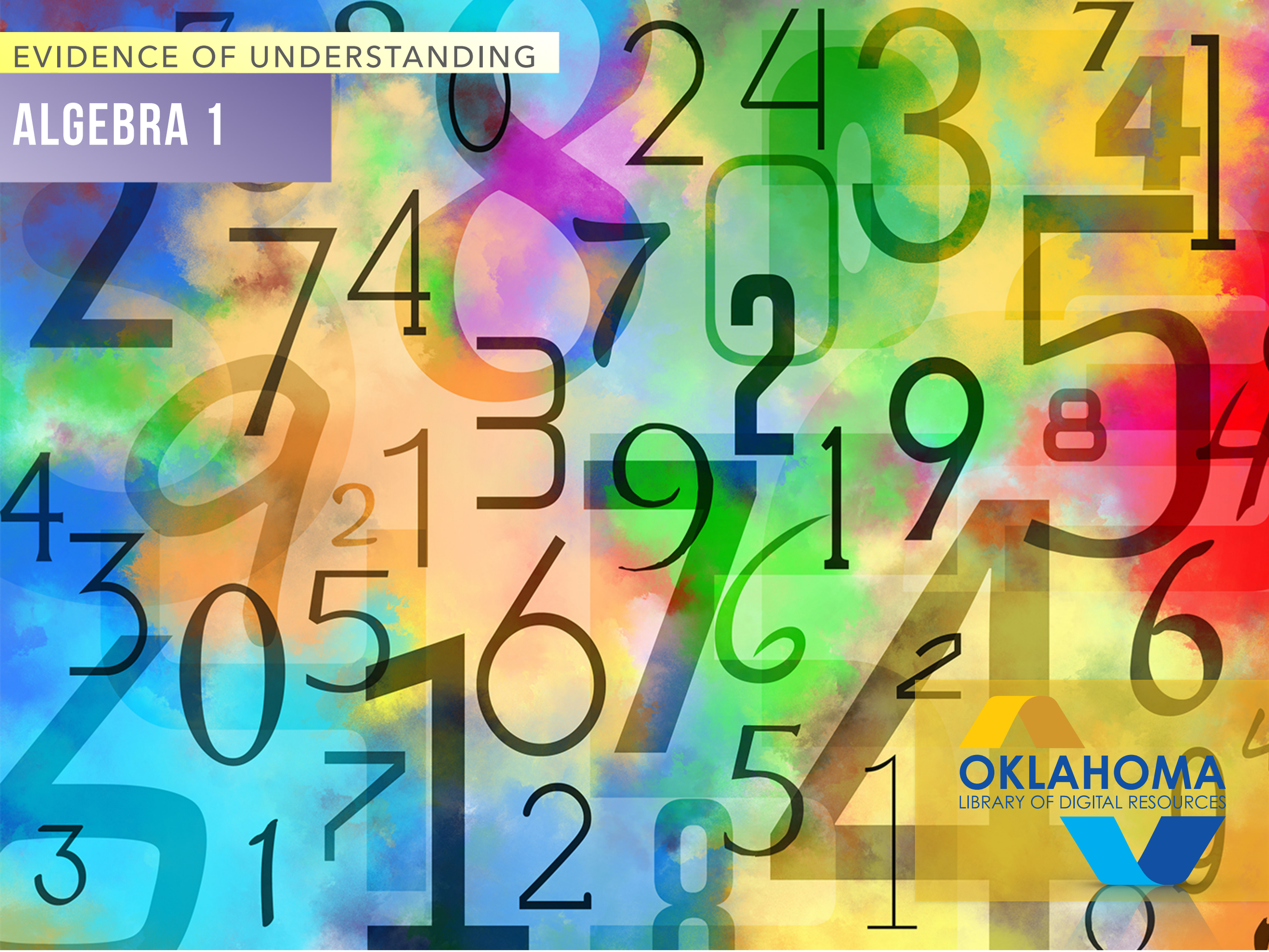
EVIDENCE OF UNDERSTANDING

ALGEBRA 1



OKLAHOMA
LIBRARY OF DIGITAL RESOURCES

The Oklahoma Library of Digital Resources is an innovative initiative to provide Oklahoma educators with high-quality, interactive teaching resources.

