Escondido Union High School District

Math 1 (Integrated)

EUHSD Board Approval Date: 4/21/15
The EUHSD Mathematics curriculum document outlines specific course expectations in a comprehensive integrated math curriculum. The curriculum documents are designed to be updated annually based on student academic achievement data, research and best practices, and input from stakeholders. The EUHSD mathematics curriculum document contains the following:

A. Course Description
B. Course Guidelines - graduation credit information, transcript information, adopted materials, adopted technology, assessment outline
C. Instructional Materials References
D. Scope and Sequence Map with Essential Standards, Unit Topics, and Key Unit Objectives delineated
E. References to key essential design and implementation documents (see items 1-8 below)

The EUHSD Mathematics program is designed so that all students have access to the rigorous curriculum necessary to graduate high school college and career ready. Pathway options and courses of study will provide students with a rich array of courses designed to meet the needs of all learners from acceleration to intervention. Regardless of a student’s entry point, the pathway provides all students access to the highest level of courses offered. The contextualized learning inherent in an integrated program provides students with deeper understanding and improved retention of math concepts. Student-Centered learning provides opportunity for collaboration, communication, and a robust learning environment and provides opportunities for all students to meet the goals of the district’s Instructional Focus at the time of this writing: “All students communicate their thinking, ideas and understanding by effectively using oral, written and/or non-verbal expression.”

A key design consideration in the transition to the new California State Standards is a focus on changes to pedagogy. The instructional shifts guide classroom teaching and learning and the foundation of curriculum and instructional design.

### Instructional Shifts in Mathematics

<table>
<thead>
<tr>
<th>Focus:</th>
<th>Focus requires that we significantly narrow and deepen the scope of content in each grade so that students experience concepts at a deeper level.</th>
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<tbody>
<tr>
<td><strong>Focus strongly where the Standards focus</strong></td>
<td>Instruction engages students through cross-curricular concepts and application. Each unit focuses on implementation of the Math Practices in conjunction with math content. Effective instruction is framed by performance tasks that engage students and promote questions in order to provide a clear and explicit purpose for instruction.</td>
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<tr>
<td>Coherence:</td>
<td>Coherence in our instruction supports students to make connections within and across grade levels.</td>
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<tr>
<td><strong>Think across grades; and link to major topics within grades</strong></td>
<td>Problems and activities connect clusters and domains through the art of questioning. A purposeful sequence of lessons build meaning by moving from concrete to abstract, with new learning built upon prior knowledge and connections made to previous learning. Coherence promotes mathematical sense making. It is critical to think across grades and examine the progressions in the standards to ensure the development of major topics over time. The emphasis on problem solving, reasoning and proof, communication, representation, and connections require students to build comprehension of mathematical concepts, procedural fluency, and productive dispositions.</td>
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<tr>
<td>Rigor:</td>
<td>Rigor helps students to read various depths of knowledge by balancing conceptual understanding, procedural skills and fluency, and real-world applications with equal intensity.</td>
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<tr>
<td><strong>In major topics, pursue conceptual</strong></td>
<td>Conceptual understanding underpins fluency; fluency is practiced in contextual applications; and applications build conceptual understanding.</td>
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understanding, procedural skills and fluency, and application

- These elements may be explicitly addressed separately or at other times combined. Students demonstrate deep conceptual understanding of core math concepts by applying them in new situations, as well as writing and speaking about their understanding. Students will make meaning of content outside of math by applying math concepts to real-world situations.
- Each unit contains a balance of challenging, multiple-step problems to teach new mathematics, and exercises to practice mathematical skills.

The EUHSD mathematics curriculum document and all supporting documentation are aligned to the California State Standards for Mathematics, the Eight Standards for Mathematical Practice, as well as the new CA ELD Standards. These standards will be integrated and delineated within each Unit Plan. A detailed list of resources around which the EUHSD Mathematics curriculum is designed and implemented are as follows:

1. California State Standards for Mathematics
2. Guide to the CASS-M Conceptual Category Abbreviations
3. Eight Standards for Mathematical Practice
4. California Frameworks for Mathematics
5. Smarter Balanced Assessment System Mathematics Assessment Blueprint
6. California English Language Development Standards
7. University of California Mathematics Pathway FAQ
8. Core Plus Instructional Materials

California State Standards for Mathematics - Content

The California Standards for high school mathematics (CASS-M) are divided into six conceptual categories which portray a coherent view of higher mathematics which cross a number of traditional course boundaries. Each conceptual category is further broken down into domains or clusters of standards that address big ideas - Guide to the CASS-M Conceptual Category Abbreviations. The conceptual categories are Number and Quantity, Algebra, Functions, Modeling, Geometry, and Statistics and Probability. Modeling is best interpreted not as a collection of topics but in relation to other standards, thus Modeling is considered both a conceptual category and a Standard for Mathematical Practice and modeling standards are called within the other conceptual categories, indicated by a (*) symbol.

Common Core Standards for Mathematical Practice

The CASS-M call for mathematical practices and content to be connected as students engage in mathematical tasks. These connections are essential to support the development of students’ broader mathematical understanding - students who lack understanding of a topic may rely too heavily on procedures. The 8 Math Practice standards must be taught as carefully and practiced as intentionally as the Standards for Math Content. Neither should be isolated from the other; effective mathematics instruction occurs when the two halves of the CASS-M come together as a powerful whole (CASS-M, 2013).
<table>
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<th>Standards for Mathematical Practice</th>
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<td><strong>1. Make sense of problems and persevere in solving them.</strong></td>
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<td>Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</td>
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<tr>
<td><strong>2. Reason abstractly and quantitatively.</strong></td>
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<td>Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to <em>decontextualize</em>—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to <em>contextualize</em>, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.</td>
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<td><strong>3. Construct viable arguments and critique the reasoning of others.</strong></td>
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<td>Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.</td>
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<td><strong>4. Model with mathematics.</strong></td>
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| Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation, assign appropriate units, and estimate quantities that are close enough to be useful.
situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see $7 \times 8$ equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as $2 \times 7$ and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 – 3(x – y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers $x$ and $y$.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through $(1, 2)$ with slope 3, middle school students might abstract the equation $(y – 2)/(x- 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x – 1)(x + 1)$, $(x – 1)(x^2 + x+ 1)$, and $(x – 1)(x^3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.
Math 1 - Course Description

