



Mathematics
Grades 8 - 9
Algebra 1

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This curriculum may be modified through varying techniques, strategies, and materials as per an individual student's Individualized Educational Plan (IEP)

Approved by the Wayne Township Board of Education at the regular meeting held on November 15, 2018.

Curriculum Document:
Mathematics

Course Title: Algebra 1

Grade Level: 8-9

UNIT 1: Linear Equations, Inequalities and
Absolute Values in One Variable

20 Days

UNIT 2: Functions, Linear Equations and
Inequalities in Two Variables, Arithmetic
Sequences

30 Days

UNIT 3: Graphing Absolute Value,
Exponential, Quadratic (in Vertex Form),
and General Graphs Using Transformations

30 days

UNIT 4: Operations with Polynomials,
Factoring Polynomials, Quadratic
Equations and Functions

50 Days

UNIT 5: Exponent Properties and
Exponential Growth and Decay

20 days

UNIT 6: Rational Expressions

15 days

****Descriptive Statistics-Supplemented
throughout the year**

New Jersey Student Learning Standards For Mathematics

Standards for Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately) and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

- Make sense of problems and persevere in solving them.
 - Mathematically proficient students:
 - explain to themselves the meaning of a problem and looking for entry points to its solution.
 - analyze givens, constraints, relationships, and goals.
 - make conjectures about the form and meaning of the solution attempt.
 - consider analogous problems, and try special cases and simpler forms of the original problem.
 - monitor and evaluate their progress and change course if necessary.
 - transform algebraic expressions or change the viewing window on their graphing calculator to get information.
 - explain correspondences between equations, verbal descriptions, tables, and graphs.
 - draw diagrams of important features and relationships, graph data, and search for regularity or trends.
 - use concrete objects or pictures to help conceptualize and solve a problem.
 - check their answers to problems using a different method.
 - ask themselves, “Does this make sense?”
 - understand the approaches of others to solving complex problems.
- Reason abstractly and quantitatively.
 - Mathematically proficient students:
 - make sense of quantities and their relationships in problem situations.
 - *decontextualize* (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
 - *contextualize* (pause as needed during the manipulation process in order to probe into the referents for the symbols involved).

- use quantitative reasoning that entails creating a coherent representation of quantities, not just how to compute them
 - know and flexibly use different properties of operations and objects.
- Construct viable arguments and critique the reasoning of others.
 - Mathematically proficient students:
 - understand and use stated assumptions, definitions, and previously established results in constructing arguments.
 - make conjectures and build a logical progression of statements to explore the truth of their conjectures.
 - analyze situations by breaking them into cases
 - recognize and use counterexamples.
 - justify their conclusions, communicate them to others, and respond to the arguments of others.
 - reason inductively about data, making plausible arguments that take into account the context
 - compare the effectiveness of plausible arguments
 - distinguish correct logic or reasoning from that which is flawed
 - elementary students construct arguments using objects, drawings, diagrams, and actions..
 - later students learn to determine domains to which an argument applies.
 - listen or read the arguments of others, decide whether they make sense, and ask useful questions
- Model with mathematics.
 - Mathematically proficient students:
 - 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.
 - simplify a complicated situation, realizing that these may need revision later.
 - identify important quantities in a practical situation
 - map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas.
 - analyze those relationships mathematically to draw conclusions.
 - interpret their mathematical results in the context of the situation.
 - reflect on whether the results make sense, possibly improving the model if it has not served its purpose.
- Use appropriate tools strategically.
 - Mathematically proficient students

- consider available tools when solving a mathematical problem.
 - are familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools
 - detect possible errors by using estimations and other mathematical knowledge.
 - know that technology can enable them to visualize the results of varying assumptions, and explore consequences.
 - identify relevant mathematical resources and use them to pose or solve problems.
 - use technological tools to explore and deepen their understanding of concepts.
- Attend to precision.
 - Mathematically proficient students:
 - try to communicate precisely to others.
 - use clear definitions in discussion with others and in their own reasoning.
 - state the meaning of the symbols they choose, including using the equal sign consistently and appropriately.
 - specify units of measure and label axes to clarify the correspondence with quantities in a problem.
 - calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the context.
 - In the elementary grades, students give carefully formulated explanations to each other.
 - In high school, students have learned to examine claims and make explicit use of definitions.
- Look for and make use of structure.
 - Mathematically proficient students:
 - look closely to discern a pattern or structure.
 - Young students might notice that three and seven more is the same amount as seven and three more.
 - Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for the distributive property.
 - In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$.
 - step back for an overview and can shift perspective.
 - see complicated things, such as some algebraic expressions, as single objects or composed of several objects.
- Look for and express regularity in repeated reasoning.
 - Mathematically proficient students:
 - notice if calculations are repeated
 - look both for general methods and for shortcuts.
 - maintain oversight of the process, while attending to the details.
 - continually evaluate the reasonableness of intermediate results.

