NOBLESVILLE SCHOOLS CURRICULUM

Mathematics

Pre-Algebra

This includes both 7th grade Bridges and 8th grade Academic Courses

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The Indiana Academic Standards define what students should know, understand, and be able to do at grade level beginning in kindergarten and progressing through grade twelve. These standards serve as the foundation to our curriculum in Noblesville Schools but are not a curriculum on their own. The Indiana Academic Standards are supported through grade-level, content-area curriculum maps. These curriculum maps and materials are aligned to the Indiana Academic standards while also providing the conditions necessary to be responsive to the needs of all learners. Therefore, these maps are revised on a yearly basis.

In addition to the academic grade level standards for math are the Indiana Mathematics Process Standards. These standards represent the ways k-12 students should develop conceptual understanding of math content and the ways students should apply mathematical skills. For example, process standard 3, “Construct viable arguments and critique the reasoning of others” refers to the critical mathematical skill of explaining one’s own strategies and ideas as well as having discussions with other students who may have used different strategies or arrived at different answers. These skills serve math students at all grades and levels, and are identified here.

- PS.1: Make sense of problems and persevere in solving them.
- PS.2: Reason abstractly and quantitatively.
- PS.3: Construct viable arguments and critique the reasoning of others.
- PS.4: Model with mathematics.
- PS.5. Use appropriate tools strategically.
- PS.6. Attend to precision.
- PS.7. Look for and make use of structure.
- PS.8.Look for and express regularity in repeated reasoning.

In eighth grade, instructional time is focused on both these process standards and the academic standards, which include number sense, computation, algebraic thinking, geometry, measurement, and data analysis. Some key concepts for seventh grade include the following:

- *Functions:* From Keep Indiana Learning, 2022: “The concept of functions grows out of the ratio work in 6th grade and the proportionality work in 7th grade. We continue the concept of rate of change and extend y=kx to y=mx + b. The constant of proportionality in 7th grade now becomes the rate of change and slope.”

- *Data:* Eighth grade students construct and interpret scatterplots and describe patterns such as clusters, outliers, and associations that are positive or negative and linear or nonlinear.

- *Equations:* In seventh grade, students worked with two-step equations. In eighth grade, they will work with multi-step equations that have one solution, no solutions, or infinite solutions in eighth grade. Systems of equations are also introduced with an emphasis on solving by graphing only.

- *Number sense:* Students work with laws of exponents, comparing irrational numbers, and solving real-world problems with rational numbers, including exploring expanded form. Operations with rational numbers are also high priority.

- *Geometry*-two important concepts are the Pythagorean Theorem and transformations.

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Mathematics

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The following units are based on Amplify Desmos's recommended unit order, pacing, and areas of focus. Teachers are using the pacing of this curriculum for the first time during the 23-24 school year and may supplement the units with additional lessons or concepts as needed. Units and pacing will be revised at the end of the year based on feedback from teachers. Families are encouraged to preview units and read through the caregiver resources provided for each unit, which provide additional information, specific vocabulary, and questions to spark mathematical conversation within the unit.

Unit Description	Indiana Academic Standards
Unit One: Rigid Transformations and Congruence Students begin Grade 8 by joining talented architects, artists, and mathematicians in the study of two-dimensional figures. Equipped with their geometry toolkits, students manipulate familiar figures with new methods, and make key discoveries along the way. **Essential Questions:** ● What happens to a figure as you move it around a two-dimensional plane? ● What does it mean for two figures to be "the same"? ● Do the measures of the interior angles of a triangle really add up to 180°? *Want to learn more? Click here for family support resources for unit one.*	8.GM.3-Verify experimentally the properties of rotations, reflections, and translations, including: lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines. 8.GM.4-Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations. Describe a sequence that exhibits the congruence between two given congruent figures. 8.GM.6-Explore dilations, translations, rotations, and reflections on two-dimensional figures in the coordinate plane

