STUDYWALKS · COURSE SYLLABUS

Algebra 2 — High School Course

Algebra 2 is the high school course that usually comes after Algebra 1 and Geometry. It starts with a short review, then works through functions and their key features, sequences and series, polynomials, factoring and division, polynomial graphs and zeros, rational expressions, equations and functions, radicals and rational exponents, complex numbers, exponential functions and logarithms, transformations of every function family, combining and inverting functions, modeling with functions, radians and the unit circle, the graphs of sine and cosine and periodic models, data and the normal distribution, inference from samples, and probability, including conditional probability, and ends with a modeling capstone. Its graphs are drawn from the course's own checked coordinates, and the narration states every number, so a lesson can still be followed by ear. It assumes a scientific calculator. Its scope is modeled on the high school Algebra II course described in the Common Core State Standards for Mathematics (Appendix A). It has its own StudyWalks final exam, and the homeschool parent grants the high school credit. Comes after: Algebra 1 and Geometry. College Algebra covers about half of the same algebra at a college pace and is a CLEP option after Algebra 2.

CREDIT LABEL	HOURS GOAL	STUDYWALKS LEARNING HOURS	SUGGESTED OFFLINE HOURS
1.0 credit	**120 h**	**37 h**	**83 h**
high school, with the study plan	the 1.0-credit convention	measured runtime plus assessment time	working problems and review

37 h StudyWalks (9.9 h of lessons, 17.9 h of lectures, 9.1 h of quizzes and exams) + **83 h** suggested offline study = **120 h**. 595 lessons in 27 units.

High school credit is granted by the homeschool parent under the state's rules. StudyWalks supplies the record: hours, scores and this syllabus. The credit label is a suggestion; the parent makes the final call.

Course contents

Unit	Title and lecture topics	Lessons	Lecture
1	**Getting Started: The Algebra 1 Toolkit and How This Course Works** How the course works · Functions · Linear and exponential functions · Quadratic functions · Exponents, systems, formulas and one problem	20	32 min
2	**Functions Revisited: Domain, Range, Key Features and Average Rate of Change** Reading a graph · How a graph moves · Average rate of change · Parent functions and domains · Key features, comparing and solving	22	33 min
3	**Sequences as Functions: Arithmetic and Geometric, Recursive and Explicit** What a sequence is · Kinds of sequence and recursive rules · Explicit formulas · Sequences as functions · Sequences in situations	22	35 min