Math 1 is the first of an integrated and investigative mathematics program designed to use patterns, modeling, and conjectures to build student understanding and competency in mathematics. The Math 1 course is designed to formalize and extend student understanding of linear functions and their applications. The critical areas of focus include: (1) extending understanding of numerical manipulation to algebraic manipulation; (2) synthesizing understanding of function; (3) deepening and extending understanding of linear relationships; (4) applying linear models to data that exhibit a linear trend; (5) establishing criteria for congruence based on rigid motions; (6) applying the Pythagorean Theorem to the coordinate plane. The Math 1 curriculum addresses each of the conceptual categories outlined by the California State Standards for Mathematics: number and quantity; algebra, functions, geometry, statistics and probability, and modeling. The curriculum includes attention to each of the Eight Standards for Mathematical Practice. Instructional materials and classroom experiences provide students with a rich array of resources and technology designed to support student mastery of specific concepts and both procedural and conceptual understanding while building essential 21st Century skills designed for college and career readiness. Assessments are outlined in the Scope and Sequence document. Each unit will culminate in a district-wide common assessment (year 1 implementation will use Core-Plus provided assessments).
# Math 1 Course Requirements

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<th>Course Length: Year-Long</th>
<th>Grade Level: Grade 9-12</th>
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**UC/CSU Requirement:** Approved by UC as a “c” mathematics course

**Graduation Requirement:** Students will receive (5) math credits per successfully completed semester for a total of (10) math credits for the year. Students who successfully complete the year-long Math 1 will fulfill the California Department of Education Algebra 1 state graduation requirement.

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<th>Course Number Semester A:</th>
<th>Transcript Name Semester A:</th>
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<td>(P) 2245 (SE) 2249 (B) 2251</td>
<td>(P): MATH 1 A (P)</td>
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<td>(SE): MATH 1 A (SE)</td>
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<td>(B): MATH 1 A (Basic)</td>
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<tr>
<th>Course Number Semester B:</th>
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<td>(P) 2246 (SE) 2250 (B) 2252</td>
<td>(P): MATH 1 B (P)</td>
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<td>(SE): MATH 1 B (SE)</td>
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<tr>
<td></td>
<td>(B): MATH 1 B (Basic)</td>
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</tbody>
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| Number of Credits Semester A: | five (5) |
| Number of Credits Semester B: | five (5) |

**Required Prerequisites:** N/A

**Recommended Prerequisites:** N/A

**Board Approval Date/Curriculum:** 4/21/15

**Board Approval Date/Textbooks:** 4/21/15  
- Core-Plus Mathematics (Course 1): McGraw Hill Education  

**Supplemental Resource/s:**
- *It's All Write* - A writing supplement for high school mathematics classes (consumable and reproducible instructional materials to improve the quality of mathematics writing)
- All adopted ancillary materials within the Core-Plus instructional program

**Supplemental Technology Resource/s:**
- Graphing Calculator
- CPMP Tools (online resource)

**Assessment/s:**
- Year 1 - All EUHSD Math 1 teachers will give common assessments which accompany the Core-Plus Mathematics Program (lesson quizzes, unit tests, common district final exams).
**Math 1 Scope and Sequence**  
**Math 1 Scope and Sequence - Introductory Writing Unit**

### It's All Write
- The *It’s All Write* supplemental project is a one-week set of writing activities which helps students at the secondary level examine and improve the quality of their writing about mathematics.

### Introductory Writing Unit Learning Goals
- The primary goal of this unit is to have students reflect on and improve the quality of their mathematical writing. They will also learn about holistic scoring and about the creation and use of rubrics to score their own and others’ writing about mathematics.
- Develop a framework for student writing, reflection and self-assessment about the process of learning mathematics that can be applied to a variety of activities and investigations throughout the entirety of the students’ mathematical careers.

### Key Assessments
- Most of the assessing in this unit will be done by the students as they reflect on their mathematical writing by answering the following questions in a culminating essay:
  - How has my mathematics writing changed?
  - How might my writing differ in the future, and why?
  - What do I think about holistic scoring and about the use of rubrics?
  - What have I learned from looking at other student papers?

### Writing Unit - Standards for Math Practice:

**SMP 3** Construct Viable Arguments and Critique the Reasoning of Others - mathematically proficient students justify their conclusions, communicate them to others and respond to the arguments of others. Students can listen to or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

**SMP 6** Attend to Precision - mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussions with others and in their own reasoning.

### Students will...
- Clarify thinking about mathematical problems and the process of solving them through writing.
- Use writing as a tool to generate new ideas in the process of problem-solving.
- Recognize writing as a tool to record important information and thinking to be used at a later time in the problem-solving process.
- Use writing as a tool to communicate their mathematical ideas to others.
- Generalize about solutions to mathematical problems.
- Work collaboratively with peers to problem solve.
- Create and use rubrics to score their own and others’ writing about mathematics.
- Reflect on their own mathematical thinking and express these reflections through writing.
- Reflect on their mathematical writing.

### Checkerboard Squares
- Students solve the traditional ‘how many squares are on a checkerboard?’ problem and use this problem as a launching place to learn about the process of solving and explaining problems. They start the process of thinking and writing about how they find answers and how they know their answers are correct.

### Rubrics
- Students use rubrics to score anchor papers (provided) for the Checkerboard Square problem and develop their own for use with future problems.
### Unit 1 Patterns of Change

- This unit develops student ability to recognize and describe important patterns that relate quantitative variables, to use data tables, graphs, words, and symbols to represent the relationships, and to use reasoning and calculating tools to answer questions and solve problems.

### Unit 1 Learning Goals

- Begin developing students’ sensitivity to the rich variety of situations in which quantities vary in relation to each other.
- Develop students’ ability to represent relations among variables in several ways—using tables of numerical data, coordinate graphs, symbolic rules, and verbal descriptions—and to interpret data presented in any one of those forms.
- Develop students’ ability to recognize important patterns of change in single variables and related variables.

### Unit 1 Assessment

- **Assessment for Learning** - Feedback given in many forms such as direct teacher conversations and revision suggestions, mini-quizzes, peer grading rubrics, and self-grading will help students to improve their quality of work and deepen their understanding. Informal daily assessments will be used daily by teachers through warm ups, journaling, questioning, and observations. Informal observations are important for teachers to conduct daily to get the pulse of the classroom and see how students are internalizing the content and procedures.
- **Assessment of Learning** - Small quizzes, larger unit tests, and benchmark exams will assess what students have learned. Small quizzes and unit tests will be made up of both highly contextualized problems and more procedural problems. The contextualized problems will assess students’ ability to make sense of problems, reason abstractly, and construct viable

### Unit 1 Focus Standards:

#### Number & Quantity

- **N-Q.3**: Reason quantitatively and use units to solve problems.

#### Algebra

- **A-SSE.1**: Interpret the structure of expressions;
- **A-CED.2**: Create equations that describe number or relationships;
- **A-REI.10**: Represent and solve equations and inequalities graphically.

