MATHBORED

Pre-Algebra

Complete Self-Paced Course

12 units · 41 lessons with worked examples

108 practice problems · 72 quiz questions

Algebra I Readiness Check · full answer key with explanations

math.boredgames.site

How this book works

This book follows the 12-unit Pre-Algebra course at math.boredgames.site/pre-algebra.html. The suggested pace is three weeks per unit, 36 weeks in all, ending with the Algebra I Readiness Check.

Pre-Algebra

Inside each unit

- **Before you start** lists what you should already know.
- **Lessons** explain one idea at a time, with the key formulas and a worked example.
- **Practice** gives nine multiple-choice problems, from easy to hard.
- **The unit quiz** has six questions. Score five of six (80%) to complete the unit.

Already know a unit?

Go straight to its quiz. If you score five of six, you can skip the lessons and move on.

Algebra I Readiness Check

The last section has 24 questions drawn from all 12 units. Score 20 of 24 (80%) and you are ready for Algebra I. If you miss questions, the answer key names the unit each one came from, so you know what to review.

Answers and explanations

The answer key starts on page 57. Every answer comes with a short explanation. Try each problem before you look.

Go deeper online

Each unit lists extra walkthroughs on the MathBored site. Type the address into a browser.

About this edition

Edition of November 2026. Built from the MathBored Pre-Algebra course data. MathBored @ math.boredgames.site · Free forever · Community-driven development.

Contents

How this book works 2

Unit 1: Powers, Roots & Scientific Notation Weeks 1–3 4

Unit 2: Rational & Real Numbers Weeks 4–6 8

Unit 3: Expressions & Linear Equations Weeks 7–9 13

Unit 4: Equations as Models & the Pythagorean Theorem Weeks 10–12 17

Unit 5: Inequalities Weeks 13–15 21

Unit 6: Ratios, Rates & Percents Weeks 16–18 25

Unit 7: Quadrilaterals, Similarity & Scale Weeks 19–21 29

Unit 8: Surface Area, Volume & Composite Figures Weeks 22–24 33

Unit 9: Proportional Relationships & Slope Weeks 25–27 37

Unit 10: Transformations & Probability Weeks 28–30 41

Unit 11: Data Analysis Weeks 31–33 45

Unit 12: Functions, Linear Models & the Algebra Bridge Weeks 34–36 49

Algebra I Readiness Check 53

Answers & Explanations 57

Powers, Roots & Scientific Notation

Use powers and the order of operations, find and estimate square roots, and read, compare, and compute with scientific notation.

BEFORE YOU START

1. Multiplication facts through 12×12 and the idea of repeated multiplication as a power.
2. Place value for whole numbers and decimals, including what each digit is worth.

GO DEEPER ONLINE

Exponents: math.boredgames.site/math/exponents/walkthrough.html

Roots & Radicals: math.boredgames.site/math/roots-and-radicals/walkthrough.html

Scientific Notation: math.boredgames.site/math/scientific-notation/walkthrough.html

Exponents Roots & Radicals Scientific Notation

Lesson 1.1: Squares, Square Roots & Order of Operations

A **square** is a number multiplied by itself. A **square root** undoes squaring. The sign placement matters: $\mathbf{(-4)^2}$ squares the negative number, but $\mathbf{-4^2}$ squares 4 first and then takes the opposite. Also keep $\mathbf{\sqrt{49}}$ (a single value, 7) separate from the equation $\mathbf{x^2 = 49}$ (two solutions).

$$(-4)^2 = 16 \text{ but } -4^2 = -16$$

$$\sqrt{49} = 7, \text{ but } x^2 = 49 \rightarrow x = 7 \text{ or } x = -7$$

WORKED EXAMPLE

Between which two whole numbers is $\sqrt{50}$?

→ $7^2 = 49$ and $8^2 = 64$

→ $49 < 50 < 64$, so $7 < \sqrt{50} < 8$

→ 50 is only 1 above 49, so $\sqrt{50}$ is just a bit more than 7 (about 7.07)

Lesson 1.2: Powers of 10

Each step to the left of the decimal point multiplies by 10; each step right divides by 10. Negative exponents are **reciprocals**: 10^{-3} means $1 \div 10^3$. Zero exponent: $10^0 = 1$.

$$10^3 = 1000$$

$$10^0 = 1$$

$$10^{-3} = 1/10^{3} = 0.001$$

WORKED EXAMPLE

Write 10^{-2} as a decimal.

→ $10^{-2} = 1 \div 10^{2}$

→ $= 1 \div 100$

→ $= 0.01$

Lesson 1.3: Scientific Notation

A number in **scientific notation** looks like $a \times 10^{n}$ with $1 \le a < 10$. A big number has a positive n; a small number has a negative n. To multiply, multiply the coefficients and add the exponents. To divide, divide the coefficients and subtract the exponents. Re-adjust if the coefficient leaves the range 1–10.

$$5200 = 5.2 \times 10^{3}$$

$$0.00046 = 4.6 \times 10^{-4}$$

$$(3 \times 10^{5})(4 \times 10^{3}) = 12 \times 10^{8} = 1.2 \times 10^{9}$$

WORKED EXAMPLE

Order 3.2×10^{-4}, 0.00029, and 4.1×10^{-5} from least to greatest.

→ Write all as decimals: 0.00032, 0.00029, 0.000041

→ Compare place by place

→ $4.1 \times 10^{-5} < 0.00029 < 3.2 \times 10^{-4}$

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **What is $(-4)^{2}$?**

(A) 16 (B) −16

(C) 8 (D) −8

P2 **What is $\sqrt{81}$?**

(A) 8 (B) 40.5

(C) 18 (D) 9

P3 **What is 10^{-2} as a decimal?**

(A) 0.1
(B) -100
(C) 0.01
(D) -20

MEDIUM

P4 **Between which two whole numbers is $\sqrt{50}$?**

(A) 6 and 7
(B) 7 and 8
(C) 8 and 9
(D) 24 and 26

P5 **Write 0.00046 in scientific notation.**

(A) 4.6×10^{-4}
(B) 4.6×10^{-5}
(C) 4.6×10^{4}
(D) 46×10^{-5}

P6 **What are all the solutions of $x^2 = 49$?**

(A) $x = 7$ only
(B) $x = 24.5$
(C) $x = -7$ only
(D) $x = 7$ or $x = -7$

HARD

P7 **Evaluate $-3^2 + (-3)^2$.**

(A) 18
(B) -18
(C) 0
(D) 9

P8 **Compute $(2 \times 10^5)(3 \times 10^{-2})$.**

(A) 6×10^{7}
(B) 6×10^{3}
(C) 5×10^{3}
(D) 6×10^{-10}

P9 **Which is greatest: 3.2×10^{-4}, 0.00029, or 4.1×10^{-5}?**

(A) 3.2×10^{-4}
(B) 0.00029
(C) 4.1×10^{-5}
(D) They are all equal

Unit 1 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **What is $\sqrt{144}$?**

(A) 72
(B) 14
(C) 24
(D) 12

Q2 **What is -5^2?**

(A) 25
(B) -10
(C) -25
(D) 10

Q3 **Write 5.2×10^3 in standard form.**

(A) 520
(B) 5200
(C) 52000
(D) 0.0052

Q4 **What is 10^0?**

(A) 1
(B) 0
(C) 10
(D) Undefined

Q5 **Between which two whole numbers is $\sqrt{30}$?**

(A) 4 and 5
(B) 6 and 7
(C) 3 and 4
(D) 5 and 6

Q6 **Compute $(6 \times 10^4) \div (2 \times 10^2)$.**

(A) 3×10^6
(B) 4×10^2
(C) 3×10^2
(D) 12×10^2

Rational & Real Numbers

Classify numbers, convert among fractions, decimals, and percents, compare signed numbers, and compute with signed fractions and decimals.

BEFORE YOU START

1. Fraction basics: equivalent fractions, common denominators, and simplifying.
2. Integer number line: negative numbers lie to the left of zero.

GO DEEPER ONLINE

Rational vs Irrational Numbers: math.boredgames.site/math/rational-vs-irrational-numbers/walkthrough.html

Operations with Integers: math.boredgames.site/math/operations-with-integers/walkthrough.html

Fraction to Decimal Conversion: math.boredgames.site/math/fraction-to-decimal-conversion/walkthrough.html

Rational vs Irrational Numbers

Operations with Integers

Fraction to Decimal Conversion

Lesson 2.1: Number Families & Real Numbers

Whole numbers sit inside the integers, and integers sit inside the **rational numbers** (anything that can be written as a fraction of integers). Decimals that stop or repeat are rational. Numbers like $\sqrt{2}$ and π never stop or repeat: they are **irrational**. Together they make up the **real numbers**.

$0.333\ldots = 1/3$ (rational)
$\sqrt{16} = 4$ (integer, so rational)
$\sqrt{20}$, π (irrational)

WORKED EXAMPLE

Classify $\sqrt{16}$, 0.25, and $\sqrt{20}$.

→ $\sqrt{16} = 4$, an integer (and rational)

→ $0.25 = 1/4$, rational

→ 20 is not a perfect square, so $\sqrt{20}$ is irrational

Lesson 2.2: Fractions, Decimals & Percents

Divide the numerator by the denominator to turn a fraction into a decimal. Multiply a decimal by 100 to get a percent. To compare numbers, convert them all to decimals and use a number line, remembering that for negatives the larger-looking number is smaller.

$$3/8 = 0.375 = 37.5\%$$

$$-3/4 = -0.75$$

WORKED EXAMPLE

Order $-3/4$, 0.666… (repeating), and $\sqrt{2}$ from least to greatest.

→ $-3/4 = -0.75$

→ $0.666\ldots \approx 0.667$

→ $\sqrt{2} \approx 1.414$

→ $-3/4 < 0.666\ldots < \sqrt{2}$

Lesson 2.3: Adding & Subtracting Signed Numbers

Adding a negative moves left. Subtracting a number is the same as adding its opposite. With fractions, find a common denominator first. With decimals, line up the decimal points.

$$7 - (-3) = 7 + 3 = 10$$

$$-3/4 + 5/6 = -9/12 + 10/12 = 1/12$$

WORKED EXAMPLE

A diver at −12.5 m rises 4.75 m. Where is the diver?

→ $-12.5 + 4.75$

→ The numbers have different signs, so subtract: $12.5 - 4.75 = 7.75$

→ The larger magnitude is negative, so the answer is −7.75 m

Lesson 2.4: Multiplying, Dividing & Checking by Estimation

Same signs give a positive product or quotient; different signs give a negative. To divide by a fraction, multiply by its reciprocal. Always estimate first (round to friendly numbers) so you can tell whether an answer is reasonable.

$$(-6)(-7) = 42$$

$$-18 \div (-3/2) = -18 \times (-2/3) = 12$$

WORKED EXAMPLE

Compute $(-2.5)(-4)$.

