

Illinois IAR Grade 9 Math Workbook

Practice Problems & Exercises with Answer Key

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PRACTICE MAKES PERMANENT

Algebra 1 Workbook

Practice Problems • Word Problems • Complete Answer Key

Algebra 1 is the gateway to all higher-level mathematics. This workbook gives you focused practice on every essential topic — from real numbers and exponents to linear equations, systems, polynomials, quadratic functions, exponential models, and data analysis.

Work through each section at your own pace, show every step, then check the answer key in the back. Mistakes are not failures — they are the moments where real learning happens.

 **37 Topics Across 9 Chapters**

Real numbers, linear equations, functions, systems, polynomials, quadratics, exponentials, and statistics — every Algebra 1 standard.

 **Progressive Difficulty**

Each topic builds from foundational recall to multi-step reasoning.

 **Real-World Applications**

Apply your skills to science, engineering, finance, and everyday problem solving.

 **Complete Answer Key**

Every problem has a detailed answer in the back. Check your work, identify mistakes, and strengthen weak spots.

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How to Use This Workbook

Four steps to get the most out of every section.

1

Read the Quick Review

Every topic opens with a brief reminder of the key idea or formula. If something feels unfamiliar, pair this workbook with the matching study guide for a full explanation before diving into problems.

2

Work the Problems in Order

Problems are arranged from straightforward to challenging. Starting with the easier ones builds momentum and warms up your thinking before the tougher questions arrive.

3

Show Every Step

Write out your reasoning on scratch paper. When an answer is wrong, your written work reveals exactly where the logic broke down — and that is the fastest way to fix it.

4

Check Answers and Reflect

After finishing a section, flip to the Answer Key and mark every problem. For each mistake, figure out why it happened. Then try a similar problem again, until it clicks.



Suggested Weekly Routine

- **Mon–Thu:** One topic per day (20–30 minutes).
- **Friday:** Review the week's mistakes and redo missed problems.
- **Weekend:** Rest — or tackle a challenge problem!



Tips for Parents & Teachers

- Let your student work independently first.
- Review mistakes together — focus on why, not just the answer.
- Praise effort and persistence, not just correct answers.

 **Pair It Up**

This workbook focuses on practice. For detailed explanations, worked examples, and teaching notes, use it alongside the Algebra 1 Math Made Easy Study Guide or your classroom textbook.

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What You'll Need

Gather these supplies before you start.



Pencils

Mechanical or sharpened



Eraser

Good erasers save time



Graph Paper

For graphing & coordinates



Straightedge

For neat graphs & lines



Scientific Calculator

For checking, not shortcuts



A Focused Mindset

Persistence is the key

A Note for Parents & Teachers

- *This workbook pairs perfectly with the **Algebra 1 Math Made Easy Study Guide**. Use the Study Guide to learn concepts, then this workbook for focused practice.*
- *Topics follow the same order as the Study Guide for easy cross-reference.*
- *Keep sessions to 20–30 minutes for best focus and retention.*
- *Encourage students to show all work — the process matters as much as the answer.*
- *Celebrate progress. Even a few problems each day builds lasting math confidence.*

Math Symbols & Vocabulary

A quick reference you can come back to any time.

X¹ Key Symbols & Notation

Symbol	Name	What It Means	
a^n	Exponent	a multiplied by itself n times.	$2^3 = 8$
$\sqrt{\quad}$	Square Root	The number that, multiplied by itself, gives the original.	$\sqrt{49} = 7$
$ x $	Absolute Value	Distance from zero on the number line.	$ -5 = 5$
\leq, \geq	Less/Greater or Equal	Includes the boundary value.	$x \leq 10$
\neq	Not Equal To	The two sides are different.	$3 \neq 5$
$f(x)$	Function Notation	The output of function f for input x .	$f(3) = 7$
\pm	Plus or Minus	Both the positive and negative value.	$x = \pm 5$
Δ	Discriminant	$b^2 - 4ac$; determines the number of solutions.	

Key Vocabulary for Algebra 1

- **Variable** — a letter representing an unknown value
- **Expression** — numbers, variables, and operations combined
- **Equation** — a statement that two expressions are equal
- **Inequality** — a statement using $<$, $>$, \leq , or \geq
- **Slope** — steepness of a line ($\frac{\text{rise}}{\text{run}}$)
- **y-intercept** — where a line crosses the y-axis
- **Function** — each input maps to exactly one output
- **Domain** — set of all possible inputs
- **Range** — set of all possible outputs
- **Polynomial** — expression with terms of whole-number exponents
- **Quadratic** — a polynomial of degree 2 ($ax^2 + bx + c$)
- **Vertex** — the highest or lowest point of a parabola
- **System of equations** — two or more equations solved together
- **Exponential** — growth or decay by a constant factor

Essential Formulas

Slope-intercept form: $y = mx + b$

Point-slope form: $y - y_1 = m(x - x_1)$

Standard form: $Ax + By = C$

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

Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Vertex: $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$

Exponential model: $f(x) = a \cdot b^x$

Arithmetic sequence: $a_n = a_1 + (n - 1)d$



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My Progress Log

Track your work through every chapter and topic.