NOBLESVILLE SCHOOLS CURRICULUM

Mathematics

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Unit Two: Dilations and Similarity Students explore a new type of transformation, dilations, and practice using dilations to create and recognize similar figures. Students' understanding of the characteristics of these similar figures, of similar triangles, specifically, will serve as the foundation for their study of the slope of a line. **Essential Questions** ● What does it mean to dilate a figure? ● How can you identify whether two figures are similar? ● How can similar triangles be used to find the slope of a line? *Want to learn more? Click here for family support resources for unit two*.	8.GM.2-Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres. 8.GM.3-Verify experimentally the properties of rotations, reflections, and translations, including: lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines. 8.GM.4-Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations. Describe a sequence that exhibits the congruence between two given congruent figures. 8.GM.5-Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. Describe a sequence that exhibits the similarity between two given similar figures. 8.GM.6-Explore dilations, translations, rotations, and reflections on two-dimensional figures in the coordinate plane.

NOBLESVILLE SCHOOLS CURRICULUM

Mathematics

Pre-Algebra

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Unit Three: Linear Relationships Students make connections between the rate of change, slope, and the constant of proportionality, drawing on previous knowledge to explore an exciting new relationship: the linear relationship. **Essential Questions** ● What does the slope of a line tell you about the line? ● What can proportional relationships teach you about linear relationships? ● What does it mean for an ordered pair to be a solution to a linear equation? *Want to learn more? Click here for family support resources for unit three.*	8.AF.1-Solve linear equations and inequalities with rational number coefficients fluently, including those whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and inequalities in one variable and solve such problems. 8.AF.2-Generate linear equations in one variable with one solution, infinitely many solutions, or no solutions. Justify the classification given. 8.AF.3-Understand that a function assigns to each x-value (independent variable) exactly one y-value (dependent variable), and that the graph of a function is the set of ordered pairs (x,y). 8.AF.5-Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equation 8.AF.6-Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem. 8.AF.7-Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed). 8.AF.8-Understand that solutions to a system of two linear equations correspond to points of intersection of their graphs because points of intersection satisfy both equations simultaneously. Approximate the solution of a system of equations by graphing and interpreting the reasonableness of the approximation. 8.GM.3-Verify experimentally the properties of rotations, reflections, and translations, including: lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.

NOBLESVILLE SCHOOLS CURRICULUM

Mathematics

Pre-Algebra

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Unit Four: Linear Equations and Systems of Linear Equations Students begin the unit by developing algebraic methods for solving linear equations with variables on both sides of the equation. They then use these algebraic methods, along with graphs and tables, to solve systems of linear equations. **Essential Questions** ● How can you determine the solution to an equation with variables on both sides? ● What does the number of solutions (none, one, or infinite) to a system of linear equations represent? ● How can systems of equations be used to represent situations and solve problems? *Want to learn more? Click here for family support resources for unit four.*	8.AF.1-Solve linear equations and inequalities with rational number coefficients fluently, including those whose solutions require expanding expressions using the distributive property and collecting like terms. Represent real-world problems using linear equations and inequalities in one variable and solve such problems. 8.AF.2-Generate linear equations in one variable with one solution, infinitely many solutions, or no solutions. Justify the classification given. 8.AF.8-Understand that solutions to a system of two linear equations correspond to points of intersection of their graphs because points of intersection satisfy both equations simultaneously. Approximate the solution of a system of equations by graphing and interpreting the reasonableness of the approximation.

NOBLESVILLE SCHOOLS CURRICULUM

Mathematics

Pre-Algebra

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Unit Five: Functions and Volume By the end of the unit, students will have derived the formulas for the volumes of cylinders, cones, and spheres. But it all starts with a deep dive into the concept of what makes a relationship a function at the beginning of the unit. **Essential Questions** ● What makes a relationship a function? ● How can you compare multiple representations of linear functions to determine which is changing at a faster rate or which is slower? ● How are the volumes of a cylinder, cone, and sphere related if their dimensions are the same? *Want to learn more? Click here for family support resources for unit five.*	8.AF.3-Understand that a function assigns to each x-value (independent variable) exactly one y-value (dependent variable), and that the graph of a function is the set of ordered pairs (x,y). 8.AF.4-Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear, has a maximum or minimum value). Sketch a graph that exhibits the qualitative features of a function that has been verbally described. 8.AF.5-Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. Describe similarities and differences between linear and nonlinear functions from tables, graphs, verbal descriptions, and equation 8.AF.6-Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Recognize in y = mx + b that m is the slope (rate of change) and b is the y-intercept of the graph, and describe the meaning of each in the context of a problem. 8.AF.7-Compare properties of two linear functions given in different forms, such as a table of values, equation, verbal description, and graph (e.g., compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed). 8.GM.1-Identify, define, and describe attributes of three-dimensional geometric objects (right rectangular prisms, cylinders, cones, spheres, and pyramids). Explore the effects of slicing these objects using appropriate technology and describe the two-dimensional figure that results. 8.GM.2-Solve real-world and other mathematical problems involving volume of cones, spheres, and pyramids and surface area of spheres.