→ Same signs, so the answer is positive

→ $2.5 \times 4 = 10$

→ $(-2.5)(-4) = 10$

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **Which number is irrational?**

(A) $1/3$ (B) 0.25

(C) $\sqrt{49}$ (D) $\sqrt{2}$

P2 **Write 3/4 as a decimal.**

(A) 0.34 (B) 0.43

(C) 0.75 (D) 1.33

P3 **What is $-8 + 5$?**

(A) 3 (B) -3

(C) -13 (D) 13

MEDIUM

P4 **Which fraction equals 0.888… (repeating)?**

(A) $8/9$ (B) $4/5$

(C) $7/9$ (D) $9/8$

P5 **What is $-1/2 + 2/3$?**

(A) $-1/6$ (B) $1/5$

(C) $7/6$ (D) $1/6$

P6 **What is $(-2.5)(-4)$?**

(A) -10 (B) 6.5

(C) 10 (D) -6.5

HARD

P7 **What is $(-3/4) \div (-3/8)$?**

(A) 1/2
(B) 2
(C) −2
(D) 9/32

P8 **Which list is in order from least to greatest?**

(A) −3/4, −0.7, 0.5, 2/3
(B) −0.7, −3/4, 0.5, 2/3
(C) 0.5, 2/3, −0.7, −3/4
(D) −3/4, −0.7, 2/3, 0.5

P9 **A diver is at −12.5 m, rises 4.75 m, then dives 3 m. Where is the diver?**

(A) −4.75 m
(B) −20.25 m
(C) −7.75 m
(D) −10.75 m

Unit 2 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **Which statement about π is true?**

(A) It is exactly 22/7
(B) It is an integer
(C) It is irrational
(D) It is a repeating decimal

Q2 **What is $7 - (-3)$?**

(A) 4
(B) 10
(C) −4
(D) −10

Q3 **What is $(-6)(-7)$?**

(A) 42
(B) −42
(C) 13
(D) −13

Q4 **Write −0.4 as a fraction in lowest terms.**

(A) −4/5
(B) −1/4
(C) −4/100
(D) −2/5

Q5 **What is 5/8 as a percent?**

(A) 58%
(B) 6.25%
(C) 62.5%
(D) 85%

Q6 **What is $-18 \div (-3/2)$?**

(A) -12

(B) 12

(C) 27

(D) -27

Expressions & Linear Equations

Identify parts of expressions, simplify by distributing and combining like terms, factor out common factors, and solve multistep equations including those with no or infinitely many solutions.

BEFORE YOU START

1. Signed-number arithmetic (Unit 2).
2. Order of operations and the meaning of a variable as a stand-in for a number.

GO DEEPER ONLINE

Combining Like Terms: math.boredgames.site/math/combining-like-terms/walkthrough.html

Distributive Property: math.boredgames.site/math/distributive-property/walkthrough.html

Multi-Step Equations: math.boredgames.site/math/multi-step-equations/walkthrough.html


Combining Like Terms


Distributive Property


Multi-Step Equations

Lesson 3.1: Parts of an Expression

In $3x^2 - 2x + 5$ the **terms** are $3x^2$, $-2x$, and 5. The **coefficients** are 3 and -2, and 5 is a **constant**. A **factor** is something multiplied. To evaluate, substitute the value in parentheses, then follow the order of operations.

$$\text{Evaluate } 3x^2 - 2x + 5 \text{ at } x = -2$$

WORKED EXAMPLE

Evaluate $3x^2 - 2x + 5$ when $x = -2$.

$\rightarrow 3(-2)^2 - 2(-2) + 5$

$\rightarrow = 3(4) + 4 + 5$

$\rightarrow = 12 + 4 + 5 = 21$

Lesson 3.2: Distribute, Combine & Factor

The **distributive property** says $a(b + c) = ab + ac$, which includes negative and fractional multipliers. **Like terms** have the same variable part and can be added. **Factoring** runs the distributive property backward by pulling out a common factor.

$$-2(3x - 4) + 5x = -6x + 8 + 5x = -x + 8$$

$$12x + 18 = 6(2x + 3)$$

WORKED EXAMPLE

Show that $-2(3x - 4) + 5x = 8 - x$ for every x.

→ Distribute: $-6x + 8 + 5x$

→ Combine like terms: $-6x + 5x = -x$

→ Result: $-x + 8$, which is $8 - x$

Lesson 3.3: Solving Multistep Equations

Keep the equation balanced: whatever you do to one side, do to the other. Distribute, collect variable terms on one side, constants on the other, then divide. **Always check** by substituting back.

$$3(x - 2) = x + 8 \rightarrow x = 7$$

WORKED EXAMPLE

Solve $3(x - 2) = x + 8$.

→ Distribute: $3x - 6 = x + 8$

→ Subtract x: $2x - 6 = 8$

→ Add 6: $2x = 14$, so $x = 7$

→ Check: $3(5) = 15$ and $7 + 8 = 15$

Lesson 3.4: One, Zero, or Infinitely Many Solutions

After simplifying, if you reach a **false** statement (like $-6 = 8$) there is **no solution**. If you reach a statement that is **always true** (like $-6 = -6$) there are **infinitely many** solutions. Otherwise there is exactly one.

$$3(x - 2) = 3x + 8 \rightarrow -6 = 8, \text{ no solution}$$

$$3(x - 2) = 3x - 6 \rightarrow -6 = -6, \text{ all numbers}$$

WORKED EXAMPLE

How many solutions does $4(x + 1) = 4x + 5$ have?

→ Distribute: $4x + 4 = 4x + 5$

→ Subtract $4x$: $4 = 5$

→ False, so there is no solution

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **What is the coefficient of x in $7x - 4$?**

(A) -4 (B) 4
(C) 7 (D) 1

P2 **Simplify $4x + 3x$.**

(A) $7x^2$ (B) $7x$
(C) $12x$ (D) 7

P3 **Solve $x + 9 = 4$.**

(A) $x = -5$ (B) $x = 5$
(C) $x = 13$ (D) $x = -13$

MEDIUM

P4 **Simplify $-3(2x - 5)$.**

(A) $-6x - 15$ (B) $-6x + 5$
(C) $6x - 15$ (D) $-6x + 15$

P5 **Solve $2x + 7 = 3x - 1$.**

(A) $x = -8$ (B) $x = 6$
(C) $x = 8$ (D) $x = 1$

P6 **Simplify $5a - 2 + 3a + 8$.**

(A) $8a - 6$ (B) $8a + 6$
(C) $8a^2 + 6$ (D) $16a$

HARD

P7 **Solve $(1/2)x - 3 = (1/4)x + 2$.**

(A) $x = 20$ (B) $x = 4$
(C) $x = -20$ (D) $x = 10$

P8 **How many solutions does $4(x + 1) = 4x + 5$ have?**

(A) One (B) Two
(C) Infinitely many (D) None

P9 **Factor $18x - 24$ using the greatest common factor.**

(A) $6(3x - 8)$ (B) $2(9x - 24)$

(C) $6(3x - 4)$ (D) $18(x - 24)$

Unit 3 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **Evaluate $2x + 5$ when $x = 3$.**

(A) 10 (B) 11

(C) 16 (D) 13

Q2 **Solve $5x = -35$.**

(A) $x = -7$ (B) $x = 7$

(C) $x = -30$ (D) $x = 30$

Q3 **Simplify $6x - 2(x - 3)$.**

(A) $4x - 6$ (B) $8x + 6$

(C) $8x - 6$ (D) $4x + 6$

Q4 **Solve $3(x - 1) = 12$.**

(A) $x = 3$ (B) $x = 4$

(C) $x = 5$ (D) $x = 15$

Q5 **Solve $6x - 4 = 2x + 12$.**

(A) $x = 2$ (B) $x = 4$

(C) $x = 8$ (D) $x = -4$

Q6 **How many solutions does $2(x + 3) = 2x + 6$ have?**

(A) Infinitely many (B) None

(C) Exactly one (D) Exactly two

Equations as Models & the Pythagorean Theorem

Write equations for fixed-plus-per-unit situations and perimeter, interpret solutions in context, and use $a^2 + b^2 = c^2$ and its converse to find lengths and distances.

BEFORE YOU START

1. Solving multistep equations (Unit 3).
2. Squares and square roots (Unit 1) and the coordinate plane.

GO DEEPER ONLINE

Pythagorean Theorem: math.boredgames.site/math/pythagorean-theorem/walkthrough.html

Two-Step Equations: math.boredgames.site/math/two-step-equations/walkthrough.html

Expressions & Equations: math.boredgames.site/math/expressions-and-equations/walkthrough.html

Pythagorean Theorem | Two-Step Equations | Expressions & Equations

Lesson 4.1: Writing Equations from Situations

Start by **defining the variable with units** (let v = number of visits). Many situations are a **fixed charge plus a per-unit charge**: cost = fixed + rate × quantity. Set two expressions equal to find when two options cost the same, then ask whether the answer makes sense (can you have 2.5 visits?).

$$\text{Plan A: } 15 + 3v \quad \text{Plan B: } 5 + 5v$$

WORKED EXAMPLE

Plan A costs $15 plus $3 per visit. Plan B costs $5 plus $5 per visit. When do they cost the same?

→ $15 + 3v = 5 + 5v$

→ $10 = 2v$, so $v = 5$

→ Cost: $15 + 3(5) = \$30$. Five visits is a whole number, so it is feasible.

Lesson 4.2: Perimeter & Constraints

Perimeter of a rectangle is 2(length + width). When a problem gives a relationship between the sides, write one side in terms of the other, substitute into the perimeter formula, and solve.

$$P = 2(l + w)$$

WORKED EXAMPLE

A rectangle's length is 3 m more than its width. Its perimeter is 26 m. Find the dimensions.

→ Let w = width, so length = w + 3

→ 2(w + w + 3) = 26 → 4w + 6 = 26

→ 4w = 20, so w = 5 and length = 8

Lesson 4.3: The Pythagorean Theorem

In a **right triangle** with legs a and b and hypotenuse c (the longest side, opposite the right angle): $\mathbf{a^2 + b^2 = c^2}$. Square the legs, add, then take the square root for c. To find a missing leg, subtract. On a coordinate plane, the horizontal and vertical differences are the legs of a right triangle, so the distance between two points is the hypotenuse.

$$a^2 + b^2 = c^2$$

legs 6 and 8: $c = \sqrt{(36 + 64)} = 10$

WORKED EXAMPLE

Find the distance between (1, 2) and (4, 6).

→ Horizontal leg: $4 - 1 = 3$. Vertical leg: $6 - 2 = 4$

→ $3^2 + 4^2 = 9 + 16 = 25$

→ Distance = $\sqrt{25} = 5$

Lesson 4.4: The Converse & Real-World Diagonals

If $a^2 + b^2 = c^2$ holds for the three sides of a triangle (c the longest), the triangle is a right triangle. This is the **converse**. The diagonal of a rectangle is the hypotenuse of a right triangle formed by two sides. Give an **exact** answer (like $\sqrt{2}$) and an **approximate** one (about 1.41) when the root is not a whole number.

5, 12, 13: $25 + 144 = 169$ ✓

4, 5, 6: $16 + 25 = 41 \neq 36$ ×

WORKED EXAMPLE

Find the diagonal of a 9 ft by 12 ft rectangle.