Unit	Title and lecture topics	Lessons	Lecture
4	**Series: Sigma Notation, Arithmetic Series, Finite Geometric Series and Infinite Geometric Series** Series and sigma notation · Arithmetic series · Finite geometric series · Savings and loans · Infinite series and choosing a formula	21	36 min
5	**Polynomials: Vocabulary, Operations and Polynomial Identities** Polynomial vocabulary · Adding and subtracting · Multiplying · Identities · Identities at work	22	35 min
6	**Factoring Higher-Degree Polynomials** Factoring and the greatest common factor · Grouping and trinomials · Squares and cubes · Quadratic form · Factoring completely · Zeros and equations · Checking, and Dario's boxes	22	46 min (2 parts)
7	**Polynomial Division; the Remainder and Factor Theorems** Division and its two results · Long division · Synthetic division · The remainder and factor theorems · Zeros and factors · Remainders at work · Any divisor, and the puzzle club	22	46 min (2 parts)
8	**Graphs of Polynomial Functions: Zeros, Multiplicity and End Behavior** The shape of a polynomial graph · End behavior · Multiplicity, turns and the y-intercept · Sketching and signs · Rules from graphs, and degree · Trapping a zero · Models, matching and the track	23	47 min (2 parts)
9	**Rational Expressions: Simplify, Multiply, Divide, Add and Subtract** Rational expressions and excluded values · Simplifying · Multiplying and dividing · Adding · Subtracting, and closure · Complex fractions · Excluded values, mixed operations and division · Mistakes, and Rosa's ride	23	48 min (2 parts)
10	**Rational Functions: Asymptotes, Holes and Graphs** Rational functions and their domains · Vertical asymptotes and holes · Horizontal asymptotes · Intercepts, branches and graphs · Stretching, shifting and rewriting · Average cost · Two asymptotes, matching and levels · Elif's keychains	23	45 min (2 parts)
11	**Rational Equations, Extraneous Solutions and Rate Models** Clearing denominators · Extraneous solutions · Proportions and quadratics · No solution, and formulas · Work rates · Travel · Concentration · Variation · Graphs, the situation and average cost · Keisha's concert	22	43 min (2 parts)
12	**Rational Exponents and Radicals: nth Roots, Properties and Simplifying** Roots · Rational exponents · Rewriting, and the exponent rules · Simplifying radicals · Quotients and like radicals · Multiplying · Rationalizing · Two special cases · Priya's garden	23	46 min (2 parts)
13	**Radical Equations; Square-Root and Cube-Root Functions** Radical equations · Quadratics, cube roots and isolating · Rational exponents and no solution · Root functions · Transformed root graphs · Roots undo powers · Models and graphs · Noor's marble ramps	22	44 min (2 parts)
14	**Complex Numbers and Quadratics with Complex Solutions** The number i · Adding, subtracting and multiplying · Powers of i · Conjugates and dividing · Quadratics with no real solutions · Solving with complex solutions · The discriminant · Pairs, quadratics and zeros · Elif's puzzle	25	47 min (2 parts)
15	**Exponential Functions, Percent Change and the Number e** Exponential functions · Writing exponential functions · Percent change · Compound interest and e · Comparing and reading models	23	35 min

Unit	Title and lecture topics	Lessons	Lecture
16	**Logarithms: Meaning, Evaluating and Properties** What a logarithm is · Evaluating logarithms · The properties · Calculators and equations · Mistakes and Tomas's yeast	23	36 min
17	**Exponential Equations, Logarithmic Functions and Applications** Solving exponential equations · Logarithmic equations · Logarithmic functions and graphs · Logarithmic scales · Models, rates and Priya's culture	22	36 min
18	**Transformations of Functions; Even and Odd Functions** Shifts · Flips and stretches · Rules and moves · Tables and other families · More families, and finding k · Even and odd functions · Models and Keisha's trellis	23	42 min (2 parts)
19	**Combining and Inverting Functions; Piecewise and Step Functions** Combining functions · Composition · Inverse functions · Piecewise functions · Step functions and Noor's bracelets	23	36 min
20	**Modeling with Functions: Choosing a Model, Constraints and Solving f(x) = g(x) by Graphs and Tables** Choosing a model · Equations, constraints and formulas · Solving f(x) = g(x) · Comparing models · Building models, and Dario's band	21	35 min
21	**Radians and the Unit Circle** Angles and radians · The unit circle · Signs and reference angles · Beyond one turn, and any radius · Calculator mode, and Keisha's ride	23	36 min
22	**Trigonometric Functions, Their Graphs and the Pythagorean Identity** Sine and cosine graphs · Odd and even · Tangent · The Pythagorean identity · Angles, waves and Elif's spinner	22	36 min
23	**Amplitude, Midline and Period: Modeling Periodic Change** Amplitude and midline · Period, shifts and flips · Graphing and reading waves · Turning wheels · Tides and daylight · Predicting and choosing · The mill's water wheel	21	42 min (2 parts)
24	**Collecting Data and the Normal Distribution** Populations and samples · Studies, samples and bias · Experiments and causes · Distributions and the normal curve · Areas as proportions · Standardized scores and technology · When the bell does not fit · The science club's study	23	42 min (2 parts)
25	**Inference: Sample Variability, Margin of Error, Experiments and Simulation, and Evaluating Reports** Samples vary · The margin of error · Estimating a mean · Claims and experiments · Significance · Questioning studies and reports · Margins of error in the news · Planning and inference · The garden club's investigation	22	41 min (2 parts)
26	**Probability: Sample Spaces, Two-Way Tables, Conditional Probability, Independence and Fair Decisions** Sample spaces · Not, or, and · Two-way tables · Conditional probability · Independence · Draws without replacement · Fair decisions · The student council's survey	22	43 min (2 parts)
27	**Capstone: Modeling Across Function Families and the Course in One Thread** The final · Families and models · The algebra, mixed · Trigonometry, statistics and probability · The course in one thread	15	31 min

