

Alaska AK STAR Grade 8 Math Made Easy

Study Guide with Key Concepts, Review & Practice

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YOUR GRADE 8 STUDY GUIDE

Math Made Easy

Key Concepts • Worked Examples • Practice with Answers

Grade 8 is the gateway to high-school math. This study guide covers every key concept you need — from irrational numbers and exponents through linear equations, functions, geometry, and data analysis.

Each topic is explained simply, backed by worked examples, and followed by focused practice with a full answer key. Use it to learn new ideas, review before a test, or fill in gaps any time.

**32 Topics Across 6 Chapters**

Irrational numbers, scientific notation, linear equations, functions, geometry, and data analysis — every Grade 8 standard.

**Clear Explanations & Worked Examples**

Every concept is broken down step by step with real examples so you understand the why, not just the how.

**Practice with Every Topic**

Short, focused problem sets after each lesson let you test your understanding immediately.

**Complete Answer Key**

Every practice problem has a detailed answer and explanation in the back of the book.



How to Use This Study Guide

Four steps to master every topic.

1

Read the Concept Box

Each topic starts with a clear explanation of the key idea or formula. Read it carefully — this is the foundation for everything that follows. Underline anything you want to remember.

2

Study the Worked Examples

Worked examples show you exactly how to apply the concept step by step. Cover the solution, try it yourself first, then compare. That one extra effort makes the method stick.

3

Solve the Practice Problems

After each explanation, a short set of problems tests your understanding. Work them on paper — writing out every step is the fastest way to learn.

4

Check Answers and Fix Mistakes

Flip to the Answer Key and mark your work. For any mistake, re-read the explanation and try again. Mistakes show you exactly where to focus next.



Study Plan Ideas

- **Daily:** One topic per day (15–25 minutes).
- **Weekly:** Review the week's concepts each Friday.
- **Before a test:** Re-do any problems you got wrong.



Tips for Parents & Teachers

- Use the guide alongside classroom lessons for extra support.
- Review mistakes together — focus on understanding, not just answers.
- Praise effort and persistence over speed or scores.

 Want More Practice?

This study guide focuses on concepts and understanding. For extra practice problems, use it alongside the Grade 8 Math Workbook or the Grade 8 Math Practice Tests for test-day preparation.

PREVIEW



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Math Quick Reference

Key formulas and facts for Grade 8 — tear out or bookmark this page.

Exponent Rules

$$a^m \cdot a^n = a^{m+n}$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$a^0 = 1 \quad (a \neq 0)$$

$$a^{-n} = \frac{1}{a^n}$$

Scientific Notation

Standard form: $a \times 10^n$

$1 \leq |a| < 10$, n is an integer

Large: $4,500 = 4.5 \times 10^3$

Small: $0.0032 = 3.2 \times 10^{-3}$

Multiply: add exponents

Divide: subtract exponents

Slope & Linear Equations

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

$$\text{Slope-intercept: } y = mx + b$$

$$\text{Point-slope: } y - y_1 = m(x - x_1)$$

$m > 0$: rises $m < 0$: falls

$m = 0$: horizontal

Systems of Equations

Substitution: Solve one equation for a variable, plug into the other.

Elimination: Add/subtract equations to cancel a variable.

One solution: lines cross

No solution: parallel lines

Infinite: same line

Functions

A function maps each input to exactly one output.

$f(x)$ means "the output for input x "

Linear: constant rate of change

Nonlinear: rate of change varies

Vertical line test: if a vertical line hits the graph twice, it's not a function.

Transformations

Translation: slide (same shape & size)

Reflection: flip over a line

Rotation: turn around a point

Dilation: resize by scale factor k

Rigid motions keep congruence.

Dilations keep similarity.

Pythagorean Theorem

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

c = hypotenuse (longest side)

Find a leg: $a = \sqrt{c^2 - b^2}$

Distance between (x_1, y_1) and (x_2, y_2) :

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Volume Formulas

$$\text{Cylinder: } V = \pi r^2 h$$

$$\text{Cone: } V = \frac{1}{3} \pi r^2 h$$

$$\text{Sphere: } V = \frac{4}{3} \pi r^3$$

A cone is $\frac{1}{3}$ of a cylinder with the same base and height.



