

BRIGHT SCHOLARS

MATH SERIES • BOOK 2

MASTERING
ALGEBRA 1

BOOK 2 Grades 8–10

A Complete Practice Workbook for Expressions, Equations, Functions,
Systems, Exponents, Polynomials, Factoring, and Quadratics

Learn it. Practice it. Prove it.

EQUATIONS • FUNCTIONS • SYSTEMS • EXPONENTS • POLYNOMIALS • QUADRATICS

THIS BOOK BELONGS TO

Name _____

Class / Period _____

Teacher _____

School Year _____

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Functions, Graphing, and Linear Equations

? BIG QUESTION

A phone bill, a draining pool, and a burning candle all change at a steady rate. How can just two numbers, a rate and a starting value, describe each one completely?

BY THE END OF THIS UNIT, I CAN

- ☐ plot points and identify their quadrants on the coordinate plane.
- ☐ find the slope of a line from two points and describe its direction.
- ☐ rewrite and graph linear equations in slope-intercept form.
- ☐ write the equation of a line from a slope and a point or from two points.
- ☐ decide whether a relation is a function and evaluate functions using function notation.
- ☐ find the domain and range of a relation and interpret them in context.

UNIT ROADMAP

5.1 The Coordinate Plane.....	p. 95
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Suggested time: 3 weeks

Standards: 6.NS.C.6; 8.EE.B.5; 8.EE.B.6; 8.F.A.1; 8.F.A.3; 8.F.B.4; F-IF.A.1; F-IF.A.2; F-IF.B.5; F-LE.A.2; A-CED.A.2; A-REI.D.10

KEY VOCABULARY

coordinate plane	ordered pair	quadrant
slope	y-intercept	x-intercept
slope-intercept form	point-slope form	
relation	function	domain range

Slope

KEY TERMS slope • rise • run • rate of change

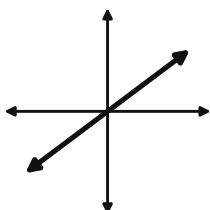
Slope measures the steepness and direction of a line. It compares the change in y (the vertical change, or **rise**) to the change in x (the horizontal change, or **run**) between any two points on the line.

THE SLOPE FORMULA

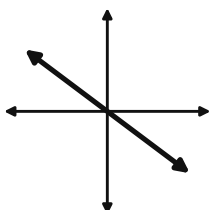
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$$

Subtract the y -values in the same order as the x -values. Either point can be (x_1, y_1) , and the slope comes out the same.

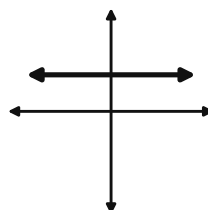
Slope types at a glance



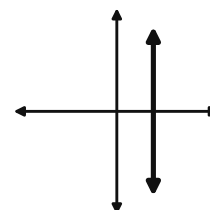
Positive slope
rises left to right



Negative slope
falls left to right



Zero slope
horizontal: $y = 1$



Undefined slope
vertical: $x = 1$

FIGURE 5.2 The four kinds of slope. A horizontal line has a rise of 0, so its slope is 0. A vertical line has a run of 0, and division by zero is undefined.

EXAMPLE 2 Find the slope through $(2, 3)$ and $(6, 11)$

STEP 1 Label the points: $(x_1, y_1) = (2, 3)$ and $(x_2, y_2) = (6, 11)$.

STEP 2 Substitute: $m = \frac{11 - 3}{6 - 2} = \frac{8}{4}$.

STEP 3 Simplify: $m = 2$.

ANSWER $m = 2$. The line rises 2 units for every 1 unit it runs to the right.

✓ **QUICK CHECK**

1 Factor $x^2 + 9x + 20$. *Hint: find two numbers that multiply to 20 and add to 9.* _____ and _____

2 Factor $x^2 + 2x - 15$.

3 Factor $x^2 - 10x + 21$.

UNIT 9 | LESSON 9.4

Factoring $ax^2 + bx + c$

KEY TERMS AC method • leading coefficient • split the middle term • factor by grouping

When the leading coefficient a is not 1, use the **AC method**. It turns the trinomial into four terms that can be factored by grouping.

THE AC METHOD FOR $AX^2 + BX + C$

1. Multiply $a \cdot c$.
2. Find two numbers that multiply to ac and add to b .
3. Split the middle term bx into two terms using those numbers.
4. Factor by grouping: factor the GCF out of each pair of terms, then factor out the common binomial.
5. Check by multiplying.

SET 2: MULTI-STEP AND COMPOUND INEQUALITIES

Solve each inequality. For problems 7 to 12, also graph the solution on the number line.

