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ALGEBRA 2

PRACTICE PROBLEMS

Comprehensive Skill-Building Resource

Quadratics • Polynomials • Radicals • Exponentials
Logarithms • Matrices • Sequences • Complex Numbers

With Guided Examples · Formula Reference · Answer Keys

Designed for High School & College Students

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Topic Distribution Overview

Topic Distribution — Algebra 2 Curriculum

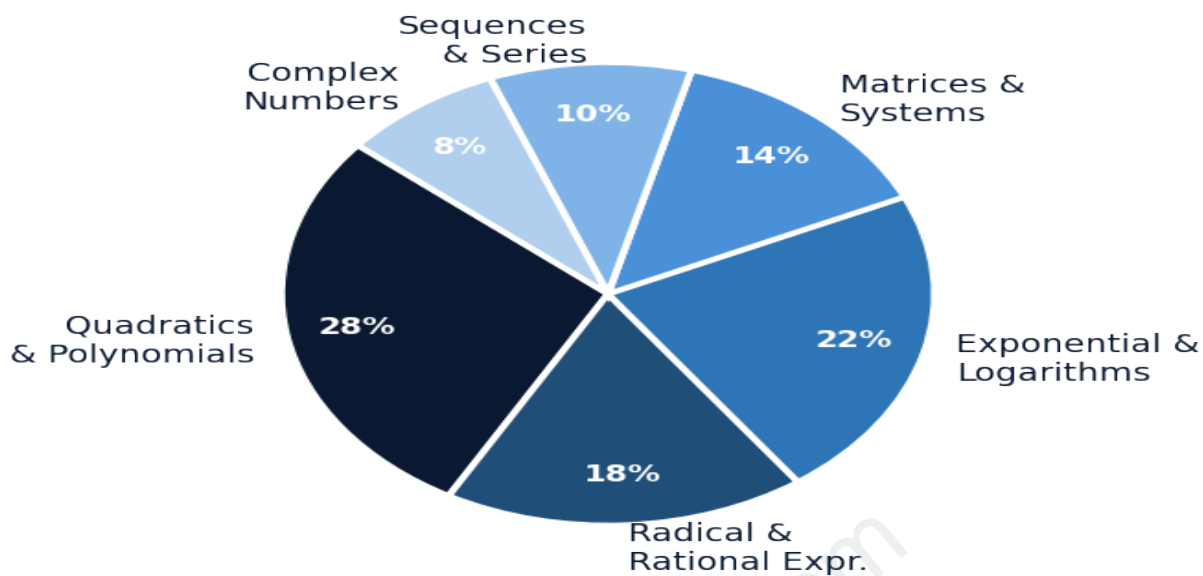


Figure 1 — Proportional breakdown of Algebra 2 topics covered in this guide.

Chapter 1 — Introduction & How to Use This Guide

Welcome to Algebra 2 Practice Problems

This resource has been carefully designed to help high school and college students master the core concepts of Algebra 2. Each chapter introduces a topic with a brief concept review, followed by worked examples, formula tables, and graded practice problems ranging from beginner to advanced.

Difficulty Legend

Level	Symbol	Description
Beginner	★■	Single-step problems; direct formula application.
Intermediate	★★■	Multi-step; requires combining two or more concepts.
Advanced	★★★	Complex, multi-concept problems; exam-level challenge.

■ **Note:** Work through each section in order. Attempt all problems before checking the answer key. Use the formula tables as reference during study, then try to solve without them during self-testing.