#### Functions

- **F-IF.3, 4*,5*,7*,9**: Understand the concept of a function and use function notation, interpret functions that arise in applications in terms of the context, analyze functions using different representations. Interpret key features of graphs and tables, sketching graphs to show key features such as intercepts, increasing, decreasing, positive or negative intervals, relative max and mins, symmetry, end behavior and periodicity.
- **F-BF.1*, 2**: Build a function that models the relationship between two quantities.
- **F-LE.2*,5**: Construct and compare linear, quadratic and exponential models and solve problems,

### Students will...

- Develop the disposition to look for cause-and effect relationships between variables.
- Review and develop skills in organizing data in tables and graphs and using words to describe patterns of change shown in those representations.
- Review or begin to develop knowledge about common patterns of change and the ability to use symbolic rules to represent and reason about those patterns.
- Use tables, graphs and rules to solve problems of cause-and-effect change.
- Recognize recursive patterns of change.
- Use calculators to iterate stages in a recursive pattern.
- Write NOW-NEXT rules to represent recursive patterns.
- Write and use spreadsheet formulas to explore recursive patterns of change.
- Use iteration to solve problems about population and money change over time.
- Write rules that express problem conditions.
- Review perimeter and area formulas for triangles, parallelograms, and circles and the Pythagorean Theorem.

### Unit 1 Learning Objectives

### Bungee Jump Physics

**Investigation** - Students use rubber bands and weights to simulate the stretch of a bungee jump cord according to weight of the jumper to investigate data that lends itself to discussions of linearity. Students will investigate relationships between independent and dependent variables (cause and effect).

**Trying to Get Rich Quick** - Students are exposed to nonlinear patterns of change in this investigation of inverse variation and exponential growth as they consider average speeds and times of NASCAR races.

**Tracking Population Changes** - Students will use a spreadsheet or graphing calculator to answer questions about population changes in humans, whales, wolves, and other endangered species.

**Communicating with Symbols** - Students will collaboratively work to find symbolic representations that describe relationships between
arguments as well as modeling with mathematics. Procedural problems will focus on assessing students’ use of tools, attending to precision, making use of structure, and expressing regularity in repeated reasoning. The benchmark exams will be common assessments that will provide data to further drive changes in teaching strategies in order to enhance student success.

- **Writing to Learn**- Students will keep a mathematics journal to write about their thinking during investigations and projects. Students will be required to justify their reasoning during any investigation and be able to summarize their conclusions. Writing about the mathematics will encourage students to construct viable arguments and critique the reasoning of others.

- **Performance Assessments**- There will be smaller projects and key assignments during the year in which students will show their mastery of the content through a project that allows students to display their learning using multiple representations.

- **Common Assessments**- Each unit will culminate in a district-wide common unit assessment (year 1 implementation will use Core-Plus provided assessments).

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<td>● Description</td>
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<td>● Sample Investigations and Assignments</td>
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<td>● Learning Goals</td>
<td>● Related Standards</td>
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**Unit 1 Related Standards:**
- N-Q.2*, 3*: Reason quantitatively and use units to solve problems.
- A-SSE.3*: Write expressions in equivalent forms.
- A-REI.3: Solve equations and inequalities in one variable.
- F-IF.1, 8: Understand the concept of a function as a mapping from a domain to a range, Reveal and explain properties of functions by writing them in equivalent forms.
- F-BF.3: Build new functions from existing functions including using technology to experiment with cases.
- F-LE.1*: Distinguish between situations that can be modeled with linear functions and with exponential functions.

- Produce tables and graphs for functions.
- Use function tables, graphs, and computer algebra manipulations to solve problems that involve functional relationships, especially solving equations in one variable.
- Develop informal knowledge about connections among function rules, tables, and graphs for linear, inverse, exponential and quadratic relations.

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interpret expressions for functions in terms of the situation they model.

They use real-life situations to make sense of and create function rules relating two variables.
Unit 2 Patterns in Data

- This unit develops student ability to summarize, represent, and interpret real-world data on a single count or measurement variable through the use of graphical displays of the distribution, measures of center, and measures of spread.

Unit 2 Learning Goals

- Use various graphical displays of data to reveal important patterns in a data set and interpret those patterns in the context of the data.
- Compute measures of center and variability for sets of data and interpret the meaning of those statistics.
- Transform distributions by adding a constant or by multiplying by a positive constant and recognize how those transformations affect the shape, center, and spread of distributions.

Unit 2 Assessments

- Assessment for Learning: Feedback given in many forms such as direct teacher conversations and revision suggestions, mini-quizzes, peer grading rubrics, and self-grading will help students to improve their quality of work and deepen their understanding. Informal daily assessments will be used daily by teachers through warm ups, journaling, questioning, and observations. Informal observations are important for teachers to conduct daily to get the pulse of the classroom and see how students are internalizing the content and procedures.
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Unit 2 Focus Standards:

Statistics and Probability
S-ID.1*, 2*, 3*: Summarize, represent, and interpret data on a single count or measurement variable - on number lines, histograms and boxplots, and choose appropriate statistics for the shape of the data to compare center and spread. Analyze differences in shape, center and spread in context.

Modeling
*aall standards marked with asterisks are modeling standards

Unit 2 Related Standards:

N-Q.1*: Reason quantitatively and use units to solve problems.
G-CO.2, 6: Congruence Experiment with transformations in the plane by representing, describing and comparing the consequences and attributes of various transformations on functions. Understand congruence in terms of rigid motions. Use the definitions of congruence in terms of rigid motions to decide if two figures are congruent.
G-MG.1*: Use geometric shapes, their measures, and their properties to describe objects.
S-ID.6*: Represent data on two quantitative variables on a scatter

Students will...

- Construct dot plots, histograms, and relative frequency histograms.
- Describe the shape of a distribution.
- Compute and interpret the mean and median (from a list of values and from a frequency table).
- Estimate the mean and median from a histogram.
- Find and interpret percentiles and quartiles as measures of the position of a value in a distribution.
- Find the five-number summary and the interquartile range (IQR) and interpret the IQR as a measure of variability.
- Determine if a value is an outlier using a common rule.
- Construct and interpret a box plot.
- Compute or estimate and interpret the standard deviation as a measure of spread.
- Predict the effect on the shape, center, and spread of a distribution when the same number is added to each value or when each value is multiplied by the same number.

Unit 2 Sample Investigations and Assignments

Penny Stacking Investigation:
Students will learn about distribution patterns, measures of central tendency and measures of variance by playing a game where students must stack pennies using their dominant and non-dominant hands. Students must make a conjecture and test it by collecting penny-stacking data.

Measuring Position: Students will explore the concepts of percentiles and quartiles by using data from growth charts and standardized test results. They will investigate the idea of outliers and use technology to compute means and standard deviations and interpret them as a measure of spread.

