

Grade 7 Mathematics

Full Curriculum Guide

Rational Reasoning • Proportionality • Pre-Algebra • Geometry • Statistics

Course purpose: Build a rigorous Pre-Algebra and proportional-reasoning foundation between Grade 6 mathematics and the Grade 8 Algebra I bridge.

Course	Grade 7 Mathematics
Primary focus	Proportional reasoning, rational numbers, Pre-Algebra, geometry and statistical reasoning
ROED structure	Concept-focused live instruction small groups reasoning + application
Course design	Five core mathematics units + cross-cutting financial literacy/modeling
Pathway role	Central Pre-Algebra bridge from Grade 6 to Grade 8

Prepared as the master Grade 7 curriculum framework for ROED. This document outlines the progression of learning objectives, instructional strands, core content standards, extensions, assessment methodologies, and cross-cutting applications.

1. Course Overview

Grade 7 Mathematics at ROED is the bridge year between foundational middle-school mathematics and the more formal algebra of Grade 8 and Grade 9. Proportional reasoning is a major organizing idea: students use ratios, rates, percent, scale, tables, graphs and equations to describe relationships.

The course also moves students toward increasingly formal algebra. Students simplify expressions, solve multi-step equations and inequalities, interpret rate of change, and work with multiple representations. Geometry becomes more transformational and theorem-oriented, while statistics and probability develop stronger data and chance reasoning.

Grade 7 is not intended to be a premature Algebra I course. Algebra I-level quadratics, systems, polynomial algebra and advanced functions remain for the later pathway. Extension work can challenge advanced learners without changing the core expectation.

2. Course Mission & Learning Philosophy

- Make rational-number fluency reliable enough that it no longer blocks algebraic reasoning.
- Make proportional reasoning a central mathematical habit.
- Develop Pre-Algebra through expressions, equations, inequalities and relationships.
- Connect tables, graphs, equations and verbal descriptions.
- Use transformations, similarity and the Pythagorean theorem to deepen geometric reasoning.
- Develop statistical thinking around variability, sampling and distributions.
- Develop probability from simple events through compound events and simulations.
- Integrate financial literacy and mathematical modeling into authentic contexts.
- Require explanation, justification, error analysis and multiple representations.
- Use Core and Extension pathways to support a wide range of Grade 7 learners.

3. Grade 6 • Grade 7 • Grade 8 Progression

Area	Grade 6	Grade 7	Grade 8
Number	Rational-number foundations	Full rational-number reasoning	Real numbers, exponents & scientific notation
Ratios	Ratios, rates & percent	Proportional reasoning focus	Linear relationships/functions
Algebra	Expressions & basic equations	Pre-Algebra	Algebra I bridge
Linear relationships	Basic relationships	Rate of change + initial value	Formal linear functions
Geometry	Measurement + coordinates	Transformations + similarity + Pythagorean	Congruence, similarity, advanced geometry
Statistics	Center/spread + displays	Sampling + MAD + comparison	Bivariate data + modeling
Probability	Simple events	Compound events + simulations	Probability models
Finance	Percent + budgeting	Financial applications	Financial modeling

4. Suggested Course Sequence

Order	Unit	Primary focus
1	Rational Numbers & The Number System	Operations, representations, inverses, properties, estimation
2	Ratios, Proportions, Percent & Proportional Relationships	The defining Grade 7 proportionality strand
3	Expressions, Equations, Inequalities & Linear Relationships	Pre-Algebra and introductory linear reasoning
4	Geometry, Transformations, Measurement & Spatial Reasoning	Transformations, similarity, Pythagorean theorem, measurement

Unit 1 Rational Numbers & The Number System

Learning Goal: Develop complete fluency and conceptual understanding of rational numbers while preparing students for proportional and algebraic reasoning.

CORE TOPICS

- Rational numbers as a complete set: integers, fractions, terminating decimals and repeating decimals.
- Convert between fractions and decimals, including repeating decimals.
- Compare and order rational numbers using symbols, benchmarks and number lines.
- Absolute value and distance between rational numbers.
- Add, subtract, multiply and divide rational numbers with positive and negative signs.
- Order of operations with rational numbers and exponents.
- Opposites, additive inverses and multiplicative inverses.
- Commutative, associative and distributive properties with negative numbers.
- Equivalent forms and choosing efficient representations.
- Estimation, mental math and reasonableness checks.
- Positive integer exponents and powers.
- Factors, multiples, prime factorization, GCF and LCM review as needed.

EXTENSION

Scientific notation and richer number-system investigations.

REAL-WORLD APPLICATIONS

Gains/losses, temperature, elevation, bank balances, distances, measurements and rates.

