DeRuyter Central School District

Mathematics Grade 8

102 Benchmarks

Problem Solving Strand

➢**Standard 1: Students will build new mathematical knowledge through problem solving.**

8.PS.1 Use a variety of strategies to understand new mathematical content and to develop more efficient methods

8.PS.2 Construct appropriate extensions to problem situations

8.PS.3 Understand and demonstrate how written symbols represent mathematical ideas
- Use the Distributive Property to simplify algebraic expressions
- Write verbal sentences as two-step equations
- Solve verbal problems by writing and solving two-step equations.

➢**Standard 2: Students will solve problems that arise in mathematics and in other contexts.**

8.PS.4 Observe patterns and formulate generalizations
- Find the terms of arithmetic and geometric sequences
- Fibonacci Sequence

8.PS.5 Make conjectures from generalizations

8.PS.6 Represent problem situations verbally, numerically, algebraically, and graphically

➢**Standard 3: Students will apply and adapt a variety of appropriate strategies to solve problems.**

8.PS.7 Understand that there is no one right way to solve mathematical problems but that different methods have advantages and disadvantages

8.PS.8 Understand how to break a complex problem into simpler parts or use a similar problem type to solve a problem

8.PS.9 Work backwards from a solution

8.PS.10 Use proportionality to model problems

- Solve proportions (cross-products method)
- Use proportions to solve real-world problems.
- Use the percent proportion to solve problems
- Identify corresponding parts and find missing measures of similar triangles

8.PS.11 Work in collaboration with others to solve problems
- Play ***Juniper Green*** game (review of factors and multiples)

➢**Standard 4: Students will monitor and reflect on the process of mathematical problem solving.**

8.PS.12 Interpret solutions within the given constraints of a problem

8.PS.13 Set expectations and limits for possible solutions
- Use tree diagrams or the Fundamental Counting Principle to count outcomes
- Use the Fundamental Counting Principle to find the probability of an event
- Use permutations and combinations
- Find the odds of a simple event
- Find the probability of independent and dependent events
- Find the probability of mutually exclusive events

8.PS.14 Determine information required to solve the problem

8.PS.15 Choose methods for obtaining required information

8.PS.16 Justify solution methods through logical argument

8.PS.17 Evaluate the efficiency of different representations of a problem

Reasoning and Proof Strand

➢**Standard 5: Students will recognize reasoning and proof as fundamental aspects of mathematics.**

8.RP.1 Recognize that mathematical ideas can be supported by a variety of strategies

➢**Standard 6: Students will make and investigate mathematical conjectures.**

8.RP.2 Use mathematical strategies to reach a conclusion

8.RP.3 Evaluate conjectures by distinguishing relevant from irrelevant information to reach a conclusion or make appropriate estimates

➢**Standard 7: Students will develop and evaluate mathematical arguments and proofs.**

8.RP.4 Provide supportive arguments for conjectures

8.RP.5 Develop, verify, and explain an argument, using appropriate mathematical ideas and language

➢**Standard 8: Students will select and use various types of reasoning and methods of proof.**

8.RP.6 Support an argument by using a systematic approach to test more than one case

8.RP.7 Devise ways to verify results or use counterexamples to refute incorrect statements

8.RP.8 Apply inductive reasoning in making and supporting mathematical conjectures

Communication Strand

➢**Standard 9: Students will organize and consolidate their mathematical thinking through communication.**

8.CM.1 Provide a correct, complete, coherent, and clear rationale for thought process used in problem solving

- Use a four-step plan to solve problems,
- Choose an appropriate method of computation.

