP 2 $x > -4$

ANSWER $x > -4$

1 What did the student forget? Show the correct work.

Unit 3 Quiz

Time goal: 20 minutes. 8 questions. Show your work for full credit.

- 1 Which value is equal to $\frac{11}{20}$?
- (A) 0.11 (B) 1.120 (C) 55% (D) 5.5%
- 2 Find 15% of 260.
- (A) 39 (B) 3.9 (C) 26 (D) 390
- 3 A price drops from \$75 to \$60. What is the percent decrease?
- (A) 15% (B) 25% (C) 80% (D) 20%
- 4 Compute $\frac{3}{5} \div \frac{9}{10}$.
- (A) $\frac{27}{50}$ (B) $\frac{2}{3}$ (C) $1\frac{1}{2}$ (D) $\frac{6}{5}$
- 5 42 is what percent of 56?
- 6 27 is 45% of what number?
- 7 A \$68 pair of shoes is 15% off, and then 8% tax is added to the sale price. Find the total to the nearest cent.
- 8 Order from least to greatest: 0.7 , $\frac{2}{3}$, 68%, 0.66.

Bridge Skill B: Exponents, Roots, and Scientific Notation

Powers, Square Roots, and Powers of Ten

Name _____ Date _____ Score _____

Pre-algebra students should be comfortable with powers, roots, and powers of ten before Algebra 1. These pages introduce the patterns without turning the workbook into a full course on the laws of exponents.

Key Ideas and Worked Examples

KEY IDEAS

Idea	Rule or meaning
Repeated multiplication	a^n means multiply a by itself n times: $5^3 = 5 \times 5 \times 5$.
Product of powers with the same base	$a^m \times a^n = a^{m+n}$. Keep the base and add the exponents.
Square root	$\sqrt{n}$ is the nonnegative number whose square is n : $\sqrt{49} = 7$ because $7^2 = 49$.
Scientific notation	Write a number as $a \times 10^n$, where $1 \leq a < 10$ and n is an integer.

EXAMPLE 1 Simplify $2^3 \times 2^4$

STEP 1 The bases are the same (2), so keep the base and add the exponents: $2^{3+4} = 2^7$.

STEP 2 Check with repeated multiplication: $(2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2)$ has seven factors of 2.

STEP 3 Evaluate: $2^7 = 128$.

ANSWER $2^7 = 128$

EXAMPLE 2 Estimate $\sqrt{30}$ between two whole numbers

STEP 1 List perfect squares near 30: $5^2 = 25$ and $6^2 = 36$.

STEP 2 Since $25 < 30 < 36$, $\sqrt{25} < \sqrt{30} < \sqrt{36}$, so $5 < \sqrt{30} < 6$.

STEP 3 30 is closer to 25 than to 36, so $\sqrt{30}$ is closer to 5.

ANSWER $\sqrt{30}$ is between 5 and 6 (about 5.5).

Practice Test A

Units 1–11 • Suggested time: 60 minutes

Name _____ Date _____ Score _____

A Multiple Choice	B Short Answer	C Word Problems	D Explain Your Reasoning	Total
____ / 36	____ / 30	____ / 28	____ / 6	____ / 100

30 questions. Take this test in one sitting with no notes. Use a calculator only if your teacher, tutor, or course plan allows it. Show your work in Sections B to D for full credit.

Section A: Multiple Choice (36 points, 3 points each)

- Evaluate $24 - 4 \times 5 + 3$.
 (A) 103 (B) 1 (C) 7 (D) -8
- Evaluate $(24 - 4) \times 5 + 3$.
 (A) 103 (B) 160 (C) 7 (D) 119
- Compute $(-11) + 6$.
 (A) 5 (B) -17 (C) 17 (D) -5
- Compute $4 - (-9)$.
 (A) -5 (B) 13 (C) 5 (D) -13
- Which shows $\frac{13}{25}$ as a decimal and as a percent?
 (A) 0.52 and 52% (B) 0.052 and 5.2%
 (C) 1.92 and 192% (D) 0.1325 and 13.25%
- Find 15% of 240.
 (A) 3.6 (B) 16 (C) 360 (D) 36
- Write the ratio 28:42 in simplest form.
 (A) 14:21 (B) 3:2 (C) 2:3 (D) 4:6

Answer Key

Accept any mathematically equivalent answer. Open-response answers show the key ideas a complete response should include. Multiple-choice and true/false answers are in bold.

