Davison Community Schools

ADVISORY CURRICULUM COUNCIL

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Lorie Smith, Amy Gottlieb, Amber Rogers, Janet Davidson, Matt Lobban, Sarah-Smith Clark

7th and 8th Grade Pre-Algebra - General and Resource Room

Course Essential Questions:

- What relationships can be modeled with linear equations and what characteristics of the relationship are found in the equation?
- How do we solve linear equations?
- What is a function?
- How is congruence and similarity affected by translations, rotations, reflections, and dilations?
- What is the Pythagorean Theorem and how does it help us to find lengths and analyze polygons?
- How do we find the volume of cones, cylinders, and spheres?

Unit 1: The Number System: Non calculator unit

Essential Question(s)	Essential Understanding(s)
● What is the difference between rational and irrational numbers? ● How do you convert rational numbers in various forms? ● How do you approximate an irrational number? ● Where are irrational numbers located on a number line?	● I know that a rational number is an integer, fraction, terminating or repeating decimal. ● I know that an irrational number is a non ending decimal or non perfect square that cannot be written as a fraction. ● A rational number can be converted to different forms: fractions, decimals, integers ● I know that an irrational will fall between two integers on a number line.

Curriculum Standards (DOK):

CC.8.NS.1. (DOK 1)*Know that there are numbers that are not rational, and approximate them by rational numbers.* Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

CC.8.NS.2 (DOK 1,2)*Know that there are numbers that are not rational, and approximate them by rational numbers.* Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). For example, by truncating the decimal expansion of √2 (square root of 2), show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
Without a Calculator I Know... ● Difference between rational and irrational numbers. ● How to write rational numbers as fractions and decimals. ● How to convert a fraction into a terminating or repeating decimal and visa versa. ● How to approximate an irrational number as a	Without a Calculator I Can... ● Restate the definition of rational and irrational numbers and give examples ● Show that the decimal expansion of rational numbers repeats eventually ● Convert a decimal expansion which repeats eventually into a rational number

rational number. ● How to locate and order irrational numbers on a number line. ● Irrationals numbers fall between integers on a number line	● Show that every number has a decimal expansion ● Approximate irrational number as rational numbers ● Approximately locate and order irrational numbers on a number line ● Estimate the value of expression involving irrational numbers using rational approximations without a calculator

Unit 2: Exponents and Scientific Notation	
Essential Question(s) ● What are the different properties of exponents? ● What are square roots and cube roots used for? ● How do you write numbers in scientific notation? ● How do you convert numbers in scientific notation to standard form? ● How do you multiply and divide numbers in scientific notation? ● How do you interpret scientific notation using technology?	**Essential Understanding(s)** • I know the Properties of Exponents including Zero Exponent Property, Negative Exponent Property, and Multiplying and Dividing Exponents • Use square root and cube root symbols to represent solutions to equations • Scientific notation is used to write very large and small numbers.

Curriculum Standards (DOK):

CC.8.EE.1 (DOK 1) *Work with radicals and integer exponents.* Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3^2 × 3^(–5) = 3^(–3) = 1/(3^3) = 1/27.
CC.8.EE.2 (DOK 1) *Work with radicals and integer exponents.*
Use square root and cube root symbols to represent solutions to equations of the form x^2 = p and x^3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.
CC.8.EE.3 (DOK 1,2) *Work with radicals and integer exponents.* Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3 × 10^8 and the population of the world as 7 × 10^9, and determine that the world population is more than 20 times larger.
CC.8.EE.4 (DOK 1,2) *Work with radicals and integer exponents.* Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● The properties of exponents: Zero Exponent Property, Negative Exponent Property, Multiplying and Dividing Exponents ● Cube roots are x^3 and represent the side of a cube. ● Square roots are x^2 and represent the side of a square. ● Scientific notation is a way to express very large or very small numbers. ● How to Interpret scientific notation when generated by technology	● Explain why a zero exponent produces a value of one and apply it. ● Apply the negative exponent property ● Explain and apply the multiplication and division properties of integer exponents. ● Use square root and cube root symbols as inverse operations to represent solutions to equations of the form x^2= p and x^3=p, where p is a positive rational number. ● Express numbers as a single digit times an integer power of 10 (Scientific Notation). ● Use scientific notation to estimate very large and/or very small quantities. ● Multiply and divide numbers in scientific notation in order to compare growth or decay. ● Compare quantities in scientific notation to express how much larger one is compared to the

	other. ● Perform operations using numbers expressed in scientific notations and decimals. Interpret scientific notation that has been generated by technology (ie. calculator displays). Choose appropriate units of measure when using scientific notation.