8.CM.2 Provide an organized argument which explains rationale for strategy selection

8.CM.3 Organize and accurately label work

➢**Standard 10: Students will communicate their mathematical thinking coherently and clearly to peers, teachers, and others.**

8.CM.4 Share organized mathematical ideas through the manipulation of objects, numerical tables, drawings, pictures, charts, graphs, tables, diagrams, models and symbols in written and verbal form

8.CM.5 Answer clarifying questions from others

➢**Standard 11: Students will analyze and evaluate the mathematical thinking and strategies of others.**

8.CM.6 Analyze mathematical solutions shared by others

8.CM.7 Compare strategies used and solutions found by others in relation to their own work

8.CM.8 Formulate mathematical questions that elicit, extend, or challenge strategies, solutions, and/or conjectures of others

➢**Standard 12: Students will use the language of mathematics to express mathematical ideas precisely.**

8.CM.9 Increase their use of mathematical vocabulary and language when communicating with others

8.CM.10 Use appropriate language, representations, and terminology when describing objects, relationships, mathematical solutions, and rationale

8.CM.11 Draw conclusions about mathematical ideas through decoding, comprehension, and interpretation of mathematical visuals, symbols, and technical writing

Connections Strand

➢**Standard 13: Students will recognize and use connections among mathematical ideas.**

8.CN.1 Understand and make connections among multiple representations of the same mathematical idea

8.CN.2 Recognize connections between subsets of mathematical ideas

8.CN.3 Connect and apply a variety of strategies to solve problems

➢**Standard 14: Students will understand how mathematical ideas interconnect and build on one another to produce a coherent whole.**

8.CN.4 Model situations mathematically, using representations to draw conclusions and formulate new situations

8.CN.5 Understand how concepts, procedures, and mathematical results in one area of mathematics can be used to solve problems in other areas of mathematics

➢**Standard 15: Students will recognize and apply mathematics in contexts outside of mathematics.**

8.CN.6 Recognize and provide examples of the presence of mathematics in their daily lives

8.CN.7 Apply mathematical ideas to problem situations that develop outside of mathematics

8.CN.8 Investigate the presence of mathematics in careers and areas of interest

8.CN.9 Recognize and apply mathematics to other disciplines, areas of interest, and societal issues

Representation Strand

➢**Standard 16: Students will create and use representations to organize, record, and communicate mathematical ideas.**

8.R.1 Use physical objects, drawings, charts, tables, graphs, symbols, equations, or objects created using technology as representations

- Display data in Stem-and-Leaf Plots and interpret
- Display data in Box-and-Whisker Plots and interpret
- Display data in Histograms and interpret

8.R.2 Explain, describe, and defend mathematical ideas using representations

8.R.3 Recognize, compare, and use an array of representational forms

8.R.4 Explain how different representations express the same relationship

8.R.5 Use standard and non-standard representations with accuracy and detail

➢**Standard 17: Students will select, apply, and translate among mathematical representations to solve problems.**

8.R.6 Use representations to explore problem situations

8.R.7 Investigate relationships between different representations and their impact on a given problem

8.R.8 Use representation as a tool for exploring and understanding mathematical ideas

➢**Standard 18: Students will use representations to model and interpret physical, social, and mathematical phenomena.**

8.R.9 Use mathematics to show and understand physical phenomena (e.g., make and interpret scale drawings of figures or scale models of objects)

- Construct and use scale drawings and models

8.R.10 Use mathematics to show and understand social phenomena (e.g., determine profit from sale of yearbooks)

8.R.11 Use mathematics to show and understand mathematical phenomena (e.g., use tables, graphs, and equations to show a pattern underlying a function)

Number Sense and Operations Strand

➢**Standard 19: Students will understand numbers, multiple ways of representing numbers, relationships among numbers, and number systems.**

➢**Standard 20: Students will understand meanings of operations and procedures, and how they relate to one another.**

Operations

8.N.1 Develop and apply the laws of exponents for multiplication and division
- Multiplication – add exponents with same base
- Division – subtract exponents with same base

8.N.2 Evaluate expressions with integral exponents
- Write and evaluate expressions containing exponents.
- Write and evaluate expressions using negative exponents.