NOBLESVILLE SCHOOLS CURRICULUM

Mathematics

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Unit Six: Exponents and Scientific Notation This unit is about the numbers so large and so small that students must develop new ways of working with them. Students deepen their knowledge of exponents before exploring how powers of 10 and scientific notation can be used to write and work with numbers as small as the mass of a bacterium or as large as the number of atoms in the Universe. **Essential Questions** ● What happens when expressions containing exponents are multiplied or divided? ● Is there a more efficient way to write really small and really large numbers? ● What strategies can be used when working with very large and very small numbers? *Want to learn more? Click here for family support resources for unit six.*	8.NS.3-Given a numeric expression with common rational number bases and integer exponents, apply the properties of exponents to generate equivalent expressions. 8.C.2-Solve real-world and other mathematical problems involving numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology, such as a scientific calculator, graphing calculator, or excel spreadsheet.
Unit 7: Irrationals and the Pythagorean Theorem Students study rational and irrational numbers using geometry and expressions before exploring a proof of the Pythagorean Theorem. **Essential Questions** ● What is the difference between a rational number and an irrational number? ● How can you estimate the square root of a number? And what does it represent? ● Is it true that leg2 + leg2 = hypotenuse2 for all right triangles? If so, can you prove it? *Want to learn more? Click here for family support resources for unit seven.*	8.NS.1-Give examples of rational and irrational numbers and explain the difference between them. Understand that every number has a decimal equivalent. For rational numbers, show that the decimal equivalent terminates or repeats, and convert a repeating decimal into a rational number. 8.NS.2-Use rational approximations of irrational numbers to compare the size of irrational numbers, plot them approximately on a number line, and estimate the value of expressions involving irrational numbers. 8.NS.4-Use square root symbols to represent solutions to equations of the form x^2 = p, where p is a positive rational number 8.C.1-Solve real-world problems with rational numbers by using multiple operations. 8.GM.7-Use inductive reasoning to explain the Pythagorean relationship. 8.GM.8-Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and other mathematical problems in two dimensions. 8.GM.9-Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane.

NOBLESVILLE SCHOOLS CURRICULUM

Mathematics

Pre-Algebra

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Unit 8: Associations in Data What makes a cat logo consumer friendly? Is there a relationship between eye distance and height for a specifies of krills? Are adults just as likely to ride a bike as kids? Did the hole in the ozone layer have an association with skin cancer rates in Australia? In this unit, students will grapple with these questions and more, as they discover new ways to represent associations in data and build their data literacy. **Essential Questions** ● What is a scatter plot? And what can it tell you ? ● How can you model data in a scatter plot? And what does that model tell you? ● What associations can you find, if any, in bivariate data? *Want to learn more? Click here for family support resources for unit eight.*	8.DSP.1-Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantitative variables. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. 8.DSP.2-Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and describe the model fit by judging the closeness of the data points to the line. 8.DSP.3-Write and use equations that model linear relationships to make predictions, including interpolation and extrapolation, in real-world situations involving bivariate measurement data. Interpret the slope and y-intercept in context. 8.DSP.4-Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. Understand and use appropriate terminology to describe independent, dependent, complementary, and mutually exclusive events. 8.DSP.5-Represent sample spaces and find probabilities of compound events (independent and dependent) using organized lists, tables, and tree diagrams. 8.DSP.6-For events with a large number of outcomes, understand the use of the multiplication counting principle. Develop the multiplication counting principle and apply it to situations with a large number of outcomes.