Unit 3: Equations	
Essential Question(s) ● How can you solve a linear equation? ● What are the types of solutions an equation can have? ● How can equations be used to model and solve real world problems?	**Essential Understanding(s)** ● Solve linear equations by isolating the variable ● Combine like terms ● Distributive property ● Number of solutions of linear equation
Curriculum Standards (DOK):	
CC.8.EE.7 (DOK 1,2) *Analyze and solve linear equations and pairs of simultaneous linear equations.* Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● Linear Equations using two-step, multi-step, variables on both sides ● What like terms are ● What is the Distributive Property ● Real world problems can be set up and solved using equation. ● Equations can have one solution, infinitely many solutions, or no solutions.	● I can solve linear equations with rational number coefficients ● I can solve linear equations by combine like terms ● I can solve linear equations using the distributive property and collecting like terms ● Write and solve multi-step equations with variables on both sides ● I can determine if an equation has one solution, infinitely many solutions or no solutions

Unit 4: Functions	
Essential Question(s) ● What is a linear function? ● What does slope represent? ● If you have two functions, how do you know which is greater?	**Essential Understanding(s)** ● A linear function makes a line and assigns one output to each input. ● Slope is the steepness of the line and can be represented in an equation, graph, table, or two points. ● You can use various ways to solve slope. (example: rise/run, y2-y2/x2-x1, y/x ● A function with the biggest slope is the greater function.

Curriculum Standards (DOK):

CC.8.F.1 (DOK 1,2) *Define, evaluate, and compare functions.* Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (Function notation is not required in Grade 8.)

CC.8.F.2 (DOK 1,2) *Define, evaluate, and compare functions.* Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.

CC.8.F.3 (DOK 1,2) *Define, evaluate, and compare functions.* 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. For example, the function A = s^2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

CC.8.EE.6 (DOK 1,2,3) Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation *y=mx + b* for a line through the origin and the equation *y= mx + b* for a line intercepting the vertical axis at *b*.

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● A linear function assigns one output for each input and makes a line. ● Slope can be determined from an equation in slope intercept form (y=mx+b) ● Slope can be determined from a graph by using rise/run and y intercept. ● Slope can be determined from a table by using the change in y over the change in x. ● Slope can be determined from two points by using y2-y1/x2-x1. ● When comparing functions, a function with the biggest slope is the greater function.	● I understand that a function is a rule that assigns each input to exactly one output ● I can determine slope and y intercept from an equation, graph, table, and two points. ● I can compare properties of two function represented in different ways (table, equation, graph, and verbal description) ● I can determine if a function is linear or nonlinear

Unit 5: Rate of Change	
Essential Question(s) ● What is rate of change and initial value? ● How can you turn a description of a situation into a graph form?	**Essential Understanding(s)** ● Rate of change is slope but describes a situation. ● Rate of change compares two quantities that are changing. ● Initial value is the point where situation starts or in a graph it is where it crosses the y axis. ● When you are given a verbal description, you can determine what the graph will look like based on interpretation of the situation.
Curriculum Standards (DOK):	
CC.8.F.4 (DOK 1,2,3) *Use functions to model relationships between quantities.* Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values. **CC.8.F.5 (DOK 1,2,3)** *Use functions to model relationships between quantities.* Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally. **CC.8.EE.5 (DOK 1,2,3)** Graph proportional relationships, interpreting the unit rate as the slope of a graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equations to determine which of two moving objects has greater speed.*	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● Rate of change is slope but describes a situation where you interpret two quantities. • Rate of change can be solved by using rise/run, y2-y2/x2-x1, y/x and attaching labels to what your numbers represent. ● Initial value is the point where situation starts or in a graph it is where it crosses the y axis. ● A verbal description has key words or situations that you can use to make a graph.	● I can determine rate of change and initial value of linear functions in different ways (table, graph, equation, verbal description) ● I can describe the relationship between two quantities ● I can sketch a graph from a verbal or written description

Unit 6: Systems

Essential Question(s)	Essential Understanding(s)
● What does a system represent? ● What does a solution to a system represent? ● What are the possibilities of solutions of linear equations?	● A system is two or more simultaneous linear equations ● Understand that a solution to a system is the point of intersection of the two equations. ● Systems can have one solution, infinitely many solutions, or no solutions.