Measuring Variability: The Standard Deviation
Students use online technology resources and their graphing calculators to investigate the idea of variability around the mean using deviations from the mean to define another measure of spread. They will
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● **Common Assessments** - Each unit will culminate in a district-wide common unit assessment (year 1 implementation will use Core-Plus provided assessments).

plot, and describe how the variables are related.

use various data sets including those about height and achievement test scores.
Math 1 Scope and Sequence - Unit 3

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**Unit 3 Linear Functions**
- This unit develops student ability to recognize and represent linear relationships between variables and to use tables, graphs, and algebraic expressions for linear functions to solve problems in situations that involve constant rate of change or slope.

**Unit 3 Learning Goals**
- Recognize patterns in tables of sample values, in problem conditions, and in data plots that can be described by linear functions.
- Write linear function rules to describe linear, or approximately linear, patterns in graphs or numerical data.
- Use table, graph, or symbolic representations of linear functions to answer questions about the situations they represent: (1) Calculate y for a given x (i.e., evaluate functions); (2) Find x for a given y (i.e., solve equations and inequalities); and (3) Describe the rate at which y changes as x changes (i.e., determine slope).
- Rewrite linear expressions in equivalent forms.

**Unit 3 Assessments**
- **Assessment for Learning**: Feedback given in many forms such as direct teacher conversations and revision suggestions, mini-quizzes, peer grading rubrics, and self-grading will help students to improve their quality of work and deepen their understanding. Informal daily assessments will be used daily by teachers through warm ups, journaling, questioning, and observations. Informal observations are important for teachers to conduct daily to get the pulse of the classroom and see how students are internalizing the content and procedures.

**Unit 3 Focus Standards:**
- **Algebra**
  - A-SSE.1*,3*: Interpret the structure of expressions, write expressions in equivalent forms to solve problems.
  - A-CED.1*,2*,3*: Create equations that describe numbers or relationships.
  - A-REI.1,3,6,10,11*: Understand solving equations as a process of reasoning and explain the reasoning, solve equations and inequalities in one variable, solve systems of equations, represent and solve equations and inequalities graphically.
- **Functions**
  - F-IF.1,4*,5*,6*,7*: Understand the concept of a function and use function notation, interpret functions that arise in applications in terms of the context, analyze functions using different representations. Interpret key features of graphs and tables, sketching graphs to show key features such as intercepts, increasing, decreasing, positive or negative intervals, relative max and mins, symmetry, end behavior and periodicity.
  - F-BF.1*,2*: Build a function that models the relationship between two quantities.
  - F-LE.1*,2*,5*: Construct and

**Students will...**
- Calculate the rate of change in one variable as another variable increases.
- Describe the relationships among the graph, symbolic rule, table of values, and related situation for a linear function.
- Interpret the meaning of the slope and y-intercept of the graph of a linear function in a context.
- Write a rule for a linear function given its graph, two points, or a table of values.
- Use linear functions to answer questions about the situations that they describe.
- Use linear functions to answer questions about the situations that they describe.
- Use a linear model to predict the value of one variable given the value of the other and describe the rate of change in one variable as the other increases in a meaningful way.
- Use a calculator or computer software to find the linear regression model for a set of data.
- Write linear equations and inequalities to express questions about linear functions.
- Estimate solutions to linear equations and inequalities by inspecting appropriate graphs and tables of values and interpret the

**Getting Credit** - This investigation sharpens student skills in seeing connections between symbolic rules for linear functions and the patterns in tables and graphs. This serves as a great jumping off point for intelligent financial behavior discussions as they consider why credit companies might want to sign up college students for accounts.

**Fitting Lines** - Students are introduced to the notion of linear functions serving as models of approximately linear patterns. Students make “eyeball” fits of lines to data plots and find related rules and then use their graphing calculators to make data plots and experiment with function graphs and the linear regression tool.

**Who Will be the Doctor?** - Students use data in tables and graphs as well as equations to describe trends in gender populations for doctors. Students use linear models to show the trends in percent of male and female doctors in the US between 1960 and 2000.
### Unit 3
- **Description**
- **Learning Goals**
- **Key Assessments**

#### Assessment of Learning
Small quizzes, larger unit tests, and benchmark exams will assess what students have learned. Small quizzes and unit tests will be made up of both highly contextualized problems and more procedural problems. The contextualized problems will assess students’ ability to make sense of problems, reason abstractly, and construct viable arguments as well as modeling with mathematics. Procedural problems will focus on assessing students’ use of tools, attending to precision, making use of structure, and expressing regularity in repeated reasoning. The benchmark exams will be common assessments that will provide data to further drive changes in teaching strategies in order to enhance student success.

#### Writing to Learn
Students will keep a mathematics journal to write about their thinking during investigations and projects. Students will be required to justify their reasoning during any investigation and be able to summarize their conclusions. Writing about the mathematics will encourage students to construct viable arguments and critique the reasoning of others.

#### Performance Assessments
There will be smaller projects and key assignments during the year in which students will show their mastery of the content through a project that allows students to display their learning using multiple representations.

#### Common Assessments
Each unit will culminate in a district-wide common unit assessment (year 1 implementation will use Core-Plus provided assessments).

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<td>compare linear, quadratic and exponential models and solve problems, interpret expressions for functions in terms of the situation they model.</td>
<td><strong>Statistics and Probability</strong></td>
<td>meaning of the solution in the real-world context.</td>
<td>and to make predictions on future prospects for aspiring doctors.</td>
</tr>
<tr>
<td>S-ID.6*,7*: Summarize, represent, and interpret data on two categorical and quantitative variables, interpret linear models.</td>
<td><strong>Modeling</strong></td>
<td>Use “undoing” and “balancing” methods to solve simple linear equations and inequalities.</td>
<td>Using Your Head...More or Less - Students explore the effect of multiplying or dividing an inequality by a negative number. The techniques for solving equations by undoing are extended to solve simple linear inequalities.</td>
</tr>
<tr>
<td><em>all standards marked with asterisks are modeling standards</em>*</td>
<td><strong>Unit 3 Related Standards:</strong></td>
<td>Use tables of values, graphs, and symbolic reasoning to solve systems of linear equations of the form ( y = ax + bx ) and ( y = c + dx ).</td>
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<tr>
<td>N-Q.1*: Reason quantitatively and use units to solve problems.</td>
<td>F-IF.3, 9: Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. Compare properties of two functions each in a different representation.</td>
<td>Write multiple expressions to represent a variable quantity from a real-world situation.</td>
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<tr>
<td>F-BF.3: Build new functions from existing functions including using technology to experiment with cases.</td>
<td><strong>Meaning of the solution in the real-world context.</strong></td>
<td>Use tables, graphs, and properties of numbers and operations to reason about the equivalence of expressions.</td>
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<tr>
<td>and to make predictions on future prospects for aspiring doctors.</td>
<td><strong>Rewrite linear expressions in equivalent forms by expanding, combining like terms, and factoring.</strong></td>
<td>Using Your Head...More or Less - Students explore the effect of multiplying or dividing an inequality by a negative number. The techniques for solving equations by undoing are extended to solve simple linear inequalities.</td>
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**Math 1 Scope and Sequence - Unit 4**

