Evidence of UndersTanding

ALGEBRA 2

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:

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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 THE BOOK

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

COMPLEX NUMBERS

A2.N.1.1: Find the value of any whole number exponent of i.

A2.N.1.2 Simplify, add, subtract, multiply, and divide complex numbers.

Evidence of Understanding

Students will be able to create an infographic with examples of each operation with complex numbers and example results.

Digital Tools

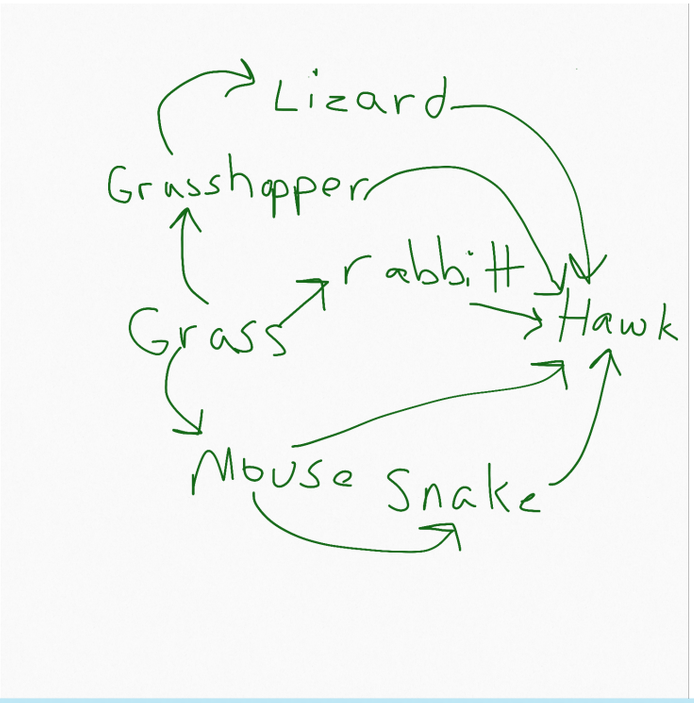
- *Word Processor* - Pages, Google Docs, Microsoft Word
- *Interactive Whiteboard Application* - Educreations , Whiteboard: Absolute Board, Show Me, Google Jamboard, Explain Everything
- *Video Editor*- Clips, WeVideo, Do-Ink, iMovie

In Practice

- Students will create a digital representation of the operations of complex numbers including explanations and examples using a video editing tool, whiteboard application, or presentation tool.

MATRICES

A2.N.1.3 Use matrices to organize and represent data. Identify the order (dimension) of a matrix, add and subtract matrices of appropriate dimensions, and multiply a matrix by a scalar to create a new matrix to solve problems.



Evidence of Understanding

Students will be able to use a mind mapping application to create a food chain, then convert into a matrix using a spreadsheet application. One portion of the food chain will be eliminated to create an additional matrix to add or subtract.

Digital Tools

- *Mind Mapping* - Mind Vector, Popplet, Padlet, Simple Mind+ Mind Mapping, PostIt
- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel

In Practice

- Students will create a food web of 7 selected animals using a mind mapping application.
- Students will use a spreadsheet application to create a matrix of their food web.
- One animal will be deleted from the food web, students will then create another matrix. The matrices will then be added or subtracted as determined by the teacher.

ALGEBRAIC REASONING AND ALGEBRA

REAL WORLD EQUATIONS

A2.N.1.4 Understand and apply the relationship of rational exponents to integer exponents and radicals to solve problems.

A2.A.1.1 Represent real-world or mathematical problems using quadratic equations and solve using various methods (including graphing calculator or other appropriate technology), factoring, completing the square, and the quadratic formula. Find non-real roots when they exist.

A2.A.1.2 Represent real-world or mathematical problems using exponential equations, such as compound interest, depreciation, and population growth, and solve these equations graphically (including graphing calculator or other appropriate technology) or algebraically.

A2.A.1.3 Solve one-variable rational equations and check for extraneous solutions.

A2.A.1.4 Solve polynomial equations with real roots using various methods and tools that may include factoring, polynomial division, synthetic division, graphing calculators or other appropriate technology.