Curriculum Standards (DOK):

CC.8.EE.8a (DOK 1,2,3) *Analyze and solve linear equations and pairs of simultaneous linear equations.* Analyze and solve pairs of simultaneous linear equations.
a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
CC.8.EE.8b (DOK 1,2,3) *Analyze and solve linear equations and pairs of simultaneous linear equations.* Analyze and solve pairs of simultaneous linear equations.
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.
CC.8.EE.8c (DOK 1,2,3) *Analyze and solve linear equations and pairs of simultaneous linear equations.* Analyze and solve pairs of simultaneous linear equations.
c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Knowledge/Content I Know …	Skills/Processes I Can …
● A system contains two or more equations. ● A solution to a system is the point of intersection of the two lines. ● A solution to a system will work in both equations. ● Systems can be solved by several methods: graphing, substitution, or elimination. ● A system can have one solution, no solutions, or infinitely many solutions. ● A system can apply to many real-world situations.	● I can understand solutions to system correspond to points of intersection ● I can determine whether a point satisfies both equations simultaneously ● I can solve a system of equations by graphing ● I can solve a system of equations by substitution ● I can solve a system of equations by elimination ● I can identify the number of solutions in a system of linear equations algebraically ● I can solve real-world problems using two linear equations in two variables.

Unit 7: Pythagorean Theorem

Essential Question(s)

1. What is the Pythagorean Theorem?
2. How does the Pythagorean Theorem work to prove a triangle is right?
3. How does the distance formula relate to the Pythagorean Theorem?

Essential Understanding(s)

- Pythagorean Theorem is $a^2 + b^2 = c^2$ and it is used in right triangles to find missing lengths.
- The distance formula D= $\sqrt{(\square_2 - \square_1)^2}$ +$\sqrt{(\square_2 - \square_1)^2}$ is a way to find the hypotenuse of a right triangle.
- Right triangle are often found in three dimensional figures so the Pythagorean Theorem can be used to determine real-world situations.

Curriculum Standards (DOK):

CC.8.G.6 (DOK 2,3) *Understand and apply the Pythagorean Theorem.* Explain a proof of the Pythagorean Theorem and its converse.
CC.8.G.7 (DOK 1,2) *Understand and apply the Pythagorean Theorem.* Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
CC.8.G.8 (DOK 1,2) *Understand and apply the Pythagorean Theorem.* Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
• Pythagorean Theorem is $a^2 + b^2 = c^2$ • Pythagorean Theorem only works for a right angle. • Legs form the right angle and the hypotenuse is the longest side across from the right angle. • To use the Pythagorean Theorem to find the missing length of a three dimensional figure. • To use the Pythagorean Theorem to find the distance between two point. • To use the Distance Formula, D= $\sqrt{(\square_2 - \square_1)^2}$ +$\sqrt{(\square_2 - \square_1)^2}$	• I can explain a proof of the Pythagorean Theorem and its converse. • I can use the Pythagorean Theorem to solve applied problems to find missing side lengths. • I can use the formula to solve three dimensional real-world problems. • I can use the Pythagorean Theorem and distance formula to solve applied problems.

Unit 8: Angles	
Essential Questions:	**Essential Understandings:**
● What different types of angles are there? ● How do angles relate when you have parallel lines that are cut by a transversal? ● What is the angle-angle criterion for similarity of triangles?	● There are vertical, adjacent, supplementary, complementary, corresponding, exterior angle theorem and alternate interior angles. ● The angles are formed when parallel lines are cut by a transversal. ● Figures are congruent is they satisfy the angle-angle criterion for similarity of triangles (SSS, SAS, ASA).
Curriculum Standards (DOK):	
CC.8.G.1b (DOK 2) *Understand congruence and similarity using physical models, transparencies, or geometry software.* Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines. **CC.8.G.5 (DOK 1,2,3)** *Understand congruence and similarity using physical models, transparencies, or geometry software.* Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the three angles appear to form a line, and give an argument in terms of transversals why this is so.	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● Parallel lines cut by a transversal form many types of angles and angle relationships including vertical, adjacent, supplementary, complementary, corresponding, exterior angle theorem, and alternate interior angles. ● Congruent polygons can be proven by angle-angle criterion (SSS, SAS, ASA). ● The Exterior Angle Theorem can be used to find the measure of exterior angles.	● Identify types of angles and find their measures ● Identify parallel lines and the angle(s) formed by cutting with a transversal ● Use angle criterion to show congruence ● Find exterior angles of triangles

