

Middle School Mathematics

Grade 7

Learning Opportunities

Students need the opportunity to practice skills and concepts taught in previous grades and to have an introduction to new skills and concepts.

Basic skill practice and mental math

Mini Lesson: Review of skills and concepts already taught or an introduction to new skills and concepts

Guided Lesson: Developing a deeper understanding of a mathematical concept through hands on exploration and problem solving

Standards

Fields of Knowledge: Science, Mathematics, Technology

Mathematical Understanding

7.6 Arithmetic, Number and Operation Concepts: Students understand arithmetic in computation, and they select and use, in appropriate situations, mental arithmetic, pencil and paper, calculator and computer.

7.7 Geometric and Measurement Concepts: Students use geometric and measurement concepts.

7.8 Function and Algebra Concepts: Students use function and algebra concepts.

7.9 Statistics and Probability Concepts: Students use statistics and probability concepts.

Mathematical Problem Solving and Reasoning

7.10 Applications: Students use concrete, formal, and informal strategies to solve mathematical problems, apply the process of mathematical modeling, and extend and generalize mathematical concepts. Students apply mathematics as they solve scientific and technological problems or work with technological systems.

Vital Results: Reasoning and Problem Solving

Problem Solving

2.5 Mathematics Dimensions: Students produce solutions to mathematical problems requiring decisions about approach and presentation, so that final drafts are appropriate in terms of these dimensions.

Content Knowledge and Skills

7.6 Arithmetic, Number and Operation Concepts

- Computing with integers, exponents, and roots
- Developing a conceptual understanding of roots, perfect and non-perfect squares
- Applying proportional reasoning to problem solving situations
- Using positive and negative scientific notation

7.7 Geometric and Measurement Concepts

- Applying the properties of angles and triangles
- Determining congruency
- Applying the concepts of proportion and scale
- Measuring area, surface area, and volume
- Increasing work with three dimensional figures

7.8 Function and Algebra Concepts

- Using simple linear and nonlinear relationships
- Applying the concepts of variable, expression and equation to linear and nonlinear relationships
- Applying the concept of equality to solve problems
- Relating linear relationships to a two-dimensional coordinate system

7.9 Statistics and Probability Concepts

- Organizing and displays data correctly
- Reading and interprets data
- Choosing appropriate method to find central tendencies (mean, median, mode, and range)
- Determining appropriate method to find probability, experimental or theoretical

7.10 Application of Mathematical Problem Solving and Reasoning

Assessment Criteria

By the end of grade 7...

Mathematical Understanding

7.6 Arithmetic, Number and Operation Concepts

..students will be able to...

1. add, subtract, multiply and divide: integers, exponents, and roots of perfect squares and non-perfect squares with and without models and diagrams
2. raise numbers to whole number powers
3. determine the square root of perfect square numbers and non-perfect square numbers with and without a calculator
4. apply order of operations
5. use fractions and decimals to represent ratios and proportions
6. fluently move between fractions, decimals and percents and scientific notation (e.g. $\frac{1}{2}$, 0.5, 50%, 5×10^{-1}) with models or placing numbers on a number line
7. Compare and order: numbers with exponents, integers, absolute value, fractions, decimals, percents and scientific notation using number lines and inequality symbols
8. add, subtract, multiply and divide fractions, decimals and percents
9. calculate without a calculator 3 digit decimal X 2 digit decimal and 3 digit decimal divided by 2 digit decimal
10. solve problems involving **proportional reasoning** such as rates, similarity, percents, measurement conversions, and scale
11. use percent to represent and compare ratios
12. use percents to represent proportions
13. use percents greater than 100%
14. convert among fractions, decimals and percents between 1 and 100
15. use percent in problems involving discounts, tax and tip
16. use positive and **negative powers** of 10
17. use properties of numbers to simplify computation (GCF, LCM, prime factorization, inverses and identities)
18. apply the commutative, distributive and associative properties of operations
19. estimate and evaluate the reasonableness of solutions
20. use the number and operation concepts to represent, explain, and solve problems

7.7 Geometric and Measurement Concepts

..students will be able to...