A2.A.1.5 Solve square root equations with one variable and check for extraneous solutions.

A2.A.1.6 Solve common and natural logarithmic equations using the properties of logarithms.

A2.A.1.7 Solve real-world and mathematical problems that can be modeled using arithmetic or finite geometric sequences or series given the nth terms and sum formulas. Graphing calculators or other appropriate technology may be used.

A2.A.1.8 Represent real-world or mathematical problems using systems of linear equations with a maximum of three variables and solve using various methods that may include substitution, elimination, and graphing (may include graphing calculators or other appropriate technology).

A2.A.1.9 Solve systems of equations containing one linear equation and one quadratic equation using tools that may include graphing calculators or other appropriate technology.

A2.A.2.3 Recognize that a quadratic function has different equivalent representations [($f(x) = ax^2+bx+c$, $f(x) = a(x - h)^2 + k$, and $f(x) = (x - h)(x - k)$]. Identify and use the representation that is most appropriate to solve real-world and mathematical problems.

A2.A.2.4 Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Evidence of Understanding

Students will be able solve a variety of equations and use a story telling application to demonstrate and interpret the results.

Digital Tools

- Graphing Calculator - Desmos,Mathway Google Calculator
- *Story Telling Application* - Book Creator, Pages, Write About This, Google Docs
- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel

In Practice

- Students will create equations or real world situations of the types listed in the standards (quadratic, logarithmic, etc).
- Students will differentiate the type of equation, write the equation if given a real world problem, and solve it using a graphing calculator.
- Students will represent the equation with a graph and table of values using spreadsheet application.
- Using a story telling application, students will create a book of their work to share with peers and teacher.

POLYNOMIAL OPERATIONS

A2.A.2.1 Factor polynomial expressions including but not limited to trinomials, differences of squares, sum and difference of cubes, and factoring by grouping using a variety of tools and strategies.

A2.A.2.2 Add, subtract, multiply, divide, and simplify polynomial and rational expressions.

Evidence of Understanding

Students will be able to find the correct dimensions and costs associated with a swimming pool by factoring the trinomials produced by the swimming pool data and use a design application to create a scaled 3D replica of the pool.

Digital Tools

- *Student Sample* - Factoring Project
- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel
- *Video Editor*- Clips, WeVideo, Do-Ink, iMovie
- *Green Screen Application*- WeVideo, Veescope
- Design Tool- Tinkercad

In Practice

- Teacher will introduce factoring project to students then students will find solutions to the four problems.
- Students will collaborate with other groups to compare solutions and check for accuracy.
- Students will use a design tool to create a scaled replica of their pool and/or a spreadsheet application to create a digital sketch of their pool, including all the calculations and results.
- Students will use a green screen application to create a video of their 3D pool, solutions to the problems, and rational for their choices while using the green screen to show the design image and/or spreadsheet data

FUNCTIONS

EXPLORING FUNCTIONS

A2.F.1.1 Use algebraic, interval, and set notations to specify the domain and range of functions of various types and evaluate a function at a given point in its domain.

A2.F.1.2 Recognize the graphs of exponential, radical (square root and cube root only), quadratic, and logarithmic functions. Predict the effects of transformations [f(x + c), c(x) + c, f(cx), and cf(x), where c is a positive or negative real-valued constant] algebraically and graphically, using various methods and tools that may include graphing calculators or other appropriate technology.

A2.F.1.3 Graph a quadratic function. Identify the x- and y-intercepts, maximum or minimum value, axis of symmetry, and vertex using various methods and tools that may include a graphing calculator or appropriate technology.

A2.F.1.4 Graph exponential and logarithmic functions. Identify asymptotes and x- and y-intercepts using various methods and tools that may include graphing calculators or other appropriate technology. Recognize exponential decay and growth graphically and algebraically.

A2.F.1.5 Analyze the graph of a polynomial function by identifying the domain, range, intercepts, zeros, relative maxima, relative minima, and intervals of increase and decrease.