Wayne School District

Curriculum Format

| | |
|--|---|
| Content Area/ Grade Level/ Course: | Mathematics 8/9 Algebra 1 |
| Unit Plan Title: | Unit 1: Linear Equations, Inequalities and Absolute Values in One Variable |
| Time Frame | 20 Days |
| Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10 | |
| <ul style="list-style-type: none">● Solve linear equations in one variable. (A.CED.A.1, A.REI.A.1, A.REI.B.3)● Rewrite and use literal equations and formulas. (A.CED.A.4)● Solve and apply proportions. (A.REI.B.3, N.Q.A.1, A.CED.A.1, N.Q.A.2,3)● Solve linear inequalities and compound inequalities in one variable. (A.REI.B.3, A.CED.A.1)● Solve absolute value equations and inequalities. (A.CED.A.1, A.SSE.A.1b)● Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CI.1● Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.CT.2 | |
| Unit Overview | |
| <p>Unit 1 builds on the previous knowledge and understanding of solving linear equations in one variable and their graphical representations. Students will be prompted to analyze and explain their methods for writing and solving linear equations and inequalities. They will also be able to write and manipulate equations to solve algebraic examples. Students will also be able to solve absolute value equations and inequalities, and represent their solutions graphically. All problem solving techniques will be related to real-life situations and applications.</p> | |
| Standard Number(s) | |
| <ul style="list-style-type: none">● N.Q.A.1 - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.● N.Q.A.2 - Define appropriate quantities for the purpose of descriptive modeling.● N.Q.A.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.● A.CED.A.1 - Create equations and inequalities in one variable and use them to solve problems.● A.CED.A.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.● A.REI.A.1 - Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.● A.REI.B.3 - Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.● A.SSE.1b - Interpret complicated expressions by viewing one or more of their parts as a single entity.● 8.1.12.CS.4 - Develop guidelines that convey systematic troubleshooting strategies that others can | |

- use to identify and fix errors.
- **8.1.12.DA.1** - Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
- **8.1.12.DA.5** - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
- **8.2.12.ED.1** - Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- **8.2.12.ED.4** - Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- **9.1.12.PB.1** - Explain the difference between saving and investing.
- **9.2.12.CAP.5** - Assess and modify a personal plan to support current interests and postsecondary plans.
- **9.4.12.CI.1** - Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
- **9.4.12.CT.2** - Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a)
- **9.4.12.TL.2** - Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- **NJSLSA.R4** - Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
- **NJSLSA.SL1** - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- **HS-ETS1-2** - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **RST.9-10.3** - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- **RST.9-10.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- **RST.9-10.7** - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **WHST.9-10.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- **WHST.9-10** - Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- **WHST.9-10.7** - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when

appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Intended Outcomes - {Essential Questions}

- How can you represent quantities, patterns, and relationships?
- How are properties related to algebra?
- Can equations that appear to be different be equivalent?
- How can you solve equations?
- What kinds of relationships can proportions represent?
- How do you represent relationships between quantities that are not equal?
- Can inequalities that appear to be different be equivalent?
- How can you solve inequalities?
- How can you represent and describe functions both in mathematics and when applied in real-world situations?
- Can inequalities that appear to be different be equivalent?
- How can you solve inequalities?

Enduring Understandings

- Using variables to represent quantities that are unknown or may vary in expressions and equations. Utilizing the properties of the real numbers to rewrite equations and find solutions.
- The ability to represent an equation in different forms that are equivalent. Manipulate numbers and equations to transform equations into more simple, yet equivalent, equations to find solutions. Recognize that the ratios of two quantities are equal, and utilize this proportional relationship to describe similar figures, scale models, and rates.
- The use of algebraic inequalities to represent relationships between quantities that are not equivalent, and how you can represent an inequality using symbols in an infinite number of ways. Using properties of inequalities to transform
- The properties of a function, and the different methods for interpreting and displaying the data of a function, both in mathematics and applied in real-world situations.
- How to represent and rewrite absolute value inequalities as well as equations as a set of equations or compound inequalities.
- Manipulate equations and formulas. Write equations in function notation.