→ $d^2 = 9^2 + 12^2 = 81 + 144 = 225$

→ d = $\sqrt{225} = 15$ ft

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **A right triangle has legs 3 and 4. What is the hypotenuse?**

(A) 7 (B) 5
(C) 25 (D) $\sqrt{7}$

P2 **A gym charges $10 plus $4 per class. What is the cost of 6 classes?**

(A) $34 (B) $24
(C) $40 (D) $64

P3 **Which equation says: 5 more than twice a number is 17?**

(A) $5n + 2 = 17$ (B) $2(n + 5) = 17$
(C) $7n = 17$ (D) $2n + 5 = 17$

MEDIUM

P4 **The hypotenuse is 13 and one leg is 5. What is the other leg?**

(A) 8 (B) $\sqrt{194}$
(C) 12 (D) 18

P5 **Could 7, 24, 25 be the sides of a right triangle?**

(A) No, because $7 + 24 = 31$, not 25
(B) Yes, because $49 + 576 = 625 = 25^2$
(C) No, because 24 is not a perfect square
(D) Only if the triangle is isosceles

P6 **What is the distance from (0, 0) to (6, 8)?**

(A) 10 (B) 14
(C) 2 (D) 48

HARD

P7 **Plan A costs $20 + $2 per visit. Plan B costs $4 + $4 per visit. For how many visits do they cost the same?**

(A) 12 (B) 6
(C) 10 (D) 8

P8 **A rectangle's length is twice its width and its perimeter is 54. What is the length?**

(A) 9 (B) 27
(C) 18 (D) 36

P9 **A 10 ft ladder's base is 6 ft from a wall. How high up the wall does it reach?**

(A) 4 ft
(B) 8 ft
(C) about 11.7 ft
(D) 16 ft

Unit 4 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **A right triangle has legs 9 and 12. What is the hypotenuse?**

(A) 15
(B) 21
(C) 225
(D) 108

Q2 **A rectangle is w by 8 with perimeter 30. What is w?**

(A) 14
(B) 11
(C) 22
(D) 7

Q3 **Which set of sides forms a right triangle?**

(A) 5, 6, 7
(B) 4, 5, 6
(C) 6, 8, 10
(D) 7, 8, 9

Q4 **The hypotenuse of a right triangle is:**

(A) The shortest side
(B) The longest side, opposite the right angle
(C) Any side next to the right angle
(D) The side labeled a

Q5 **What is the distance between (2, 1) and (5, 5)?**

(A) 5
(B) 7
(C) 25
(D) 3

Q6 **What is the diagonal of a 5 by 12 rectangle?**

(A) 17
(B) 60
(C) 7
(D) 13

Inequalities

Translate inequality language, graph solution sets, solve linear inequalities (including reversing the sign), and apply inequalities to budgets and limits.

BEFORE YOU START

1. Solving multistep equations (Unit 3).
2. Ordering signed numbers on a number line (Unit 2).

GO DEEPER ONLINE

Inequalities: math.boredgames.site/math/inequalities/walkthrough.html

Multi-Step Equations: math.boredgames.site/math/multi-step-equations/walkthrough.html

Inequalities

Multi-Step Equations

Lesson 5.1: Inequalities & Solution Sets

At least means ≥, **at most** means ≤, **more than** means >, and **fewer than** means <. On a number line, use an **open circle** when the endpoint is not included and a **closed circle** when it is. Shade in the direction of the solutions. To check a graph, test the endpoint and a value on each side.

$x \leq 8$: closed circle at 8, shade left

$x > 8$: open circle at 8, shade right

WORKED EXAMPLE

Is 8 a solution of $x > 8$? Of $x \leq 8$?

→ $8 > 8$ is false, so 8 is not a solution of $x > 8$ (open circle)

→ $8 \leq 8$ is true, so 8 is a solution of $x \leq 8$ (closed circle)

Lesson 5.2: Solving Linear Inequalities

Solve like an equation with one exception: when you **multiply or divide by a negative number, reverse the inequality sign**. (On the number line, multiplying by −1 flips the order: $2 < 5$ but $-2 > -5$.) Check the boundary and one value on each side.

$-2x < 10 \rightarrow x > -5$

WORKED EXAMPLE

Solve and graph $-3(2x - 1) \geq 15$.

→ Divide by -3 and reverse the sign: $2x - 1 \leq -5$

→ Add 1: $2x \leq -4$

→ Divide by 2: $x \leq -2$

→ Check: $x = -2$ gives $-3(-5) = 15$ ✓. Closed circle at -2, shade left.

Lesson 5.3: Inequalities in Context

Model budgets, minimum scores, capacity, and time limits. After solving, restrict the answer to **feasible** values. If you can only buy whole items, a maximum means **round down**; a minimum needed to reach a goal means **round up**.

$$4t + 7 \leq 30 \rightarrow t \leq 5.75 \rightarrow \text{at most 5 tickets}$$

WORKED EXAMPLE

How many $4 tickets can be bought with $30 after a $7 fee?

→ $4t + 7 \leq 30$

→ $4t \leq 23$, so $t \leq 5.75$

→ You cannot buy part of a ticket, so the maximum is 5

→ Verify: $4(5) + 7 = 27 \leq 30$ ✓ but $4(6) + 7 = 31 > 30$

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **Which inequality means x is at least 6?**

(A) $x \geq 6$ (B) $x > 6$

(C) $x \leq 6$ (D) $x < 6$

P2 **Solve $x + 5 > 9$.**

(A) $x > 14$ (B) $x < 4$

(C) $x > -4$ (D) $x > 4$

P3 **Why is $x < 3$ drawn with an open circle at 3?**

(A) 3 is the largest solution

(B) 3 is a solution

(C) 3 is not included in the solutions

(D) The graph shades right

MEDIUM

P4 **Solve $-2x < 10$.**

(A) $x < -5$

(B) $x > -5$

(C) $x > 5$

(D) $x < 5$

P5 **Solve $3x - 4 \leq 11$.**

(A) $x \leq 5$

(B) $x \geq 5$

(C) $x \leq 3$

(D) $x \leq 7/3$

P6 **Which value is a solution of $2x + 1 > 9$?**

(A) 4

(B) 3

(C) 0

(D) 5

HARD

P7 **Solve $5 - 3x \geq -7$.**

(A) $x \geq 4$

(B) $x \leq -4$

(C) $x \leq 4$

(D) $x \geq -4$

P8 **Solve $2(x - 3) < 4x + 2$.**

(A) $x < -4$

(B) $x > -4$

(C) $x > 4$

(D) $x < 4$

P9 **You have a $50 gift card. T-shirts cost $12 each and shipping is a $6 flat fee. What is the greatest number of shirts you can buy?**

(A) 3

(B) 4

(C) 3.67

(D) 5

Unit 5 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **Which inequality means x is at most 10?**

(A) $x \geq 10$

(B) $x < 10$

(C) $x > 10$

(D) $x \leq 10$

Q2 Solve $x - 3 \geq 2$.

(A) $x \geq -1$ (B) $x \leq 5$

(C) $x \geq 5$ (D) $x \geq 6$

Q3 Solve $4x < -20$.

(A) $x > -5$ (B) $x < -5$

(C) $x < 5$ (D) $x < -80$

Q4 Solve $-x/2 \leq 3$.

(A) $x \geq -6$ (B) $x \leq -6$

(C) $x \geq 6$ (D) $x \leq 6$

Q5 Solve $2x + 5 \geq 1$.

(A) $x \leq -2$ (B) $x \geq 2$

(C) $x \geq -3$ (D) $x \geq -2$

Q6 Books cost \$6 each and you have \$28. What is the most books you can buy?

(A) 5 (B) 4.67

(C) 4 (D) 3

Ratios, Rates & Percents

Simplify ratios, compute and compare unit rates, solve proportional problems with unit conversion, and handle percent, discount, tax, and percent-change problems.

BEFORE YOU START

1. Fraction and decimal multiplication and division (Unit 2).
2. Solving one-step equations.

GO DEEPER ONLINE

Ratios & Proportions: math.boredgames.site/math/ratios-and-proportions/walkthrough.html

Rate & Unit Rate: math.boredgames.site/math/rate-and-unit-rate/walkthrough.html

Percent Change: math.boredgames.site/math/percent-change/walkthrough.html

Percent Applications: math.boredgames.site/math/percent-applications/walkthrough.html

Ratios & Proportions | Rate & Unit Rate | Percent Change | Percent Applications

Lesson 6.1: Ratios & Unit Rates

A **ratio** compares two quantities and can be simplified like a fraction. A **unit rate** compares a quantity to **one** of something (dollars per ounce, miles per hour). To compare options, convert both to the **same unit rate**.

$$12 : 18 = 2 : 3$$

$$\text{unit rate} = \text{total} \div \text{amount}$$

WORKED EXAMPLE

Compare 12 oz for $3.60 and 20 oz for $5.40.

→ $3.60 ÷ 12 = $0.30 per oz

→ $5.40 ÷ 20 = $0.27 per oz

→ The 20 oz package is cheaper per ounce

Lesson 6.2: Proportional Reasoning

Two quantities are **proportional** when their ratio is constant. In a table, check that y ÷ x is the same for every pair. Use ratio tables, double number lines, or a proportion to find a missing value, and distinguish **multiplicative** comparisons (twice as many) from **additive** ones (two more).

$$y \div x = k \text{ (constant)}$$

$$1 \text{ in} = 2.54 \text{ cm}$$

WORKED EXAMPLE

3 cups of flour make 24 cookies. How many cookies from 5 cups?

→ $24 \div 3 = 8$ cookies per cup

→ $5 \times 8 = 40$ cookies

Lesson 6.3: Percents & Consumer Math

Part = percent × whole. For a discount of p%, you pay (100 − p)% of the price; for tax of p%, you pay (100 + p)%. **Percent change = change ÷ original.** Successive changes use **multipliers** and each applies to the **new** base, so +20% then −20% does not return to the start.

$$25\% \text{ of } 80 = 0.25 \times 80 = 20$$

$$\text{percent change} = (\text{new} - \text{old}) \div \text{old}$$

WORKED EXAMPLE

A $100 price rises 20%, then falls 20%. What is the final price?

→ $100 \times 1.20 = 120$

→ $120 \times 0.80 = 96$

→ The final price is $96, not $100, because the decrease is 20% of the larger $120

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **Simplify the ratio 12 : 18.**

(A) 3 : 2 (B) 6 : 9

(C) 4 : 6 (D) 2 : 3

P2 **What is 25% of 80?**

(A) 25 (B) 32

(C) 20 (D) 2

P3 **A car travels 150 miles in 3 hours. What is the unit rate?**

(A) 450 miles per hour
(B) 50 miles per hour
(C) 3 miles per hour
(D) 147 miles per hour

MEDIUM

P4 **6 notebooks cost $9. How much do 10 notebooks cost at the same rate?**

(A) $15
(B) $12
(C) $13.50
(D) $16

P5 **A $40 shirt is 25% off. What is the sale price?**

(A) $10
(B) $15
(C) $35
(D) $30

P6 **18 is what percent of 24?**

(A) 133%
(B) 25%
(C) 75%
(D) 80%

HARD

P7 **A price rises from $50 to $65. What is the percent increase?**

(A) 15%
(B) 30%
(C) 23%
(D) 130%

P8 **A $60 jacket is 10% off, and then 8% tax is added. What is the final price?**

(A) $58.32
(B) $58.80
(C) $57.60
(D) $64.80

P9 **Which table shows a proportional relationship?**

(A) x: 1, 2, 3 and y: 3, 5, 7
(B) x: 2, 4, 6 and y: 5, 9, 13
(C) x: 1, 2, 3 and y: 6, 6, 6
(D) x: 1, 2, 3 and y: 4, 8, 12

Unit 6 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **Simplify the ratio 4 : 6.**

(A) 3 : 2
(B) 4 : 3
(C) 2 : 3
(D) 1 : 2

Q2 What is 40% of 50?

(A) 10
(B) 20
(C) 40
(D) 25

Q3 8 oz of cheese costs $2.40. What is the unit price?

(A) $0.30 per oz
(B) $3.33 per oz
(C) $19.20 per oz
(D) $0.03 per oz

Q4 A map scale is 1 inch = 20 miles. How far is 3.5 inches?