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PREVIEW

CHAPTER

1

Irrational Numbers

★ *What's Inside* ★

1.1 <i>Rational and Irrational Numbers</i>	2
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★ 1.1 Rational and Irrational Numbers ★

🎯 Learning Goals

- Know the difference between rational and irrational numbers
- Classify numbers into the real number subsets

🎓 Rational vs. Irrational

A **rational number** can be written as $\frac{a}{b}$ where a and b are integers and $b \neq 0$. An **irrational number** cannot.

Every number has a decimal expansion. The decimal either:

- **Terminates:** $\frac{3}{4} = 0.75$
- **Repeats:** $\frac{1}{3} = 0.\overline{3}$
- **Never terminates or repeats:** $\sqrt{2} = 1.41421\dots$

Terminates or repeats → **rational**. Never repeats → **irrational**.

🎓 The Real Number Subsets

The **real numbers** include every number on the number line. They are organized into subsets:

- **Natural numbers:** $1, 2, 3, 4, \dots$ (counting numbers)
- **Whole numbers:** $0, 1, 2, 3, \dots$ (naturals plus zero)
- **Integers:** $\dots, -2, -1, 0, 1, 2, \dots$ (whole numbers and negatives)
- **Rational numbers:** any number written as $\frac{a}{b}$ (includes all integers)
- **Irrational numbers:** cannot be written as a fraction ($\sqrt{2}, \pi$)

Each subset fits inside the next: $\text{Natural} \subset \text{Whole} \subset \text{Integer} \subset \text{Rational} \subset \text{Real}$. Irrational numbers are also real, but they sit **outside** the rational set.



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 Classifying into Subsets

Classify each number into **all** subsets it belongs to.

1. 7: Natural, Whole, Integer, Rational, Real
2. 0: Whole, Integer, Rational, Real (not Natural)
3. -3 : Integer, Rational, Real
4. $\frac{2}{3} = 0.\overline{6}$: Rational, Real
5. $\sqrt{5} = 2.236\dots$: Irrational, Real



“ Every integer is rational! Write it as a fraction: $-3 = \frac{-3}{1}$, $0 = \frac{0}{1}$. ”

 Rational and Irrational Numbers

1. Classify -8 into all real number subsets it belongs to.
2. Is $\sqrt{49}$ rational or irrational? List all subsets.
3. Classify $0.\overline{3}$ into all subsets.
4. Is $\sqrt{11}$ rational or irrational? List all subsets.
5. Every whole number is also a rational number.

True ☐ False ☐



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CHAPTER

2

Lines and Linear Equations

★ *What's Inside* ★

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★ 2.1 Graphing Proportional Relationships ★

🎯 Learning Goals

- Graph proportional relationships and interpret the unit rate as slope
- Compare proportional relationships shown in different ways

🎓 Proportional Relationships on a Graph

A proportional relationship has the equation $y = kx$, where k is the **constant of proportionality** (also called the unit rate).

On a graph, a proportional relationship is a **straight line through the origin** $(0, 0)$.

The constant k equals the **slope**: $k = \frac{y}{x}$ for any point on the line.

✏ Comparing Two Relationships

Store A charges \$3 per pound of candy. Store B's prices are in the table:

Pounds	2	4	6	8
Cost (\$)	5	10	15	20

Store A: $k = 3$. Store B: $k = \frac{5}{2} = 2.50$.

Store B is cheaper per pound.



“ To find the unit rate from a graph, pick any point (x, y) and divide: $k = \frac{y}{x}$. ”



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 Graphing Proportional Relationships

1. A car travels at a constant speed. It goes 150 miles in 3 hours. What is the unit rate?
2. Write the equation for the car in the previous problem.
3. A graph of a proportional relationship passes through $(4, 12)$. What is k ?
4. Runner A: $y = 8x$ (miles per hour). Runner B covers 35 miles in 5 hours. Who is faster?
5. A proportional relationship always passes through the origin. True ☐ False ☐



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- ✓ *Hundreds of practice problems*
- ✓ *Complete answer key with explanations*
- ✓ *Colorful visuals and step-by-step examples*
- ✓ *Reference sheets and progress trackers*

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