

Illinois Algebra 2 Made Easy

Study Guide with Key Concepts, Review & Practice

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YOUR ALGEBRA 2 STUDY GUIDE

Math Made Easy

Functions • Advanced Algebra • Modeling • Practice with Answers

Algebra 2 connects the algebra you already know to the function families used in advanced math, science, finance, and data. This guide reviews equations, functions, quadratics, polynomials, rational and radical expressions, exponential and logarithmic models, sequences, trigonometry, conics, statistics, probability, and financial applications.

Each topic is short and built for review: read the key idea, study the examples, try the practice, then check the answer explanations.

Complete Review

15 chapters cover the major Algebra 2 skills and state pathways.

Worked Examples

Key ideas and examples come before each short practice set.

Built-in Practice

Every topic ends with quick questions for immediate review.

Answer Support

Final answers include explanations for correcting mistakes.

How to Use This Study Guide

A practical path for review, homework support, and test prep.

1

Start with the Learning Goals

Each topic begins by naming what you should be able to do. Use those goals as a checklist before and after you study the lesson.

2

Work Through the Examples

Algebra 2 problems often combine several skills. Read each worked example slowly, then cover the solution and try the same steps on your own paper.

3

Practice Immediately

Do the practice problems before moving on. Write the algebra, graph, table, or explanation that supports your answer; mental math alone is rarely enough for Algebra 2 tests.

4

Use Mistakes as a Study Map

Check the answer explanations. If you missed a problem, label the reason: vocabulary, setup, algebra, graph reading, calculator use, or careless error.

Study Plan Ideas

- **Quick review:** Read one topic and solve its practice set.
- **Chapter review:** Rework the examples and redo missed practice.
- **Before a test:** Review the quick reference, then focus on weak topics.

For Parents & Teachers

- Use topic names to match classroom lessons or state standards.
- Ask students to explain the method, not just report the answer.
- Keep a short error log so review time targets the right skills.

Algebra 2 Quick Reference

Key formulas and facts to bookmark while you study.

Function Features

Domain: allowed inputs.

Range: possible outputs.

Average rate of change:

$$\frac{f(b) - f(a)}{b - a}$$

Transformations:

$$f(x) + k, f(x - h), af(x), f(bx).$$

Polynomials

Remainder Theorem: remainder from division by $x - a$ is $f(a)$.

Factor Theorem: $x - a$ is a factor exactly when $f(a) = 0$.

End behavior comes from degree and leading coefficient.

Quadratics

Standard: $ax^2 + bx + c$

Vertex: $a(x - h)^2 + k$

Factored: $a(x - r_1)(x - r_2)$

Axis: $x = -\frac{b}{2a}$

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

Rational Expressions

Factor first, then cancel common factors.

Excluded values come from the original denominator.

Vertical asymptotes often come from denominator zeros that do not cancel.

Holes come from factors that cancel.

Algebra 2 Quick Reference

Continued

Radicals & Exponents

$$a^{m/n} = \sqrt[n]{a^m}$$

For even roots, keep real-domain restrictions in mind.

To solve radical equations, isolate the radical, raise both sides to a power, and check.

Sequences & Series

$$\text{Arithmetic: } a_n = a_1 + (n - 1)d$$

$$\text{Geometric: } a_n = a_1 r^{n-1}$$

Finite geometric sum:

$$S_n = \frac{a_1(1 - r^n)}{1 - r}, r \neq 1.$$

Exponential & Logarithmic

$y = ab^x$ has initial value a and base b .

$\log_b(x) = y$ means $b^y = x$.

Product: $\log_b(MN) = \log_b M + \log_b N$

Power: $\log_b(M^p) = p \log_b M$.

Trigonometry & Data

Unit circle: $(\cos \theta, \sin \theta)$.

$$\sin^2 \theta + \cos^2 \theta = 1$$






Residual: actual value – predicted value.

Strong models have residuals with no clear pattern.