(A) 23.5 miles
(B) 6 miles
(C) 17.5 miles
(D) 70 miles

Q5 30 is 20% of what number?

(A) 6
(B) 600
(C) 150
(D) 50

Q6 A $200 price rises 10% and then falls 10%. What is the final price?

(A) $200
(B) $198
(C) $220
(D) $180

Quadrilaterals, Similarity & Scale

Classify quadrilaterals using sides, angles, and diagonals, use scale factors to find unknown lengths, and predict how perimeter and area change under scaling.

BEFORE YOU START

1. Proportional reasoning and ratios (Unit 6).
2. Basic angle facts: angles on a line add to 180° and angles in a triangle add to 180°.

GO DEEPER ONLINE

Scale Drawings: math.boredgames.site/math/scale-drawings/walkthrough.html

Ratios & Proportions: math.boredgames.site/math/ratios-and-proportions/walkthrough.html

Scale Drawings

Ratios & Proportions

Lesson 7.1: Classifying Quadrilaterals

Classify using sides, angles, and diagonals. The categories overlap: every **square** is a **rectangle** and a **rhombus**, and every rectangle is a **parallelogram**. A **trapezoid** has **at least one** pair of parallel sides (inclusive definition). In a parallelogram, opposite angles are equal and consecutive angles add to 180°. The angles of any quadrilateral sum to 360°.

$$\text{Square} \subset \text{Rectangle} \subset \text{Parallelogram} \subset \text{Trapezoid}$$

$$\text{Angles of a quadrilateral: } 360°$$

WORKED EXAMPLE

In a parallelogram, opposite angles are $(3x + 10)°$ and $100°$. Find x.

→ Opposite angles are equal: $3x + 10 = 100$

→ $3x = 90$

→ $x = 30$

Lesson 7.2: Similar Figures & Scale Factor

Similar figures have equal corresponding angles and corresponding sides in the same ratio, the **scale factor**. To find an unknown length, multiply by the scale factor (or set up a proportion between corresponding sides).

$$\text{new length} = \text{scale factor} \times \text{old length}$$

WORKED EXAMPLE

A drawing uses 1 cm for every 4 m. A wall is 3 cm in the drawing. How long is the real wall?

→ Scale: each 1 cm stands for 4 m

→ $3 \times 4 = 12$

→ The real wall is 12 m

Lesson 7.3: Scale, Perimeter & Area

If all lengths are multiplied by a scale factor k, **perimeter is multiplied by k** and **area is multiplied by k^2**. This is why doubling every length quadruples the area.

perimeter $\times$ k
area $\times$ k^2

WORKED EXAMPLE

A 3×5 rectangle is enlarged by scale factor 3. How do the perimeter and area change?

→ New size: 9×15

→ Perimeter: 16 → 48, which is $\times$ 3

→ Area: 15 → 135, which is $\times$ $9 = 3^2$

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **Which quadrilateral has 4 equal sides and 4 right angles?**

(A) Rectangle
(B) Trapezoid
(C) Square
(D) Rhombus that is not a square

P2 **In a parallelogram, opposite angles are:**

(A) Supplementary
(B) Equal
(C) Complementary
(D) Always 90°

P3 **What is the sum of the interior angles of any quadrilateral?**

(A) 360° (B) 180°
(C) 270° (D) 540°

MEDIUM

P4 **One angle of a parallelogram is 70°. What is the angle next to it?**

(A) 70° (B) 20°
(C) 290° (D) 110°

P5 **A triangle with sides 4, 6, 8 is enlarged by scale factor 2.5. How long is the longest side now?**

(A) 10.5 (B) 16
(C) 20 (D) 12

P6 **A square with side 5 is enlarged by scale factor 3. What is its new area?**

(A) 75 (B) 225
(C) 45 (D) 150

HARD

P7 **Which statement is true?**

(A) Every square is a rhombus
(B) Every rectangle is a square
(C) Every trapezoid is a parallelogram
(D) Every rhombus is a rectangle

P8 **All lengths of a figure are multiplied by 1/2. By what is its area multiplied?**

(A) 1/2 (B) 2
(C) 1/8 (D) 1/4

P9 **A model car is 1/24 of the real size and is 18 cm long. How long is the real car?**

(A) 0.75 cm (B) 42 cm
(C) 432 cm (D) 4,320 cm

Unit 7 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **Which shape can have exactly one pair of parallel sides?**

(A) Parallelogram (B) Trapezoid
(C) Rectangle (D) Rhombus

Q2 The diagonals of a rectangle are:

Ⓐ Equal in length
Ⓑ Always perpendicular
Ⓒ Never equal
Ⓓ Half the sides

Q3 A rhombus has side length 7. What is its perimeter?

Ⓐ 14
Ⓑ 49
Ⓒ 21
Ⓓ 28

Q4 A length of 3 is scaled by factor 4. What is the new length?

Ⓐ 7
Ⓑ 1
Ⓒ 12
Ⓓ 0.75

Q5 A triangle has area 10 and is enlarged by scale factor 2. What is the new area?

Ⓐ 20
Ⓑ 40
Ⓒ 100
Ⓓ 12

Q6 In a parallelogram, opposite angles are $(2x + 10)°$ and $70°$. Find x.

Ⓐ 30
Ⓑ 35
Ⓒ 60
Ⓓ 20

Surface Area, Volume & Composite Figures

Calculate surface area and volume of prisms, cylinders, pyramids, and cones, solve for missing dimensions, and work with composite figures and scaling.

BEFORE YOU START

1. Area of rectangles, triangles, and circles ($A = \pi r^2$).
2. Squares and the Pythagorean theorem (Units 1 and 4) for slant heights.

GO DEEPER ONLINE

Surface Area: math.boredgames.site/math/surface-area/walkthrough.html

Volume: math.boredgames.site/math/volume/walkthrough.html

Volume of Cylinders: math.boredgames.site/math/volume-of-cylinders/walkthrough.html

Volume of Cones & Spheres: math.boredgames.site/math/volume-of-cones-and-spheres/walkthrough.html

Surface Area | Volume | Volume of Cylinders | Volume of Cones & Spheres

Lesson 8.1: Prisms & Cylinders

Volume = base area × height (V = Bh). For a cylinder the base is a circle: $V = \pi r^2 h$. **Surface area** is the total area of the net. For a cylinder, the side unrolls into a rectangle of length $2\pi r$. Use **radius** (half the diameter), and report **square** units for area, **cubic** units for volume. An open container has no top.

$V = Bh$
Cylinder: $V = \pi r^2 h$
Open-top cylinder: $SA = \pi r^2 + 2\pi rh$

WORKED EXAMPLE

An open-top cylinder has r = 3 and h = 10. Find the material needed and the volume it holds.

→ Base: $\pi(3^2) = 9\pi$. Side: $2\pi(3)(10) = 60\pi$

→ Material: $69\pi \approx 216.8$ square units

→ Volume: $\pi(9)(10) = 90\pi \approx 282.7$ cubic units

Lesson 8.2: Pyramids & Cones

A pyramid or cone holds **one-third** as much as a prism or cylinder with the same base and height: **$V = Bh/3$**. Distinguish the **perpendicular height** (used for volume) from the **slant height** (used for lateral surface area). Find slant height with the Pythagorean theorem.

$$V = Bh/3$$

$$\text{Cone: } V = (1/3)\pi r^2 h, \text{ lateral area} = \pi r l$$

WORKED EXAMPLE

A cone has r = 3 and h = 4. Find its slant height and volume.

→ Slant height: $l = \sqrt{(3^2 + 4^2)} = 5$

→ Volume: $(1/3)\pi(9)(4) = 12\pi$

→ A cylinder with the same r and h holds 36π, three times as much

Lesson 8.3: Measurement Design & Scaling

Different shapes can hold the same volume with different surface areas. If every dimension is multiplied by k, **surface area is multiplied by k^2** and **volume by k^3**. Rounding too early changes final answers, so round at the end.

$$\text{Dimensions} \times k\text{: } SA \times k^2,\ V \times k^3$$

WORKED EXAMPLE

A cube has side 2, then side 4. Compare surface area and volume.

→ Side 2: $SA = 6(4) = 24$, $V = 8$

→ Side 4: $SA = 6(16) = 96$, $V = 64$

→ $SA \times 4 = 2^2$ and $V \times 8 = 2^3$

Lesson 8.4: Composite Figures & Missing Dimensions

Break a composite figure into simple pieces, add the parts, and **subtract cutouts**. Do not double-count a shared face. To find a missing dimension, rearrange the formula: from $V = Bh$, $h = V \div B$.

$$h = V \div B$$

WORKED EXAMPLE

A box has volume 120 and a 4×5 base. Find its height.

→ Base area $B = 20$

→ $h = 120 \div 20$

→ $h = 6$

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 What is the volume of a box that is 2 by 3 by 5?

(A) 10 (B) 30

(C) 31 (D) 62

P2 Which formula gives the volume of a cylinder?

(A) $V = \pi r^2 h$ (B) $V = 2\pi rh$

(C) $V = \pi rh^2$ (D) $V = \pi r^2$

P3 A circle has diameter 10. What is its radius?

(A) 10 (B) 20

(C) 2 (D) 5

MEDIUM

P4 What is the surface area of a cube with side 3?

(A) 27 (B) 36

(C) 54 (D) 18

P5 A cone has radius 3 and height 4. What is its volume?

(A) 36π (B) 12π

(C) 4π (D) 24π

P6 A square pyramid has a base of side 6 and height 5. What is its volume?

(A) 60 (B) 180

(C) 30 (D) 90

HARD

P7 What is the volume of a cylinder with r = 2 and h = 5?

(A) 10π (B) 40π

(C) 100π (D) 20π

P8 An open-top box is 4 by 3 by 2. How much material covers it?

(A) 52 (B) 24

(C) 40 (D) 26

P9 Every dimension of a cube is doubled. By what factor does the volume grow?

(A) 2 (B) 8

(C) 4 (D) 6

Unit 8 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 What is the volume of a cube with side 4?

(A) 64 (B) 16

(C) 48 (D) 12

Q2 What is the base area of a cylinder with radius 5?

(A) 10π (B) 5π

(C) 50π (D) 25π

Q3 A cone and a cylinder have the same radius and height. The cone's volume is what fraction of the cylinder's?

(A) 1/2 (B) 2/3

(C) 1/3 (D) 1/4

Q4 What is the slant height of a cone with r = 6 and h = 8?

(A) 14 (B) 10

(C) 7 (D) 48

Q5 A box has volume 90 and a 3×5 base. What is its height?

(A) 6 (B) 30

(C) 15 (D) 75

Q6 A 8×5 rectangle has a 2×2 square hole cut out. What is the remaining area?

(A) 44 (B) 40

(C) 32 (D) 36

Proportional Relationships & Slope

Represent proportional relationships with tables, graphs, and y = kx, find slope from graphs, tables, and points, and write and compare lines in y = mx + b form.

BEFORE YOU START

1. Ratios, unit rates, and proportional tables (Unit 6).
2. Plotting points on the coordinate plane and solving equations (Unit 3).

GO DEEPER ONLINE

Proportional Relationships: math.boredgames.site/math/proportional-relationships/walkthrough.html

Slope: math.boredgames.site/math/slope/walkthrough.html

Proportional Relationships

Slope

Lesson 9.1: Proportional Relationships: y = kx

In a **proportional relationship**, y = kx where k is the constant of proportionality (the unit rate). The graph is a straight line **through the origin** because x = 0 gives y = 0. A relationship like y = 3x + 2 is linear but **not proportional** because it has a fixed starting value.

$$y = kx$$

$$k = y \div x$$

WORKED EXAMPLE

A table has (2, 6) and (5, 15). Is it proportional? What is k?