This book belongs to: _____

 Chapter 1: Foundations of Algebra

Done Score: _____ / _____

 Chapter 2: Linear Equations and Inequalities

Done Score: _____ / _____

 Chapter 3: Introduction to Functions

Done Score: _____ / _____

 Chapter 4: Linear Functions and Their Graphs

Done Score: _____ / _____

 Chapter 5: Systems of Equations and Inequalities

Done Score: _____ / _____

 Chapter 6: Polynomials and Factoring

Done Score: _____ / _____

 Chapter 7: Quadratic Functions and Equations

Done Score: _____ / _____

 **Chapter 8: Exponential Functions and Sequences**

Done Score: _____ / _____

 **Chapter 9: Data Analysis and Statistics**

Done Score: _____ / _____

 **My Goal**

I want to finish _____ topics each week.

Target date:

PREVIEW








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CHAPTER

1

Foundations of Algebra

★ What's Inside ★

1.1 Classifying Real Numbers	2
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★ 1.1 Classifying Real Numbers ★

🎯 Learning Goals

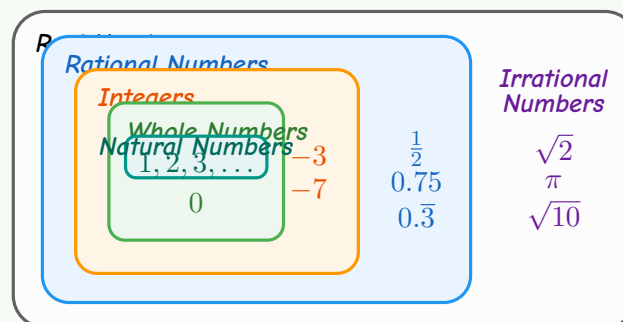
- Classify numbers as natural, whole, integer, rational, or irrational
- Know that rational decimals terminate or repeat

🎓 Number Subsets

Every number you use belongs to at least one of these groups:

- **Natural numbers:** $1, 2, 3, \dots$ (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 that equals $\frac{a}{b}$ where a, b are integers and $b \neq 0$
- **Irrational numbers:** decimals that never end and never repeat ($\sqrt{2}, \pi$)

These sets nest like rings. $\text{Natural} \subset \text{Whole} \subset \text{Integer} \subset \text{Rational}$. Rational and Irrational together make the **real numbers**.



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 **Classifying Numbers**

Place each number in all groups that fit.

1. 7 – Natural, Whole, Integer, Rational ($\frac{7}{1}$), Real
2. 0 – Whole, Integer, Rational ($\frac{0}{1}$), Real
3. -3 – Integer, Rational ($\frac{-3}{1}$), Real
4. $\frac{2}{5} = 0.4$ – Rational (terminates), Real
5. $\sqrt{3} = 1.7320\dots$ – Irrational (never repeats), Real



“ Every integer is rational! Just write it over 1. For example, $-5 = \frac{-5}{1}$. ”

Rational Numbers

- Written as $\frac{a}{b}$, $b \neq 0$
- Decimals terminate or repeat
- Examples: $\frac{3}{4}$, -2 , $0.\bar{6}$

Irrational Numbers

- Cannot be written as $\frac{a}{b}$
- Decimals never terminate or repeat
- Examples: $\sqrt{2}$, π , $\sqrt{10}$

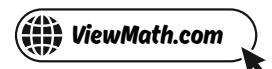
 **Classifying Real Numbers** 

1. Classify -12 : natural, whole, integer, rational, or irrational?
2. Is $\sqrt{25}$ rational or irrational?
3. Is $\sqrt{7}$ rational or irrational?
4. Write $0.\bar{3}$ as a fraction.
5. All whole numbers are integers.

True False



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CHAPTER

2

Introduction to Functions

★ What's Inside ★

2.1 What Is a Function?	5
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★ 2.1 What Is a Function? ★

🎯 Learning Goals

- Decide whether a relation is a function
- Use the vertical line test on graphs

🎓 What Is a Function?

A **relation** is any set of ordered pairs (x, y) .

A **function** is a special relation where every input (x) gives exactly one output (y) . No x -value may repeat with a different y -value.

Think of a vending machine. Press button **A3**, you always get the same snack. If one button gave a random item each time, that machine would not be a function!

Ways to show a relation: ordered pairs, table, graph, mapping diagram, or equation.

✏️ Checking a Table

Is this relation a function?

x	1	2	3	1
y	5	8	10	7

The input $x = 1$ maps to both 5 and 7. One input gives two outputs, so this is **not a function**.



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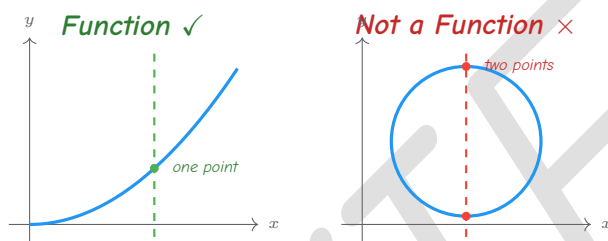


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The Vertical Line Test

- 1 Draw or look at the graph of the relation.
- 2 Imagine sliding a vertical line across the graph from left to right.
- 3 If the vertical line ever hits the graph in **two or more points** at the same time, it is **not** a function.
- 4 If every vertical line hits at most one point, it **is** a function.



