Math MS Level 3 (9175) Course Overview Curriculum Document

Course Description

Students begin grade 8 with transformational geometry. They study rigid transformations and congruence, then dilations and similarity (this provides background for understanding the slope of a line in the coordinate plane). Next, they build on their understanding of proportional relationships from grade 7 to study linear relationships. They express linear relationships using equations, tables, and graphs, and make connections across these representations. They expand their ability to work with linear equations in one and two variables. Building on their understanding of a solution to an equation in one or two variables, they understand what is meant by a solution to a system of equations in two variables. They learn that linear relationships are an example of a special kind of relationship called a function. They apply their understanding of linear relationships and functions to contexts involving data with variability. They extend the definition of exponents to include all integers, and in the process codify the properties of exponents. They learn about orders of magnitude and scientific notation in order to represent and compute with very large and very small quantities. They encounter irrational numbers for the first time and informally extend the rational number system to the real number system, motivated by their work with the Pythagorean Theorem.

Credits	Prerequisites
N.A.	MS Math Level 2

Board Approved	Revised
September 2013	June 2019, June 2022, June 2023

Required Assessments

District-wide, standards-based common summative assessments

Textbooks/Resources

Illustrative Mathematics. (2020). *Middle School Math: Grade 8*. Kendall Hunt.

Course Essential Understandings

As a result of successfully completing this course, students will understand that:

- Making sense of patterns through analyzing concrete, visual, and abstract representations and identifying connections between these help deepen their understanding of important mathematical concepts and relationships.
- To be successful mathematical thinkers, students must strategically choose appropriate tools and strategies while analyzing their progress to adjust and persevere towards a solution.

Course Relevance Questions

- How can our experience with transformations deepen our understanding of the connections between different models of linear relationships?
- How will our ability to represent relationships in multiple ways support us in making sense of equations, systems of equations, data, functions, exponents, irrational numbers, and 2D and 3D figures?

Unit Overviews

Unit Name	Unit Description	Unit Relevance Question	Instructional Standards	Assessed Standards
Unit 1 Rigid Transformations and Congruence	In this unit, students learn to understand and use the terms “reflection,” “rotation,” “translation,” recognizing what determines each type of transformation. They identify and describe translations, rotations, and reflections, and sequences of these, using the terms “corresponding sides” and “corresponding angles,” and recognizing that lengths and angle measures are preserved. They draw images of figures under rigid transformations on and off square grids and the coordinate plane. They use rigid transformations to generate shapes and to reason about measurements of figures. They learn to understand congruence of plane figures in terms of rigid transformations. Students use the definition of “congruent” and properties of congruent figures to justify claims of congruence or non-congruence.	• What patterns can we find between pre-images and their images formed through rigid transformations? • How does knowing two figures are congruent or similar help one to solve problems?	M.8.G.A.1 M.8.G.A.3 M.8.G.A.1.a M.8.G.A.1.b M.8.G.A.1.c M.8.G.A.2 M.8.G.A.5	M.8.G.A
Unit 2 Dilations, Similarity, and Introducing Slope	In this unit, students learn to understand and use the term “dilation,” and to recognize that a dilation is determined by a point called the “center” and a number called the “scale factor.” They draw images of figures under dilations on and off the coordinate plane. They use the terms “corresponding sides” and “corresponding angles” to describe correspondences between a figure and its dilated image, and recognize that angle measures are preserved, but lengths are multiplied by the scale factor. They learn to understand similarity of plane figures in terms of rigid transformations and dilations. They use the definition of “similar” and properties of similar figures to justify claims of similarity or non-similarity. Students learn the terms “slope” and “slope triangle,” and use the similarity of slope triangles on the same line to understand that any two distinct points on a line determine the same slope.	• What patterns can we find between pre-images and their images formed through rigid transformations? • How does knowing two figures are congruent or similar help one to solve problems?	M.8.G.A M.8.G.A.3 M.8.G.A.2 M.8.G.A.4 M.8.G.A.5 M.8.EE.B.6	M.8.EE.B
Unit 3 Linear Relationships	In this unit, students learn to understand and use the terms “rate of change,” “linear relationship,” and “vertical intercept.” They deepen their understanding of slope, and they learn to recognize connections among rate of change, slope, and constant of proportionality, and between linear and proportional relationships. They represent linear relationships with tables, equations, and graphs that include lines with negative slopes or vertical intercepts, and horizontal and vertical lines. They learn to use the term	• How does representing relationships between variables in more than one way deepen our understanding of linear relationships? • How is understanding the key characteristics of a linear relationship helpful?	M.8.EE.B M.8.EE.B.5 M.8.EE.B.6 M.8.G.A.1 M.8.EE.C M.8.EE.C.8.a	M.8.EE.B