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CHAPTER

1

Algebra 2 Foundations

★ *What's Inside* ★

1.1	<i>Real Number System and Set Notation</i>	2
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1.1 Real Number System and Set Notation

The real number system is a way to organize every number on the number line. Some groups sit inside larger groups, so one number can belong to several sets at the same time.

Key Point

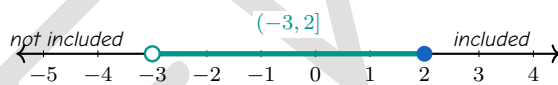
A **rational** number can be written as $\frac{a}{b}$, where a and b are integers and $b \neq 0$. Its decimal either terminates or repeats. An **irrational** number is real, but cannot be written as a ratio of integers; its decimal never terminates and never repeats.

$$\text{natural} \subset \text{whole} \subset \text{integers} \subset \text{rational} \subset \text{real}$$

Use the smallest accurate category when describing one number. Use interval or set-builder notation when describing many numbers at once.

Key Point

Set-builder notation gives a rule: $\{x \mid x \geq -2\}$. Interval notation shows the same set on the number line: $[-2, \infty)$. Brackets include endpoints, parentheses exclude endpoints, and ∞ always uses a parenthesis.



Example

Classify $\sqrt{49}$ as precisely as possible.

Since $\sqrt{49} = 7$, the smallest set is natural. It is also whole, integer, rational, and real, but “natural” is the most precise description.

Answer: natural

Example

Write $\{x \mid -3 < x \leq 2\}$ in interval notation.

The values are between -3 and 2 . The left endpoint is not included, and the right endpoint is included.

Answer: $(-3, 2]$



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 **Practice**

1. Classify $\sqrt{36}$ as rational or irrational.
2. Decide whether $0.3131131113\dots$ is rational or irrational.
3. Write $\{x \mid x \leq 4\}$ in interval notation.

PREVIEW



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CHAPTER

2

Functions, Transformations, and Inverses

★ *What's Inside* ★

2.1	<i>Function Notation and Evaluation</i>	5
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2.1 Function Notation and Evaluation

A function is an input-output rule. Function notation gives the rule a name, so $f(3)$ means “the output of function f when the input is 3.”

Key Point

The expression $f(a)$ is not multiplication. To evaluate it from a formula, replace every input variable with a , use parentheses for negative inputs or expression inputs, and then simplify.

Functions can also be shown by tables, graphs, and contexts. In every form, the input is the value you start with and the output is the value the function returns.

Key Point

From a table or graph, read the output paired with the input. From a context, include the meaning and units of the output so the value is not just a number.

Example

Let $p(x) = x^2 - 4x + 6$. Find $p(-2)$.

Substitute -2 for every x :

$$p(-2) = (-2)^2 - 4(-2) + 6 = 4 + 8 + 6 = 18.$$

Answer: 18

Example

Use the table to find $g(2)$ and the input where $g(x) = 9$.

x	-1	0	2	5
$g(x)$	7	4	-2	9

The input 2 is paired with output -2 , so $g(2) = -2$. The output 9 occurs when the input is 5.

Answer: $g(2) = -2$; input 5

Practice

1. Let $f(x) = 2x - 5$. Find $f(7)$.
2. Let $g(t) = t^2 + 3$. Find $g(-4)$.



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3. A ride costs $C(m) = 4 + 2.50m$ dollars for m miles. Find and interpret $C(8)$.

PREVIEW



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Answer Key



Chapter 1

Section 1.1 Real Number System and Set Notation

[Answer Key](#)

Answers

- 1 rational 2 irrational 3 $(-\infty, 4]$

Explanations

- 1 First simplify the square root: $\sqrt{36} = 6$. Any whole number can be written as a fraction, such as $6 = \frac{6}{1}$, so it is rational.
- 2 A rational decimal either stops or repeats the same block forever. Here the groups of 1's keep changing, so there is no fixed repeating block.
- 3 The rule $x \leq 4$ means all numbers to the left of 4, including 4 itself. Infinity always uses a parenthesis, and 4 uses a bracket.