1 $3(x + 4) > 18$

2 $-2(x - 5) \leq 16$

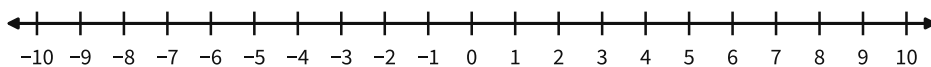
3 $4x - 3 < 2x + 9$

4 $5(2x + 1) \geq 7x - 4$

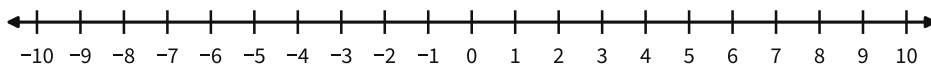
5 $-(x + 6) > 2x - 9$

6 $6x - 4(x - 2) \leq 18$

7 $-4 < x + 3 < 8$



8 $1 \leq 2x - 5 \leq 11$



13 Evaluate $(3x - y) \div 2$ when $x = 4$ and $y = -2$.

14 Simplify $30 - 2(5 - 9)^2$.

FIND AND FIX

Error Analysis

Common Mistake	Do This Instead
MISTAKE Adding before multiplying because addition comes first when reading left to right: $4 + 3 \times 2 = 14$.	FIX Multiplication and division come before addition and subtraction: $4 + 3 \times 2 = 4 + 6 = 10$.
MISTAKE Always doing multiplication before division.	FIX Multiplication and division share one step. Work from left to right: $60 \div 5 \times 2 = 12 \times 2 = 24$.
MISTAKE Treating "minus a negative" as a larger negative: $-6 - (-8) = -14$.	FIX Subtracting a negative means adding its opposite: $-6 - (-8) = -6 + 8 = 2$.
MISTAKE Squaring the negative sign in $-x^2$.	FIX The exponent applies to x only. When $x = 4$, $-x^2 = -16$, but $(-x)^2 = 16$.
MISTAKE Thinking that an expression with absolute value bars must have a positive value.	FIX Each absolute value is zero or positive, but subtracting one can still give a negative result. For example, $5 - 6 = -1$.

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

! STUDENT WORK Simplify $4 + 3 \times 2$

STEP 1 $4 + 3 = 7$

STEP 2 $7 \times 2 = 14$

ANSWER 14

1 Where did the student go wrong? Write the correct answer.

Unit 5 Quiz

Time goal: 25 minutes. 10 questions. Show your work for full credit.

- 1 The point $(-2, 5)$ is in which quadrant?
(A) I (B) II (C) III (D) IV
- 2 What is the slope of the line through $(1, 2)$ and $(4, 14)$?
(A) 4 (B) 3 (C) $\frac{1}{4}$ (D) -4
- 3 In $y = -5x + 9$, the y-intercept is
(A) -5 (B) 5 (C) -9 (D) 9
- 4 A horizontal line has a slope that is
(A) undefined (B) positive (C) zero (D) negative
- 5 Which relation is a function?
(A) $\{(2, 3), (4, 3), (6, 5)\}$ (B) $\{(1, 2), (1, 5), (3, 4)\}$
(C) $\{(0, 1), (2, 3), (0, -1)\}$ (D) $\{(5, 5), (6, 7), (5, 8)\}$
- 6 If $f(x) = 4x - 3$, what is $f(-2)$?
(A) 5 (B) -11 (C) -5 (D) 11
- 7 Find the slope through $(-3, 6)$ and $(5, -2)$.
- 8 Rewrite $2x - 5y = 10$ in slope-intercept form. State m and b .
- 9 Write the equation of the line with slope $-\frac{1}{2}$ through $(4, -3)$.
- 10 Write the equation of the line through $(-2, 1)$ and $(4, 13)$.

Mid-Book Exam

Units 1–4 • Suggested time: 60 minutes

Name _____ Date _____ Score _____

A Multiple Choice	B Matching	C Short Answer	D Application	Total
____ / 40	____ / 18	____ / 24	____ / 18	____ / 100

? EXAM DIRECTIONS

This exam covers Unit 1 (Foundations of Algebra), Unit 2 (Expressions and Operations), Unit 3 (Solving Equations), and Unit 4 (Inequalities). It has 32 questions. Show all work for full credit on the short-answer and application questions.

Section A: Multiple Choice (40 points, 2 points each)

- Simplify $8 + 2 \times 5 - 3$.
 (A) 12 (B) 15 (C) 21 (D) 47
- Compute $-7 - (-4) + (-9)$.
 (A) -12 (B) -20 (C) 0 (D) -6
- Simplify $|-6| - |-8|$.
 (A) 14 (B) 2 (C) -14 (D) -2
- Evaluate $3x^2 - 4x$ when $x = -2$.
 (A) 4 (B) -4 (C) 20 (D) -20
- Simplify $5(2x - 3) + 4$.
 (A) $10x - 11$ (B) $10x + 1$ (C) $7x - 3$ (D) $10x - 7$
- Combine like terms: $8a - 5b + 3a + 7b$.
 (A) $11a - 12b$ (B) $5a + 2b$ (C) $11a + 2b$ (D) $11a + 12b$
- Distribute: $-2(4x - 7)$.
 (A) $-8x - 14$ (B) $-8x + 14$ (C) $8x - 14$ (D) $-8x - 7$

