

MS Challenged by Choice Math Program Goals

Grade 8

Unit 1 – Linear Equations and Problem Solving

Green – Standard Concept

- Students solve multi-step equations and equations with variables on both sides using inverse operations. They also solve more complicated word problems, with an emphasis on Distance, Rate, Time problems
- Students recognize equations that have non-standard solutions (equations with many solutions, no solutions, or a solution of zero). Students also solve a formula for a variable.
- Students learn what to do when there is more than one unknown value in a problem and apply the 4 Step problem solving process to a variety of situations (translations, consecutive integers, rectangle geometry, age problems).

Blue – Additional Concepts

- Complicated distance, rate, time problems
- Solving and problem solving with basic inequalities
- Solving for a variable where factoring is required
- More complicated situations

Black – Additional Concepts

- Challenging problem solving exercises involving rates
- Solving and problem solving more complicated and/or abstract inequalities
- Solving for a variable where factoring is required
- Highly complex situations

Unit 2 – Converting Graphical, Symbolic, and Numerical Representation of Data

Green – Standard Concept

- Make scatter plots to display bivariate data and estimate lines of best fit to make conjectures
- Plot points in a coordinate plane
- Determine whether ordered pairs are solutions to equations
- Write equations in function form
- Students graph a linear equation using a table of values
- Students graph equations of horizontal and vertical lines
- Quickly create the graph of a linear equation by finding its x and y intercepts
- Find the slope of a line that passes through 2 points
- Determine whether the slope of a line is positive negative zero or undefined
- Write and graph equations that represent direct variations
- Students graph linear equations that are written in slope intercept form

- From a graph, students write equations for lines in both slope-intercept form and point-slope form, recognizing when each form is more beneficial.
- Students write an equation of a line given two points on the line.
- Given a point on a line, students write the equation of a line parallel to another line
- Write in slope-intercept form the equation of the line passing through the given point and perpendicular to the given point

Blue – Additional Concepts

- Pythagorean Theorem
- Deriving the equation of a line from a pattern seen from a set of ordered pairs
- Geometric Probability
- Reflections in the coordinate plane
- Using a table of values to graph the following functions

Blue Level Functions
Absolute Value Functions: $y = x $
Quadratic (Parabolic) Functions: $y = x^2$
Inverse (Hyperbolic) Functions: $y = \frac{1}{x}$
Exponential Functions: $y = 2^x$

- Midpoint Formula
- Reflections in the coordinate plane
- Graphing inequalities

Black – Additional Concepts

- Radicals
- Using a table of values to graph the following functions/relations

Black Level Functions/Relations
Step Functions: $y = [x]$
Cubic Functions: $y = x^3$
Circle Relations: $x^2 + y^2 = 1$

- Graphing inequalities
- Simple system of equations involving substitution
- Writing a linear inequality given a solution to the inequality and two points on the solution set's boundary line.
- Simple system of equations involving substitution
- Applying hyperbolic functions.
- Applying exponential functions

Unit 3 – Analyzing Patterns, Relations and Functions

Green – Standard Concept

- Students feel comfortable understanding stories that are told with graphs instead of words. Also, students graph relations and describe relations in a clear and complete manner.
- Sketch the graph of the following relation and explain why you sketched the graph as you did. Let x = the number of minutes you have been running and y = your speed
- Understand what a function is and related vocabulary: function, domain, range, input, output, independent variable, dependent variable, input-output table
- Be able to derive the equations of functions in simple real life situations
- Students continue to practice deriving equations for real life situations
- Students interpret (read) graphs representing a variety of real life situations
- Students understand what "Slope" and "Vertical Intercepts" mean when looking at a graph

Blue – Additional Concepts

- Students solve problems by **creating** and interpreting graphs of real life situations

Black – Additional Concepts

- none

Unit 4 – Point, Lines, and Planes

Green – Standard Concept

- Students visualize and solve problems in two and three dimensional space
- A. Demonstrate concept of points, lines, and planes
 - B. Describe the result when points, lines, and planes intersect.
 - C. Describe relationships between lines and planes in terms of parallel and skew
 - Identify the intersections of lines, line segments, and rays
 - Derive and apply formulas for the distances and midpoints of line segments
 - Students are able to create constructions using a straight edge and compass by reading directions provided

Blue – Additional Concepts

- 3-Dimensional Sketching
- Spherical Geometry
- Shows the relationship between distance and absolute value visually
- Find the midpoint of a segment that lies in the coordinate plane
- Students apply all previously mentioned constructions in context. Instructions are provided.
- Additionally, students are able to do the following construction:
- Given three points on a circle, locate the center of the circle.