END-OF-UNIT OUTCOMES

- Perform all four operations with rational numbers accurately.
- Convert among fraction, decimal and repeating-decimal representations.
- Compare, order and locate rational numbers.
- Use inverses and properties strategically.
- Solve multi-step numerical problems and justify reasonableness.

Unit 2 Ratios, Proportions, Percent & Proportional Relationships

Learning Goal: Make proportional reasoning a defining Grade 7 competency and connect ratios, rates, tables, graphs and equations.

CORE TOPICS

- Part-to-part and part-to-whole ratios.
- Equivalent ratios and scaling.
- Unit rates and constant of proportionality.
- Recognize proportional relationships from tables, graphs, equations and verbal descriptions.
- Represent proportional relationships with $y = kx$
- Graph proportional relationships and interpret slope as rate of change/unit rate.
- Distinguish proportional from non-proportional relationships.
- Solve proportions using multiple strategies.
- Percent increase and decrease.
- Discounts, markups, markdowns, tax, tips and commissions.
- Reverse-percent and original-value problems.
- Successive percent changes.
- Percent error/difference as an introductory extension.
- Simple interest.
- Scale drawings, maps and scale factors.
- Similar figures and missing lengths using proportional reasoning.
- Unit conversions and rate-based applications.

EXTENSION

More complex proportional models, multi-stage percent problems, area scaling and challenging reverse-percent tasks.

REAL-WORLD APPLICATIONS

Shopping, maps, recipes, speed, unit prices, discounts, taxes, tips, commissions, travel and financial decisions.

END-OF-UNIT OUTCOMES

- Recognize and explain proportional relationships.
- Calculate and interpret constants of proportionality and unit rates.
- Represent proportional relationships in tables, graphs, equations and words.
- Interpret slope as rate of change in appropriate contexts.
- Solve multi-step percent problems.
- Use scale and similarity to find unknown quantities.

Unit 3 - Expressions, Equations, Inequalities & Linear Relationships

Learning Goal: Develop a genuine Pre-Algebra core: students move from symbolic manipulation to reasoning about relationships and constraints.

CORE TOPICS

- Variables, constants, coefficients and terms.
- Write algebraic expressions from verbal descriptions.
- Evaluate expressions by substitution.
- Combine like terms.
- Use the distributive property.
- Expand and factor simple linear expressions.
- Generate and identify equivalent expressions.
- Solve multi-step linear equations in one variable.
- Equations with parentheses, fractions and decimals.
- Equations with rational coefficients.
- Variables on both sides of an equation.
- Use equations to model real-world situations.
- Solve multi-step inequalities in one variable.
- Reverse the inequality when multiplying or dividing by a negative number.
- Represent inequalities with notation and number lines.
- Interpret solutions as constraints in context.
- Introductory linear relationships: tables, graphs, equations and verbal descriptions.
- Rate of change and initial value.
- Basic introduction to $y = mx + b$ without requiring full Grade 8 mastery.

EXTENSION

More challenging equations, richer variable manipulation and multi-representation linear problems.

REAL-WORLD APPLICATIONS

Cost, distance/time, age, temperature, shopping, measurement formulas and simple business scenarios.

END-OF-UNIT OUTCOMES

- Simplify and transform equivalent linear expressions.
- Solve multi-step equations and inequalities.
- Interpret solutions in context.
- Translate among verbal, tabular, graphical and algebraic representations.
- Explain why algebraic steps preserve equality or inequality relationships.

Unit 4 - Geometry, Transformations, Measurement & Spatial Reasoning

Learning Goal: Create a complete Grade 7 geometry foundation connecting transformations, similarity, measurement, coordinates and the Pythagorean theorem.

CORE TOPICS

- Coordinate-plane geometric reasoning.
- Translations, reflections and rotations.
- Dilations and scale factors.
- Transformation rules on the coordinate plane.
- Sequences of transformations.
- Congruent figures and corresponding parts.
- Similar figures and proportional side relationships.
- Complementary, supplementary and vertical angles.
- Angles formed by parallel lines and transversals.
- Triangle classification and angle relationships.
- Triangle angle sum and exterior angles.
- Pythagorean theorem and applications.
- Determine whether a triangle is right using side lengths.
- Scale drawings and maps.
- Circles: radius, diameter, circumference and area.
- Area of triangles, rectangles, parallelograms and composite figures.
- Surface area using nets and formulas.
- Volume of prisms and pyramids.
- Composite three-dimensional figures.
- Unit conversion and dimensional reasoning.

EXTENSION

More advanced coordinate proofs, composite solids, richer transformation compositions and challenging similarity problems.

