

Middle School Mathematics

Grade 8

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

- Numbers, ways of representing numbers, relationships among numbers, and number systems
- Meaning of operations and how they relate to one another
- Computing and making reasonable estimates

7.7 Geometric and Measurement Concepts

- Characteristics and properties of two- and three- dimensional geometric shapes
- Spatial locations using coordinate geometry
- Transformations and symmetry in analyzing mathematical situations
- Measurable attributes of objects and the units
- Application of appropriate techniques, tools, and formulas to determine measurement

7.8 Function and Algebra Concepts

- Patterns, relations, and functions
- Represent and analysis of mathematical situations and structures using algebraic symbols
- Mathematical models to represent and understand quantitative relationships
- Analysis of change in various contexts

7.9 Statistics and Probability Concepts

- Formulating questions that can be addressed with data and collecting, organizing, and displaying relevant data to answer them
- Selection and use of appropriate statistical methods to analyze data
- Development and evaluation of inferences and predictions that are based on data
- Understanding and application of basic concepts of probability

7.10 Application of Mathematical Problem Solving and Reasoning

Assessment Criteria

By the end of grade eight ...

Mathematical Understanding

7.6 Arithmetic, Number and Operation Concepts

...students will be able to...

1. order and compare: rational numbers, common irrational numbers, complex fractions, whole number exponents, square roots, absolute values, integers, and scientific notation using number lines and inequality symbols
2. solve problems involving squares, cubes, square roots, cube roots
3. apply order of operations
4. estimate and evaluate the reasonableness of solutions
5. solve problems involving percents, including tax, tips, scaling, discounts and interest rates, percents of increase or decrease
6. use the number and operation concepts to represent, explain, and solve problems

7.7 Geometric and Measurement Concepts

students will be able to...

1. model situations geometrically
2. use properties of lines, angles, two and three dimensional shapes
3. use the concepts of scale, proportion, growth and rate
4. make scale models
5. use the triangle inequality theorem
6. determine the sum of angles in a convex polygon of any number of sides
7. determine the Pythagorean relationship
8. construct and accurately represent: angle bisectors, perpendicular bisectors
9. construct and accurately represent: congruent segments, regular polygons
10. identify and distinguish between 3 dimensional shapes
11. sketch 3-d objects including orthogonal views
12. draw nets of three dimensional shapes
13. determine the surface area and volume of: prisms, cylinders, spheres and cones
14. determine what happens to the perimeter, area, and volume when the given units of a figure are multiplied by a constant factor
15. uses appropriate tools and unit
16. measures appropriately and consistently across content

17. converts within and between customary and metric systems
18. use geometry and measurement concepts to represent, explain, and solve problems

7.8 Function and Algebra Concepts

students will be able to...

1. generalize a linear relationship (including finding a specific case) in models, tables, sequences, graphs, and problem situations
2. generalize a nonlinear relationship (including finding a specific case) in models, tables, sequences, graphs, and problem situations
3. demonstrate understanding of linear relationships by solving problems involving the relationship between slope and rate of change
4. determine slopes and intercepts represented in graphs, tables, and problem situations
5. describe the meaning of slope and intercept in context
6. distinguish **between** linear relationships and nonlinear relationships represented in tables, graphs, equations, and problem situations
7. describe how the change in the value of one variable relates in the value of a second variable in linear and nonlinear relationships
8. evaluate and simplifies algebraic expressions (involving square roots, whole number exponents, rational numbers)
9. evaluate an expression within an equation
10. show an equivalence between two expressions
11. solve formulas for a variable requiring one transformation
12. solve multi-step linear equations with integer coefficients
13. show equivalence (or nonequivalence) using commutative, associative, distributive properties, order of operations and substitution
14. informally solve systems in context
15. ..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 charts, line plots, stem and leaf plots, line graphs (continuous and discrete data), histograms, scatter plots, and box and whiskers plots
2. make a hypothesis to a question and collect and organize and appropriately display data
3. analyze data and draw conclusions about hypothesis

4. read and interpret (interpolates and extrapolates) representations to: answer questions, make observations and draw conclusions (line graphs, scatter plots, histograms, box and whisker plots)
5. analyze patterns, trends, in a data set using central tendency, range, outliers, quartile values, and estimate line of best fit
6. select most appropriate measure of central tendency for a given data set
7. evaluate the sample from which the statistics were developed (bias, random or non-random)
8. solve problems involving combinations and permutations, using lists, tables, tree diagrams, models and Fundamental Counting Principle
9. determine probability by organized list, tables, tree diagram, area model and Fundamental Counting Principle
10. express theoretical probability as a fraction, decimal, or percent
11. compare and contrast theoretical and experimental probability of compound events
12. use probability to determine the fairness of a game
13. 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

These levels are based the Vermont State Problem Solving Rubric and standards set by Vermont teachers. Grade 8 achievement levels to be set by 200?.

Assessment Portfolio Requirements Scored using the Vermont State Scoring Guide and given a performance level for each problem

- 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 Eight Mathscape
Mathscape manipulative kit
Calculator