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Thank you to the following educators for their work in curating digital resources:

Sam Holthe, Duncan Public Schools
Sara Moren, Broken Arrow Public Schools
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Abby Tanner, Broken Arrow Public Schools
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GETTING TO KNOW OKLDR

WHO IS OSSBA?

The Oklahoma State School Boards Association (OSSBA) works to promote quality public education for the children of Oklahoma through training and information services to school board members. The Association is a leader among leaders in Oklahoma education and a visible presence in the local school districts and throughout the state.

The OSSBA was created in 1944 to provide support for local school board members with a variety of information, assistance, and representation services. OSSBA reaches every school board member through training opportunities. It creates and encouraged effective leaders to promote public education and cultivates productive alliances with governing bodies. OSSBA trains school board members to participate in an effective and supportive manner to provide direction for educational innovation and improves public perception of education in Oklahoma by sharing strategies and tools with our member school districts to focus on the success of Oklahoma public education.

OSSBA works with school boards to demonstrate the impact they have on student achievement. We work to provide meaningful two-way communication of advocacy, services, and training activities to local boards of education and their stakeholders. Other services we provide that have a direct impact on student achievement include strategic planning and superintendent searches. Our legal team provides free legal information to the school districts.

WHY OKLDR?

In the summer of 2016, OSSBA set out on a journey assist teachers in the integration of technology into their classrooms. The Oklahoma Library of Digital Resources (OKLDR) became a collection of digital content resources selected by Oklahoma educators to support the Oklahoma Academic Standards. The resources were curated by teachers from school districts across Oklahoma. Each collection contained a variety of learning resources, such as videos, apps, pdf documents, and websites, and are designed so that teachers can then build their lesson plans. The resources helped bridge the digital equity gap among students while helping schools make the most of limited resources.

After collaborating with educators, school and district leaders for a couple of years, OKLDR has been enhanced in the following ways:

- Resources are now an Open Education Resource (OER) "book" format, making it easier to use and accessible on multiple devices.
- Resources map to ESSA expectations for evidence of student understanding and students' mastery of the academic standards.
- Tools are now agnostic and can be used on multiple devices.
- Lessons are now focused on student engagement through the use of technology. The first OKLDR version focused on teacher resources. This is a major change.
- To prioritize student learning, teacher resources are now located at the back of each book.

HOW TO USE OKLDR

The Oklahoma Academic Standards for this lesson are grouped together by key topics. Sometimes you will see only one standard, but other times you will see a grouping of standards.

Evidence of Understanding is the key. This is the concept you want your students to master that reinforces the standards. Mastery means deeper understanding, not just "skim the surface" learning.

Digital Tools are the recommended applications and/or tools for the lesson. Think of this element as the "supplies box."

In Practice is a suggested activity to engage the students to demonstrate mastery of the standard. You will notice that this is just one suggested lesson, and sometimes there might be a second lesson. The suggested lesson, developed by Oklahoma teachers, is meant to give you a starting point. You might decide to use the lesson or it might give you an idea of something else you could do to teach the concept.

MOVING FORWARD

As you can see the OKLDR book has been designed to inspire educators to have students demonstrate their understanding of the Oklahoma Academic Standards through the use of technology as a productivity tool. While educators have limited time in the day to plan and research high quality content, this book is a jumping off point, with suggested peer-reviewed activities and resources.

While you might encounter extra white space in the book, it is intentional for growth. As you integrate the activities into your lessons, you are encouraged to send us student work samples that might be included in the book, as well as additional activities and resources that could be included in future revisions.