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<td></td>
<td><strong>Unit 4 Discrete Mathematical Models</strong></td>
<td><strong>Unit 4 Focus Standards:</strong></td>
<td><strong>Students will...</strong></td>
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<tr>
<td></td>
<td>● Discrete Mathematical Modeling develops student ability in modeling, reasoning, and problem solving as they use vertex-edge graphs to model and solve problems about networks, paths, and relations.</td>
<td><strong>Number and Quantity</strong></td>
<td>● Use vertex-edge graphs to model problems related to finding efficient routes - in this case, routes that use each edge exactly once.</td>
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<td>● Understand and apply Euler paths and vertex coloring.</td>
<td><strong>N-VM.6:</strong> Vector and Matrix quantities - Perform operations on matrices and use matrices in applications. Use matrices to represent and manipulate data.</td>
<td>● Use Euler circuits, circuits through a graph that use each edge exactly once, to help solve such problems</td>
</tr>
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<td></td>
<td>● Use vertex-edge graphs to represent and solve problems related to paths, networks, and relationships among a finite number of objects.</td>
<td><strong>Modeling</strong></td>
<td>● Learn and reason about properties of graphs and Euler circuits</td>
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<td>● Gain further experience in mathematical modeling by building and using vertex-edge graph models to solve problems in a variety of settings.</td>
<td>● <em>all standards marked with asterisks are modeling standards</em></td>
<td>● Investigate algorithms for constructing Euler circuits.</td>
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<td>● Develop skill in algorithmic problem solving: designing, using, and analyzing systematic procedures for solving problems.</td>
<td>This unit covers all aspects of the Modeling Conceptual Category. Students will choose and use appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. They will model quantities and their relationships in physical, economic, public policy, social or everyday situations using mathematical and statistical methods. They will use technology for varying assumptions, exploring consequences and comparing predictions with data.</td>
<td>● Investigate algorithms for vertex coloring.</td>
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<td>● Further develop skill in mathematical reasoning by exploring and reasoning about properties of vertex-edge graphs.</td>
<td><strong>Unit 4 Related Standards:</strong></td>
<td>● Use vertex-edge graphs to model problems related to avoiding conflict in a variety of settings.</td>
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<td><strong>Unit 4 Learning Goals</strong></td>
<td>A-SSE.1: Seeing structure in expressions. Interpret the structure of expressions that represent a quantity in terms of its context. Interpret terms, factors, and coefficients.</td>
<td>● Color the vertices of a graph so that adjacent vertices have different colors.</td>
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<td>● Understand and apply Euler paths and vertex coloring.</td>
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<td>● Investigate algorithms for vertex coloring.</td>
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<td>● Use vertex-edge graphs to represent and solve problems related to paths, networks, and relationships among a finite number of objects.</td>
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<td>● Use vertex coloring to solve a variety of problems, including assigning frequencies to radio stations, scheduling club meetings, and coloring the countries of a map.</td>
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### Contextualized Problems

Contextualized problems will assess students’ ability to make sense of problems, reason abstractly, and construct viable arguments as well as modeling with mathematics. Procedural problems will focus on assessing students’ use of tools, attending to precision, making use of structure, and expressing regularity in repeated reasoning. The benchmark exams will be common assessments that will provide data to further drive changes in teaching strategies in order to enhance student success.

- **Writing to Learn** - Students will keep a mathematics journal to write about their thinking during investigations and projects. Students will be required to justify their reasoning during any investigation and be able to summarize their conclusions. Writing about the mathematics will encourage students to construct viable arguments and critique the reasoning of others.

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### Sample Investigations and Assignments

**A-CED.2*, 4*: Create equations or inequalities that describe numbers or relationships between quantities.** Graph equations on coordinate axes with labels and scales. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

*to color the vertices of a graph to solve the problem.*
Unit 5 Exponential Functions

- This unit develops student ability to recognize and represent exponential growth and decay patterns, to express those patterns in symbolic forms, to solve problems that involve exponential change, and to use properties of exponents to write expressions in equivalent forms.

Unit 5 Learning Goals

- Recognize and give examples of growth and decay situations in which exponential functions are likely to match the patterns of change that are observed or expected. This function-recognition skill should apply to information given in data tables, graphs, or verbal descriptions of related changing variables.
- Develop ability to use reasoning, estimation, and curve-fitting utilities to find exponential functions to match patterns of change in exponential growth and decay situations. This should include rules in the “y = …” and NOW-NEXT forms.
- Use exponential rules to produce tables and graphs to answer questions about exponential change of variables.
- Interpret an exponential function rule in order to sketch or predict the shape of its graph and the pattern of change in tables of values.
- Describe major similarities and differences between linear and exponential patterns of change.
- Develop skill in rewriting exponential and radical expressions in equivalent forms.

Unit 5 Assessments

- Assessment for Learning - Feedback given in many forms such as direct teacher conversations and revision suggestions, mini-quizzes, peer grading rubrics, and self-grading will help students to improve their quality of work and deepen their understanding of the material.
- Statistics and Probability - Students will summarize, represent, and interpret data on two categorical and quantitative variables, represent data in equivalent forms.

Unit 5 Focus Standards:

**Number and Quantity**
N-RN.1, 2: Extend the properties of exponents to rational exponents. Explain how the properties follow from each other and rewrite expressions involving radicals and rational exponents using this properties.

**Algebra**
A-SSE.1*, 3*: See structure in expressions and interpret this structure. Write expressions in equivalent forms to solve problems.
A-CED.1*, 2*: Create equations (1 or 2 variables) and inequalities (1 variable only) that describe numbers or relationships, including ones with absolute value (CA), and use them to solve problems. Graph equations on coordinate axes with labels and scales.
A-REI.10: Represent and solve equations and inequalities graphically and understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane.

Students will...

- Develop disposition to look for and ability to recognize exponential growth patterns and phenomena.
- Represent exponential functions with rules in the form \( y = a (b^x) \) where \( a > 0 \) and \( b > 1 \).
- Write NOW-NEXT rules for exponential growth patterns.
- Use tables and graphs to solve problems about exponential growth.
- Use reasoning, estimation, and curve-fitting utilities to model data patterns exhibiting exponential-type trends - decay and growth.
- Use standard rules for writing exponential expressions in equivalent forms.
- Recognize patterns of change characterizing exponential decay phenomena.
- Interpret zero and fractional exponents and calculate or estimate values of expressions with those exponents.
- Interpret half-life of decay phenomena and use symbolic rules, tables, and graphs to estimate those values.
- Use symbolic rules, tables and graphs to solve problems involving exponential decay.
- Simplify radicals.