8.N.3 Read, write, and identify percents less than 1% and greater than 100%
- Fraction, Decimal, Percent Conversions

8.N.4 Apply percents to:
  - Tax
  - Percent increase/decrease
  - Simple interest
  - Sale price
  - Commission
  - Interest rates
  - Gratuities
- Percent Proportion
- Solve real-life problems involving discount and interest
- Percent of Change – Find percent of increase or decrease

➢**Standard 21: Students will compute accurately and make reasonable estimates.**

Estimation

8.N.5 Estimate a percent of quantity, given an application
- Finding percents mentally
- Using a Percent Model

8.N.6 Justify the reasonableness of answers using estimation

Algebra Strand

➢**Standard 22: Students will represent and analyze algebraically a wide variety of problem solving situations.**

Variables and Expressions

8.A.1 Translate verbal sentences into algebraic inequalities
- Understand vocabulary terms with inequalities
- Write inequalities

8.A.2 Write verbal expressions that match given mathematical expressions
- Translating verbal expressions into equations
- Writing two-step equations
- Translating expressions into words

8.A.3 Describe a situation involving relationships that matches a given graph
- Scatter Plots
- Positive, Negative, or No Relationship between two sets of data

8.A.4 Create a graph given a description or an expression for a situation involving a linear or nonlinear relationship
- Scatter Plots
- Solve and graph linear equations with two variables using ordered pairs Draw and use Best-Fit lines to make predictions about data

8.A.5 Use physical models to perform operations with polynomials
- Using algebra tiles to model equations with variable on both sides
- Modeling polynomials with algebra tiles

➢**Standard 23: Students will perform algebraic procedures accurately.**

Variables and Expressions

8.A.6 Multiply and divide monomials
- Apply laws of exponents for multiplication and division
- Simplify fractions and algebraic fractions using the Greatest Common Factor.
- Multiplying rational numbers (fractions)
- Dividing rational numbers (fractions)

8.A.7 Add and subtract polynomials (integer coefficients)
- Combine Like Terms

- Subtraction must be rewritten as addition (Add the Opposites)
- Add polynomials
- Subtract polynomials

8.A.8 Multiply a binomial by a monomial or a binomial (integer coefficients)
- Use the Distributive Property to multiply
- Apply laws of exponents for multiplication
- Multiplying a polynomial by a monomial

8.A.9 Divide a polynomial by a monomial (integer coefficients) *Note: The degree of the denominator is less than or equal to the degree of the numerator for all variables.*
- Apply laws of exponents for division

8.A.10 Factor algebraic expressions using the GCF
- Prime Factorization – breaking a number down into the product of all prime numbers.
- Factor monomials
- Find the Greatest Common Factor of two or more numbers or monomials.
- Use the Distributive Property to factor algebraic expressions.

8.A.11 Factor a trinomial in the form $ax^2 + bx + c$; a=1 and c having no more than three sets of factors

Equations and Inequalities

8.A.12 Apply algebra to determine the measure of angles formed by or contained in parallel lines cut by a transversal and by intersecting lines
- Identify the relationships of angles formed by two parallel lines and a transversal
- Identify the relationships of vertical, adjacent, complementary, supplementary, corresponding, alternate interior, and alternate exterior angles.

8.A.13 Solve multi-step inequalities and graph the solution set on a number line
- Solve inequalities that involve more than one operation

8.A.14 Solve linear inequalities by combining like terms, using the distributive property, or moving variables to one side of the inequality (include multiplication or division of inequalities by a negative number)
- Solve inequalities by using the Addition or Subtraction Properties of Inequality

➢**Standard 24: Students will recognize, use, and represent algebraically patterns, relations, and functions.**

Patterns, Relations, and Functions

8.A.15 Understand that numerical information can be represented in multiple ways: arithmetically, algebraically, and graphically

- Determine whether relations are functions and use functions to describe relationships between two quantities

8.A.16 Find a set of ordered pairs to satisfy a given linear numerical pattern (expressed algebraically); then plot the ordered pairs and draw the line

- Graph points on a coordinate plane
- Graph algebraic relationships

8.A.17 Interpret multiple representations using equation, table of values, and graph

- Ordered Pairs and Relations
- Coordinate Graphing System
- Define and use correct terminology when referring to a function (domain and range)

Geometry Strand

➢**Standard 25: Students will use visualization and spatial reasoning to analyze characteristics and properties of geometric shapes.**

Constructions

8.G.0 Construct the following, using a straight edge and compass:
Segment congruent to a segment
Angle congruent to an angle
Perpendicular bisector
Angle bisector

- Constructions

➢**Standard 26: Students will identify and justify geometric relationships, formally and informally.**