→ 6 ÷ 2 = 3 and 15 ÷ 5 = 3

→ The ratio is constant, so it is proportional with k = 3

→ y = 3x. Interpreting k: 3 units of y for each 1 unit of x.

Lesson 9.2: Slope

Slope = rise ÷ run = $(y_2 - y_1) \div (x_2 - x_1)$. Positive slope rises left to right, negative falls, a horizontal line has slope 0, and a vertical line has undefined slope. Similar triangles along a line have the same rise-to-run ratio, which is why slope is constant everywhere on a line.

$$m = (y_2 - y_1) \div (x_2 - x_1)$$

WORKED EXAMPLE

Find the slope of the line through (1, 2) and (4, 8).

→ Rise: $8 - 2 = 6$

→ Run: $4 - 1 = 3$

→ $m = 6 \div 3 = 2$

Lesson 9.3: Slope-Intercept Form

$y = mx + b$ shows the slope m and the **y-intercept** b (where the line crosses the y-axis, the starting value). To compare two plans, set their expressions equal and solve for x.

$$y = mx + b$$

WORKED EXAMPLE

Plan A: $y = 4x + 6$. Plan B: $y = 6x$. When are the values equal?

→ $4x + 6 = 6x$

→ $6 = 2x$, so $x = 3$

→ Value: $y = 6(3) = 18$

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **In $y = 4x$, what is the constant of proportionality?**

Ⓐ 4 Ⓑ 1

Ⓒ x Ⓓ 0

P2 **What is the slope of the line through (0, 0) and (2, 6)?**

Ⓐ 2 Ⓑ 6

Ⓒ 12 Ⓓ 3

P3 **What is the y-intercept of $y = 2x + 5$?**

Ⓐ 2 Ⓑ −5

Ⓒ 5 Ⓓ 7

MEDIUM

P4 **What is the slope of the line through (1, 3) and (3, 11)?**

(A) 8
(B) 4
(C) 2
(D) 1/4

P5 **Which equation is proportional?**

(A) $y = 5x$
(B) $y = 5x + 1$
(C) $y = x + 5$
(D) $y = 5 - x$

P6 **What is the slope of a horizontal line?**

(A) Undefined
(B) 1
(C) -1
(D) 0

HARD

P7 **What is the slope of the line through (2, 5) and (6, −3)?**

(A) 2
(B) $-1/2$
(C) -2
(D) -8

P8 **Plan A: $y = 3x + 4$. Plan B: $y = 5x$. For what x are they equal?**

(A) $x = 4$
(B) $x = 2$
(C) $x = 1$
(D) $x = 8$

P9 **A table has x: 2, 4, 6 and y: 7, 13, 19. Which description fits?**

(A) $y = 3x + 1$, linear but not proportional
(B) $y = 3x$, proportional
(C) $y = x + 5$, proportional
(D) $y = 3.5x$, proportional

Unit 9 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **The point (4, 20) lies on a proportional graph. What is k?**

(A) 80
(B) 16
(C) 4
(D) 5

Q2 **What is the slope of $y = -3x + 7$?**

(A) 7
(B) 3
(C) -3
(D) -7

Q3 **What is the slope of a vertical line?**

Ⓐ 0 Ⓑ Undefined

Ⓒ 1 Ⓓ Infinite area

Q4 **A line has slope 4 and passes through (0, −2). Which equation is it?**

Ⓐ $y = 4x - 2$ Ⓑ $y = -2x + 4$

Ⓒ $y = 4x + 2$ Ⓓ $y = -2x - 4$

Q5 **What is the slope of the line through (0, 1) and (2, 5)?**

Ⓐ 4 Ⓑ 1/2

Ⓒ −2 Ⓓ 2

Q6 **A proportional graph always passes through:**

Ⓐ The point (1, 1) Ⓑ The y-axis at 1

Ⓒ The origin Ⓓ No fixed point

Transformations & Probability

Dilate, translate, and reflect figures on the coordinate plane, distinguish congruence from similarity, and find probabilities with sample spaces and two-stage experiments.

BEFORE YOU START

1. Coordinate plane and plotting points; scale factors (Unit 7).
2. Fraction multiplication (Unit 2).

GO DEEPER ONLINE

Transformations: math.boredgames.site/math/transformations/walkthrough.html

Probability Basics: math.boredgames.site/math/probability-basics/walkthrough.html

Transformations

Probability Basics

Lesson 10.1: Dilations

A **dilation** centered at the origin with scale factor k sends (x, y) to (kx, ky). Angles stay the same, lengths are multiplied by k, and area is multiplied by k^2. A factor above 1 enlarges; a factor between 0 and 1 shrinks.

$$(x, y) \to (kx, ky)$$

WORKED EXAMPLE

Dilate the triangle (2, 4), (6, 4), (6, 8) by 1/2.

→ Multiply each coordinate by 1/2

→ (1, 2), (3, 2), (3, 4)

→ Side lengths halve, so the area is one-fourth as large

Lesson 10.2: Translations & Reflections

A **translation** slides every point by the same amount: (x, y) → (x + a, y + b). A **reflection across the x-axis** gives (x, −y), and across the y-axis gives (−x, y). Translations and reflections preserve size and shape, so the image is **congruent** to the original. A dilation preserves shape only, so the image is **similar**.

Translate: (x + a, y + b)

Reflect over x-axis: (x, −y)

Reflect over y-axis: (−x, y)

WORKED EXAMPLE

Translate (3, 2) by (−4, +1), then reflect across the y-axis.

→ Translate: $(3 - 4, 2 + 1) = (-1, 3)$

→ Reflect over the y-axis: (1, 3)

Lesson 10.3: Probability & Sample Spaces

For equally likely outcomes, **P(event) = favorable ÷ total**. The **complement** has probability $1 - P$. List outcomes with a table or tree diagram. **Experimental** probability is observed frequency; it can differ from the theoretical value, especially with few trials. With two-stage events, multiply the stage probabilities, remembering that **without replacement** changes the second-stage totals.

$$\text{P} = \text{favorable} \div \text{total}$$

$$\text{P(not A)} = 1 - \text{P(A)}$$

WORKED EXAMPLE

A bag has 3 red and 2 blue marbles. Draw two without replacement. What is P(both red)?

→ First red: 3/5

→ Second red (2 red left of 4): 2/4

→ $3/5 \times 2/4 = 6/20 = 3/10$

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **Reflect (3, 5) across the x-axis.**

Ⓐ (−3, 5)
Ⓑ (−3, −5)
Ⓒ (5, 3)
Ⓓ (3, −5)

P2 **Translate (2, 1) by 3 right and 2 down.**

Ⓐ (5, 3)
Ⓑ (−1, 3)
Ⓒ (5, −1)
Ⓓ (−1, −1)

P3 **What is the probability of rolling a 4 on a fair die?**

Ⓐ 1/4
Ⓑ 1/6
Ⓒ 4/6
Ⓓ 1/2

MEDIUM

P4 **Dilate (4, 6) by a factor of 1/2 about the origin.**

(A) (2, 3)
(B) (8, 12)
(C) (3, 5)
(D) (4.5, 6.5)

P5 **Reflect (−2, 7) across the y-axis.**

(A) (−2, −7)
(B) (2, −7)
(C) (7, −2)
(D) (2, 7)

P6 **What is the probability of NOT rolling a 6 on a fair six-sided die?**

(A) 1/6
(B) 1/5
(C) 5/6
(D) 6/5

HARD

P7 **A figure is dilated by a scale factor of 3. By what factor does its area change?**

(A) 3
(B) 9
(C) 6
(D) 27

P8 **You flip a coin and roll a die. What is P(heads and an even number)?**

(A) 1/4
(B) 1/12
(C) 1/2
(D) 1/6

P9 **A bag has 4 red and 2 blue marbles. Draw two without replacement. What is P(both blue)?**

(A) 1/9
(B) 1/3
(C) 1/6
(D) 1/15

Unit 10 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **Which transformation can change a figure's size?**

(A) Translation
(B) Reflection over the x-axis
(C) Dilation
(D) Reflection over the y-axis

Q2 **Reflect (−4, −1) across the x-axis.**

(A) (4, −1)
(B) (−4, 1)
(C) (4, 1)
(D) (−1, −4)

Q3 A bag has 3 red and 7 blue marbles. What is P(red)?

(A) 3/10 (B) 3/7

(C) 7/10 (D) 1/3

Q4 You flip two coins. What is P(two tails)?

(A) 1/2 (B) 1/3

(C) 3/4 (D) 1/4

Q5 The chance of rain is 0.35. What is the chance of no rain?

(A) 0.35 (B) 0.45

(C) 0.65 (D) 1.35

Q6 In 20 flips you get 13 heads. What is the experimental probability of heads?

(A) 1/2 (B) 13/20

(C) 7/20 (D) 13/7

Data Analysis

Write statistical questions, build histograms, compute center and spread, construct and compare boxplots, and make claims supported by data.

BEFORE YOU START

1. Ordering numbers and computing averages.
2. Reading a bar graph.

GO DEEPER ONLINE

Histograms: math.boredgames.site/math/histograms/walkthrough.html

Box Plots: math.boredgames.site/math/box-plots/walkthrough.html

Mean (Average): math.boredgames.site/math/mean-average/walkthrough.html

Median & Mode: math.boredgames.site/math/median-and-mode/walkthrough.html

Histograms Box Plots Mean (Average) Median & Mode

Lesson 11.1: Statistical Questions & Histograms

A **statistical question** expects the answers to **vary** (How many hours do students at our school sleep on school nights?). A **histogram** groups numerical data into **equal-width intervals** with no gaps or overlaps, and the bar height shows the count. Describe the **shape**, **clusters**, **gaps**, and **outliers**. Different interval widths can reveal different features.

Interval 70–79 contains 70, 71, ..., 79

WORKED EXAMPLE

Group the scores 62, 68, 71, 74, 75, 77, 81, 83, 84, 88, 90, 95 into intervals of 10.

→ 60–69: 62, 68 → 2

→ 70–79: 71, 74, 75, 77 → 4

→ 80–89: 81, 83, 84, 88 → 4

→ 90–99: 90, 95 → 2

Lesson 11.2: Center, Spread & Boxplots

Mean = total ÷ count. **Median** = middle value of the ordered data. **Range** = max − min. **Quartiles** split the data into four parts: Q1 is the median of the lower half and Q3 is the median of the upper half. **IQR = Q3 − Q1.** A boxplot shows min, Q1, median, Q3, and max; the box holds the middle 50%. An extreme value pulls the mean much more than the median.

$$\text{IQR} = Q3 - Q1$$

$$\text{Range} = \max - \min$$

WORKED EXAMPLE

Find the median, Q1, Q3, IQR, and range of 2, 4, 6, 8, 10, 12, 14.

→ Median: 8

→ Lower half 2, 4, 6 → Q1 = 4. Upper half 10, 12, 14 → Q3 = 12

→ IQR = 12 − 4 = 8

→ Range = 14 − 2 = 12

Lesson 11.3: Data Investigation

Pose a question, collect or analyze data, choose a display, and make a claim that the data supports. Always name a **limitation**: a small or unrepresentative sample, or measurement error. Use a histogram to see shape and a boxplot to compare groups.

