CURRICULUM COLLECTION

Advanced Mathematics Unit 1, Twelve Lessons

Read, practice, explain, and review

Name: _____ Date: _____

Level and skill goal: _____

Keep finished work with your parent or caregiver. These original learning units support study but do not themselves constitute a complete annual grade-level curriculum.

Advanced Scholars Mathematics | Unit 1, Twelve Lessons

ADVANCED IS ABOUT READINESS, NOT AGE

Advanced Scholars welcomes ready learners ages 5, 6, 7, 8, 9, 10, 11 and 12. This mathematics unit teaches algebra-oriented skills. Younger advanced learners are not excluded, but should enter at the specific prerequisites they have mastered. Parents may accelerate one subject while using different levels elsewhere. Independent reading ability is not required to demonstrate advanced mathematical reasoning if an adult reads the directions without solving the task.

Three routes: Early Advanced (often 5-7): concrete modeling, number structures, patterns, and mathematical explanations. Developing Advanced (often 8-10): multi-step operations, fractions, ratios, introductory variables, and independent work. Advanced Preteen (often 11-12): algebra, functions, proof and data analysis. These are teaching routes, not age ceilings, grade equivalencies, or claims about a child’s placement.

For the age-accessible bridge assignments in every subject, visit Advanced Scholars, All Ages . If a learner already has the prerequisites for the algebra below, proceed directly. Otherwise, teach the missing skill first, then reassess with unfamiliar problems.

A dedicated advanced course for learners ready for middle-school to early algebra reasoning, regardless of age. Placement by prerequisites is essential: students should confidently use fractions, signed numbers, multi-step arithmetic and text problems before this level. This is the first course unit, not a full-year transcript or verified completion of every Alabama standard.

Student routine: read the worked model, copy three questions and show complete reasoning, verify solutions, and keep a private error log. Use graph paper and a calculator only when the parent specifies. A separate parent guide contains answers.

Advanced Lesson 1: Linear equations and inverse operations

Learn and model: Equality is maintained by performing the same operation on both sides. For 3(2x-1)=27, divide by 3 to get 2x-1=9, add 1 and divide by 2, giving x=5. Substitute to verify 3(10-1)=27.

- 1. Solve 4(2x+1)=36 and verify.

- 2. Solve 5x-7=2x+11 and verify.

- 3. Explain why subtracting 5x from just one side of an equation is invalid.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 2: Inequalities and number lines

Learn and model: An inequality has a range of solutions. Solve 2x+3<11 by subtracting 3 then dividing by 2, giving x<4. Multiplying or dividing both sides by a negative reverses the inequality sign.

- 1. Solve 3x-5<=13 and graph the solution.

- 2. Solve -2x+7>15, explaining the direction change.

- 3. Write an inequality for a $25 budget after spending $7 with items costing $3 each.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 3: Rates, proportions, and dimensional analysis

Learn and model: Unit rates include units. If 180 km is traveled in 3 h, speed=60 km/h. A ratio equation 4/7=x/35 yields x=20; verify equality before accepting a proportion.

- 1. A recipe uses 3/4 cup flour for 2 servings. Find amount for 7 servings.

- 2. A 1:25,000 map has a 6 cm distance. Calculate actual distance in kilometers.

- 3. Compare a 250 mL drink at $1.50 to 400 mL at $2.20 by cost per 100 mL.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 4: Functions and tables

Learn and model: A function assigns exactly one output to each input. In y=2x-3, x=0,2,5 gives y=-3,1,7. A function can be represented as table, graph, rule, or verbal description.

- 1. Complete a table for y=-3x+4 with x=-2,0,2,4.

- 2. Explain whether pairs (1,2),(1,3),(2,4) form a function.

- 3. For a taxi fare y=5+2x, interpret slope and intercept.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 5: Slope and systems

Learn and model: Slope is change in y divided by change in x. Between (1,2) and (4,11), slope=9/3=3. A system’s solution satisfies every equation, e.g. y=x+2 and y=2x-1 intersect at (3,5).