Pay it Forward: Counting in Tree Graphs - Students develop their understanding and skill in recognizing and modeling patterns of exponential growth. Tree graphs are used to model a Pay it Forward process providing a visual image of the multiplicative growth pattern.

Compound Interest Lottery
Payout - Students decide which payoff method is a better deal for a lottery winner. Students use recursive formulas for compound interest to calculate how much money will be in a CD balance after certain numbers of years. Students will investigate change in exponential relationships and make predictions using tables, graphs, and equations.

More Bounce to the Ounce - Students investigate ball elasticity by collecting data on heights of successive rebounds when a ball is dropped from a fixed height. Students discover exponential decay relationships through testing different types of balls and their successive rebound heights.
understanding. Informal daily assessments will be used daily by teachers through warm ups, journaling, questioning, and observations. Informal observations are important for teachers to conduct daily to get the pulse of the classroom and see how students are internalizing the content and procedures.

- **Assessment of Learning** - Small quizzes, larger unit tests, and benchmark exams will assess what students have learned. Small quizzes and unit tests will be made up of both highly contextualized problems and more procedural problems. The contextualized problems will assess students’ ability to make sense of problems, reason abstractly, and construct viable arguments as well as modeling with mathematics. Procedural problems will focus on assessing students’ use of tools, attending to precision, making use of structure, and expressing regularity in repeated reasoning. The benchmark exams will be common assessments that will provide data to further drive changes in teaching strategies in order to enhance student success.

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- **Common Assessments** - Each unit will culminate in a district-wide common unit assessment (year 1 implementation will use Core-Plus provided assessments).

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A scatter plot and describe how the variables are related.

**Modeling**

- all standards marked with asterisks are modeling standards

**Unit 5 Related Standards:**

- **N-Q.1**: Reason quantitatively and use units to solve problems.
- **A-SSE.1**: Interpret the structure of expressions.
- **F-IF.4*,5, 9**: Understand the concept of a function and use function notation, interpret functions that arise in applications in terms of the context, analyze functions using different representations.
- **F-BF.3**: Build new functions from existing functions including using technology to experiment with cases.
- **F-LE.3**: Observe linear, quadratic and exponential graphs and realize that the increase in the exponential quantity eventually exceeds that of a linear or quadratic (or polynomial) quantity.

**Medicine and Mathematics** - The goal of this investigation is to extend student understanding of, and skill in working with, exponential decay relationships and their tables, graphs, and rules. Since decay or metabolism of medicines in the body is a nearly continuous process, the problems here motivate interpretation of fractional exponents.

**Modeling Decay** - In this investigation, students develop the ability to derive exponential models that fit patterns in experimental data and compare the data patterns to what logical analysis of the experiment suggests might happen. They are asked to think first, then experiment, and to compare the function models suggested by logic to the models derived from use of the graphing calculator or computer tools.

heights. Students must use tables, graphs, and equations to answer questions about their data and make predictions.
**Unit 6 Patterns in Shape**

- This unit develops student ability to visualize and describe two- and three-dimensional shapes, to represent them with drawings, to examine shape properties through both experimentation and careful reasoning, and to use those properties to solve problems.

**Unit 6 Learning Goals**

- Recognize and classify common two- and three-dimensional shapes.
- Visualize and represent two- and three-dimensional shapes. Analyze and apply properties of polygons and polyhedral.
- Use rigid transformations to verify SSS, SAS, ASA conditions for congruence of triangles and use these conditions in solving problems.
- Begin to develop ability to establish properties of shapes by careful reasoning from definitions and given or assumed facts.

**Unit 6 Assessments**

- **Assessment for Learning** - Feedback given in many forms such as direct teacher conversations and revision suggestions, mini-quizzes, peer grading rubrics, and self-grading will help students to improve their quality of work and deepen their understanding. Informal daily assessments will be used daily by teachers through warm ups, journaling, questioning, and observations. Informal observations are important for teachers to conduct daily to get the pulse of the classroom and see how students are internalizing the content and procedures.
- **Assessment of Learning** - Small quizzes, larger unit tests, and benchmark exams will assess what students have learned. Small quizzes and unit tests will be made up of both highly contextualized problems and more procedural problems. The contextualized problems will assess students’ ability to make sense of problems, reason abstractly, and construct viable arguments as well as modeling with mathematics. Procedural abilities for solving problems and proving properties will be assessed through quizzes and unit tests.

**Unit 6 Focus Standards:**

- **Geometry**
  - **G-CO.1, 2, 3, 8, 9, 10, 11, 12:** Congruence - Experiment with transformations in the plane, know precise definitions of geometric objects, represent transformation in the plane, describe them as functions, compare transformations and horizontal stretches, describe rotations and reflections of trapezoids, rectangles, parallelograms, and regular polygons. Explain criteria for triangle congruence (ASA, SAS, SSS) in terms of rigid transformations. Prove geometric theorems and make geometric constructions.
  - **G-SRT.5:** Prove theorems using similarity, use congruence and similarity criteria for triangles to solve problems and prove relationships in geometric figures.
  - **G-GMD.1, 2, 3:** Explain volume formulas and use them to solve problems. Formulas include but not limited to circumference of a circle, area of a circle, volumes of cylinders, pyramids and cones.
  - **G-MG.1, 2, 3:** Model with Geometry, applying geometric concepts to modeling situations, Use geometric shapes, their measures, and their properties to describe objects, apply properties of density, and their properties to describe objects, apply properties of density.

**Students will...**

- Discover and apply the Triangle Inequality and its analog for quadrilaterals.
- Investigate rigidity of two-dimensional shapes.
- Discover and apply properties of quadrilateral linkages, including those with rotating bars.
- Discover and verify using rigid transformations (translations, rotation about a point, and line reflection) combinations of side and angle conditions that are sufficient for testing the congruence of two triangles: Side-Side-Side (SSS), Side-Angle-Side (SAS), Angle-Side-Angle (ASA).
- Use congruence conditions to reason about properties of isosceles triangles and select properties of parallelograms.
- Use area and congruence relationships to justify why the Pythagorean Theorem and its converse are true, and use these results to solve problems involving right triangles.
- Recall, justify derivations of, and use formulas to find areas of triangle and special quadrilaterals.
- Discover and apply properties of the interior, exterior, and central angles of polygons.