A2.F.1.6 Graph a rational function and identify the x- and y-intercepts, vertical and horizontal asymptotes, using various methods and tools that may include a graphing calculator or other appropriate technology. (Excluding slant or oblique asymptotes and holes.)

A2.F.1.7 Graph a radical function (square root and cube root only) and identify the x- and y-intercepts using various methods and tools that may include a graphing calculator or other appropriate technology.

A2.F.1.8 Graph piecewise functions with no more than three branches (including linear, quadratic, or exponential branches) and analyze the function by identifying the domain, range, intercepts, and intervals for which it is increasing, decreasing, and constant.

A2.F.2.1 Add, subtract, multiply, and divide functions using function notation and recognize domain restrictions

A2.F.2.2 Combine functions by composition and recognize that g(x) = f^-1(x), the inverse function of f(x), if and only if f(g(x)) = g(f(x)) = x.

A2.F.2.3 Find and graph the inverse of a function, if it exists, in real-world and mathematical situations. Know that the domain of a function f is the range of the inverse function f^-1, and the range of the function f is the domain of the inverse function f^-1.

A2.F.2.4 Apply the inverse relationship between exponential and logarithmic functions to convert from one form to another.

Evidence of Understanding

Students will be able to collect and analyze college tuition data to determine the linear, quadratic and exponential curve of best fit, and predict future tuition costs using the above standards.

Digital Tools

- *Sketch Application*- Sketches School, Notes, ibis, Absolute Board, Google Draw
- Word Processor - Pages, Google Docs, Microsoft Word
- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel

In Practice

- Students will work in groups using a spread sheet application to collect, analyze, and graph data on college/tech/trade school tuition rates.
- Students will use a sketch application to work through the data, sketch graphs, and make notes on their process and calculations.
- Using a spreadsheet application students will write a final overview of their findings, select one of the universities that they would choose to attend and write a rationale.

DATA AND PROBABILITY

INVESTIGATING DATA

A2.D.1.1 Use the mean and standard deviation of a data set to fit it to a normal distribution (bell-shaped curve)

A2.D.1.2 Collect data and use scatterplots to analyze patterns and describe linear, exponential or quadratic relationships between two variables. Using graphing calculators or other appropriate technology, determine regression equation and correlation coefficients; use regression equations to make predictions and correlation coefficients to assess the reliability of those predictions.

A2.D.1.3 Based upon a real-world context, recognize whether a discrete or continuous graphical representation is appropriate and then create the graph.

A2.D.2.1 Evaluate reports based on data published in the media by identifying the source of the data, the design of the study, and the way the data are analyzed and displayed. Given spreadsheets, tables, or graphs, recognize and analyze distortions in data displays. Show how graphs and data can be distorted to support different points of view.

A2.D.2.2 Identify and explain misleading uses of data. Recognize when arguments based on data confuse correlation and causation.

Evidence of Understanding

Students will collect data and use scatterplots to analyze patterns and describe linear, exponential or quadratic relationships between two variables.

Digital Tools

- *Spreadsheet*- Numbers, Google Sheets, Microsoft Excel
- *Video Editor*- Clips, WeVideo, Do-Ink, iMovie
- *Mind Mapping* - Mind Vector, Popplet, Padlet, Simple Mind+ Mind Mapping, PostIt
- *Green Screen Application*- WeVideo, Veescope , Doink Green Screen

In Practice

- Using a spreadsheet application and mind mapping application, students will analyze the Oklahoma lottery, as well as a lottery of their choice.
- Students will analyze and create graphs of the pros and cons of the lottery, different issues surrounding the lottery, how the money could have been alternatively spent, and to create a lottery of their own.
- Students will answer- what is the lottery, can playing the lottery be profitable, what are issues surrounding the lottery, who is harmed the most by playing the lottery?
- Students will use a video editor and a green screen application to make a commercial of their findings and promote their own lottery.

RESOURCES

TEACHER

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

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Kerry Weingartner, Broken Arrow Public Schools
Taler Broadbent, Merritt Public Schools
Robyn Wright, Sand Springs Public Schools
Sarah Peffer, Merritt Public Schools