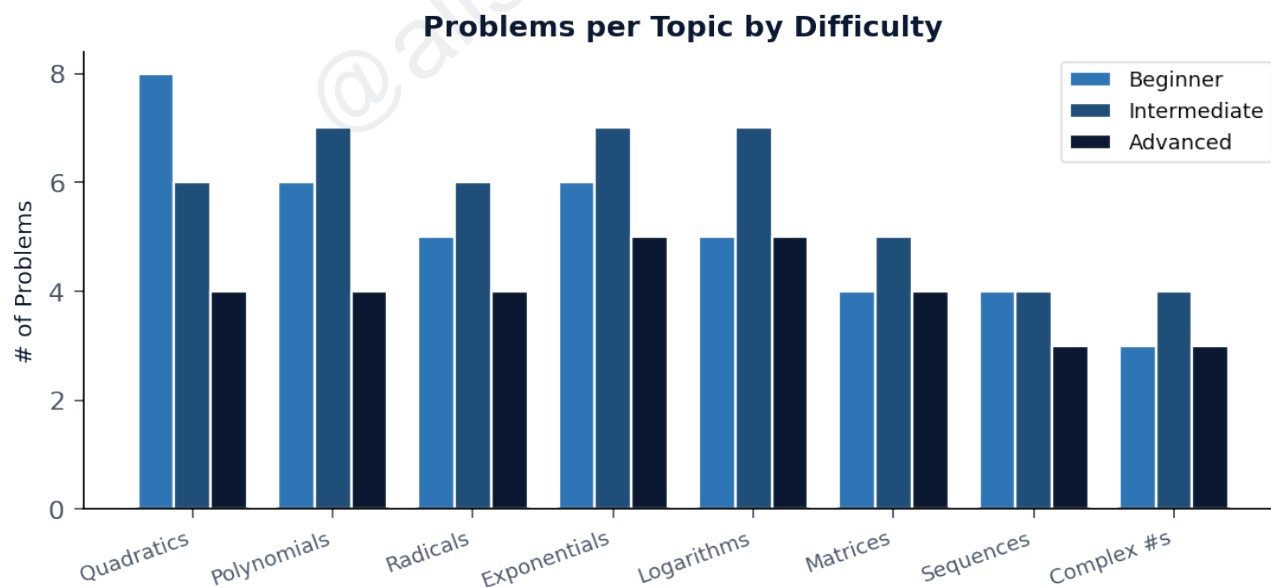


Figure 2 — Problem count by topic and difficulty level.

Chapter 2 — Quadratic Equations & Functions

Key Formulas

Formula	Description
$ax^2 + bx + c = 0$	Standard form of a quadratic equation.
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	Quadratic Formula — finds all real and complex roots.
Discriminant: $b^2 - 4ac$	>0 : two real roots; $=0$: one real root; <0 : two complex roots.
$y = a(x - h)^2 + k$	Vertex form; vertex at (h, k) , opens up if $a > 0$.
$y = a(x - r_1)(x - r_2)$	Factored form; roots at $x = r_1$ and $x = r_2$.

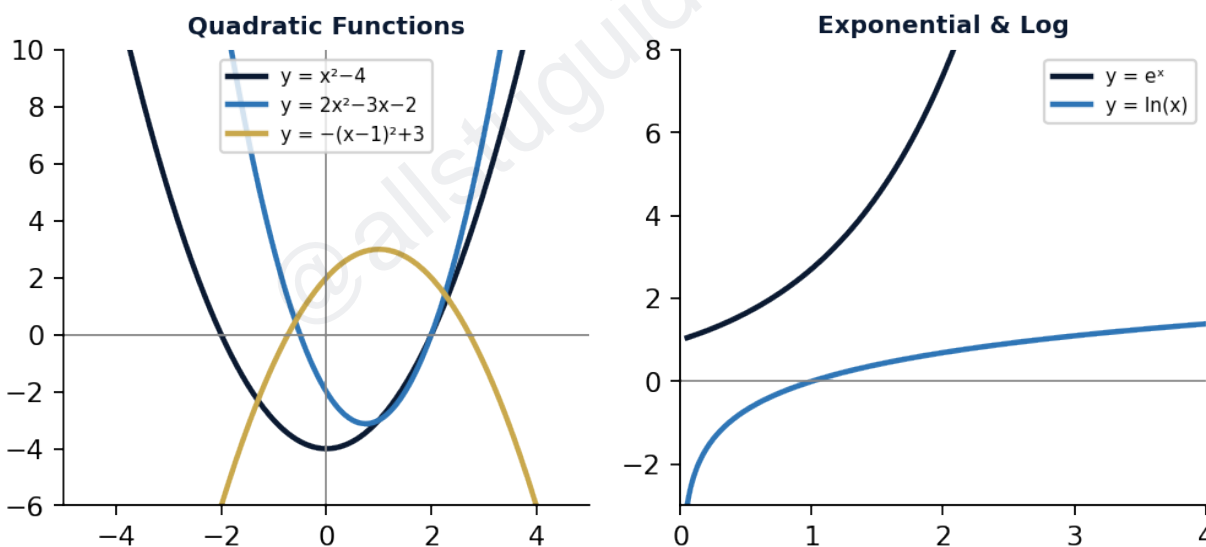


Figure 3 — Sample quadratic parabolas (left) and exponential/log curves (right).