Black – Additional Concepts

- Partitioning space

- Shows the relationship between distance and absolute value visually while solving more complicated absolute value equations.
- Students apply all previously mentioned constructions in an unfamiliar context in which the instructions are not provided.

Unit 5 – Linear Systems

Green – Standard Concept

- Students find the solutions to linear systems by using the graph-and-check method. They also recognize systems with many or no solutions.
- Students find the solutions to linear systems by using the substitution method.
- Students find the solutions to linear systems by using the linear combinations method.
- Students use linear systems to solve real life problems using the 4 step problem solving process.

Blue – Additional Concepts

- Graphically represent the solutions of a system of inequalities

Black – Additional Concepts

- Linear programming

Unit 6 – Exponents, Radicals and Pythagorean Theorem

Green – Standard Concept

- Understand the difference between linear and exponential growth.
- Write really big numbers using scientific notation (Review from Grade 7)
- Successfully use multiplication properties of exponents (Review from Grade 7)
- Write really small numbers using scientific notation (Review from Grade 7)
- Evaluate powers that have zero or negative exponents (Review from Grade 7)
- Graph exponential growth and decay functions
- Identify the domain and range of exponential functions
- Successfully apply division properties of exponents
- Understand, write, apply and graph exponential growth functions
- Understand square root vocabulary and evaluate square roots
- Solve (quadratic) equations where it's necessary to use square roots.
- Understand and apply the simplest form of a radical expression.
- Understand and apply the Pythagorean Theorem

Blue – Additional Concepts

- Factorials
- Deriving Exponential Functions
- Exponential Decay Functions
- Graph functions involving square roots
- Rational exponents
- Factorials

- Roots other than square roots

Black – Additional Concepts

- Combinations
- Deriving Exponential Functions
- Exponential Decay Functions
- Solve radical equations
- Distance Formula

Unit 7– Angle Pair Relationship

Green – Standard Concept

- Students are able to apply the angle addition postulate and solve problems that require an understanding of: linear pairs, adjacent angles, vertical angles, complementary and supplementary angles.
- Students are able to create constructions using a straight edge and compass by reading directions provided
- Students are able to solve problems that require an understanding of parallel lines intersected by a transversal. They are comfortable working with all interior and exterior angle pairs, and corresponding angle pairs. They are knowledgeable about the properties relating parallel lines and certain angles.
- Students solve problems involving their understanding of the following triangle properties: the sum of a triangle’s interior angles is 180 degrees; an exterior angle is equal in measure to the sum of the two remote interior angles
- Students are able to apply problem solving processes to situations involving special angle pairs.
- Students name and label corresponding parts of congruent triangles. They also use congruency tests to prove triangle congruence.

Blue – Additional Concepts

- Students apply all previously mentioned constructions in context. Instructions are provided.

Black – Additional Concepts

- Students apply all previously mentioned constructions in an unfamiliar context in which the instructions are not provided.
- Students are also familiar and able to apply the following in theorems in proofs:

If a triangle has two congruent sides, then the triangle has two congruent angles opposite those sides.

If a pair of alternate interior angles formed by a transversal of two lines are congruent, then the lines are parallel.

The measure of an exterior angle of a triangle equals the sum of the measures of the two non-adjacent interior angles.

The sum of the measures of the three angles of a triangle is 180 degrees.