Assessment and grading

- **Unit quizzes.** 27 quizzes, 10 questions each, checked as the student goes, each answer with the lesson to review. Untimed; retakes are unlimited.
- **Mid exam.** 50 questions on units 1–13, drawn fresh each time and scored at the end with a breakdown by content area. Untimed; retakes are unlimited.
- **Final exam.** 48 questions, 90 minutes, on the whole course. Scored 20–80; 50 passes (32 of 48 correct, about 67%). Retakes are unlimited with a 24-hour wait, each a fresh draw.

Suggested composite grade

Part	Weight
Unit quizzes (average of best scores)	20%
Mid exam (best score)	20%
Final exam (percent correct)	60%

Suggested letter scale

Letter	Composite
A	90–100
B	80–89
C	70–79
D	60–69
F	below 60

Suggested; the parent sets the grade. A passing final is the completion standard for the course record.

Study plan

The 83 offline hours are spread over the units in proportion to each unit's StudyWalks time. For each unit: work the practice problems for the matching lessons of IM 9–12 Math Algebra 2 (free online; this course never reproduces them) or the odd problems in the matching sections of Wallace's Beginning and Intermediate Algebra (answers in the book), check the answers, sketch each lesson's graph by hand, and rework the unit quiz misses by hand. Log the time as you go.

Unit	Title	StudyWalks	Offline, suggested	Unit total
1	Getting Started: The Algebra 1 Toolkit and How This Course Works	52 min	2 h 35 min	3 h 27 min
2	Functions Revisited: Domain, Range, Key Features and Average Rate of Change	55 min	2 h 45 min	3 h 40 min
3	Sequences as Functions: Arithmetic and Geometric, Recursive and Explicit	56 min	2 h 50 min	3 h 46 min
4	Series: Sigma Notation, Arithmetic Series, Finite Geometric Series and Infinite Geometric Series	56 min	2 h 45 min	3 h 41 min
5	Polynomials: Vocabulary, Operations and Polynomial Identities	57 min	2 h 50 min	3 h 47 min
Lessons and lectures		**27 h 41 min**	**83 h**	**110 h 41 min**
Quizzes, mid exam and final (stated time)		**9 h 6 min**	**—**	**9 h 6 min**