Practice Problems — Quadratics ★■ to ★★★

Q1 ★■. Solve: $x^2 - 5x + 6 = 0$	$x = 2$ or $x = 3$ (factor: $(x-2)(x-3)=0$)
Q2 ★■. Find the vertex of $y = 2x^2 - 8x + 5$	Vertex: $(2, -3)$
Q3 ★★★. Use the quadratic formula to solve $3x^2 + 4x - 2 = 0$	$x = \frac{-4 \pm \sqrt{40}}{6} \approx 0.387$ or -1.720

Q4 ★★■. Determine the discriminant of $2x^2 - 3x + 5 = 0$ and describe the roots.	$b^2 - 4ac = 9 - 40 = -31 < 0 \rightarrow$ two complex roots
Q5 ★★★. Write $y = x^2 + 6x + 5$ in vertex form, then sketch key features.	$y = (x+3)^2 - 4$; vertex $(-3, -4)$; roots $x = -1, x = -5$
Q6 ★★★. A ball is launched: $h(t) = -16t^2 + 80t + 4$. Find max height & time.	Max height = 104 ft at $t = 2.5$ s

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Chapter 3 — Polynomial Operations & Factoring

Key Formulas & Identities

Formula	Description
$(a+b)^2 = a^2+2ab+b^2$	Perfect square trinomial (sum).
$(a-b)^2 = a^2-2ab+b^2$	Perfect square trinomial (difference).
$a^2-b^2 = (a+b)(a-b)$	Difference of two squares.
$a^3\pm b^3 = (a\pm b)(a^2\mp ab+b^2)$	Sum / Difference of cubes.
Remainder Theorem	Dividing $p(x)$ by $(x-c)$ gives remainder $p(c)$.

Practice Problems — Polynomials ★■ to ★★★

P1 ★■. Expand $(2x + 3)^2$	$4x^2 + 12x + 9$
P2 ★■. Factor: $x^2 - 9$	$(x+3)(x-3)$
P3 ★★★. Divide $(x^3 - 2x^2 - 5x + 6)$ by $(x - 3)$ using synthetic division.	Quotient: $x^2 + x - 2$; remainder: 0
P4 ★★★. Factor completely: $2x^3 - 5x^2 - 4x + 3$	$(2x+1)(x-3)(x-1)$
P5 ★★★. Find all zeros of $p(x) = x^4 - 5x^2 + 4$	$x = \pm 1, \pm 2$
P6 ★★★. Use the Rational Root Theorem to find roots of $x^3 - 6x^2 + 11x - 6$.	$x = 1, 2, 3$

Chapter 4 — Radical & Rational Expressions

Key Rules

Formula	Description
$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$	Product rule for radicals.
$\sqrt{a/b} = \sqrt{a} / \sqrt{b}$	Quotient rule for radicals.
$a^{m/n} = (\sqrt[n]{a})^m$	Rational exponents and radical equivalence.
$(a/b) \div (c/d) = (a \cdot d)/(b \cdot c)$	Division of rational expressions.
LCD Method	Use lowest common denominator to add/subtract rational expressions.

Practice Problems — Radicals & Rationals ★■ to ★★★

R1 ★■. Simplify: $\sqrt{72}$	$6\sqrt{2}$
R2 ★■. Rewrite $16^{3/4}$ in simplest form.	8
R3 ★★★. Simplify: $(x^2-4)/(x^2-x-2)$	$(x+2)/(x+1)$, $x \neq 2$, $x \neq -1$
R4 ★★★. Solve: $\sqrt{2x+3} = x-1$	$x = 7$ (check: $x=1$ extraneous)
R5 ★★★. Add: $3/(x+2) + 5/(x-2)$	$(8x-1)/((x+2)(x-2))$
R6 ★★★. Solve: $(x+1)/(x-3) = (2x)/(x^2-9)$	$x = -3$ (check domain)

Chapter 5 — Exponential & Logarithmic Functions

Key Properties

Formula	Description
$\log_b(xy) = \log_b x + \log_b y$	Product rule for logarithms.
$\log_b(x/y) = \log_b x - \log_b y$	Quotient rule for logarithms.
$\log_b(x^n) = n \cdot \log_b x$	Power rule for logarithms.
$\log_b x = \ln(x)/\ln(b)$	Change of base formula.
$A = P \cdot e^{rt}$	Continuous compound growth (P = principal, r = rate, t = time).