The measure of the median on the hypotenuse of a right triangle is one-half the measure of the hypotenuse

Grade 7

Unit 1 – Algebraic Expressions and Integers

Green – Standard Concept

- Students write variable expressions for word phrases.
- Students correctly use the order of operations (+, −, ÷, ×) and grouping symbols
- Students evaluate variable expressions by substitution and solve word problems by evaluating expressions.
- Students represent, graph, and order integers. They also find opposites and absolute values.
- Students subtract positive and negative integers with the help of integer chips and by recognizing that subtracting is the same as adding the opposite.
- Students multiply and divide positive and negative integers
- Students name coordinates and quadrants in the coordinate plane. Students also graph ordered pairs in the coordinate plane

Blue – Additional Concepts

- More complicated situations, including the use of more than one variable for multiple unknowns
- Exponents
- Fraction operations
- Higher level reasoning problems involving variables and absolute values
- Additional problem solving and order of operations problems involving the multiplication and division of integers
- Finding the missing coordinate of a single point that will make lines perpendicular which are connected by a set of 4 points
- Areas of triangles and rectangles

Black – Additional Concepts

- Situations leading to equations with variables on both sides
- Exponents
- Factorials, determinants, and square roots
- Solving one-step absolute value equations - solve and show on a number line
- Additional problem solving involving integers
- Additional problem solving and order of operations problems involving the multiplication and division of integers
- Graphing equations of functions written in “ $y = \underline{\hspace{1cm}}$ ” form by generating a set of ordered pairs that make the equation true.

Unit 2 – Simplifying Expressions and Solving Basic Equations

Green – Standard Concept

- Students recognize how the commutative and associative properties demonstrate exceptions to the order of operations and improve their mental math skills through the

use of these properties. Students begin to apply the distributive property as a mental math tool and to simplify variable expressions

- Students apply the distributive property as a mental math tool and to simplify variable expressions. Students also identify parts of a variable expression.
- Students use Backtracking to solve complicated looking equations and learn to check if a solution makes an equation true by substitution.
- Students learn to solve and check solutions to basic, one-step equations using inverse operations
- Students solve, distance, rate, and time problems using their skills at solving one-step equations

Blue – Additional Concepts

- Distributing negatives in complicated expressions
- Finding and graphing solutions to 2 variable equations by recognizing that an ordered pair represents a single solution (of an infinite number of possibilities) to the equation
- Additional practice with word problems
- Related rate problems

Black – Additional Concepts

- Using algebra tiles and the distributive property to multiply binomials
- Writing 2 variable equations in function form.
- Related rate problems
- More complex related rate problems

Unit 3 – Factors, Fractions, and Exponents

Green – Standard Concept

- Students apply divisibility rules (for 2, 3, 5, 6, 9, and 10) and are able to find all factors of a number
- Students learn to work with exponents and to use the order of operations with exponents
- Students learn to find the prime factorization of a number, the greatest common factor (GCF) of two or more numbers, to find equivalent fractions and to write fractions in simplest form.
- Students learn to identify and graph rational numbers. They will also evaluate fractions containing variables.
- Students learn to multiply powers with the same base, find a power of a power, divide expressions containing exponents, simplify expressions with integer exponents, and understand the concept of a negative exponent.
- Learn to use scientific notation to write and evaluate very big and small numbers.
- Learn to calculate with scientific notation

Blue – Additional Concepts

- Divisibility rules for 4, 7, and 8
- Finding the total number of factors for a number
- Fraction addition and reciprocals

- Fraction Operations
- palindromic numbers
- the Fibonacci Sequence.
- square root
- Fraction operations
- Finding a general formula for a pattern involving exponents
- More practice with problems that call for division or addition of numbers written in scientific notation.
- Distance, rate, time applications

Black – Additional Concepts

- Divisibility rule for 11
- Factorials
- Intersection of 2 set
- Combinations
- Natural numbers
- Reciprocal of a decimal
- Factorial in fractions
- Abundant numbers
- Fraction operations
- Multiplying polynomials
- Factorials
- Probability
- Roots
- Finding a general formula for a pattern involving exponents
- More practice with problems that call for division or addition of numbers written in scientific notation.
- Distance, rate, time applications
- Problems involving factorials, reciprocals, and unit analysis