	"solution of an equation" when working with one or two linear equations in two variables, and learn to understand the graph of a linear equation as the set of its solutions.			
Unit 4 Linear Equations and Linear Systems	In this unit, students write and solve linear equations in one variable. Students also write and solve systems of linear equations in two variables and interpret the solutions in the contexts from which the equations arose. They learn what is meant by a solution for a system of equations, namely that a solution of the system is a solution for each equation in the system. Students learn to understand and use the terms "system of equations," "solution for the system of equations," "zero solutions," "no solution," "one solution," and "infinitely many solutions."	• How do I use linear equations to represent, analyze, and solve a variety of problems?	M.8.EE.C M.8.EE.C.7 M.8.EE.C.7.b M.8.EE.C.7.a M.8.EE.C.8 M.8.EE.C.8.a M.8.EE.C.8.b M.8.EE.C.8.c	M.8.EE.C
Unit 5 Functions and Volume	In this unit, students are introduced to the concept of a function. They learn to understand and use the terms "input," "output," and "function," e.g., "temperature is a function of time." They use tables, equations, and graphs to represent functions, and describe information presented in tables, equations, or graphs in terms of functions. In working with linear functions, students coordinate and synthesize their understanding of "constant of proportionality" (which was introduced in grade 7), "rate of change" and "slope" (which were introduced earlier in grade 8), and increasing and decreasing. Students perceive similarities in structure between pairs of known and new volume formulas: for a rectangular prism and a cylinder; and for a cylinder and a cone. Students rearrange these formulas to show functional relationships and use them to reason about how the volume of a figure changes as another measurement changes.	• How is understanding the key characteristics of a function helpful? • How can graphs be used to tell a story?	M.8.F.A M.8.F.A.1 M.8.F.A.2 M.8.F.A.3 M.8.F.B M.8.F.B.4 M.8.F.B.5 M.8.G.C M.8.G.C.9	M.8.F.B M.8.G.C.
Unit 6 Associations in Data	In this unit, students generate and work with bivariate data sets that has more variability than in previous units. They learn to understand and use the terms "scatter plot" and "association," and describe associations as "positive" or "negative" and "linear" or "non-linear." Students describe scatter plots, using a term previously used to describe univariate data "cluster," and the new term "outlier." They fit lines to scatter plots and informally assess their goodness of fit by judging the closeness of the data points to the lines, and compare predicted and actual values. Students learn to understand and use the terms "two-way table," "bar graph," and "segmented bar graph," using two-way tables to investigate categorical data.	• Why is it important to analyze and describe patterns of an association between two quantities?	M.8.SP.A.1 M.8.SP.A.2 M.8.SP.A.3 M.8.SP.A.4	M.8.SP.A
Unit 7 Exponents and Scientific Notation	In grade 6, students studied whole-number exponents. In this unit, they extend the definition of exponents to include all integers, and in the process codify the properties of exponents. They apply these concepts to the base-ten system, and learn about orders of magnitude and scientific notation in order to represent and compute with very large and very small quantities.	• How can we use patterns to help determine whether two expressions involving exponents are equivalent?	M.8.EE.A.1 M.8.EE.A.3 M.8.EE.A.4	M.8.EE.A
Unit 8 Pythagorean Theorem and Irrational Numbers	In this unit, students work with geometric and symbolic representations of square and cube roots. They understand and use notation such as $\sqrt{2}$ and $\sqrt[3]{5}$ for square and cube roots. They understand the terms "rational number" and "irrational number," using long division to express fractions as decimals. They use their understanding of fractions to plot rational numbers on the number line and their understanding of approximation of irrationals by rationals to approximate the number-line location of a given irrational. Students learn (without proof) that $\sqrt{2}$ is irrational. They understand two proofs of the Pythagorean Theorem—an algebraic proof that involves manipulation of two expressions for the same area and a geometric proof that involves decomposing and rearranging two squares. They use the Pythagorean Theorem in two and three dimensions, e.g., to determine lengths of diagonals of rectangles and right rectangular prisms, and to estimate distances between points in the coordinate plane.	• How can we use patterns to help make sense of irrational numbers? • How can the Pythagorean Theorem be used to solve problems about real-world situations?	M.8.NS.A.1 M.8.NS.A.2 M.8.EE.A.2 M.8.F.B M.8.NS.A M.8.G.B M.8.G.B.6 M.8.G.B.7 M.8.G.B.8	M.8.G.B