Practice Problems — Exp & Log ★■ to ★★★

E1 ★■. Evaluate: $\log_2(32)$	5
E2 ★■. Solve: $2^x = 128$	$x = 7$
E3 ★■. Solve: $\log_3(x - 1) + \log_3(x + 1) = 3$	$x = \sqrt{28} \approx 5.29$ ($x > 1$ required)
E4 ★■. Expand: $\ln(x^3 y^2 / z)$	$3\ln(x) + 2\ln(y) - \ln(z)$
E5 ★★★. Solve: $5^{2x-1} = 3^{x+2}$	$x = (2\ln 3 + \ln 5) / (2\ln 5 - \ln 3) \approx 2.795$
E6 ★★★. A culture triples every 4 hours. Write an exponential model and find population after 10 hours if $P = 500$.	$P(t) = 500 \cdot 3^{t/4}$; $P(10) \approx 3,834$

Chapter 6 — Systems of Equations & Matrices

Matrix Operations Reference

Operation	Condition	Result
Addition / Subtraction	Same dimensions	Add/subtract corresponding entries
Scalar Multiplication	Any matrix	Multiply every entry by the scalar
Matrix Multiplication $A \times B$	$\text{Cols}(A) = \text{Rows}(B)$	Dot products of rows \times columns
Determinant $ A $	Square matrix	$ A = ad - bc$ (2x2)
Inverse A^{-1}	$ A \neq 0$	$A^{-1} = (1/ A) \cdot \text{adj}(A)$
Cramer's Rule	$ A \neq 0$	$x = A_x / A , y = A_y / A $

Practice Problems — Matrices & Systems ★■ to ★★★

M1 ★■. Solve the system: $2x + y = 7$ and $x - y = 2$	$x = 3, y = 1$
M2 ★■. Find the determinant of $[[4, 3], [2, 1]]$	$ A = 4 - 6 = -2$
M3 ★★★. Multiply $[[2, 1], [0, 3]] \times [[1, 4], [2, -1]]$	$[[4, 7], [6, -3]]$
M4 ★★★. Solve using Cramer's Rule: $3x + 2y = 12, x - y = 1$	$x = 14/5, y = 9/5$
M5 ★★★. Find the inverse of $[[2, 5], [1, 3]]$	$A^{-1} = [[3, -5], [-1, 2]]$
M6 ★★★. Solve the 3x3 system: $x + y + z = 6, 2x - y + z = 3, x + 2y - z = 4$	$x = 1, y = 2, z = 3$

Chapter 7 — Sequences, Series & Complex Numbers

Sequence & Series Formulas

Formula	Description
$a_n = a_1 + (n-1)d$	nth term of an arithmetic sequence; d = common difference.
$S_n = n(a_1 + a_n)/2$	Sum of first n terms of an arithmetic series.
$a_n = a_1 \cdot r^{n-1}$	nth term of a geometric sequence; r = common ratio.
$S_n = a_1(1-r^n)/(1-r)$	Partial sum of geometric series (r≠1).
$S_\infty = a_1/(1-r), r < 1$	Sum of infinite geometric series.
$i^2 = -1; i^3 = -i; i^4 = 1$	Powers of the imaginary unit i.
$ a + bi = \sqrt{a^2 + b^2}$	Modulus (absolute value) of a complex number.