**Form and Function Investigating Two-Dimensional Shapes**

- **Reasoning with Shapes** - Students used uncooked spaghetti noodles, plastic strips, and interactive software to investigate relationships in triangles and quadrilaterals with regard to side length and angle measures. Students are led to discover concepts such as the triangle inequality, rigidity, and Grashof’s Principle for quadrilaterals.

- **The Triangle Connection**

  Students explore relationships involving the measures of interior angles and exterior angles of convex polygons. Connections between algebra and geometry are achieved through the development and analysis of function rules.
problems will focus on assessing students’ use of tools, attending to precision, making use of structure, and expressing regularity in repeated reasoning. The benchmark exams will be common assessments that will provide data to further drive changes in teaching strategies in order to enhance student success.

**Writing to Learn** - Students will keep a mathematics journal to write about their thinking during investigations and projects. Students will be required to justify their reasoning during any investigation and be able to summarize their conclusions. Writing about the mathematics will encourage students to construct viable arguments and critique the reasoning of others.

**Performance Assessments** - There will be smaller projects and key assignments during the year in which students will show their mastery of the content through a project that allows students to display their learning using multiple representations.

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<td><strong>Related Standards</strong></td>
<td><em>Recognize and describe line and rotational symmetries of polygons and other two-dimensional shapes.</em></td>
<td><em>Recognize and describe symmetries of tessellations, including translation symmetry.</em></td>
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<td><strong>Unit 6 Related Standards:</strong></td>
<td><em>(Re) discover which triangles, quadrilaterals, and regular polygons will tile a plane and explore semi regular tessellations.</em></td>
<td><strong>Regular Polyhedra</strong></td>
<td><strong>Regular Polyhedra</strong> (the Platonic solids) have fascinated people for centuries. In this investigation, students have the opportunity to develop their understanding of these wonderful shapes with unique properties and make models to confirm conjectures about the polyhedra.</td>
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<tr>
<td>A-REI.1: Reason with equations and inequalities and understand solving equations as a process of reasoning, including providing explanations of the reasoning.</td>
<td><strong>G-CO.9:</strong> Prove geometric theorems about lines and angles including the vertical angle theorem, when transversals cross parallel lines, alternate interior angles, corresponding angles, perpendicular bisector theorems.</td>
<td><em><em>G-MG.2</em>, 3</em>: Apply geometric</td>
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<td>F-IF.4*: Interpret functions that arise in applications in terms of the context, including interpreting key features of graphs and tables, sketching graphs to show key features such as intercepts, increasing, decreasing, positive or negative intervals, relative max and mins, symmetry, end behavior and periodicity.</td>
<td><strong>G-GMD.4:</strong> Visualize relationships between 2- and 3-dimensional objects. Identify shapes of 2-dimensional cross-sections of 3-d objects and identify 3-d objects generated through rotations of 2-d objects.</td>
<td><em><em>G-MG.2</em>, 3</em>: Apply geometric</td>
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<td>Recognizing and (Re) discovering which triangles, quadrilaterals, and regular polygons will tile a plane and explore semi regular tessellations.</td>
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<td><strong>Recognizing and Constructing 3-D Shapes</strong></td>
<td>Students construct 3-D shapes (polyhedra) by folding up 2-D nets composed of polygons, emphasizing that polyhedra are constructed from polygons. They classify polyhedra as pyramids, prisms or neither and construct models for these polyhedra. They discover Euler’s relationships among the number of vertices, faces, and edges of a polyhedron.</td>
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<td>Recognize and describe symmetries of tessellations, including translation symmetry.</td>
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<tr>
<td>Recognize and describe line and rotational symmetries of polygons and other two-dimensional shapes.</td>
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<td>Recognizing and Constructing 3-D Shapes</td>
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<td>Regular Polyhedra</td>
<td>Regular polyhedra (the Platonic solids) have fascinated people for centuries. In this investigation, students have the opportunity to develop their understanding of these wonderful shapes with unique properties and make models to confirm conjectures about the polyhedra.</td>
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- **Description:**
  - Apply concepts of density based on area and volume in modeling situations, apply geometric methods to solve design problems.
  - **S-ID.6**: Summarize, represent, and interpret data on 2 categorical and quantitative variables. Represent data on a scatter plot and describe how the variables are related. Fit functions to data and use them to solve problems. Assess fit of functions by plotting and analyzing residuals and fit linear functions for a scatter plot suggesting a linear association.
## Math 1 Scope and Sequence - Unit 7

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<tr>
<th>Unit 7 Quadratic Functions</th>
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<tr>
<td>● This unit develops student ability to recognize and represent quadratic relations between variables using data tables, graphs, and symbolic formulas, to solve problems involving quadratic functions, and to express quadratic polynomials in equivalent factored and expanded forms.</td>
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| **Algebra**  
A-SSE.1*, 2*, 3*: See structure in expressions and interpret this structure. Write expressions in equivalent forms to solve problems. Factor, complete the square and use properties of exponents to transform expressions.  
A-CED.2*: Create equations (1 or 2 variables) and inequalities (1 variable only) that describe numbers or relationships and Graph equations on coordinate axes with labels and scales.  
A-REI.4, 10: Solve quadratic equations by completing the square, factoring, taking square roots and inspections and derive the quadratic formula. Represent and solve equations and inequalities graphically and understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane. |

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| ● Recognize patterns in tables of sample values, in problem conditions, and in data plots that can be described by quadratic functions.  
● Write quadratic function rules to describe quadratic, or approximately quadratic, patterns in graphs or numerical data.  
● Use table, graph, or symbolic representations of quadratic functions to answer questions about the situations they represent: (1) Calculate y for a given x (i.e., evaluate functions); (2) Find x for a given y (i.e., solve equations and inequalities); and (3) Describe the rate at which y changes as x changes.  
● Rewrite simple quadratic expressions in equivalent forms by expanding or factoring given expressions and/or by combining like terms. |
| ● Determine patterns of change associated with quadratic functions.  
● Use tables of values and graphs to estimate answers for questions about situations modeled by quadratic functions.  
● Describe the effects of each parameter in the functions rule $y = a(x^2) + bx + c$.  
● Find symbolic rules for quadratic functions using data modeling and reasoning.  
● Determine whether two given quadratic expressions are equivalent.  
● Decide on most useful equivalent forms of quadratics for different question types.  
● Create equivalent quadratic expressions by expanding products of linear factors.  
● Factor quadratic expressions by extracting common linear factors.  
● Write quadratic equations and inequalities to express questions about quadratic functions.  
● Find exact values of solutions for quadratic equations in the form $a(x^2) + bx = 0$ by reasoning and factoring.  
● Relate factored forms of quadratic expressions to x-intercepts of graphs for the related functions. |

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| **Punkin’ Chunkin’ Investigation**: Students discover quadratic relationships in data collected at flying pumpkin competitions. Students use tables, graphs, and equations to answer questions about time and height data of projectiles.  
**Golden Gate Quadratics**: Students will investigate the height of a suspension bridge cable above the surface of the bridge which can be modeled by a quadratic equation that opens upward. They return to the Physics and Bungee Jump questions that were raised about business and have the opportunity to build and study a quadratic function with a rule in a non-standard form and a graph with a negative y-intercept. |

**Finding Expressions for Quadratic Patterns**  
In this investigation, students will develop strategies that are useful in finding rules for quadratic functions, in deciding when two quadratic expressions are equivalent, and in deciding when one type of quadratic expression is
### Unit 7

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**Function to its Graph** - Key features include intercepts, increasing, decreasing, positive or negative intervals, relative max and mins, symmetry, end behavior and periodicity.