Compare center (median) and spread (IQR)

WORKED EXAMPLE

Class A: median 78, IQR 10. Class B: median 78, IQR 22. What can you claim?

→ The medians are the same, so the typical score is similar

→ Class B has the larger IQR, so its scores are more spread out

→ Claim: same center, B is less consistent

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **Which is a statistical question?**

Ⓐ How many hours did I sleep last night?

Ⓑ What time is it now?

Ⓒ How many hours do students at our school sleep on school nights?

Ⓓ How tall is the Eiffel Tower?

P2 What is the median of 3, 7, 9?

Ⓐ 6.33 Ⓑ 7

Ⓒ 9 Ⓓ 3

P3 What is the mean of 2, 4, 6?

Ⓐ 4 Ⓑ 6

Ⓒ 12 Ⓓ 3

MEDIUM

P4 What is the range of 5, 9, 12, 20?

Ⓐ 20 Ⓑ 5

Ⓒ 11.5 Ⓓ 15

P5 What is the median of 4, 8, 10, 12?

Ⓐ 8 Ⓑ 10

Ⓒ 9 Ⓓ 8.5

P6 For 1, 3, 5, 7, 9, 11, 13, what are Q1 and Q3?

Ⓐ Q1 = 1, Q3 = 13 Ⓑ Q1 = 3, Q3 = 11

Ⓒ Q1 = 5, Q3 = 9 Ⓓ Q1 = 3, Q3 = 9

HARD

P7 What is the IQR of 2, 4, 6, 8, 10, 12, 14?

Ⓐ 8 Ⓑ 12

Ⓒ 6 Ⓓ 4

P8 The value 100 is added to the data 10, 12, 13, 15. Which measure changes least?

Ⓐ The mean Ⓑ The range

Ⓒ They all change equally Ⓓ The median

P9 Which is required for a correctly built histogram?

Ⓐ Bars separated by gaps

Ⓑ Intervals of different widths

Ⓒ Equal-width intervals with no gaps or overlaps

Ⓓ Only categorical data

Unit 11 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **What is the mean of 10, 20, 30, 40?**

(A) 30
(B) 25
(C) 100
(D) 20

Q2 **What is the median of 7, 1, 5, 3, 9?**

(A) 5
(B) 7
(C) 3
(D) 25

Q3 **What is the range of 12, 3, 19, 8?**

(A) 19
(B) 3
(C) 11
(D) 16

Q4 **In a boxplot, the box shows:**

(A) The whole range
(B) The mean
(C) The middle 50% of the data
(D) The outliers

Q5 **Q1 = 12 and Q3 = 30. What is the IQR?**

(A) 42
(B) 18
(C) 21
(D) 9

Q6 **The bar for 20–29 on a histogram has height 6. What does that mean?**

(A) 6 values fall in the interval 20–29
(B) The mean is 6
(C) The values add to 6
(D) The interval is 6 wide

Functions, Linear Models & the Algebra Bridge

Use function notation, write and graph linear models from contexts, compare models and find break-even points, and consolidate the skills that Algebra I builds on.

BEFORE YOU START

1. Slope and slope-intercept form (Unit 9).
2. Solving equations and inequalities (Units 3 and 5).

GO DEEPER ONLINE

Introduction to Functions: math.boredgames.site/math/functions-introduction/walkthrough.html

Linear vs Non-Linear Functions: math.boredgames.site/math/linear-vs-non-linear-functions/walkthrough.html

Systems of Equations: math.boredgames.site/math/systems-of-equations/walkthrough.html

Introduction to Functions

Linear vs Non-Linear Functions

Systems of Equations

Lesson 12.1: Functions & Function Notation

A **function** gives exactly **one output for each allowed input**. A relation like {(1, 2), (1, 5)} is not a function because the input 1 has two outputs. In **function notation**, f(x) = 2x + 1 means 'the output when the input is x'. A **linear** function changes at a constant rate; a table of x^2 has differences 1, 3, 5 that grow, so it is nonlinear.

$$f(x) = 2x + 1 \rightarrow f(3) = 7$$

WORKED EXAMPLE

Is $y = x^2$ linear? Check x = 0, 1, 2, 3.

→ Outputs: 0, 1, 4, 9

→ Differences: 1, 3, 5

→ The rate of change is not constant, so it is not linear

Lesson 12.2: Writing Linear Models

Write y = mx + b from a slope and a point, from two points, or from a context (b is the starting value and m is the rate). Interpret the intercepts, and **restrict the domain** when the context requires it (hours cannot be negative).

$$m = (y_2 - y_1) \div (x_2 - x_1)$$

$$b = y - mx$$

WORKED EXAMPLE

Write the line through (1, 5) and (3, 11).

→ $m = (11 - 5) \div (3 - 1) = 3$

→ $5 = 3(1) + b \rightarrow b = 2$

→ $y = 3x + 2$

Lesson 12.3: Comparing Models & Break-Even

To compare two plans, set the expressions equal to find the **break-even** point and then use an inequality to decide which is cheaper on each side of it. Interpret the shared input and output in context.

$$10 + 4v = 6v \rightarrow v = 5$$

WORKED EXAMPLE

Membership A costs $10 + $4 per visit. Membership B costs $6 per visit. When is each cheaper?

→ Break-even: $10 + 4v = 6v \rightarrow v = 5$

→ At 5 visits both cost $30

→ For more than 5 visits A is cheaper; for fewer than 5, B is cheaper

Lesson 12.4: The Algebra Bridge: Cumulative Skills

Algebra I leans on: signed fractions and decimals, exponent rules ($\mathbf{x^a \cdot x^b = x^{a+b}}$), distributing and factoring, rearranging formulas, and reversing an inequality when dividing by a negative. Clear fractions by multiplying both sides by the common denominator.

$$x^2 \cdot x^3 = x^5$$

$$3x^2 \cdot 4x = 12x^3$$

WORKED EXAMPLE

Solve $(2/3)x - 1/2 = 5/6$.

→ Multiply by 6: $4x - 3 = 5$

→ $4x = 8$

→ $x = 2$. Check: $4/3 - 1/2 = 8/6 - 3/6 = 5/6$ ✓

Practice

Circle the best answer for each problem. Work in order from easy to hard. Check your work in the answer key at the back of the book.

EASY

P1 **If $f(x) = x + 4$, what is $f(5)$?**

(A) 20 (B) 9

(C) 1 (D) 54

P2 **Which relation is a function?**

(A) $\{(1, 2), (2, 3), (3, 4)\}$ (B) $\{(1, 2), (1, 5), (2, 3)\}$

(C) $\{(2, 1), (2, 4), (2, 7)\}$ (D) $\{(0, 0), (0, 1), (1, 1)\}$

P3 **Simplify $x^3 \cdot x^4$.**

(A) x^{12} (B) $2x^7$

(C) x^4 (D) x^7

MEDIUM

P4 **If $f(x) = 2x - 3$, what is $f(-2)$?**

(A) 1 (B) -1

(C) -7 (D) -5

P5 **Which equation is the line through (0, 4) and (2, 10)?**

(A) $y = 4x + 3$ (B) $y = 3x + 4$

(C) $y = 3x + 10$ (D) $y = 6x + 4$

P6 **Is $y = x^2$ a linear function?**

(A) No, because its rate of change is not constant

(B) Yes, because it has one variable

(C) Yes, because it passes through the origin

(D) No, because it is not a function

HARD

P7 **Membership A costs \$20 + \$5 per visit. Membership B costs \$50 + \$2 per visit. For how many visits do they cost the same?**

(A) 30 (B) 6

(C) 15 (D) 10

P8 **Using the memberships above (A: \$20 + \$5 per visit; B: \$50 + \$2 per visit), which is cheaper for 12 visits?**

(A) A, which costs \$80 versus \$74 for B

(B) They cost the same

(C) B, which costs \$74 versus \$80 for A

(D) A, which costs \$60

P9 **Solve $(2/3)x - 1/2 = 5/6$.**

(A) $x = 1/2$

(B) $x = 2$

(C) $x = 3$

(D) $x = 5/4$

Unit 12 Quiz

6 questions. Score 5 of 6 (80%) to complete this unit. Already know the material? Take the quiz first to test out. Cover the answer key until you have answered every question.

Q1 **If $f(x) = 3x$, what is $f(4)$?**

(A) 12

(B) 7

(C) 34

(D) 1

Q2 **What is the slope of the line through (1, 2) and (3, 8)?**

(A) 6

(B) 1/3

(C) 2

(D) 3

Q3 **Which relation is NOT a function?**

(A) $\{(1, 1), (2, 4), (3, 9)\}$

(B) $\{(0, 5), (1, 5), (2, 5)\}$

(C) $\{(2, 1), (2, 4), (3, 5)\}$

(D) $\{(-1, 0), (0, 1), (1, 2)\}$

Q4 **A service costs \$15 plus \$2 per minute. Which model gives the cost C for m minutes?**

(A) $C = 15m + 2$

(B) $C = 2m + 15$

(C) $C = 17m$

(D) $C = 2m - 15$

Q5 **Solve $-2x + 3 > 11$.**

(A) $x < -4$

(B) $x > -4$

(C) $x < 4$

(D) $x > 4$

Q6 **Simplify $3x^2 \cdot 4x$.**

(A) $12x^2$

(B) $7x^3$

(C) $12x$

(D) $12x^3$

Algebra I Readiness Check

24 questions across all 12 units. Score 20 of 24 (80%) to show you are ready for Algebra I. If you score lower, use the answer key to find the units to review, then try again.

WHAT YOU SHOULD BE ABLE TO DO INDEPENDENTLY

Number fluency. Compute with signed fractions and decimals, estimate roots, compare scientific notation, and judge whether answers are reasonable.

Symbolic reasoning. Distribute and factor, combine like terms, and justify equivalent expressions.

Equations and inequalities. Solve multistep problems with variables on both sides, verify solutions, and graph solution sets.

Linear relationships. Move among tables, graphs, equations, and words. Interpret slope, intercept, and intersection.

Modeling. Define variables and units, choose a model, solve, and explain whether the result makes sense.

Mathematical explanation. Justify steps, correct errors, and support conclusions with calculations, graphs, or counterexamples.

C1 **Which of these is between 8 and 9?**

(A) $\sqrt{50}$ (B) $\sqrt{70}$
(C) $\sqrt{90}$ (D) $\sqrt{100}$

C2 **Which is smallest: 2×10^{-3}, 0.0005, 9×10^{-4}, or 1×10^{-2}?**

(A) 0.0005 (B) 2×10^{-3}
(C) 9×10^{-4} (D) 1×10^{-2}

C3 **Which is the greatest: $-1/3$, -0.3, -0.35, -0.4?**

(A) -0.3 (B) $-1/3$
(C) -0.35 (D) -0.4

C4 **A balance is −$45.50. You deposit $60 and then withdraw $20.25. What is the new balance?**

(A) $5.75 (B) $14.50
(C) −$125.75 (D) −$5.75

C5 **Solve $-2(x - 4) + 5x = 20$.**

(A) $x = 12$ (B) $x = 28/3$
(C) $x = -4$ (D) $x = 4$

C6 **Which expression equals $-2(3x - 4) + 5x$?**

(A) $-x - 8$ (B) $-11x + 8$
(C) $8 - x$ (D) $x + 8$

C7 Taxi X costs \$3 + \$2 per mile. Taxi Y costs \$1 + \$3 per mile. For how many miles do they cost the same?

(A) 4 miles
(B) 1 mile
(C) 2 miles
(D) 3 miles

C8 What is the exact length of the hypotenuse of a right triangle with legs 1 and 1?