Practice Problems — Sequences, Series & Complex ★■ to ★★★

S1 ★■. Find the 20th term: arithmetic sequence 3, 7, 11, ...	$a_{20} = 79$
S2 ★■. Simplify: $(3+4i)(2-i)$	$10 + 5i$
S3 ★★★. Find the sum of the first 15 terms: geometric sequence 2, 6, 18, ...	$S_{15} = 2(3^{15} - 1)/2 = 14,348,906$
S4 ★★★. Find the infinite sum: $8 + 4 + 2 + 1 + \dots$	$S_\infty = 16$
S5 ★★★. Divide $(5+2i)/(3-4i)$; express in a+bi form.	$(7+26i)/25 = 0.28 + 1.04i$
S6 ★★★. Expand using the Binomial Theorem: $(x + 2)^5$	$x^5 + 10x^4 + 40x^3 + 80x^2 + 80x + 32$

Chapter 8 — Mixed Review & Challenge Problems

The following problems draw on multiple Algebra 2 concepts. No hints are provided — solve independently and verify in the answer key.

C1 ★★■. Solve: $x^4 - 13x^2 + 36 = 0$	$x = \pm 2, \pm 3$
C2 ★★■. The population of a city doubles every 12 years. If the 2010 population was 50,000, predict the 2046 population.	400,000 (tripled doubling period)
C3 ★★■. Solve the system: $y = x^2 - 3$ and $y = 2x$	(3,6) and (-1,-2)
C4 ★★★. Find all real and complex roots of $x^4 - 1 = 0$	$x = 1, -1, i, -i$
C5 ★★★. Write the sum $\Sigma(k=1 \text{ to } 10)$ of $(3k - 2)$ and evaluate.	$S = 145$
C6 ★★★. A rectangular garden has perimeter 40 m and area 96 m ² . Find the dimensions.	12 m x 8 m
C7 ★★★. Solve: $\log_2(x+3) + \log_2(x-1) = 5$	$x = 5$ ($x = -7$ extraneous)
C8 ★★★. Prove that the sum of the first n odd numbers equals n^2 using series formulas.	$S_n = n/2 \cdot (1 + (2n-1)) = n^2 \checkmark$

Chapter 9 — Answer Key Summary

■ **Note:** This section provides a consolidated answer reference. Detailed step-by-step solutions are available in the full solution guide at [allstuguide.com](https://www.allstuguide.com).

Chapter 2 — Quadratics

Q1	$x = 2$ or $x = 3$
Q2	Vertex: $(2, -3)$
Q3	$x \approx 0.387$ or -1.720
Q4	Two complex roots
Q5	$y = (x+3)^2 - 4$; roots at $x = -1, -5$
Q6	104 ft at $t = 2.5$ s

Chapter 3 — Polynomials

P1	$4x^2 + 12x + 9$
P2	$(x+3)(x-3)$
P3	$x^2 + x - 2, R=0$
P4	$(2x+1)(x-3)(x-1)$
P5	$x = \pm 1, \pm 2$
P6	$x = 1, 2, 3$

Chapter 4 — Radicals

R1	$6\sqrt{2}$
R2	8
R3	$(x+2)/(x+1)$
R4	$x=7$
R5	$(8x-1)/((x+2)(x-2))$
R6	$x=-3$

Chapter 5 — Exp & Log

E1 5

E2 $x=7$

E3 $x \approx 5.29$

E4 $3 \ln x + 2 \ln y - \ln z$

E5 $x \approx 2.795$

E6 $\approx 3,834$

Chapter 6 — Matrices

M1 $x=3, y=1$

M2 -2

M3 $[[4,7],[6,-3]]$

M4 $x=14/5, y=9/5$

M5 $[[3,-5],[-1,2]]$

M6 $x=1, y=2, z=3$

Chapter 7 — Sequences

S1 $a_{11}=79$

S2 $10+5i$

S3 $14,348,906$

S4 $S_{\infty}=16$

S5 $0.28+1.04i$

S6 $x^4+10x^3+40x^2+80x+32$

Chapter 8 — Mixed

C1 $x=\pm 2, \pm 3$

C2 $400,000$

C3 $(3,6), (-1,-2)$

C4	$1, -1, i, -i$
C5	145
C6	$12m \times 8m$
C7	$x=5$
C8	$S_n = n^2 \checkmark$

For full worked solutions, additional practice sets, and video explanations, visit [allstuguide.com](https://www.allstuguide.com). This document may be freely used for personal study. Redistribution for commercial purposes is not permitted.

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