Unit 4 – Operations with fractions

Green – Standard Concept

- Students will learn to find the least common multiple and they will be able to compare fractions.
- Students are able to write fractions as decimals (repeating or terminating) and decimals (terminating) as fractions.
- Students are able to multiply fractions and are able to identify the real life situations that call for multiplying fractions
- Students are able to divide fractions. They also understand when real life situations call for dividing fractions
- Students are able to add and subtract fractions with like and unlike denominators.
- Students understand why common denominators are necessary for addition and subtraction

- Students are able to identify which operation is needed to solve a problem. They can multiply, divide, add and subtract fractions

Blue – Additional Concepts

- Finding number of factors
- The sum of three consecutive numbers is always a multiple of three
- Writing repeating decimals as fractions
- Multiplying fractions that include variable expressions
- Dividing rational expressions that include variable expressions
- Adding and subtracting rational algebraic expressions
- Solving equations involving fractions.
- Solving equations with variables on both sides

Black – Additional Concepts

- When LCM is a decimal
- Probability
- Finding the nth term in a geometric sequence
- Writing repeating decimals as fractions
- Square roots of rational numbers
- Introduction to irrational numbers, including a method for estimating the value of an irrational number
- Geometric sequences
- Factoring polynomials
- Multiplying binomials
- Factoring trinomials (coefficient of the quadratic term is 1)
- Solving equations with variables on both sides
- Special Cases : A number divided by its opposite equals -1. A number divided by itself equals 1 ($x + 5$ and $5 + x$ are equal). A number divided by its conjugate is nothing special.
- The Density Property of number.

Unit 5 – Solving Multi-Step Equations

Green – Standard Concept

- Students solve equations by multiplying fractions and improve their ability to develop equations that can be used to solve word problems.
- Students solve 2-step equations using Inverse Operations.
- Students get better at seeing the relationship between word problems and the equations used to solve them.
- Students combine like terms and use the distributive property to simplify and then solve multi-step equations.
- Students apply these skills to consecutive integer word problems
- Students use algebra to solve word problems

Blue – Additional Concepts

- 2-step equations involving fractions
- Writing multi-step equations to solve word problems

- Work problems
- Transposing Formulae
- Solving multi-step equations involving absolute values
- Problem solving emphasis
- Multi-step equations involving fractions
- Rate problems
- Equations with rational expressions and variables on both side
- Students solve equations with variables on both sides
- More problem solving (including distance, rate, time problems)

Black - Additional Concepts

- Writing multi-step equations with variables on both sides to solve complicated word problems
- Transposing Formulae
- Special Situations (Identity, No Solution)
- Introduction to Systems
- Graphing equations by calculating x and y intercepts.
- Solving systems of equations by graphing
- Problem Solving with Systems of Equations

Unit 6 - Area and Volume

Green - Standard Concept

- Students understand and apply area formulas for polygons. Students decompose irregular two dimensional shapes into smaller component shapes.
- Students understand and apply area and circumference formulas for circles. Students are also able to identify nets of space figures.
- Students find surface areas of prisms and cylinders
- Students find volumes of prisms, pyramids, and cylinders.

Blue - Additional Concepts

- Similar triangles
- Pythagorean Theorem
- Using the Pythagorean theorem to find the slant heights in surface area problems.

Black - Additional Concepts

- The relationship between side lengths in Right, Isosceles Triangles.
- Heron's Formula
- The relationship between side lengths in Right, Isosceles Triangles
- Packaging problems
- Multiplying binomials

Unit 7 - Data Analysis

Green - Standard Concept

- In addition to the median, students determine the 25th and 75th percentiles (1st and 3rd quartiles) to obtain information about the spread of data. Students use box-and-whisker plots to convey this information
- Students apply percentages to make and interpret histograms

Blue - Additional Concepts

- Misleading graphs and choosing the most appropriate data display

Black - Additional Concepts

- Misleading graphs and choosing the most appropriate data display