In this unit plan, the following 21st Century themes and skills are addressed.

| Check all that apply. 21 st Century Themes | | Indicate whether these skills are <i>E-Encouraged</i> , <i>T-Taught</i> , or <i>A-Assessed</i> in this unit by marking <i>E</i> , <i>T</i> , <i>A</i> on the line before the appropriate skill. 21 st Century Skills | |
|--|---|--|---------------------------------------|
| <input checked="" type="checkbox"/> | Global Awareness | <input checked="" type="checkbox"/> | Creativity and Innovation |
| <input type="checkbox"/> | Environmental Literacy | <input type="checkbox"/> | Critical Thinking and Problem Solving |
| <input type="checkbox"/> | Health Literacy | <input type="checkbox"/> | Communication |
| <input type="checkbox"/> | Civic Literacy | <input type="checkbox"/> | Collaboration |
| <input checked="" type="checkbox"/> | Financial, Economic, Business, and Entrepreneurial Literacy | | |

Student Learning Targets/Objectives (Students will know/Students will understand)

- Reason quantitatively and use units to solve problems.
 - Interpret the structure of expressions, equations, and functions.
 - Create equations that describe numbers or relationships.
 - Understand solving equations as a process of reasoning and explain the reasoning.
 - Solve equations and inequalities in one variable.
 - Solve absolute value equations and inequalities.
 - Manipulate and rewrite equations including function notation.
1. A friend calls you and asks you to meet at the park 2 miles away in 25 minutes. You set off on your skateboard after the call. At what speeds (in miles per minute) can you ride your skateboard to be at the park in at most 25 minutes? How are the distance you travel, your speed, and time related? How can an inequality help you to solve the problem?
 2. Determine whether the statement is ***always, sometimes, or never true***. Justify your answer.
 - If $x > 3$ and $y < 1$, then $xy > 0$.
 - If $x < 0$ and $y < 0$, then $xy > 0$.
 - If $x \geq 0$ and $y > 1$, then $xy > 0$.
 3. If $ax \leq ay$ and $ay \leq az$, is $x \leq z$? Explain.
 4. The hard drive on your computer has a capacity of 120 GB. You have used 85 GB. You want to save some home videos to your hard drive. What are the possible sizes of the home video collection you can save?
 5. Your cell phone plan costs \$39.99 per month plus \$0.15 for each text message you send or receive. You have at most \$45 to spend on your cell phone bill. What is the maximum number of text messages that you can send or receive next month? Are the solutions of the resulting inequality reasonable?
 6. Determine whether the statement is ***always true or never true***. Justify your answer.
 - $5s + 7 \geq 7 + 5s$
 - $4t + 6 > 4t - 3$
 - $5(m + 2) < 5m - 4$

7. The monthly average temperature T for San Francisco, California, is usually within 7.5°F of 56.5°F , inclusive. What is the monthly average temperature in San Francisco?
8. Belle surveyed her classmates in music class. There were 42 students enrolled. The ratio of students who prefer playing string instruments to those who prefer wind instruments is $2 : 5$. How many students prefer playing string instruments?
9. Travis sells black and white photos of cities across the country. Each rectangular photo's width is half its height. Write an equation to represent the area A of a photo given its height h . Use this equation to find the area of a photo that is 4 inches tall.
10. When Paige left middle school and entered high school, her class increased by 225%. There were 56 students in her middle school class. How many students are in her high school class?
11. The relationship between degrees Fahrenheit F and degrees Celsius C can be given by $C = \frac{5}{9}(F - 32)$. Solve the equation for F . Determine the Fahrenheit equivalent to 25°C . Utilize Google Sheets to share and represent the data.
12. A builder measured the perimeter of the foundation of a new house to be 330 feet. He must order the steel beams for the foundation in meters. How many meters should the builder order? Round to the nearest tenth of a meter.
13. Students will utilize the grading feature through Pearson realize to develop a digital portfolio of their progress.
14. Students will utilize advanced calculators such as TI-84 in order to solve problems too difficult to calculate by hand. Additionally, students will utilize math programming languages as needed (LaTex, Desmos, Equatio, etc.)

Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an **

- Chapter Quizzes and Tests
- Final Exam*
- Communicator Activities
- Classroom Clickers Activities
- True-False Sorts Activities
- Student Questioning Activities
- Classroom Warm-Up Activities

Teaching and Learning Activities

Activities

- Explore Learning Linear Functions
<http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=216>
A gizmo to determine if a relation is a function
- Explore Learning Function Machines 1
<http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=1035>
A gizmo to create and explore and create functions
- Explore Learning Inequalities Involving Absolute Values