Next Steps:

- We would love to add samples of student work to the activities, so please send the work to: okldr@ossba.org.
- If you would like to be involved in future course creation, or know teachers who would like to be involved, please contact us at: okldr@ossba.org.
- See anything that needs to be changed or enhanced? Contact us at: okldr@ossba.org.

NUMBERS AND OPERATIONS

SQUARE ROOTS AND CUBE ROOTS

A1.N.1.1 Write square roots and cube roots of monomial algebraic expressions in simplest radical form.

A1.N.1.2 Add, subtract, multiply, and simplify square roots of monomial algebraic expressions and divide square roots of whole numbers, rationalizing the denominator when necessary.

Evidence of Understanding

Students will be able to use 3D Design to determine the square root of squares and the cube roots of cubes.

Digital Tools

- *3D Design* - 3DCio, Tinkercad, uMake
- *Video Editor*- Clips, WeVideo, Flipgrid, iMovie, Loom, Majisto

In Practice

- Students will use a 3D design application to create a model of a 3D cube and a 2D square.
- Students will create a video that includes pictures of the models as well as the related cube root and square root for each model and describe the process.

ALGEBRAIC REASONING AND ALGEBRA

ALGEBRAIC REPRESENTATION

A1.A.1.1 Use knowledge of solving equations with rational values to represent and solve mathematical and real-world problems (e.g., angle measures, geometric formulas, science, or statistics) and interpret the solutions in the original context.

A1.A.1.3 Analyze and solve real-world and mathematical problems involving systems of linear equations with a maximum of two variables by graphing (may include graphing calculator or other appropriate technology), substitution, and elimination. Interpret the solutions in the original context.

A1.A.4.1 Calculate and interpret slope and the x- and y-intercepts of a line using a graph, an equation, two points, or a set of data points to solve real- world and mathematical problems.

A1.A.4.3 Express linear equations in slope-intercept, point-slope, and standard forms and convert between these forms. Given sufficient information (slope and y-intercept, slope and one-point on the line, two points on the line, x- and y-intercept, or a set of data points), write the equation of a line.

A1.A.4.4 Translate between a graph and a situation described qualitatively.

Evidence of Understanding

Students will be able to create a story that can be translated algebraically and create a table, equations, and a graph of the data within the story.

Digital Tools

- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel
- *Story Telling* - Book Creator, Pages, Write About This, Google Docs
- *Interactive Whiteboard* - Educreations , Whiteboard: Absolute Board, Show Me, Google Jamboard, Explain Everything

In Practice

- Student will use a story telling application to create a story that can be represented algebraically in multiple forms. The story will include a race between two characters with one character receiving a head-start, characters should travel at different rates.
- Students will use a spreadsheet or whiteboard application to create a table of values that represents the distance traveled by each character over time, equations written in slope-intercept form, point-slope form, and standard form that represent each character's motion over time.
- Students will also create a graph that shows the motion of each character as a separate line in relation to the other.

ABSOLUTE VALUE EQUATIONS

A1.A.1.2 Solve absolute value equations and interpret the solutions in the original context.

Evidence of Understanding

Students will be able to create a number line and solve absolute value equations.

Digital Tools

- *Sketch* - Sketches School, Notes, ibis, Absolute Board, Google Draw
- *Video Editor*- Clips, WeVideo, Flipgrid, iMovie, Loom, Majisto

In Practice

- Students will use a sketch application to create number lines and solve absolute value equations that are provided by the teacher.
- Students will take screen shots or recordings after they have completed the equations.
- Students will then use a video editor to create a video explaining the process of solving the absolute value equations.

ALGEBRAIC INEQUALITIES

A1.A.2.1 Represent relationships in various contexts with linear inequalities; solve the resulting inequalities, graph on a coordinate plane, and interpret the solutions.

A1.A.2.3 Solve systems of linear inequalities with a maximum of two variables; graph and interpret the solutions on a coordinate plane.

A1.A.4.2 Solve mathematical and real-world problems involving lines that are parallel, perpendicular, horizontal, or vertical.