REAL-WORLD APPLICATIONS

Architecture, maps, design, construction, packaging, sports fields, room plans and three-dimensional objects.

END-OF-UNIT OUTCOMES

- Perform and describe transformations on the coordinate plane.
- Explain congruence and similarity through transformations and proportionality.
- Solve angle and triangle problems.
- Apply the Pythagorean theorem accurately.
- Calculate area, surface area and volume with appropriate units.
- Use scale factors and coordinate reasoning to solve geometric problems.

Unit 5 - Statistics, Probability & Data Modeling

Learning Goal: Teach students to reason about variability, sampling, distributions and chance rather than merely perform calculations.

CORE TOPICS

- Statistical versus non-statistical questions.
- Populations and samples.
- Random sampling and representative samples.
- Convenience sampling and sampling bias.
- Collect and organize data.
- Dot plots, line plots, histograms, box plots and stem-and-leaf plots.
- Mean, median and mode.
- Range and interquartile range.
- Mean absolute deviation (MAD).
- Outliers and their effects on center and spread.
- Describe distributions using center, spread and shape.
- Clusters, gaps, skew and symmetry.
- Compare two distributions using center and variability.
- Choose appropriate data displays and statistics.
- Read and critique misleading graphs.
- Simple theoretical probability.
- Experimental probability.
- Sample spaces.
- Compound events using lists, tables and tree diagrams.
- Complementary events.
- Introductory independent and dependent events.
- Simulations.
- Experimental versus theoretical probability.
- Law of large numbers conceptually.

EXTENSION

More sophisticated simulations, probability models and introductory expected-value intuition. Formal combinatorics is reserved for later grades.

REAL-WORLD APPLICATIONS

Surveys, sports, science experiments, games, weather data, news graphics and classroom investigations.

END-OF-UNIT OUTCOMES

- Represent and compare distributions.
- Calculate and interpret mean, median, range, IQR and MAD.
- Recognize sampling bias and describe distribution shape.
- Identify outliers and compare center/spread.
- Calculate and interpret simple and compound probabilities.
- Use simulations to investigate probability.

Unit 6 Financial Literacy & Mathematical Modeling - Cross-Cutting

Learning Goal: Use mathematics for authentic decisions and modeling while integrating ideas from the other Grade 7 units.

CORE TOPICS

- Income, expenses and budgeting.
- Savings goals and spending constraints.
- Unit price and best-buy analysis.
- Discounts, markups, markdowns and sales tax.
- Tips and commissions.
- Simple interest.
- Percent change in financial contexts.
- Compare financial options using tables and calculations.
- Introductory loans and repayment concepts.
- Introductory compound-interest concept without making it a major Grade 7 topic.
- Read and critique graphs from advertising, news and science.
- Identify assumptions, constraints and relevant quantities.
- Build tables, graphs, equations and simple models.
- Estimate before calculating and check whether a result is reasonable.
- Integrated multi-topic word problems.
- Student-designed mathematical modeling projects.

EXTENSION

More complex financial comparisons and constrained models for advanced students.

REAL-WORLD APPLICATIONS

Personal finance, shopping, entrepreneurship, travel, budgeting, data interpretation and everyday decision-making.

END-OF-UNIT OUTCOMES

- Build and interpret simple mathematical models.
- Combine ratios, percent, equations and data in realistic problems.
- Explain assumptions and constraints.
- Communicate conclusions clearly.
- Evaluate the reasonableness of a mathematical model and its output.

Mathematical Practices & Mathematical Thinking - Embedded All Year

All eight mathematical practices should appear across the curriculum. Grade 7 increasingly asks students to justify choices, compare methods, interpret representations and evaluate whether a result makes sense.

- **1. Make sense of problems and persevere:** identify knowns, unknowns, constraints and useful strategies.
- **2. Reason abstractly and quantitatively:** connect symbols, quantities and real contexts.
- **3. Construct arguments and critique reasoning:** explain solutions, identify errors and evaluate another method.
- **4. Model with mathematics:** build equations, tables, graphs, diagrams and data models.
- **5. Use tools strategically:** select calculators, graphing tools, spreadsheets, rulers, protractors and digital tools appropriately.
- **6. Attend to precision:** use correct signs, notation, units, labels and mathematical language.
- **7. Look for and use structure:** recognize algebraic, proportional, numerical and geometric structure.
- **8. Look for regularity in repeated reasoning:** identify patterns and generalize from repeated calculations.