(A) 2
(B) $\sqrt{2}$
(C) 1
(D) $\sqrt{3}$

C9 Solve $-3(2x - 1) \geq 15$.

(A) $x \geq -2$
(B) $x \leq -2$
(C) $x \leq 2$
(D) $x \geq 2$

C10 Your scores are 72, 85, and 78. You want an average of at least 80 after a fourth test with score x. What must x satisfy?

(A) $x \geq 85$
(B) $x \geq 80$
(C) $x \geq 75$
(D) $x \leq 85$

C11 Which is the better buy: A) 10 oz for \$2.50 or B) 16 oz for \$3.76?

(A) B, at about \$0.235 per ounce
(B) A, at \$0.25 per ounce
(C) They cost the same per ounce
(D) A, because the total price is lower

C12 Why does a 20% increase followed by a 20% decrease not restore the original price?

(A) Percents cannot be undone
(B) The decrease is applied to the original price
(C) Because $20\% + 20\% = 40\%$
(D) The 20% decrease is taken from a larger amount

C13 Why is every square a rectangle?

(A) A square has four equal sides
(B) Rectangles have four equal sides
(C) Squares are larger than rectangles
(D) A square has four right angles and opposite sides equal

C14 A 3 by 4 rectangle is enlarged by a scale factor of 3. How does its area compare?

(A) 3 times as large
(B) 6 times as large
(C) 9 times as large
(D) 27 times as large

C15 **Which calculation uses slant height?**

(A) Volume of a cone

(B) Volume of a prism

(C) Lateral surface area of a cone

(D) Base area of a cylinder

C16 **An open-top cylinder has r = 2 and h = 6. How much material covers it?**

(A) 32π

(B) 28π

(C) 24π

(D) 56π

C17 **Plan A: y = 2x + 10. Plan B: y = 4x. For what x are they equal?**

(A) $x = 10$

(B) $x = 5$

(C) $x = 2$

(D) $x = 6$

C18 **Why is slope the same between any two points on a line?**

(A) The triangles formed are similar, so rise ÷ run stays the same

(B) All triangles are congruent

(C) Lines are always horizontal

(D) Slope depends on which points you pick

C19 **A triangle is dilated by a factor of 1/2. Compared with the original, the image has:**

(A) The same angles, half the side lengths, one-fourth the area

(B) Half the angles, half the sides, half the area

(C) The same angles, the same sides, half the area

(D) The same angles, half the sides, half the area

C20 **Two players flip two coins. A wins if both match (HH or TT); B wins if they differ. Is the game fair?**

(A) No, B wins 3 of 4 outcomes

(B) No, A wins 3 of 4 outcomes

(C) No, because there are 3 possible outcomes

(D) Yes, each player wins with probability 1/2

C21 **Group A has median 70 and IQR 8. Group B has median 70 and IQR 24. Which claim is supported?**

(A) A has higher scores overall

(B) B has a lower median

(C) They have identical distributions

(D) The groups have the same center, but B is more spread out

C22 **What is a limitation of surveying only 10 students in one class to learn about the whole school?**

(A) Surveys cannot be statistical

(B) Ten is always enough

(C) The sample may not represent the whole school

(D) Only the mean can be used

C23 **Event A charges $100 + $5 per guest. Event B charges $40 + $8 per guest. For how many guests do they cost the same?**

(A) 12 guests

(B) 30 guests

(C) 20 guests

(D) 60 guests

C24 **Event B costs $40 + $8 per guest, and your budget is $180. What is the greatest number of guests you can have?**

(A) 18 guests

(B) 17 guests

(C) 17.5 guests

(D) 22 guests

Answers & Explanations

Unit 1: Powers, Roots & Scientific Notation

PRACTICE

P1 **A 16** | $(-4)(-4) = 16$. The negative is inside the parentheses, so it is squared too.

P2 **D 9** | $9 \times 9 = 81$.

P3 **C 0.01** | $10^{-2} = 1/100 = 0.01$.

P4 **B 7 and 8** | $7^2 = 49$ and $8^2 = 64$, so $\sqrt{50}$ is between 7 and 8.

P5 **A 4.6×10^{-4}** | Move the decimal 4 places right to get 4.6, so the exponent is -4.

P6 **D $x = 7$ or $x = -7$** | Both 7 and -7 square to 49.

P7 **C 0** | $-3^2 = -9$ and $(-3)^2 = 9$, so the sum is 0.

P8 **B 6×10^3** | $2 \times 3 = 6$ and $5 + (-2) = 3$.

P9 **A 3.2×10^{-4}** | As decimals: 0.00032, 0.00029, 0.000041. The first is greatest.

UNIT QUIZ

Q1 **D 12** | $12 \times 12 = 144$.

Q2 **C -25** | Square 5 first (25), then take the opposite.

Q3 **B 5200** | Move the decimal 3 places right.

Q4 **A 1** | Any non-zero number to the zero power is 1.

Q5 **D 5 and 6** | $25 < 30 < 36$, so $5 < \sqrt{30} < 6$.

Q6 **C 3×10^2** | $6 \div 2 = 3$ and $4 - 2 = 2$.

Unit 2: Rational & Real Numbers

PRACTICE

P1 **D $\sqrt{2}$** | $\sqrt{2}$ never terminates or repeats. $\sqrt{49} = 7$ is rational.

P2 **C 0.75** | $3 \div 4 = 0.75$.

P3 **B -3** | Different signs: $8 - 5 = 3$, and the larger magnitude is negative.

P4 **A 8/9** | A single repeating digit d over 9: 8/9.

P5 **D 1/6** | $-3/6 + 4/6 = 1/6$.

P6 **C 10** | Two negatives multiply to a positive: $2.5 \times 4 = 10$.

P7 **B 2** | $(-3/4)(-8/3) = 24/12 = 2$.

P8 **A $-3/4, -0.7, 0.5, 2/3$** | As decimals: $-0.75, -0.7, 0.5, 0.667$.

P9 **D -10.75 m** | $-12.5 + 4.75 = -7.75$, then $-7.75 - 3 = -10.75$.

UNIT QUIZ

Q1 **C It is irrational** | π never terminates or repeats, so it cannot be written as a fraction of integers. (22/7 is only an approximation.)

Q2 **B 10** | Subtracting -3 is adding 3.

Q3 **A 42** | Two negatives make a positive.

Q4 **D $-2/5$** | $-4/10$ simplifies to $-2/5$.

Q5 **C 62.5%** | $5 \div 8 = 0.625 = 62.5\%$.

Q6 **B 12** | $-18 \times (-2/3) = 12$.

Unit 3: Expressions & Linear Equations

PRACTICE

P1 **C 7** | The coefficient is the number multiplied by the variable.

P2 **B 7x** | Add the coefficients of like terms: $4 + 3 = 7$.

P3 **A x = −5** | Subtract 9 from both sides.

P4 **D −6x + 15** | $-3 \times 2x = -6x$ and $-3 \times (-5) = +15$.

P5 **C x = 8** | $7 + 1 = 3x - 2x$, so $x = 8$.

P6 **B 8a + 6** | $5a + 3a = 8a$ and $-2 + 8 = 6$.

P7 **A x = 20** | Multiply by 4: $2x - 12 = x + 8$, so $x = 20$. Check: $7 = 7$.

P8 **D None** | It simplifies to $4 = 5$, which is false.

P9 **C 6(3x − 4)** | GCF of 18 and 24 is 6: $18x \div 6 = 3x$ and $24 \div 6 = 4$.

UNIT QUIZ

Q1 **B 11** | $2(3) + 5 = 11$.

Q2 **A x = −7** | Divide both sides by 5.

Q3 **D 4x + 6** | $6x - 2x + 6 = 4x + 6$.

Q4 **C x = 5** | $x - 1 = 4$, so $x = 5$.

Q5 **B x = 4** | $4x = 16$, so $x = 4$.

Q6 **A Infinitely many** | Both sides simplify to $2x + 6$, so every x works.

Unit 4: Equations as Models & the Pythagorean Theorem

PRACTICE

P1 **B 5** | $9 + 16 = 25$, and $\sqrt{25} = 5$.

P2 **A $34** | $10 + 4(6) = 34$.

P3 **D 2n + 5 = 17** | Twice a number is 2n, and 5 more is + 5.

P4 **C 12** | $13^2 - 5^2 = 169 - 25 = 144$, and $\sqrt{144} = 12$.

P5 **B Yes, because 49 + 576 = 625 = 25^2** | The converse of the Pythagorean theorem confirms it.

P6 **A 10** | $\sqrt{(36 + 64)} = \sqrt{100} = 10$.

P7 **D 8** | $20 + 2v = 4 + 4v \rightarrow 16 = 2v \rightarrow v = 8$.

P8 **C 18** | $2(w + 2w) = 54 \rightarrow 6w = 54 \rightarrow w = 9$, so length = 18.

P9 **B 8 ft** | $10^2 - 6^2 = 64$, and $\sqrt{64} = 8$.

UNIT QUIZ

Q1 **A 15** | $81 + 144 = 225$, and $\sqrt{225} = 15$.

Q2 **D 7** | $2(w + 8) = 30 \rightarrow w + 8 = 15 \rightarrow w = 7$.

Q3 **C 6, 8, 10** | $36 + 64 = 100 = 10^2$.

Q4 **B The longest side, opposite the right angle** | It is always opposite the 90° angle.

Q5 **A 5** | Legs 3 and 4 give $\sqrt{25} = 5$.

Q6 **D 13** | $25 + 144 = 169$, and $\sqrt{169} = 13$.

Unit 5: Inequalities

PRACTICE

P1 **A $x \geq 6$** | At least means 6 or more.

P2 **D $x > 4$** | Subtract 5 from both sides.

P3 **C 3 is not included in the solutions** | $3 < 3$ is false.

P4 **B $x > -5$** | Dividing by -2 reverses the sign.

P5 **A $x \leq 5$** | $3x \leq 15$, so $x \leq 5$.

P6 **D 5** | $2(5) + 1 = 11 > 9$. For $x = 4$, 9 is not greater than 9.

P7 **C $x \leq 4$** | $-3x \geq -12$; dividing by -3 reverses the sign: $x \leq 4$.

P8 **B $x > -4$** | $2x - 6 < 4x + 2 \rightarrow -8 < 2x \rightarrow x > -4$.

P9 **A 3** | $12t + 6 \leq 50 \rightarrow t \leq 3.67$. Round down: 3.

UNIT QUIZ

Q1 **D $x \leq 10$** | At most means 10 or less.

Q2 **C $x \geq 5$** | Add 3 to both sides.

Q3 **B $x < -5$** | Divide by 4 (positive, so the sign stays).

Q4 **A $x \geq -6$** | Multiply by -2 and reverse the sign.

Q5 **D $x \geq -2$** | $2x \geq -4$, so $x \geq -2$.

Q6 **C 4** | $6b \leq 28 \rightarrow b \leq 4.67$. Round down: 4.

Unit 6: Ratios, Rates & Percents

PRACTICE

P1 **D 2 : 3** | Divide both by 6.

P2 **C 20** | $0.25 \times 80 = 20$.

P3 **B 50 miles per hour** | $150 \div 3 = 50$.

P4 **A $15** | $\$9 \div 6 = \$1.50$ each, and $10 \times 1.50 = 15$.

P5 **D $30** | 25% of $40 = 10$, and $40 - 10 = 30$.

P6 **C 75%** | $18 \div 24 = 0.75$.