**F-BF.1**, **F-BF.3**: Build a function that models a relationship between two quantities, and build a new function from existing ones.

**F-LE.3**: Observe linear, quadratic and exponential graphs and realize that the increase in the exponential quantity eventually exceeds that of a linear or quadratic (or polynomial) quantity.

**Modeling**: *all standards marked with asterisks are modeling standards*

### Unit 7 Related Standards:

- N-RN.2: Extend the properties of exponents to rational exponents. Rewrite expressions involving radicals and rational exponents using the properties of exponents.
- A-CED.1: Create equations (1 or 2 variables) and inequalities (1 variable only) that describe numbers or relationships, including ones with absolute value (CA), and use them to solve problems.
- A-REI.1, 7: Reason with equations and inequalities and understand solving equations as a process of reasoning, including providing more useful than another. They use data analysis tools for modeling patterns and use logical analysis to reason from problem conditions to a function rule.

**Solving Quadratic Equations** - Students use different situations to solve quadratic equations in context using the quadratic formula. Situations such as party planning, sports, and architecture are used to model quadratic relationships and students use the quadratic formula to write and solve equations for these situations.
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Explanations of the reasoning. Solve systems with linear and quadratic equations in two variables algebraically and graphically.

**A-APR.3:** Understand the relationship between zeroes and factors of polynomials. Identify zeroes when suitable factorizations are available and use the zeroes to construct a rough graph of the function defined by the polynomial.

**F-IF.1:** Understand the concept of a function and use function notation. Understand function as a mapping from each element of the domain to exactly one element of the range. Understand that the graph of \( f \) is the graph of the equation \( y = f(x) \).

**G-GMD.4:** Visualize relationships between 2- and 3-dimensional objects. Identify shapes of 2-dimensional cross-sections of 3-d objects and identify 3-d objects generated through rotations of 2-d objects.

**S-ID.6**: Summarize, represent, and interpret data on 2 categorical and quantitative variables. Represent data on a scatter plot and describe how the variables are related. Fit functions to data and use them to solve problems. Assess fit of functions by plotting and analyzing residuals and fit linear functions for a scatter plot suggesting a linear association.
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<td>• This unit develops student ability to solve problems involving chance by constructing sample spaces of equally-likely outcomes or geometric models and to use simulation to decide whether a model is consistent with the data.</td>
<td><strong>Geometry</strong>&lt;br&gt;G-MG.2*: Applying geometric concepts to modeling situations, apply properties of density based on area and volume in modeling situations. &lt;br&gt;<strong>Statistics and Probability</strong>&lt;br&gt;S-ID.1*: Summarize, represent, and interpret data on a single count or measurable variable. Represent data with dot plots, histograms and boxplots.&lt;br&gt;S-CP.1*,7*: Understand independence and conditional probability and use them to interpret data. Describe events as subsets of sample spaces using characteristics of the outcomes or as unions, intersections, or complements of other events. Use the rules of probability to compute probabilities of compound events in a uniform probability model. Apply the Addition Rule and interpret the answer in terms of the model.&lt;br&gt;S-MD.1*, 3*, 4*: Calculate expected values and use them to solve problems. Define random variable for quantities of interest by assigning numerical values to events in sample spaces and graph the corresponding distribution. Develop probability distributions for random variables defined for a sample space in which theoretical probabilities can be calculated and for sample space in which probabilities are assigned empirically.</td>
<td>• Students will...&lt;br&gt;- Construct sample spaces for chance situations involving equally likely outcomes.&lt;br&gt;- Construct probability distributions for sample spaces.&lt;br&gt;- Identify mutually exclusive (disjoint) events.&lt;br&gt;- Compute P(A and B) using the Addition Rule or its special case for mutually exclusive events.&lt;br&gt;- Design and carry out simulations to decide whether the probability model is consistent with the data.&lt;br&gt;- Use the Law of Large Numbers to understand situations involving chance.&lt;br&gt;- Use tables of random digits to perform simulations and understand some properties of random digits.&lt;br&gt;- Use random numbers to perform simulations in situations that involve continuous variables.&lt;br&gt;- Use geometric diagrams to solve probability problems that involve continuous variables.</td>
<td><strong>Probability Distributions:</strong> Students will learn to construct sample spaces and probability distributions and consider what the differences are between the two. They will roll dice and flip coins to develop these spaces and distributions and use their observed data to solve problems. <strong>50-50 Chance Simulation:</strong> Students simulate gender population control in China by investigating different options for families while still helping China to reduce population growth. Students first make a conjecture deciding if it is better for Chinese parents to have only one child, children until they have a boy, or some other option. Students simulate this situation by flipping a coin and calculating the number of flips it would take to “get a boy”. This simulation challenges assumptions about chance and leads students to discover the Law of Large Numbers for probability. <strong>Geometric Probability</strong> In this investigation, students will extend their...</td>
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### Modeling:
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### Unit 8 Related Standards:

- **A-CED.2**: Create equations in two or more variables to represent relationships between quantities: graph equations on coordinate axes with labels and scales.

- **S-ID.2**, **5, 6**: Use statistics appropriate to the shape of the data distribution to compare center and spread. Summarize categorical data in two-way frequency tables and interpret relative frequencies in the context of the data. Summarize, represent, and interpret data on 2 categorical and quantitative variables. Represent data on a scatter plot and describe how the variables are related. Fit functions to data and use them to solve problems. Assess fit of functions by plotting and analyzing residuals and fit linear functions for a scatter plot suggesting a linear association.

- **S-MD.2**: Use probability to make decisions by calculating expected values of random variables and interpreting it as the mean of the probability distribution.

- **S-CP.9**: Use the rules of probability to compute probabilities of compound events in a uniform probability model. Use permutations and combinations to compute probabilities of compound events and solve problems.

understanding of probability to area models of situations where the numbers are selected at random from a continuous interval. The diagrams will enable students to compute a probability exactly.