Soda (x)	Chicken (y)	Total
3	3	$13.30
5	2	$13.15

Example equation-

$\$1.45x + 2.95y \leq 15$

Evidence of Understanding

Students will be able to write, and interpret inequality equations and finally graph.

Digital Tools

- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel
- *Content Application*-Geo Board, Geogebra, Desmos

In Practice

- Students will access the Chick-Fil-A or any other teacher selected online menu to create five to ten food combinations and their total cost.
- Students will use a spreadsheet application to chart the food choice combinations and create inequality equations.
- Students will use an Desmos or other graphing calculator to graph the inequalities.

REPRESENTING INEQUALITIES

A1.A.2.2 Represent relationships in various contexts with compound and absolute value inequalities and solve the resulting inequalities by graphing and interpreting the solutions on a number line.

Evidence of Understanding

Students will be able to show understanding of representing inequalities using a digital tool.

Digital Tools

- *Desmos Activities*- Inequalities on the number line, Compound inequalities, Absolute value inequalities
- *Graphing Calculator* - Desmos, Google Graphing Calculator
- *Design Tools* - Canva, Web Poster Wizard, Collage Maker

In Practice

- Students explore linear inequalities and make connections using multiple representations using Desmos activity on linear inequalities.
- Students explore compound inequalities and make connections using multiple representations using Desmos activity on compound inequalities.
- Students explore absolute value inequalities and make connections using multiple representations using Desmos activity on absolute value inequalities.
- Students will create an anchor chart using design tools to show steps, important information, and evidence of understanding inequalities.

LITERAL EQUATIONS

A1.A.3.1 Solve equations involving several variables for one variable in terms of the others.

Evidence of Understanding

Student will be able to accurately show a formula being solved for more than one variable using a digital tool.

Digital Tools

- *Video Editor*- Clips, WeVideo, Flipgrid, iMovie, Loom, Majisto
- *Interactive Whiteboard* - Educreations , Whiteboard: Absolute Board, Show Me, Google Jamboard

In Practice

- Students will select a formula from a list the teacher provides and using a whiteboard application students will write each variable.
- Students will use a video editor and create a video how to solve the steps needed to manipulate the formula in terms of another. For example, given I = prt, the student would show how to solve the equation in terms of r (I/pt=r).

SIMPLIFYING POLYNOMIALS

A1.A.3.2 Simplify polynomial expressions by adding, subtracting, or multiplying.

Evidence of Understanding

Using a podcast and presentation app, students will be able to demonstrate their understanding of simplifying polynomials.

Digital Tools

- *Presentation* -Keynote, Google Slides, Microsoft PowerPoint
- Podcast-Anchor Google Play Anchor

In Practice

- Students will find or create a polynomial expression that must be simplified by using each operation (adding, subtracting, or multiplying).
- Students must create a presentation showing the step by step process on simplifying polynomials using each operation.
- Students will then create a podcast to go with their presentation explaining each process.

FACTORING

A1.A.3.3 Factor common monomial factors from polynomial expressions and factor quadratic expressions with a leading coefficient of 1.

Evidence of Understanding

Students will be able to use a digital tool to show each step in factoring expressions.

Digital Tools

- *Comic Maker* - Comic Touch 2, Comic Puppets, Canva Comic Strip Maker, Powtoon, Comic Strip - Comic Maker

In Practice

- Students will use a comic maker to create comic strips showing steps in factoring monomial, binomial, and trinomial expressions.

EVALUATING EXPRESSIONS

A1.A.3.4 Evaluate linear, absolute value, rational, and radical expressions. Include applying a nonstandard operation such as a (*) b=2a+b.

Evidence of Understanding

Students will be able to create a digital game board with a variety of equations.

Digital Tools

- *Sketch* - Sketches School, Notes, ibis, Absolute Board, Google Draw
- Game Board App- Gamestructor, Flippity

In Practice

- Students will use a sketch application to create a digital game board that will include various equations based off of teachers rubric.
- Students will critique their game boards with classmates and play the game created.

