

Middle School Mathematics

Grade 6

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

- Developing a conceptual understanding of integers
- Understanding and explaining fractions, decimals, and percents
- Comparing and ordering fractions, decimals and percents
- Computing, using fractions, decimals and percents
- Scientific notation to explain very large and small numbers

7.7 Geometric and Measurement Concepts

- Analyzing two and three dimensional figures
- Using concepts of proportion and scale to show an understanding of similarity
- Using 2 and 3 dimensional models to measure area, volume, and surface area

7.8 Function and Algebra Concepts

- Describing and extending patterns
- Using simple linear equations to solve problems
- Applying the concepts of variable, expression and equation
- Apply the concept of equality to solve problems
- Using a two-dimensional coordinate system

7.9 Statistics and Probability Concepts

- Organizing and displaying data correctly
- Reading and interpreting data
- Using mean, median, mode, and range to solve problems
- Determining theoretical probability
- Determining experimental probability

7.10 Application of Mathematical Problem Solving and Reasoning

Assessment Criteria

By the end of grade six ...

In *Mathematical Understanding*

7.6 Arithmetic, Number and Operation Concepts

...students are able to...

1. add, subtract, and multiply integers **using models and diagrams**
2. use models and diagrams to show understanding of powers
3. raise numbers to whole number powers and show expanded notation ($3^4 = 3*3*3*3=81$)
4. multiply and divide whole numbers with and without a calculator.
(without a calculator 2 digits X 2 digits and 3 digits divided by 2 digits)
5. solve problems using order of operations including exponents
6. use commutative and associative properties of operations to solve problems and simplify computations
7. recall all multiplication and division facts through 12
8. compute perfect squares through 20
9. use fractions and decimals to represent proportions (introduce a:b representation of ratios)
10. compare and order fractions and decimals and place on a number line
11. convert among commonly used fractions, decimals, and percents with models or number line
12. represent a out of b as a percent
13. compare and order numbers with exponents and integers
14. add and subtract fractions
15. multiply commonly used fractions
16. add, subtract, multiply and divide decimals with and without a calculator
(without a calculator 2 digit decimal X 1 digit decimal and 3 digit decimal divided by 1 digit decimal)
17. represent commonly used percents (1%, 10%, 20%, 33 1/3%, 50%, 75%, 100%), using models, diagrams, and explanations
18. use place value through 1,000,000 to thousandths to show the relative magnitude of numbers
19. represent whole numbers as powers of 10 (scientific notation)
20. use equality and inequality symbols
21. use properties of numbers to solve problems and simplify computation
(factor, multiple, prime, composite, GCF, LCM, composition/decomposition, divisibility, remainders)

22. reasonably estimates the operations of multiplying and dividing with whole numbers, fractions, and decimals
23. accurately solve problems involving fractions, decimals, and percents
24. use number operations concepts to represent, explain, and solve problems

7.7 Geometric and Measurement Concepts

1. identify congruent, parallel, and perpendicular sides
2. identify and classify different types of triangles (right, acute, obtuse, equilateral, isosceles, scalene)
3. identify and classify different types of quadrilaterals (rectangles, squares, parallelograms, rhombi, trapezoids) by types of angles and number of sides, congruent sides, parallel sides and perpendicular sides
4. identify and use slides, flips, and turns to classify and compare plane figures
5. demonstrates congruency using the results of combining and subdividing shapes (rectangle into two triangles),
6. demonstrates congruency using transformations (flips, slides, and turns), and properties of angles and lengths of lines
7. use proportionality/scale to make similar drawings with polygons or circles
8. use scale to determine distances represented on a map
9. use similarity to make larger and smaller scale drawings
10. identify, classify and distinguish between three-dimensional figures using symmetry, number of vertices, edges, faces, and types of angles (rectangular prisms, cubes, triangle prisms, pyramids, cones, spheres)
11. construct angles using protractor
12. find the perimeter of polygons
13. find the area of triangles and quadrilaterals
14. find the volume of rectangular prisms/cube using models and formulas
15. demonstrate conceptual understanding of circle measurements (radius to diameter, diameter to circumference)
16. express all measurements using appropriate units (length, weight, capacity, temperature, rotation, and angles in customary and metric units)
17. select and use appropriate tools and units of measurements
18. convert measurements *within* customary or metric units
19. use geometry and measurement concepts to represent, explain, and solve problems

7.8 Function and Algebra Concepts

1. find additional elements by extending a simple linear and nonlinear patterns
2. describe patterns in words, symbols, tables, and graphs
3. demonstrate and describe a simple linear relationship as a rate of change using words, symbols and diagrams
4. describe slope in concrete situations represented on a graph (faster/slower, greater/smaller rate)
5. use variables, variable expressions, equations and formulas to solve problems
6. evaluate a variable expression given a replacement set for the variables
7. understand equality and solves multi-step linear equations ($ax + b = c$, $ax - b = c$ where a , b , and c are whole numbers)
8. use two-dimensional coordinate system to locate coordinates and represent data
9. represent linear equations ($y = mx$, $y = mx + b$) from a real world or mathematical situation on a two-dimensional coordinate graph
10. use Function and Algebra concepts to represent, explain and solve problems

7.9 Statistics and Probability Concepts

1. organize and represent data using tables, bar graphs, frequency charts, line plots, stem and leaf plots, and line graphs
2. read and interpret representations of data from the following representations, tables, bar graphs, frequency charts, line plots, stem and leaf plots, and line graphs, and circle graphs
3. analyze patterns, trend in a data set to draw conclusions and make predictions
4. find measures of central tendency (mean, median, mode)
5. use central tendencies and range to analyze situations
6. determine the probability of an event using an organized list, table, tree diagram, area model
7. use the Fundamental Counting Principle to determine combinations
8. determine probability as a ratio, as a fraction, decimal or percent
9. use experimental probability to make and test conjectures or design fair games
10. 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 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 Six Mathscape
Mathscape manipulative kit
Calculator
Other