Unit	Title	StudyWalks	Offline, suggested	Unit total
6	Factoring Higher-Degree Polynomials	1 h 8 min	3 h 25 min	4 h 33 min
7	Polynomial Division; the Remainder and Factor Theorems	1 h 8 min	3 h 25 min	4 h 33 min
8	Graphs of Polynomial Functions: Zeros, Multiplicity and End Behavior	1 h 9 min	3 h 25 min	4 h 34 min
9	Rational Expressions: Simplify, Multiply, Divide, Add and Subtract	1 h 11 min	3 h 30 min	4 h 41 min
10	Rational Functions: Asymptotes, Holes and Graphs	1 h 8 min	3 h 25 min	4 h 33 min
11	Rational Equations, Extraneous Solutions and Rate Models	1 h 5 min	3 h 15 min	4 h 20 min
12	Rational Exponents and Radicals: nth Roots, Properties and Simplifying	1 h 9 min	3 h 25 min	4 h 34 min
13	Radical Equations; Square-Root and Cube-Root Functions	1 h 6 min	3 h 15 min	4 h 21 min
14	Complex Numbers and Quadratics with Complex Solutions	1 h 12 min	3 h 35 min	4 h 47 min
15	Exponential Functions, Percent Change and the Number e	58 min	2 h 55 min	3 h 53 min
16	Logarithms: Meaning, Evaluating and Properties	58 min	2 h 55 min	3 h 53 min
17	Exponential Equations, Logarithmic Functions and Applications	58 min	2 h 55 min	3 h 53 min
18	Transformations of Functions; Even and Odd Functions	1 h 5 min	3 h 15 min	4 h 20 min
19	Combining and Inverting Functions; Piecewise and Step Functions	58 min	2 h 55 min	3 h 53 min
20	Modeling with Functions: Choosing a Model, Constraints and Solving f(x) = g(x) by Graphs and Tables	55 min	2 h 45 min	3 h 40 min
21	Radians and the Unit Circle	58 min	2 h 55 min	3 h 53 min
22	Trigonometric Functions, Their Graphs and the Pythagorean Identity	58 min	2 h 55 min	3 h 53 min
23	Amplitude, Midline and Period: Modeling Periodic Change	1 h 3 min	3 h 10 min	4 h 13 min
24	Collecting Data and the Normal Distribution	1 h 4 min	3 h 10 min	4 h 14 min
25	Inference: Sample Variability, Margin of Error, Experiments and Simulation, and Evaluating Reports	1 h 3 min	3 h 10 min	4 h 13 min
26	Probability: Sample Spaces, Two-Way Tables, Conditional Probability, Independence and Fair Decisions	1 h 5 min	3 h 15 min	4 h 20 min
Lessons and lectures		**27 h 41 min**	**83 h**	**110 h 41 min**
Quizzes, mid exam and final (stated time)		**9 h 6 min**	**—**	**9 h 6 min**

Unit	Title	StudyWalks	Offline, suggested	Unit total
27	Capstone: Modeling Across Function Families and the Course in One Thread	46 min	2 h 20 min	3 h 6 min
Lessons and lectures		**27 h 41 min**	**83 h**	**110 h 41 min**
Quizzes, mid exam and final (stated time)		**9 h 6 min**	**—**	**9 h 6 min**

Unit times are the unit's lecture runtime plus its lessons at the course's measured average lesson length; totals can differ from the learning hours by rounding.

Sources

- **Anchor:** Illustrative Mathematics. *IM 9–12 Math Algebra 2* (student edition), and *IM 9–12 Math Geometry* unit 8 (conditional probability), © 2019. Topic order and definitions informed by this course; the Illustrative Mathematics name and logo are not covered by its licence. CC BY 4.0
- **Anchor:** Barbara Illowsky and Susan Dean. *Statistics* (high school). OpenStax, Rice University (probability, the normal distribution and confidence intervals). CC BY 4.0
- **Witness:** Lynn Marecek, MaryAnne Anthony-Smith and Andrea Honeycutt Mathis. *Intermediate Algebra 2e*, with *Precalculus 2e*, *College Algebra 2e* and *Algebra and Trigonometry 2e* (Jay Abramson et al.). OpenStax, Rice University. CC BY-NC-SA 4.0
- **Witness:** Carl Stitz and Jeff Zeager. *Precalculus*, 4th edition. CC BY-NC-SA 3.0
- **Witness:** Tyler Wallace. *Beginning and Intermediate Algebra* (2010). CC BY 3.0
- **Witness:** David Diez, Mine Çetinkaya-Rundel and Christopher Barr. *OpenIntro Statistics*, 4th edition. CC BY-SA 3.0

This StudyWalks final is an end-of-course exam built from the Algebra 2 course, whose scope is modeled on the high school Algebra II course described in the Common Core State Standards for Mathematics (Appendix A). Scores are StudyWalks scores on a 20–80 scale. The course and exam have not been reviewed, certified or endorsed by any state, standards body or testing organization, and passing does not award credit: high school credit is granted by the homeschool parent.

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