Starting Skills Diagnostic

Part 1: Number Sense and Order of Operations (p. 13)

- 7 (multiply first: $22 - 15$)
- 51 (parentheses first: 17×3)
- 12 ($8 + 4$)
- 18 (left to right: 6×3)

Part 2: Integers and Rational Numbers (p. 13)

- 9
- 13 ($5 + 8$)
- 24 (unlike signs give a negative product)
- 17
- 1.2, $-\frac{3}{4}$, 0, $\frac{1}{2}$ ($-\frac{3}{4} = -0.75$, which is greater than -1.2)

Part 3: Fractions, Decimals, and Percents (p. 13)

- $\frac{9}{20}$ ($\frac{45}{100}$, divide both by 5)
- 0.28 ($\frac{7}{25} = \frac{28}{100}$)
- 8.5% (0.085×100)
- 0.62
- $24 (\frac{1}{4} \times 96)$
- 25% (change 12; $\frac{12}{48} = 0.25$)

Part 4: Ratios, Rates, and Proportions (p. 14)

- 5:8 (divide both by 4)
- 56 miles per hour ($252 \div 4.5$)
- $x = 15$ ($7 \times 5 = 35$, so $3 \times 5 = 15$)
- \$2.50 ($12.50 \div 5$)
- 7.5 cups ($\frac{3}{8}$ cup per muffin $\times 20 = \frac{60}{8}$)

Part 5: Variables and Expressions (p. 14)

- $2n + 7$
- $7x - 5$ ($5x + 2x = 7x$; $3 - 8 = -5$)
- 16 ($18 - 2$)
- $4x - 12$

- $3x$ and $-2x$ (same variable with the same exponent)

Part 6: One-Step and Two-Step Equations (p. 15)

- $x = 14$
- $x = 8$ ($56 \div 7$)
- $x = 35$ ($\frac{x}{5} = 7$)
- $x = 7$ ($3x = 21$)
- Yes. $2(4) + 1 = 8 + 1 = 9$

Part 7: Multi-Step Equations (p. 15)

- $x = 8$ ($2x - 7 = 9$; $2x = 16$)
- $x = 5$ ($4x + 12 = 32$; $4x = 20$)
- $x = 6$ ($6x - 2 = 4x + 10$; $2x = 12$)
- $x = 16$ ($x + 5 = 21$)

Part 8: Inequalities (p. 15)

- $x > 7$
- $x \geq -4$ (divide both sides by -7 and reverse the sign)
- $n \leq 18$
- Yes. $2(5) - 1 = 9$, and $9 < 12$

Part 9: Functions and Patterns (p. 16)

- 13 ($3(5) - 2 = 15 - 2$)
- Yes. The pair (4, 1) is listed twice, but the input 4 still has only one output, 1, and the input 6 has one output, 3.
- $y = 4x + 1$ (y goes up 4 each time x goes up 1, and $y = 1$ when $x = 0$)
- 24 (add 5 each time)

Part 10: Coordinate Plane, Slope, and Linear Graphs (p. 16)

- Quadrant II (x negative, y positive)
- $4 (\frac{10-2}{5-3} = \frac{8}{2})$
- slope -6; y-intercept 1
- $y = 3x - 4$

Part 11: Word Problem Mastery (p. 17)

- $5 + 2.75h$ dollars (or $2.75h + 5$)
- \$54 (discount $0.25 \times 72 = 18$; $72 - 18$)
- $11h \geq 132$; $h \geq 12$. At least 12 hours.
- 578 miles ($340 \div 5 = 68$ miles per hour; 68×8.5)