P7 **B 30%** | Change is 15, and $15 \div 50 = 0.30$.

P8 **A $58.32** | $60 \times 0.90 = 54$, and $54 \times 1.08 = 58.32$.

P9 **D x: 1, 2, 3 and y: 4, 8, 12** | $y \div x = 4$ for every pair in the table with x: 1, 2, 3 and y: 4, 8, 12.

UNIT QUIZ

Q1 **C 2 : 3** | Divide both by 2.

Q2 **B 20** | $0.40 \times 50 = 20$.

Q3 **A $0.30 per oz** | $2.40 \div 8 = 0.30$.

Q4 **D 70 miles** | $3.5 \times 20 = 70$.

Q5 **C 150** | $30 \div 0.20 = 150$.

Q6 **B $198** | $200 \times 1.10 = 220$, and $220 \times 0.90 = 198$.

Unit 7: Quadrilaterals, Similarity & Scale

PRACTICE

P1 **C Square** | A square is the only one with both properties.

P2 **B Equal** | Opposite angles of a parallelogram are congruent.

P3 **A 360°** | Split into two triangles: $2 \times 180° = 360°$.

P4 **D 110°** | Consecutive angles add to 180°.

P5 **C 20** | $8 \times 2.5 = 20$.

P6 **B 225** | New side 15, area $15^2 = 225$.

P7 **A Every square is a rhombus** | A square has 4 equal sides, so it is a rhombus.

P8 **D 1/4** | Area scales by $k^2 = (1/2)^2 = 1/4$.

P9 **C 432 cm** | $18 \times 24 = 432$ cm.

UNIT QUIZ

Q1 **B Trapezoid** | Parallelograms, rectangles, and rhombuses always have two pairs. Only a trapezoid can have exactly one.

Q2 **A Equal in length** | Rectangle diagonals are congruent.

Q3 **D 28** | $4 \times 7 = 28$.

Q4 **C 12** | $3 \times 4 = 12$.

Q5 **B 40** | Area scales by $2^2 = 4$, and $10 \times 4 = 40$.

Q6 **A 30** | $2x + 10 = 70 \rightarrow x = 30$.

Unit 8: Surface Area, Volume & Composite Figures

PRACTICE

P1 **B 30** | $2 \times 3 \times 5 = 30$.

P2 **A $V = \pi r^2 h$** | Base area πr^2 times height h.

P3 **D 5** | Radius is half the diameter.

P4 **C 54** | 6 faces $\times$ 9 = 54.

P5 **B 12π** | $(1/3)\pi(9)(4) = 12\pi$.

P6 **A 60** | $(1/3)(36)(5) = 60$.

P7 **D 20π** | $\pi(4)(5) = 20\pi$.

P8 **C 40** | Base 12, plus sides $2(4 \times 2) + 2(3 \times 2) = 16 + 12$, so 40.

P9 **B 8** | Volume scales by $2^3 = 8$.

UNIT QUIZ

Q1 **A 64** | $4^3 = 64$.

Q2 **D 25π** | $\pi(5^2) = 25\pi$.

Q3 **C 1/3** | V cone = (1/3)Bh.

Q4 **B 10** | $\sqrt{(36 + 64)} = 10$.

Q5 **A 6** | $h = 90 \div 15 = 6$.

Q6 **D 36** | $40 - 4 = 36$.

Unit 9: Proportional Relationships & Slope

PRACTICE

P1 **A 4** | k is the coefficient of x.

P2 **D 3** | Rise 6, run 2: $6 \div 2 = 3$.

P3 **C 5** | b is the y-intercept.

P4 **B 4** | $(11 - 3) \div (3 - 1) = 8 \div 2 = 4$.

P5 **A $y = 5x$** | Only $y = 5x$ has no added constant.

P6 **D 0** | No rise, so the slope is 0.

P7 **C -2** | $(-3 - 5) \div (6 - 2) = -8 \div 4 = -2$.

P8 **B $x = 2$** | $3x + 4 = 5x \rightarrow 4 = 2x \rightarrow x = 2$.

P9 **A $y = 3x + 1$, linear but not proportional** | Slope 3 and $y = 3(2) + 1 = 7$. The ratio $y \div x$ is not constant.

UNIT QUIZ

Q1 **D 5** | $20 \div 4 = 5$.

Q2 **C -3** | m is the coefficient of x.

Q3 **B Undefined** | The run is 0, and you cannot divide by 0.

Q4 **A $y = 4x - 2$** | $m = 4$ and $b = -2$.

Q5 **D 2** | $(5 - 1) \div 2 = 2$.

Q6 **C The origin** | $x = 0$ gives $y = 0$.

Unit 10: Transformations & Probability

PRACTICE

P1 **D (3, −5)** | Reflecting over the x-axis changes the sign of y.

P2 **C (5, −1)** | $(2 + 3, 1 - 2) = (5, -1)$.

P3 **B 1/6** | One favorable outcome out of six.

P4 **A (2, 3)** | Multiply both coordinates by 1/2.

P5 **D (2, 7)** | Reflecting over the y-axis changes the sign of x.

P6 **C 5/6** | $1 - 1/6 = 5/6$.

P7 **B 9** | Area scales by $k^2 = 9$.

P8 **A 1/4** | 3 favorable of 12 outcomes = 1/4.

P9 **D 1/15** | $2/6 \times 1/5 = 2/30 = 1/15$.

UNIT QUIZ

Q1 **C Dilation** | Only a dilation changes size.

Q2 **B (−4, 1)** | Change the sign of y.

Q3 **A 3/10** | 3 of the 10 marbles are red.

Q4 **D 1/4** | Outcomes: HH, HT, TH, TT.

Q5 **C 0.65** | $1 - 0.35 = 0.65$.

Q6 **B 13/20** | Observed frequency: 13 of 20.

Unit 11: Data Analysis

PRACTICE

P1 **C How many hours do students at our school sleep on school nights?** | A statistical question expects varied answers across a group.

P2 **B 7** | 7 is the middle value.

P3 **A 4** | $12 \div 3 = 4$.

P4 **D 15** | $20 - 5 = 15$.

P5 **C 9** | Average the two middle values: $(8 + 10) \div 2 = 9$.

P6 **B Q1 = 3, Q3 = 11** | The lower half is 1, 3, 5 and the upper half is 9, 11, 13.

P7 **A 8** | $Q3 - Q1 = 12 - 4 = 8$.

P8 **D The median** | The median goes from 12.5 to 13, but the mean jumps from 12.5 to 30.

P9 **C Equal-width intervals with no gaps or overlaps** | Equal widths make bar heights comparable.

UNIT QUIZ

Q1 **B 25** | $100 \div 4 = 25$.

Q2 **A 5** | Ordered: 1, 3, 5, 7, 9.

Q3 **D 16** | $19 - 3 = 16$.

Q4 **C The middle 50% of the data** | The box runs from Q1 to Q3.

Q5 **B 18** | $30 - 12 = 18$.

Q6 **A 6 values fall in the interval 20–29** | Bar height is the frequency.

Unit 12: Functions, Linear Models & the Algebra Bridge

PRACTICE

P1 **B 9** | $5 + 4 = 9$.

P2 **A {(1, 2), (2, 3), (3, 4)}** | Each input has exactly one output.

P3 **D x^7** | Add the exponents: $3 + 4 = 7$.

P4 **C −7** | $2(-2) - 3 = -7$.

P5 **B $y = 3x + 4$** | Slope is $6 \div 2 = 3$ and the intercept is 4.

P6 **A No, because its rate of change is not constant** | The outputs 0, 1, 4, 9 have growing differences.

P7 **D 10** | $20 + 5v = 50 + 2v \rightarrow 3v = 30 \rightarrow v = 10$.

P8 **C B, which costs $74 versus $80 for A** | A: $20 + 60 = 80$. B: $50 + 24 = 74$.

P9 **B $x = 2$** | Multiply by 6: $4x - 3 = 5 \rightarrow x = 2$.

UNIT QUIZ

Q1 **A 12** | $3 \times 4 = 12$.

Q2 **D 3** | $(8 - 2) \div (3 - 1) = 3$.

Q3 **C {(2, 1), (2, 4), (3, 5)}** | The input 2 has two outputs.

Q4 **B $C = 2m + 15$** | Rate 2 per minute plus a $15 fixed fee.

Q5 **A $x < -4$** | $-2x > 8$; dividing by −2 reverses the sign.

Q6 **D $12x^3$** | Multiply coefficients, add exponents: $2 + 1 = 3$.

Algebra I Readiness Check

C1 **B $\sqrt{70}$** | $64 < 70 < 81$, so $8 < \sqrt{70} < 9$. Unit 1

C2 **A 0.0005** | As decimals: 0.002, 0.0005, 0.0009, 0.01. Unit 1

C3 **A -0.3** | On the number line -0.3 is closest to zero. ($-1/3 \approx -0.333$.) Unit 2

C4 **D $-\$5.75$** | $-45.50 + 60 = 14.50$, then $14.50 - 20.25 = -5.75$. Unit 2

C5 **D $x = 4$** | $-2x + 8 + 5x = 20 \rightarrow 3x = 12 \rightarrow x = 4$. Unit 3

C6 **C $8 - x$** | $-6x + 8 + 5x = -x + 8$. Unit 3

C7 **C 2 miles** | $3 + 2m = 1 + 3m \rightarrow m = 2$. Unit 4

C8 **B $\sqrt{2}$** | $1 + 1 = 2$, so the hypotenuse is $\sqrt{2}$ (about 1.41). Unit 4

C9 **B $x \leq -2$** | $2x - 1 \leq -5 \rightarrow x \leq -2$. Unit 5

C10 **A $x \geq 85$** | $(235 + x)/4 \geq 80 \rightarrow 235 + x \geq 320 \rightarrow x \geq 85$. Unit 5

C11 **A B, at about \$0.235 per ounce** | A is \$0.25 per oz; B is $3.76 \div 16 = \$0.235$ per oz. Unit 6

C12 **D The 20% decrease is taken from a larger amount** | The second percent applies to the new, larger base. Unit 6

C13 **D A square has four right angles and opposite sides equal** | A square meets every requirement of a rectangle. Unit 7

C14 **C 9 times as large** | Area scales by $3^2 = 9$. Unit 7

C15 **C Lateral surface area of a cone** | Lateral area is πrl, where l is the slant height. Unit 8

C16 **B 28π** | Base 4π + side $2\pi(2)(6) = 24\pi$, total 28π. Unit 8

C17 **B $x = 5$** | $2x + 10 = 4x \rightarrow x = 5$. Unit 9

C18 **A The triangles formed are similar, so rise ÷ run stays the same** | Similar triangles have equal ratios of corresponding sides. Unit 9

C19 **A The same angles, half the side lengths, one-fourth the area** | Angles are preserved, lengths scale by k, and area by k^2. Unit 10

C20 **D Yes, each player wins with probability 1/2** | HH and TT favor A; HT and TH favor B. Two of four each. Unit 10

C21 **D The groups have the same center, but B is more spread out** | Equal medians, larger IQR for B. Unit 11

C22 **C The sample may not represent the whole school** | A small, single-class sample may be biased. Unit 11

C23 **C 20 guests** | $100 + 5g = 40 + 8g \rightarrow 60 = 3g \rightarrow g = 20$. Unit 12

C24 **B 17 guests** | $40 + 8g \leq 180 \rightarrow g \leq 17.5$. You cannot host half a guest, so round down to 17. Unit 12

Notes