Geometric Relationships

8.G.1 Identify pairs of vertical angles as congruent

- Vertical angles formed by intersecting lines

8.G.2 Identify pairs of supplementary and complementary angles

- Complementary – two or more angles whose sum is 90^o
- Supplementary – two or more angles whose sum is 180^o

8.G.3 Calculate the missing angle in a supplementary or complementary pair
- Subtract know angle from 90^o or 180^o

8.G.4 Determine angle pair relationships when given two parallel lines cut by a transversal
- Alternate Interior Angles
- Alternate Exterior Angles
- Corresponding Angles

8.G.5 Calculate the missing angle measurements when given two parallel lines cut by a transversal
- Corresponding and Supplementary Angles

8.G.6 Calculate the missing angle measurements when given two intersecting lines and an angle
- Vertical and Supplementary Angles

➢**Standard 27: Students will apply transformations and symmetry to analyze problem solving situations.**

Transformational Geometry

8.G.7 Describe and identify transformations in the plane, using proper function notation (rotations, reflections, translations, and dilations)
- Translation – slide
- Reflection – flip
- Rotation – turn
- Dilation – enlargement or reduction

8.G.8 Draw the image of a figure under rotations of 90 and 180 degrees
- 90 degrees – turn paper
- 180 degrees – change all coordinates to their opposites
- Turn the figure around a fixed point (origin)

8.G.9 Draw the image of a figure under a reflection over a given line
- Reflect over the x- or y-axis

8.G.10 Draw the image of a figure under a translation
- Translate (slide) figure from one position to another without turning it

8.G.11 Draw the image of a figure under a dilation
- Multiply or divide coordinates by dilation amount

8.G.12 Identify the properties preserved and not preserved under a reflection, rotation, translation, and dilation

- Reflection – same size and shape
- Rotation – same size and shape
- Translation – same size, shape, and orientation
- Dilation – same orientation and shape

➢ **Standard 28: Students will apply coordinate geometry to analyze problem solving situations.**

Coordinate Geometry

8.G.13 Determine the slope of a line from a graph and explain the *meaning of slope as a constant rate of change*

- Find the slope of a line or the slope of a line passing through two given points
- Find rates of change

8.G.14 Determine the y-intercept of a line from a graph and be able to explain the y-intercept

- Find the x- and y-intercepts of graphs and graph linear equations using the x- and y-intercepts

8.G.15 Graph a line using a table of values

- Coordinate System
- Graph linear equations using ordered pairs

8.G.16 Determine the equation of a line given the slope and the y-intercept

- Write equations given the slope and y-intercept, a graph, or two points

8.G.17 Graph a line from an equation in slope-intercept form ($y = mx + b$)

- Determine slopes and y-intercepts of lines and graph linear equations using slopes and y-intercepts

8.G.18 Solve systems of equations graphically (only linear, integral solutions, $y = mx + b$ format, no vertical/horizontal lines)

- Solve systems of linear equations by graphing or by substitution

8.G.19 Graph the solution set of an inequality on a number line

- Graphing inequalities – Open circle/Closed circle
- Graphing solutions to inequalities
- Graph linear inequalities
-

8.G.20 Distinguish between linear and nonlinear equations $ax^2 + bx + c$; a=1 (only graphically)

- Linear and Nonlinear Functions

- Determine whether a function is linear or nonlinear

8.G.21 Recognize the characteristics of quadratics in tables, graphs, equations, and situations

Measurement Strand

➢**Standard 29: Students will determine what can be measured and how, using appropriate methods and formulas.**

Units of Measurement

8.M.1 Solve equations/proportions to convert to equivalent measurements within metric and customary measurement systems *Note: Also allow Fahrenheit to Celsius and vice versa.*

➢**Standard 30: Students will use units to give meaning to measurements.**
➢**Standard 31: Students will understand that all measurement contains error and be able to determine its significance.**
➢***Standard 32: Students will develop strategies for estimating measurements.***

Statistics and Probability Strand

➢**Standard 33: Students will collect, organize, display, and analyze data.**
➢**Standard 34: Students will make predictions that are based upon data analysis.**

➢**Standard 35: Students will understand and apply concepts of probability.**