Chapter 2

Section 2.1 Function Notation and Evaluation

[Answer Key](#)

Answers

- 1 9 2 19 3 24 dollars

Explanations

- 1 Substitute 7 for x : $f(7) = 2(7) - 5 = 9$. Careful substitution keeps the order of operations clear and gives 9.
- 2 Use parentheses: $g(-4) = (-4)^2 + 3 = 19$. So the result is 19.
- 3 The ride costs $4 + 2.50(8) = 24$ dollars for 8 miles. So the answer is 24 dollars.



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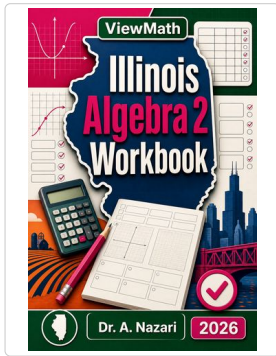


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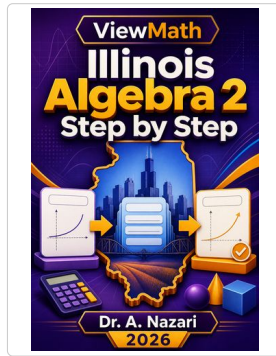
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Workbook



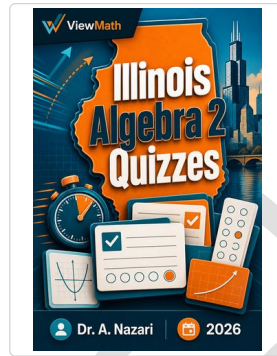
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Step-by-Step



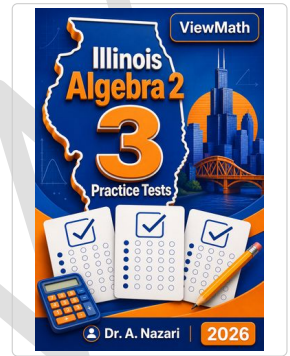
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Quizzes



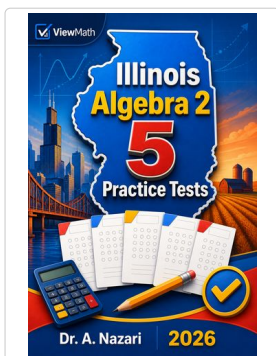
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3 Practice Tests



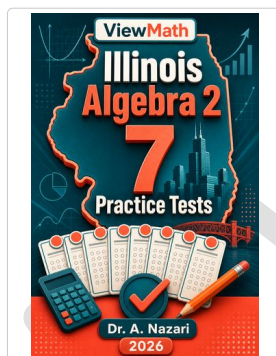
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5 Practice Tests



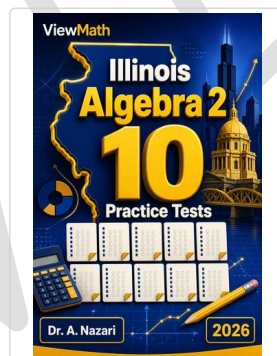
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7 Practice Tests



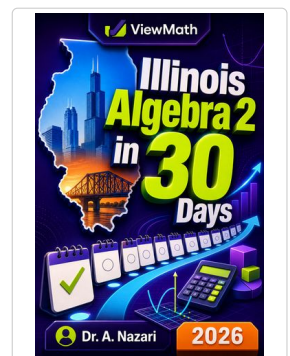
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10 Practice Tests



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Math in 30 Days



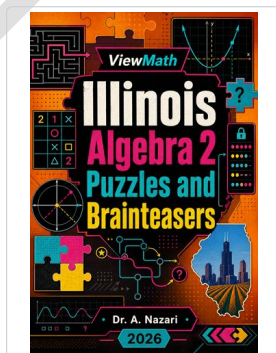
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Math in 10 Days



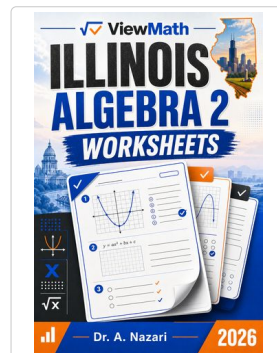
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