| | |
|--|--|
| | <p>http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=141 A gizmo to solve absolute value inequalities by studying graphically</p> |
| <p><i>Differentiation Strategies and Activities</i></p> | <ul style="list-style-type: none"> ● Use of communicators. ● Kahoot/Socrative/Plickers activities. ● Online assessments. ● Flipped Classroom. ● Use of formative and summative assessments. ● Partner and group work/projects. ● Mixed ability groups. ● Pearson Realize Online textbook <p>Differentiation Strategies for Special Education Students Differentiation Strategies for Gifted and Talented Students Differentiation Strategies for ELL Students Differentiation Strategies for At Risk Students</p> |
| <p><i>Honors</i></p> | <ul style="list-style-type: none"> ● Students must be able to use higher-order thinking skills to perform multi-step tasks to show a deep understanding of the content. ● Students should be able to provide a detailed written explanation of the concept to show deep comprehension of a given topic. ● Students should be able to apply their learning to interdisciplinary projects, activities or applications. |
| <p>Resources</p> | |
| <ul style="list-style-type: none"> ● Classzone.com ● ExploreLearning.com ● Graphing Calculator ● Algebra tiles ● Communicators ● LCD Projector & Document Camera ● Textbook Resources ● Khan academy | |

Wayne School District

Curriculum Format

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|---|--|
| Content Area/ Grade Level/ Course: | Mathematics 8/9 Algebra 1 |
| Unit Plan Title: | Unit 2: Functions, Linear Equations and Inequalities in Two Variables, Arithmetic Sequences |
| Time Frame | 30 Days |

Anchor Standards/Domain*

- Determine whether a relation is a function from a graph, table of values, or describe as a set, identify domain and range, and use function notation. (F.IF.A.1,2)
- Graph equations that represent functions. (N.Q.A.1, A.REI.D.10, F.IF.B.5)
- Find rates of change from tables and graphs; calculate slope. (F.LE.A.1b, F.IF.B.6, N.Q.A.1,2)
- Write and graph linear equations in slope – intercept form. (F.IF.C.7a)
- Write and graph linear equations using point – slope form. (F.LE.A.2, F.LE.B.5, A.SSE.A.1a,2, A.CED.A.2, F.IF.B.4, F.IF.C.7a, F.BF.A.1a)
- Graph linear equations using intercepts; express linear equations in standard form. (A.CED.A.2, N.Q.A.2)
- Write and graph an equation of a direct variation. (A.CED.A.2, N.Q.A.2)
- Write an equation of a trend line, line of best fit, and make predictions. (S.ID.B.6.a-c, S.ID.C.7,8,9, N.Q.A.1)
- Represent and describe data for two variables on a scatter plot, fit a function to the data, analyze residuals (in order to informally assess fit), and use the function to solve problems. Uses a given function or choose a function suggested by the context. Emphasize linear and exponential models.(S.ID.B.6a)
- Interpret the slope and intercept of a linear model in the context of the data; compute (using technology) and interpret the correlation coefficient of a linear fit. (S.ID.C.7, S.ID.C.8)
- Distinguish between correlation and causation. (S.ID.C.9)
- Solve systems of linear equations in two variable by graphing, linear combination, and substitution; analyze special systems. (A.REI.C.5,6, A.REI.D.11)
- Choose the best method for solving a system of linear equations in two variables with context; find solution and explain outcomes. (A.REI.C.6, N.Q.A.2,3, A.CED.A.3)
- Graph systems of linear inequalities in two variables, use linear inequality systems in modeling and interpret feasible region. (A.REI.D.12, A.CED.A.3)
- Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CI.1
- Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.CT.2

Unit Overview

Unit 2 will explore the relationship between variables, while building on their prior knowledge of rate of change. Students will be formally introduced to function notation, and build on their previous exposure to function relationships. Students will demonstrate mastery of graphing and writing linear equations in all forms. Students will also be able to use their ability of writing linear equations to write equations of parallel and perpendicular lines, as well as explore scatterplots and line of best fit. Students will master graphing linear inequalities, and use their graphs to represent real-world situation sets. Students will be able to write and solve systems of linear equations and inequalities.

Standard Number(s)

- **N.Q.A.1** - Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- **N.Q.A.2** - Define appropriate quantities for the purpose of descriptive modeling.
- **N.Q.A.3** - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- **A.CED.A.2** - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- **A.CED.A.3** - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
- **A.REI.C.5** - Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
- **A.REI.C.6** - Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
- **A.REI.D.10** - Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
- **A.REI.D.11** - Explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, absolute value, and exponential functions.
- **A.REI.D.12** - Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
- **A.SSE.A.1a** - Interpret parts of an expression, such as terms, factors, and coefficients.
- **A.SSE.A.2** - Use the structure of an expression to identify ways to rewrite it.
- **F.IF.A.1** - Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.
- **F.IF.A.2** - Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- **F.IF.B.4** - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**
- **F.IF.B.5** - Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**
- **F.IF.B.6** - Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
- **F.IF.C.7a** - Graph linear and quadratic functions and show intercepts, maxima, and minima.
- **F.BF.A.1a** - Determine an explicit expression, a recursive process, or steps for calculation from a context..