1. identify complementary, supplementary, adjacent, and vertical angles
2. identify and classify among different types of triangles and quadrilaterals
3. identify congruency by combining and subdividing shapes
4. identify congruency by transformations (reflections, translations, rotation) and by the properties of angles and side length
5. use the proportionality and scale factor to determine similarity
6. scale a figure up or down and understand the impact on angle measurement, linear dimensions,
7. scale a figure up or down and understand the impact on the area of polygons and circles
8. apply the triangle inequality theorem to determine if three line segments with given lengths form a triangle
9. use the property of the sum of angles to determine a missing angle in polygons
10. apply bilateral and rotational symmetry
11. identify, classify and distinguish between three-dimensional figures (rectangular prisms, cubes, triangular prisms, pyramids) using number of vertices, edges, faces, symmetry and types of angles
12. sketch three dimensional solids
13. determine area and perimeter of composites of quadrilaterals, triangles, and parts of circles
14. draw nets of prisms, cylinders, and pyramids
15. construct angles
16. find the area of circles, polygons, composites of quadrilaterals, triangles, and parts of circles
17. determine the surface area and volume of rectangular prisms
18. determine the volume of cylinders
19. express all measurements using appropriate units including correct dimensions (ft, ft², ft³)
20. select and use appropriate tools and units (length, weight, capacity, temperature, rotation, and angles in customary and metric units)
21. convert *within* customary and metric systems including length, weight, capacity, and temperature
22. use rates as a measure (e.g. unit pricing, miles/hour, dollars per gallon, etc.)
23. use geometry and measurement concepts to represent, explain, and solve problems

7.8 Function and Algebra Concepts

..students will be able to...

1. describe the meaning of slope in concrete situations and as rate of change
2. determine the slope of a line from a graph or table
3. identify the patterns and translates between tables, graphs, words, and symbolic notation
4. generalize a nonlinear relationship using words or symbols
5. distinguish between constant and varying rate of change in concrete situations and representations in tables and graphs
6. describe how change in the value of one variable relates to change in the value of a second variable with constant and varying rates of change
7. use variable and variable expressions and formulas that include exponents and parenthesis
8. evaluate variable expressions given a replacement set of variables including exponents
9. show how expressions are equivalent using models or different representations of the expressions 11. ..apply order of operations and substitutions
10. solve multi-step linear equations $ax + b = c$, $ax - b = c$, $ax \pm b = cx \pm d$, where a,b,c, and d are whole numbers
11. translate a problem solving situation into an equation consistent with types of equations for this grade level
12. graph linear equations in a real world context find common solutions of linear systems
13. use Function and Algebra concepts to represent, explain and solve problems

7.9 Statistics and Probability Concepts

..students will be able to...

1. organize and represent data using tables, bar graphs, frequency table, line plots, stem and leaf plots, line graphs, histograms, and scatter plots,
2. represent continuous data and shows trend in discrete data on a line graph
3. make a hypothesis to a question and collect and organize and appropriately display data (numerical and categorical data)
4. read and interpret (interpolates and extrapolates) representations to answer questions, make observations and draw conclusions
5. analyze patterns, trends, and distributions in a data set using measures of central tendency (mean, median, mode)

6. analyze dispersion using range, variation and outliers (limited to graphs, tables of values, and lists)
7. use outliers to describe the effect on mean , median, mode
8. evaluate the sample from which statistics were developed
9. determine the experimental or theoretical probability of a simple or compound event (sample space may or may not equal likely outcomes)
10. express probability as a fraction, decimal, or percent
11. compare and contrast theoretical and experimental probability
12. use theoretical or experimental probability to determine the fairness of a game
13. use combinations to solve problems (organized lists, tables, tree diagrams, area models, Fundamental Counting Principle)
14. use Statistics and Probability concepts to represent, explain, and solve problems

7.10 Assessment to be integrated in the other standards

2.5 Mathematics Dimensions

Approach and Reasoning	Level 3
Connections	Level 2(3,4)
Solution	Level 3
Mathematical Language	Level 3(2)
Mathematical Representation	Level 3
Documentation	Level 3

Assessment Portfolio Requirements Score using the Vermont State Scoring Guide

- One Number and operation problem 7.6
- One Geometry or Measurement problem 7.7
- One Algebra problem 7.8
- One Statistics or Probability problem 7.9

Resources

Grade Seven Mathscape
Mathscape manipulative kit including...
Calculator