“ A function is like a rule: one question, one answer. If one input gives two answers, it breaks the rule! ”



TIP

In a mapping diagram, each input arrow must point to exactly one output. An input with two arrows means it is not a function.

What Is a Function?

1. A relation has the pairs $(2, 4)$, $(3, 6)$, $(4, 8)$, $(5, 10)$. Is it a function?
2. A relation has the pairs $(1, 3)$, $(2, 5)$, $(1, 7)$. Is it a function?
3. A circle is drawn on a coordinate plane. Does it pass the vertical line test?
4. Every function is a relation. True False
5. A mapping diagram shows $3 \rightarrow 9$, $4 \rightarrow 16$, $5 \rightarrow 25$. Is it a function?



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Answer Key



Answer Key

Try each problem on your own first, then check your work here.

Chapter 1

> Section 1.1

1 Integer, Rational

2 Rational

3 Irrational

4 $\frac{1}{3}$

5 True

Explanations

1 -12 is negative, so not natural or whole. It is an integer. Since $-12 = \frac{-12}{1}$, it is also rational.

2 $\sqrt{25} = 5$, a whole number. Every integer is rational: $5 = \frac{5}{1}$.

3 7 is not a perfect square. So $\sqrt{7}$ is a non-repeating, non-terminating decimal.

4 $0.\overline{3} = 0.333\dots$. The repeating decimal equals $\frac{1}{3}$, which is rational.

Chapter 2



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[> Section 2.1](#)

1 Yes

2 No

3 No

4 True

5 Yes

 **Explanations**

1 Each input appears only once. Every x -value maps to exactly one y -value, so it is a function.

2 The input $x = 1$ maps to both 3 and 7. One input gives two outputs, so it is not a function.

3 A vertical line through the middle of a circle hits it at two points. So a circle is not a function.

5 Each input maps to exactly one output. No input is repeated, so it is a function.



Well done checking your answers!

Keep practicing to strengthen your skills.



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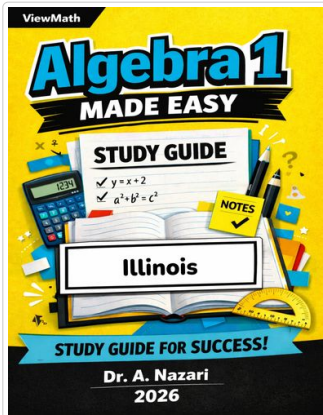


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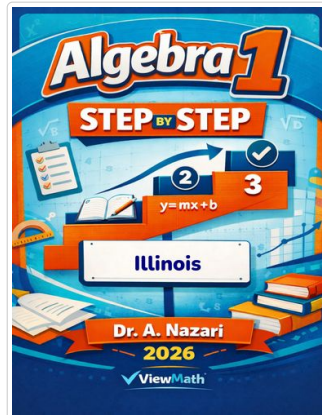
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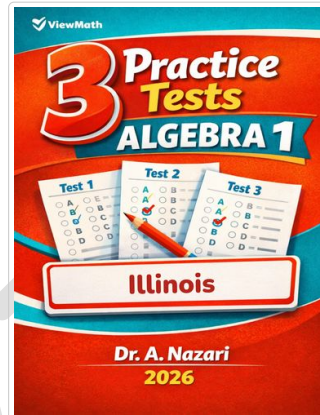
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Step-by-Step



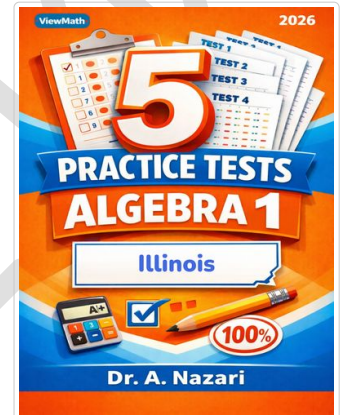
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3 Practice Tests



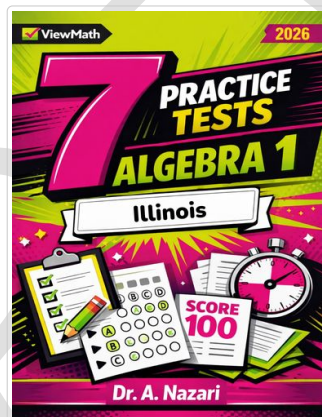
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5 Practice Tests



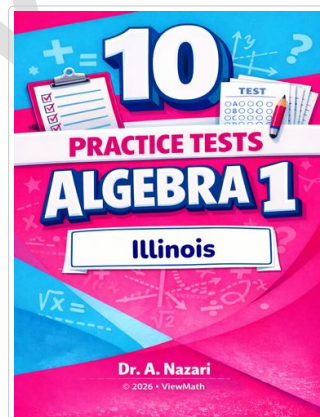
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7 Practice Tests



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10 Practice Tests



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