- **F.LE.A.1b** - Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- **F.LE.A.2** - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
- **F.LE.B.5** - Interpret the parameters in a linear or exponential function in terms of a context.
- **S.ID.B.6a** - Fit a function to the data (including the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
- **S.ID.B.6b** - Informally assess the fit of a function by plotting and analyzing residuals, including the use of technology.
- **S.ID.B.6c** - Fit a linear function for a scatter plot that suggests a linear association.
- **S.ID.C.7** - Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
- **S.ID.C.8** - Compute (using technology) and interpret the correlation coefficient of a linear fit.
- **S.ID.C.9** - Distinguish between correlation and causation.
- **8.1.12.CS.4** - Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.
- **8.1.12.DA.1** - Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
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- **9.4.12.CT.2** - Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a)
- **9.4.12.TL.2** - Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
- **NJSLSA.SL1.** - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
- **HS-ETS1-2.** - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **RST.9-10.3.** - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

- **RST.9-10.4.** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- **RST.9-10.7.** - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **WHST.9-10.4.** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- **WHST.9-10.** - Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- **WHST.9-10.7.** - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Intended Outcomes - {Essential Questions}

- How are statistics used to describe the center and spread of a set of data?
- What is the significance of correlation?
- What is the significance of a linear regression model and why is the slope of the model meaningful and useful?
- Why are outliers significant? What impact do they have on measures of central tendency (mean, median, mode)?
- How do we solve systems of equations?
- How do we represent and solve equations and inequalities graphically?
- How do we understand the concept of a function and use function notation?
- How do we interpret functions that arise in applications in terms of a context?
- How do we analyze functions using different representations?
- How do we build a function that models a relationship between two quantities?
- How do we build new functions from existing functions?
- How do we interpret expressions for functions in terms of the situation they model?
- How do we determine which method to use when solving systems of equations?
- How do we represent a real-world scenario using a system of equations or inequalities?
- How can you solve a system of equations or inequalities?
- Can system of equations model real world situations?
- Can two algebraic expressions that appear to be different be equivalent?
- What information does the equation of a line give you?

Enduring Understandings

- Students will be able to use reasoning skills established in Unit 2 to be able to adjust to real-life situations involving numbers
- Students will be able to build, analyze, and interpret graphs and charts using skills obtained in Unit 2.
- Students will be able to solve systems of equations and represent systems of inequalities graphically.
- Students will be able to write and graph equations of lines and inequalities.
- Students will be able to use real-world data sets to identify correlation as well as use the data to interpolate or extrapolate information.

In this unit plan, the following 21st Century themes and skills are addressed.

| Check all that apply. 21 st Century Themes | | Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill. 21 st Century Skills | |
|--|---|--|---------------------------------------|
| <input type="checkbox"/> | Global Awareness | <input type="checkbox"/> E | Creativity and Innovation |
| <input type="checkbox"/> | Environmental Literacy | <input type="checkbox"/> E, T, A | Critical Thinking and Problem Solving |
| <input type="checkbox"/> | Health Literacy | <input type="checkbox"/> E | Communication |
| <input type="checkbox"/> | Civic Literacy | <input type="checkbox"/> E | Collaboration |
| <input checked="" type="checkbox"/> | Financial, Economic, Business, and Entrepreneurial Literacy | | |

Student Learning Targets/Objectives (Students will know/Students will understand)

- Students will solve systems of equations.
 - Students will represent and solve equations and inequalities graphically.
 - Students will understand the concept of a function and use function notation.
 - Students will interpret functions that arise in applications in terms of a context.
 - Students will analyze functions using different representations.
 - Students will build a function that models a relationship between two quantities.
 - Students will build new functions from existing functions.
 - Students will interpret expressions for functions in terms of the situation they model.
 - Students will graph linear equations, inequalities and systems of inequalities.
 - Students will comprehend what the solution to a system of equations represents graphically.
1. A particular washing machine uses an average of 41 gallons of water for every load of laundry.
 - Identify the independent and dependent variables in this situation.
 - Write a function rule to represent the situation.
 - Suppose you use 533 gallons of water for laundry in one month. *How many loads of laundry did you wash?
 2. Johnny wants to raise at least \$200 for a new bike. He works two jobs walking dogs for \$5 per hour and mowing lawns for \$8 per hour. He cannot work more than 25 hours in the week. Write a system of inequalities to represent this situation.
 3. A printer finds that it costs \$1290 to print 30 books and \$1335 to print 45 books. Let c be the cost of printing b books. Assume c is linearly related to b . How much will cost to print 100 books? How much will cost to print 0 books? How do you interpret the cost to print 0 books in context?
 4. Carlos began swimming 20 min every day for the first week. Each week he increased his daily swim time by 15 min. After how many weeks was he swimming 110 min daily?
 5. On a trip, Jay and Terri bought lunch for themselves and a friend. Jay bought 3 slices of pizza and 1 lemonade for \$4.50. Terri paid \$4.00 for 2 slices of pizza and 2 lemonades. What should their friend reimburse Terri for his lemonade? Students will collaborate to develop a plan and present to their peers on the most efficient prices to generate the highest revenue using data from a spreadsheet.