RECOGNIZING SEQUENCES

A1.A.3.5 Recognize that arithmetic sequences are linear using equations, tables, graphs, and verbal descriptions. Use the pattern, find the next term.

A1.A.3.6 Recognize that geometric sequences are exponential using equations, tables, graphs and verbal descriptions. Given the formula f(x) =a(r)^x, find the next term and define the meaning of a and r within the context of the problem.

Evidence of Understanding

Students will be able to create a digital presentation that will include a scenario to fit the data, an equation for the sequence and determine the next three numbers in the sequence.

Digital Tools

- Kahoot game on recognizing sequences
- *Presentation* - Keynote, Google Slides, Microsoft PowerPoint
- *Photo Library* - Pics4Learning, Photos 4 Class,

In Practice

- Students will play the Kahoot game on sequences as a class before completing the project.
- After playing Kahoot, the teacher will distribute sample sequences to each student group of 2 or 3 students.
- The students will create a digital presentation based on their sequence that includes the following:
  - Determine whether the sequence is arithmetic or geometric
  - Develop a scenario to fit the data using images to go with the scenario.
  - Create the equation for the sequence
  - Use the equation to determine the next three numbers in the sequence.

FUNCTIONS

REPRESENTING FUNCTIONS

A1.F.1.1 Distinguish between relations and functions.

A1.F.1.2 Identify the dependent and independent variables as well as the domain and range given a function, equation, or graph. Identify restrictions on the domain and range in real-world contexts.

A1.F.1.3 Write linear functions, using function notation, to model real-world and mathematical situations.

A1.F.1.4 Given a graph modeling a real-world situation, read and interpret the linear piecewise function (excluding step functions).

A1.F.2.1 Distinguish between linear and nonlinear (including exponential) functions arising from real-world and mathematical situations that are represented in tables, graphs, and equations. Understand that linear functions grow by equal intervals and that exponential functions grow by equal factors over equal intervals.

A1.F.2.2 Recognize the graph of the functions f(x) = x and f(x) = abv x and predict the effects of transformations [f(x + c) and f(x) + c, where c is a positive or negative constant] algebraically and graphically using various methods and tools that may include graphing calculators.

A1.F.3.1 Identify and generate equivalent representations of linear equations, graphs, tables, and real-world situations.

A1.F.3.2 Use function notation; evaluate a function, including nonlinear, at a given point in its domain algebraically and graphically. Interpret the results in terms of real-world and mathematical problems.

Evidence of Understanding

Students will be able to create a mind-map of representing function terms, including related examples and explain the relationships among the terms as organized.

Digital Tools

- *Mind Mapping* - ReadWriteThink, Popplet, Padlet, Simple Mind+ Mind Mapping, Post-It, Visme
- *Story Telling Application* - ChatterPix Kids, Shadow Puppets EDU, Book Creator, Seesaw, Pages, Write About This, Google Docs
- *QR Code Generator* - QR Code Generator, QR Stuff, Flowcode

In Practice

- Students will use a mind mapping application to create a mind map of function vocabulary.
- Students will include an example for each term and should be able to evaluate the connections were made between particular terms.
- Representing Function terms: relations, functions, independent variable, dependent variable, domain, range, function notation, real-world piecewise function, linear function, non-linear function, graph of a function [f(x) and f abv (x)], transformations of graphs, and equivalent representations of equations, graphs, tables, and situations.
- Students will use their mind map to create an interactive notebook using a storytelling application of each specific standard/term. Students will incorporate links, images, and qr codes in their notebook.

OPERATIONS WITH FUNCTIONS

A1.F.3.3 Add, subtract, and multiply functions using function notation.

Evidence of Understanding

Students will be able to create a graph using linear, absolute value, and quadratic functions and write a function that represents the graph.

