

# Indiana ILEARN Grade 9 Math Workbook

*Practice Problems & Exercises with Answer Key*

**Dr. A. Nazari**

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PRACTICE MAKES PERMANENT

# Algebra 1 Workbook

Practice Problems • Word Problems • Complete Answer Key

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*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.*

## X<sup>1</sup> 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.	$x = \pm 5$
$\Delta$	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:  $y = mx + b$

Standard form:  $Ax + By = C$

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

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

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

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

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

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:

\_\_\_\_\_

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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

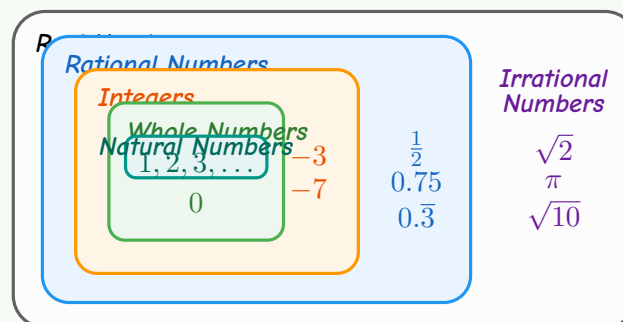
- Classify numbers as natural, whole, integer, rational, or irrational
- Know that rational decimals terminate or repeat

### 🎓 Number Subsets

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

- **Natural numbers:** 1, 2, 3, ... (counting numbers)
- **Whole numbers:** 0, 1, 2, 3, ... (naturals plus zero)
- **Integers:** ..., -2, -1, 0, 1, 2, ... (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:  $\sqrt{2}$ ,  $\pi$ ,  $\sqrt{10}$

 **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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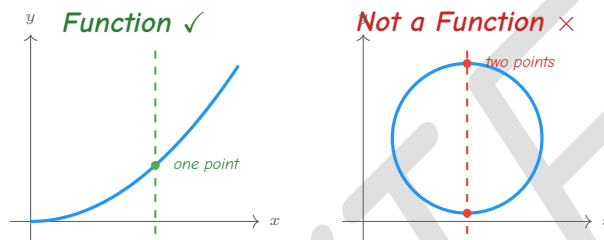


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## The Vertical Line Test

- 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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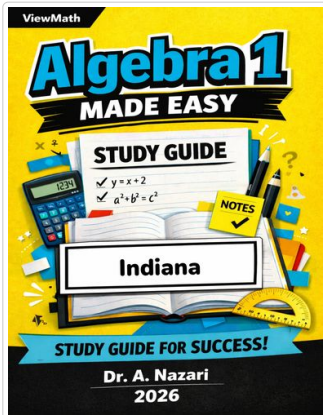


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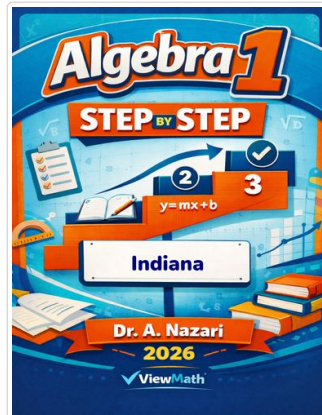
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Study Guide



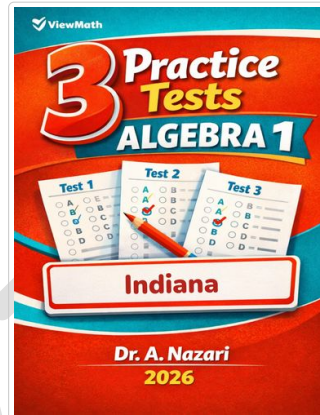
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Step-by-Step



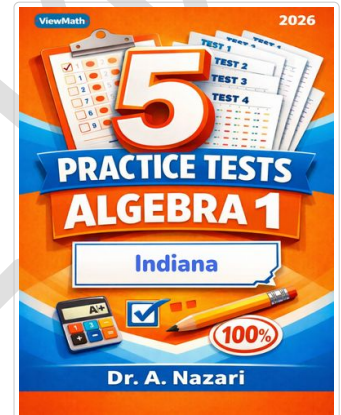
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3 Practice Tests



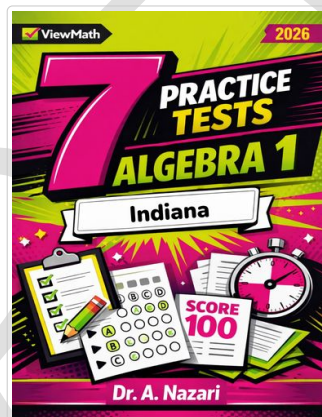
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5 Practice Tests



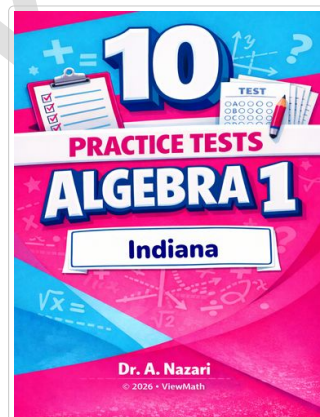
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7 Practice Tests



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10 Practice Tests



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