6. A relation is defined by $\{(1, -2), (-3, 4), (5, 6), (k, 8)\}$. For which of the following values of k will the relation be a function? Select **all** that apply.

- a) -1
- b) 1
- c) 2
- d) 5
- e) 6

7. Margo painted her bedroom. It took her 10 hours. Each hour she wrote down the percent of the job she thought she had finished. The percentages are illustrated in the table below.

| Hours (t) | % Finished (P) |
|--------------|-------------------|
| 1 | 5 |
| 2 | 20 |
| 3 | 35 |
| 4 | 50 |
| 5 | 50 |
| 6 | 65 |
| 7 | 70 |
| 8 | 80 |
| 9 | 95 |
| 10 | 100 |

- a) If $P(t)$ is the percent finished after t hours, interpret the meaning of the value of $P(7)$.
- b) If Margo began at 8 AM, in which hour did she not work at all?

- 8. Students will utilize the grading feature through Pearson realize to develop a digital portfolio of their progress
- 9. Students will utilize advanced calculators such as TI-84 in order to solve problems too difficult to calculate by hand.
- 10. Students will utilize systems of linear equations and inequalities (in two variables) to analyze costs and maximize profits.

Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an **

- Chapter Quizzes and Tests
- Final Exam*
- Communicator Activities
- Classroom Clickers Activities
- True-False Sorts Activities
- Student Questioning Activities
- Classroom Warm-Up Activities

Teaching and Learning Activities

| | |
|--|---|
| <p><i>Activities</i></p> | <p>Writing an Equation from a Table https://learnzillion.com/lesson_plans/9003</p> <p>Illuminations Bouncing Tennis Balls http://illuminations.nctm.org/LessonDetail.aspx?ID=L246 An activity to graph scatterplots</p> <p>Explore Learning Slope Activity B http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=102 A gizmo to calculate slope given two points</p> <p>Explore Learning Slope-Intercept Form of a Line Activity A http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=164 A gizmo to compare the slope-intercept form of a line to its graph</p> <p>Explore Learning Special Types of Solutions to Linear Systems http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=121 A gizmo exploring special solutions to linear systems</p> <p>Explore Learning Systems of Linear Inequalities (Slope-Intercept Form) Activity A http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=162 A gizmo comparing linear inequalities to their graphs</p> |
| <p><i>Differentiation Strategies and Activities</i></p> | <ul style="list-style-type: none"> ● Use of communicators. ● Kahoot/Socrative/Plickers activities. ● Online assessments. ● Flipped Classroom. ● Use of formative and summative assessments. ● Partner and group work/projects. ● Mixed ability groups. <p>Differentiation Strategies for Special Education Students Differentiation Strategies for Gifted and Talented Students Differentiation Strategies for ELL Students Differentiation Strategies for At Risk Students</p> |
| <p><i>Honors</i></p> | <ul style="list-style-type: none"> ● Students must be able to use higher-order thinking skills to perform multi-step tasks to show a deep understanding of the content. ● Students should be able to provide a detailed written explanation of the concept to show deep comprehension of a given topic. ● Students should be able to apply their learning to interdisciplinary projects, activities or applications. |
| <ul style="list-style-type: none"> ● Classzone.com ● ExploreLearning.com ● Graphing Calculator ● Algebra tiles ● Communicators ● LCD Projector & Document Camera ● Textbook Resources | |

- Khan Academy

Wayne School District Curriculum

| | |
|---|---|
| Content Area/ Grade Level/ Course: | Mathematics 8/9 Algebra 1 |
| Unit Plan Title: | Unit 3: Graphing Absolute Value, Exponential, Quadratic (in Vertex Form), and General Graphs Using Transformations |
| Time Frame | 30 days |

Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10

- Graph absolute value, exponential, quadratic, and general graphs using transformations. (F.IF.B.4,5, F.IF.C.7a, A.CED.A.2, F.BF.B.3)
- Evaluate and graph exponential functions. (F.IF.B.4,5, F.IF.C.7e,9, A.CED.A.2, F.LE.A.2)
- Identify domain and range. (F.IF.A.1)
- Write a function that describes a linear, quadratic or exponential relationship (e.g. growth/decay and arithmetic and geometric sequences) from graphs, tables, or a written description of the relationship. (F.BF.A.1, F.LE.A.1, F.LE.A.2)
- Represent arithmetic sequences using function notation; calculate values. (F.BF.A.2)
- Write and apply recursive and explicit formulas for geometric sequences. (F.BF.A.1a,2, F.IF.A.3, F.LE.A.2, A.SSE.A.1a)
- Identify the effects of transformations [$f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$] on a function and find the value of k given the graphs. (F.BF.B.3)
- Compare (using graphs and tables) linear, quadratic, and exponential models to determine that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function; include interpret parameters in terms of a context. (F.LE.A.3, F.LE.B.5)
- Given a graph, table, or equation classify the function as linear, exponential, or quadratic. (F.LE.A.3, F.LE.B.5)
- Create linear, quadratic, and exponential models, calculate values, and interpret (F.LE.A.1a,2,3, F.IF.B.4, S.ID.B.6a)
- Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CI.1
- Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.CT.2

Unit Overview

Unit 3 begins with students exploring arithmetic and geometric sequences. Students will be able to write and utilize both the recursive and explicit formulas. Students will explore absolute value, exponential, and quadratic functions through the transformation of the parent function. Students will be able to analyze tables, graphs, and equations to classify and identify functions. Students will be able to write the equations of absolute value, exponential, and quadratic functions given a table, graph, or verbal model.

Standard Number(s)

- A.CED.A.2** - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- A.SSE.A.1a** - Interpret parts of an expression, such as terms, factors, and coefficients.
- F.BF.A.1** - Write a function that describes a relationship between two quantities.
- F.BF.A.1a** - Determine an explicit expression, a recursive process, or steps for calculation from a context.
- F.BF.A.2** - Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

F.BF.B.3 - Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

F.IF.A.1 Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.

F.IF.A.3 - Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.*

F.IF.B.4 - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

F.IF.B.5 - Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*

F.IF.C.7a Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.C.7b - Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

F.IF.C.7e - Graph exponential functions, showing intercepts and end behavior.

F.IF.C.9 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

F.LE.A.1 - Distinguish between situations that can be modeled with linear functions and with exponential functions.

F.LE.A.1.c - Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F.LE.A.2 - Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

F.LE.A.3 - Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

F.LE.B.5 - Interpret the parameters in a linear or exponential function in terms of a context.

S.ID.B.6a - Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.

8.1.12.CS.4 - Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.DA.1 - Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.

8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

8.2.12.ED.1 - Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.

8.2.12.ED.4 - Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.

9.2.12.CAP.5 - Assess and modify a personal plan to support current interests and postsecondary plans.

9.4.12.CI.1 - Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

9.4.12.CT.2 - Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a)

NJSLSA.SL1. - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

HS-ETS1-2. - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

RST.9-10.3. - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4. - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.7. - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

WHST.9-10.4. - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10. - Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.9-10.7. - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Intended Outcomes - {Essential Questions}

- How do we construct and compare linear, quadratic, and exponential models and solve problems?
- How do we determine if a function is linear, quadratic, exponential or absolute value?
- How do we identify what the transformations must be applied to a parent function to graph a given equation?
- How do we identify the domain and range of a function, what do they represent?
- How do you construct a parent function given the equation or graph?

Enduring Understandings

- Students will know what the properties are for quadratic, linear, absolute value and exponential functions and how to identify the type of function given a graph, equation or table.
- Students will know how to create a parent function table and apply transformations to create the graph of an exponential, quadratic, absolute value or general function.
- Students will be able to identify the domain and range of a function.

- Students will be able to model equations of quadratic, linear, and exponential functions using transformations given a graph or verbal representation.

In this unit plan, the following 21st Century themes and skills are addressed.

| Check all that apply. 21 st Century Themes | | Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill. 21 st Century Skills | |
|--|---|--|---------------------------------------|
| <input type="checkbox"/> | Global Awareness | <input type="checkbox"/> E | Creativity and Innovation |
| <input type="checkbox"/> | Environmental Literacy | <input type="checkbox"/> E, T, <input type="checkbox"/> A | Critical Thinking and Problem Solving |
| <input type="checkbox"/> | Health Literacy | <input type="checkbox"/> E | Communication |
| <input type="checkbox"/> | Civic Literacy | <input type="checkbox"/> E | Collaboration |
| <input checked="" type="checkbox"/> | Financial, Economic, Business, and Entrepreneurial Literacy | | |

Student Learning Targets/Objectives (Students will know/Students will understand)