Digital Tools

- *Graphing Calculator* - Desmos, Google Graphing Calculator
- *Video Editor*- Clips, WeVideo, Flipgrid, iMovie, Loom, Majisto
- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel

In Practice

- Students will design a ramp or rollercoaster.
- Using a digital graphing calculator students will create a graph of their ramp/ roller coaster in regard to time and height using linear, absolute value, and quadratic functions.
- Students will write a function that represents their graph.
- Using a video editor students will tell the story of their roller coaster using the above elements.
- In the video students will include a spreadsheet made with a spreadsheet application including a graph and an answer key for their function that identifies the function attributes.

DATA AND PROBABILITY

ANALYZING DATA

A1.D.1.2 Collect data and use scatterplots to analyze patterns and describe linear relationships between two variables. Using graphing technology, determine regression lines and correlation coefficients; use regression lines to make predictions and correlation coefficients to assess the reliability of those predictions.

A1.D.1.1 Describe a data set using data displays, describe and compare data sets using summary statistics, including measures of central tendency, location, and spread. Know how to use calculators, spreadsheets, or other appropriate technology to display data and calculate summary statistics.

A1.D.1.3 Interpret graphs as being discrete or continuous.

A1.D.2.4 Apply probability concepts to real-world situations to make informed decisions.

Evidence of Understanding

Students will be able to conduct a survey, gather results, construct graphs, and create a presentation using their results and graphs.

Digital Tools

- Teaching notes for survey project
- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel
- *Presentation* - Keynote, Google Slides, Microsoft PowerPoint
- *Polling Application*- Plickers, Poll Everywhere

In Practice

- Teachers will access the teaching notes for project details.
- Groups will decide on a question and collect data using a polling application.
- Students will combine results and using a spreadsheet application create graphs.
- Students will incorporate results in a presentation application, make predictions for the future data, and present.

PROBABILITY CONCEPTS

A1.D.2.1 Select and apply counting procedures, such as the multiplication and addition principles and tree diagrams, to determine the size of a sample space (the number of possible outcomes) and to calculate probabilities.

A1.D.2.3 Calculate experimental probabilities by performing simulations or experiments involving a probability model and using relative frequencies of outcomes.

Evidence of Understanding

Students will be able to calculate probabilities of their event and using a whiteboard application or presentation application, explain their calculations.

Digital Tools

- *Video Editor*- Clips, WeVideo, iMovie
- *Interactive Whiteboard* - Educreations , Whiteboard: Absolute Board, Show Me, Google Jamboard, Explain Everything
- *Presentation* - Keynote, Google Slides, Microsoft PowerPoint
- *Teacher and Student Sample* - What are the chances of that?

In Practice

- Teacher will review the student projects of the "What are the Chances of That?" with students.
- In a group, students will design a probability experiment that they can conduct.
- Students will calculate theoretical and experimental probability.
- Students will use an interactive whiteboard, presentation tool, or video editor to create a video of their experiment, combining both the actual experiment and the mathematical explanation behind their findings.

VENN DIAGRAM

A1.D.2.2 Describe the concepts of intersections, unions, and complements using Venn diagrams to evaluate probabilities. Understand the relationships between these concepts and the words AND, OR, and NOT.

Evidence of Understanding

Students will be able to use a mind mapping application to successfully build Venn diagrams based on a chosen rule.

Digital Tools

- *Mind Mapping* - ReadWriteThink, Popplet, Padlet, Simple Mind+ Mind Mapping, Post-Itj, Visme
- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel

In Practice

- Students will create their own test board and set of rules for dice probability.
- Students will use a spreadsheet application to create a table of the data from rolling the die.
- Students will use a mind mapping application and choose a rule for each circle and sort the data in the diagram according to the rule they chose.

RESOURCES

TEACHER

- Openmiddle Cube Root Challenge
- Algebra Concepts
- Simplifying Radicals
- Square Root Game
- Khan Academy - Denominators
- Youtube - MyWhyU Math
- Absolute Value
- Kahoot!