Digital Mathematics & Technology

- Use Desmos or equivalent graphing technology to explore proportional and introductory linear relationships.
- Use calculators strategically for complex rational-number and percent calculations after conceptual work.
- Use spreadsheets for budgets, tables, repeated calculations and data analysis.
- Use digital geometry tools to investigate transformations, similarity and coordinates.
- Use simulations to explore experimental probability.
- Use digital data visualizations and learn to question graph scales and representations.
- Use technology to test conjectures, then justify conclusions mathematically.

Assessment Framework

Assessment	Purpose
Diagnostic/readiness	Identify gaps in fractions, decimals, integers and prerequisite Grade 6 concepts.
Formative checks	Detect misconceptions during instruction and guide reteaching.
Fluency practice	Build reliable rational-number, ratio and algebraic procedures.
Reasoning tasks	Assess explanation, justification, error analysis and multiple representations.
Unit assessments	Measure mastery of core outcomes.
Modeling/project tasks	Integrate proportionality, algebra, geometry, data and finance.
Cumulative review	Use spaced retrieval to strengthen long-term retention and Grade 8 readiness.

Homework & Practice Philosophy

- Reinforce concepts that have already been taught.
- Mix procedural fluency, reasoning and application.
- Use spaced retrieval of rational numbers, ratios and algebra throughout the year.
- Include estimation, mental math and answer-checking regularly.
- Use occasional technology-free practice to maintain independence.
- Prefer purposeful problem sets over excessive repetitive volume.
- Provide extension problems for advanced students without making advanced content mandatory.

Differentiation at ROED

Student profile	ROED response
Prerequisite gaps	Targeted Grade 6 rational-number and ratio support alongside current work.
On-level	Core Grade 7 instruction with reasoning and application.
Strong mastery	More complex proportional, algebraic, geometric and statistical problems.
Advanced	Extension in scientific notation, richer algebra, modeling, probability and coordinate reasoning.
Needs visual support	Use number lines, diagrams, tables, manipulatives and digital representations.
Fast procedural solver	Increase explanation, representation switching, error analysis and modeling.

Suggested Integrated Projects

- **Travel Planner:** use scale, rates, percent, budgeting and data to create a realistic travel plan.
- **Best Buy Investigation:** compare package sizes, unit prices, discounts and tax and justify a decision.
- **Transformation Design:** create a coordinate-plane design using translations, reflections, rotations and dilations.
- **Data & Sampling Study:** design a survey, discuss sampling bias, display data and compare distributions.
- **Probability Game Lab:** design a game, calculate theoretical probabilities, run trials and analyze differences.
- **Mini Business Model:** create a product, pricing structure, budget and simple algebraic model.

End-of-Year Grade 7 Outcomes

- Operate fluently with positive and negative rational numbers.
- Convert among fractions, decimals and repeating decimals.
- Compare and order rational numbers and interpret absolute value.
- Use inverses and properties strategically.
- Recognize, represent and explain proportional relationships.
- Use the constant of proportionality and unit rate.
- Represent proportional relationships with tables, graphs, equations and words.
- Interpret slope as rate of change in appropriate proportional/linear contexts.
- Solve multi-step percent, scale and proportional problems.
- Simplify and transform linear expressions.
- Solve multi-step equations, including rational coefficients and variables on both sides.
- Solve and graph multi-step inequalities and interpret them as constraints.
- Use tables, graphs, equations and verbal descriptions to analyze relationships.
- Perform and describe geometric transformations.
- Reason about congruence and similarity.
- Apply angle relationships and the Pythagorean theorem.
- Calculate area, surface area and volume accurately.
- Analyze distributions using center, spread, shape and outliers.
- Use mean, median, range, IQR and MAD appropriately.
- Distinguish samples from populations and identify potential bias.
- Calculate and interpret simple and compound probability.
- Use simulations to investigate probability.
- Build and evaluate simple mathematical and financial models.
- Communicate mathematical reasoning clearly and use technology strategically.

Final Curriculum Map - One-Page Reference

Unit	Core focus	Major integrated/application focus
1	Rational numbers & number system	Operations, representation, inverses, estimation
2	Ratios, proportions, percent & proportional relationships	Unit rate, $y = kx$, scale, similarity, finance
3	Expressions, equations, inequalities & linear relationships	Pre-Algebra, rate of change, constraints
4	Geometry, transformations, measurement & spatial reasoning	Congruence, similarity, Pythagorean theorem, 2D/3D measurement
5	Statistics, probability & data modeling	Sampling, MAD, distributions, compound probability, simulation
6	Financial literacy & mathematical modeling	Budgeting, percent, simple interest, real-world modeling.

Curriculum design principle: Grade 7 is the ROED Pre-Algebra bridge. It strengthens proportional reasoning and rational-number fluency while introducing the algebraic, geometric, statistical and modeling habits required for Grade 8 and beyond.