32 Simplify $(2x^3y)^2 \cdot 3xy^2$.

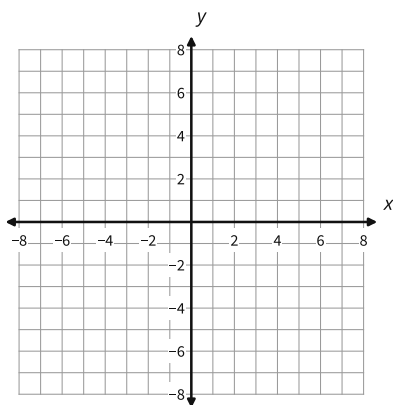
33 Multiply $(3x - 4)(x + 5)$.

34 Subtract: $(6x^2 - 3x + 4) - (2x^2 + 5x - 8)$.

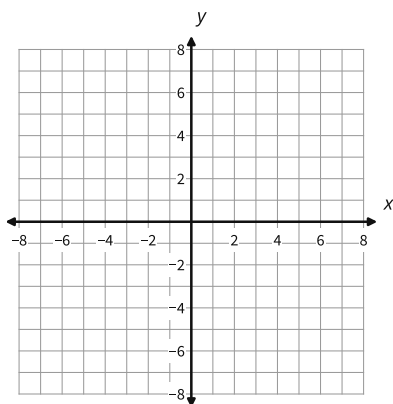
35 "Twice a number, decreased by 9, is 21." Write an equation and solve it.

Section C: Graphing (25 points, 5 points each)

36 Graph $y = 2x - 3$. List the y-intercept and one other point on the line.



37 Graph $y = -\frac{1}{2}x + 4$. List two points you used.



7. 36
8. -8
9. 8
10. -30

ABSOLUTE VALUE

1. 14
2. 12
3. 6
4. 12
5. 8
6. -1

EVALUATING EXPRESSIONS

1. 5
2. 16
3. 8
4. -10
5. 22
6. 2
7. 11
8. -24
9. 25
10. 4
11. 5.5 (or $\frac{11}{2}$)
12. 7

MIXED PRACTICE

1. -21
2. 24
3. 11
4. 0
5. 12
6. -22
7. 74
8. -12
9. 5
10. 16
11. 3
12. -19
13. 7
14. -2

Error Analysis (p. 23)

1. The student added before multiplying. Multiply first: $3 \times 2 = 6$, then $4 + 6 = 10$.
2. Subtracting a negative means adding its opposite: $-6 - (-8) = -6 + 8 = 2$.

3. In $-x^2$, the exponent applies to x first and the negative is applied last: $-(4^2) = -16$. The student squared -4 instead.

Real-World Applications (p. 24)

1. -19°F ($-12 + 18 - 25$)
2. $145 + 80 - 30 - 95 = \$100$
3. $-250 - 175 + 90 = -335$ m
4. $48 - 2 + 5 - 3 + 1 = \$49$
5. $8 - 12 + 5 - 3 = -2$ yards (a net loss of 2 yards)

Unit 1 Review and Challenge (p. 26)

VOCABULARY

1. 1 C; 2 H; 3 G; 4 A; 5 F; 6 D; 7 B; 8 E

TRUE OR FALSE

1. F. Multiplication and division share a step and are done from left to right.
2. T
3. T
4. F. $(-5)^2 = 25$ but $-5^2 = -25$.

SIMPLIFY AND EVALUATE

1. 17
2. -1
3. -7
4. 6
5. 9
6. -1
7. -14
8. 9
9. 7

CHALLENGE PROBLEMS

1. -22 (inside: $4 - 7 = -3$; $5 - 3(-3) = 14$; $-2(14) + 6 = -22$)
2. Every real number except 0. For any $x \neq 0$, x^2 is positive, so $-x^2$ is negative. When $x = 0$, $-x^2 = 0$, which is not less than 0.
3. $8 - 4 \div 2 + 3 \times 1 = 9$ (other arrangements may also work; check each one with the order of operations)

Unit 1 Quiz (p. 29)

1. C. $3 + 20 - 2 = 21$
2. B. $-16 + 4 = -12$
3. D. $4 + 3 = 7$
4. A. $2(9) - (-3) = 18 + 3 = 21$
5. -1 ($25 \div 5 - 6$)
6. 18 ($30 - 12$)
7. 13 ($15 + 2 - 4$)
8. $-24 + 50 - 18 = \$8$
9. 17 ($-[5 - 16] + 6 = 11 + 6$)

BRIGHT SCHOLARS

Certificate of Completion

This certifies that

has successfully completed

Mastering Algebra 1

Bright Scholars Math Series • Book 2

and has shown the persistence, precision, and careful reasoning of a
real mathematician.

TEACHER / PARENT

DATE