- 1. Calculate slope through (-2,4) and (2,-4).

- 2. Solve y=2x+1 and y=-x+7 using substitution.

- 3. Explain what parallel lines mean for solutions of distinct linear equations.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 6: Exponents and scientific notation

Learn and model: Exponent 3^2=9; exponent rules follow multiplication. 103=1000; 4.2x105=420,000. Scientific notation uses a coefficient at least 1 and less than 10 multiplied by an integer power of ten.

- 1. Simplify 23x24 and (3^2)3.

- 2. Write 0.00056 in scientific notation.

- 3. Compute (6x104)(2x10-^2) in scientific notation.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 7: Geometry and proof

Learn and model: Triangle interior angles total 180 deg. in Euclidean plane geometry. A right triangle with legs a,b and hypotenuse c satisfies a^2+b^2=c^2. For legs 6 and 8, c=10.

- 1. Find missing angle if triangle angles are 43 deg., 68 deg. and x.

- 2. Find hypotenuse of right triangle with legs 5 and 12.

- 3. Explain why the Pythagorean theorem does not directly apply to an arbitrary obtuse triangle.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 8: Area, volume, and scale

Learn and model: A cylinder volume is pir^2h. With r=3 cm and h=8 cm, V=72pi-226.2 cm3. Scaling lengths by 2 changes area by 4 and volume by 8 for similar objects.

- 1. Find cylinder volume for r=2, h=10, leaving answer in terms of pi.

- 2. A square of side 4 cm is scaled to side 10 cm. What is area scale factor?

- 3. A rectangular box is 4x5x6 cm. Find its volume and surface area.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 9: Data, distributions, and outliers

Learn and model: Mean is arithmetic average; median is center after sorting. For 2,3,4,5,26 the mean is 8, median 4. An outlier can distort the mean. Always consider data provenance.

- 1. Find mean and median of 1,2,3,4,20.

- 2. Interpret why a median may represent typical household income better than a mean in skewed data.

- 3. Propose a fair sampling method to estimate weekly reading hours in a community.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 10: Probability and conditional reasoning

Learn and model: Probability of independent events multiplies: P(two heads)=1/2x1/2=1/4. Conditional probability requires the correct restricted sample space. Do not assume real-world events independent without evidence.

- 1. List sample space for rolling a fair die and flipping a fair coin.

- 2. Find probability of drawing a red counter from 4 red and 6 blue counters without replacement, then drawing blue.

- 3. Explain why a sample of five siblings cannot estimate a town’s probability of a trait reliably.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 11: Personal finance and percent change

Learn and model: Percent change=(new-old)/oldx100%. From $80 to $92, increase=12/80=15%. Simple interest I=Prt when P is principal, r annual rate, t years; real loans may compound and have fees.

- 1. Calculate 8% sales tax on $65 and final cost.

- 2. An account earns simple interest on $500 at 4% for 2 years. Find interest and total.

- 3. Compare paying $90 cash to $100 paid over installments; identify information needed about fees and credit terms.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Advanced Lesson 12: Cumulative challenge and independent mastery

Learn and model: Work new problems without a key. Explain each solution and check whether an answer is reasonable. Demonstrating mastery requires transfer beyond repeated examples.

- 1. Solve 3(x+5)=2x+22 and graph x>=-2.

- 2. Solve system y=3x-4 and y=x+2.

- 3. Given 4,5,5,7,19 compute median, mean and range; explain the impact of 19.

Explain at least one step in complete sentences, record units where appropriate, and evaluate whether your solution is reasonable.

Assessment and Extension

Lesson 12 is a cumulative assessment. Require at least 80% correct independent work with sound reasoning as a local instructional target, not an official certification. Reassess with unfamiliar problems after reteaching.

Academy course directory .