Unit 9: Transformations	
Essential Questions:	
● What is a transformation? ● What types of transformations are there?	● A transformation is a movement of a shape on the coordinate plane. ● There are translations, rotations, reflections, and dilations.
Curriculum Standards (DOK):	
CC.8.G.1b (DOK 2) *Understand congruence and similarity using physical models, transparencies, or geometry software.* Verify experimentally the properties of rotations, reflections, and translations: a.Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines. **CC.8.G.2 (DOK 1,2)** *Understand congruence and similarity using physical models, transparencies, or geometry software.* 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; given two congruent figures, describe a sequence that exhibits the congruence between them. **CC.8.G.3 (DOK 1,2)** *Understand congruence and similarity using physical models, transparencies, or geometry software.* Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates. **CC.8.G.4 (DOK 1,2)** *Understand congruence and similarity using physical models, transparencies, or geometry software.* 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; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● A transformation is a movement of a shape on the coordinate plane. ● A translation is a slide of a figure on the coordinate plane. It does not change size or shape, only position. ● A reflection is a flip of a figure over a given line. It does not change size or shape ● A rotation is a turn of a figure about a fixed point. It does not change size or shape. ● A dilation is the enlargement or reduction of a figure by a given scale factor.	● Graph and describe translations in the coordinate plane ● Graph reflections in the coordinate plane and to identify lines of symmetry ● Graph rotations and to identify rotational symmetry ● Graph dilations to determine the scale factor of a dilation ● Graph a figure that undergoes a sequence of transformations.

Unit 10: Scatter Plots	
Essential Questions:	**Essential Understandings:**
● What is a scatter plot? ● What does a scatter plot represent? ● What is a line of best fit and what does it represent? ● What is an outlier and what does it represent? ● What is a two way table and how can you predict an association from one?	● A scatter plot is a graph that displays two sets of data as ordered pairs. (bivariate data) ● A scatter plot can help you determine if the two sets of data are related and what is their relationship. ● A line of best fit shows a relationship between the data sets and can be used to make predictions about the data. ● An outlier is a data point with values that are significantly different from the other data points in the set and it is often ignored when trying determine the association between the two sets of data. . ● A two way table is a way to investigate relationships among the two sets of data.

Curriculum Standards (DOK):

CC.8.SP.1 (DOK 1,2,3) *Investigate patterns of association in bivariate data.* Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
CC.8.SP.2 (DOK 1,2) *Investigate patterns of association in bivariate data.* 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 informally assess the model fit by judging the closeness of the data points to the line.
CC.8.SP.3 (DOK 1,2) *Investigate patterns of association in bivariate data.* Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.
CC.8.SP.4 (DOK 1,2,3) *Investigate patterns of association in bivariate data.* Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● Constructing a scatter plot requires plotting points on a coordinate plane. ● Scatter plots can be used to describe the association between the sets of data. (positive, negative, no trend)	● I can construct scatter plots for bivariate measurement data ● I can interpret scatter plots by describing: clustering, outliers, association ● I can determine the line of best fit for a scatter plot

● A line of best fit falls in the middle of the cluster of dots. ● An equation for the line of best fit can be determined by finding the slope and initial value. ● Two way tables to be used to interpret different scenarios. ● Relative frequency shows the relationship of data given in a two way table.	● I can use the line of best fit to find slope and y-intercept ● I can use the line of best fit to interpret data ● I can construct a two way table ● I can interpret a two way table ● I can use relative frequency to interpret data and predict association

Unit 11: Volume	
Essential Questions:	**Essential Understandings:**
● What is the formula to solve volume in a cylinder, cone, sphere? ● When would I use the formula for volume of a cylinder, cone, sphere in real world situations and mathematical problems?	● Know the volume formula for cylinder, cone, sphere ● Compute the volume of cylinder, cone, sphere ● Apply formula of volume to solve real world and mathematical problems involving cylinder, cone, sphere
Curriculum Standards (DOK):	
CC.8.G.9 (DOK 1,2) *Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.* Know the formulas for the volume of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	
Knowledge/Content **I Know …**	**Skills/Processes** **I Can …**
● A cylinder, cone and sphere are 3 dimensional figures. ● The formulas of cylinder, cone, and sphere ● How to apply the formula of volume solve real world and mathematical problems involving cylinders, cones, and spheres	● Restate the formula $V = \pi r^2 h$ for the volume of a cylinder. ● Use the formula $V = \pi r^2 h$ to find the volume of a cylinder in both mathematical and real world situations. ● Restate the formula $V = \frac{1}{3} \pi r^2 h$ for the volume of a cone. ● Use the formula $V = \frac{1}{3} \pi r^2 h$ to find the volume of a cone in both mathematical and real world situations. ● Restate the formula $V = \pi r^2 h$ for the volume of a sphere. ● Use the formula $V = \frac{4}{3} \pi r^3$ to find the volume of a sphere in both mathematical and real world situations.