- Students will be able to graph exponential, quadratic, absolute value and general function by constructing a parent function and applying the transformations.
- Students will be able to classify and identify if a function is quadratic, exponential, absolute value, or linear given a graph, table or equation.
- Students will be able to model a function using an equation or function notation given a graph, table or a verbal representation.
- Students will be able to find the domain and range of functions as well as identify key parts such as asymptotes and a vertex.
- Look at the patterns (first and second differences, common ratio) in the data to determine the type of model that would best fit.

| x | y |
|-----|-----|
| -1 | 1 |
| 0 | -1 |
| 1 | 1 |
| 2 | 7 |
| 3 | 17 |

| x | y |
|-----|-----|
| -2 | -1 |
| -1 | 2 |
| 0 | 5 |
| 1 | 8 |

| x | y |
|-----|-----|
| | |

| | |
|-----|------|
| - 2 | 0.25 |
| - 1 | 0.5 |
| 0 | 1 |
| 1 | 2 |

2. How would the graph of the function

$$f(x) = x^2 - 8$$

be affected if the function were changed to $f(x) = x^2 - 3$?

- The graph would shift 5 units to the left.
- The graph would shift 5 units down.
- The graph would shift 5 units up.
- The graph would shift 3 units down.

3. What is the transformation of the graph of $f(x) = x^3$ that yields $f(x) = 2(x - 4)^3 - 1$?

- Vertical stretch of 2, shift 3 units right and 1 unit up
- Shift 8 units right and 1 unit down
- Vertical stretch of 2, shift 4 units left and 1 unit up
- Vertical stretch of 2, shift 4 units right and 1 unit down

4. Explain how the relationship between $y = |x|$ and $y = |x| + k$ is similar to the relationship between $y = mx$ and $y = mx + b$.

5. Graph $y = |2x|$ by making a table of values. Create a spreadsheet to showcase the table of values to determine how the translations affect the results.

- Translate $y = |2x|$ to graph $y = |2x| + 3$
- Translate $y = |2x|$ to graph $y = |2(x-1)|$
- Translate $y = |2x|$ to graph $y = |2(x-1)| + 3$

6. Students will utilize the grading feature through Pearson realize to develop a digital portfolio of their progress

7. Students will utilize advanced calculators such as TI-84 in order to solve problems too difficult to calculate by hand.

Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an **

- Chapter Quizzes and Tests
- Final Exam*
- Communicator Activities
- Classroom Clickers Activities
- True-False Sorts Activities
- Student Questioning Activities
- Classroom Warm-Up Activities

Teaching and Learning Activities

| | |
|--|--|
| <i>Activities</i> | <p>Explore Learning Absolute Value with Linear Functions Activity A http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=94 A gizmo comparing absolute value functions to linear functions</p> <p>Function Matching http://illuminations.nctm.org/ActivityDetail.aspx?ID=215 A gizmo that matches types of functions to their graphs</p> <p>Graphing Quadratics in Vertex Form https://learnzillion.com/lesson_plans/793</p> <p>Graphing Quadratics through the parent function https://learnzillion.com/lesson_plans/791</p> |
| <i>Differentiation Strategies and Activities</i> | <ul style="list-style-type: none">● Use of communicators.● Kahoot/Socrative/Plickers activities.● Online assessments.● Flipped Classroom.● Use of formative and summative assessments.● Partner and group work/projects.● Mixed ability groups. <p>Differentiation Strategies for Special Education Students Differentiation Strategies for Gifted and Talented Students Differentiation Strategies for ELL Students Differentiation Strategies for At Risk Students</p> |
| <i>Honors</i> | <ul style="list-style-type: none">● Students must be able to use higher-order thinking skills to perform multi-step tasks to show a deep understanding of the content.● Students should be able to provide a detailed written explanation of the concept to show deep comprehension of a given topic.● Students should be able to apply their learning to interdisciplinary projects. activities or applications. |

Resources

- Classzone.com
- ExploreLearning.com
- Graphing Calculator
- Algebra tiles
- Communicators
- LCD Projector & Document Camera
- Textbook Resources
- Khan Academy

Wayne School District Curriculum Format

| | |
|---|--|
| Content Area/ Grade Level/ Course: | Mathematics 8/9 Algebra 1 |
| Unit Plan Title: | Unit 4: Operations with Polynomials, Factoring Polynomials, Quadratic Equations and Functions |
| Time Frame | 50 days |

Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10

- Classify, add, and subtract polynomials. (A.APR.A.1)
- Multiply a monomial by a polynomial or factor a monomial from a polynomial. (A.APR.A.1)
- Multiply binomials or a binomial by a trinomial. (A.APR.A.1)
- Multiply special cases – square of a binomial, product of a sum and difference. (A.APR.A.1, A.SSE.B.3)
- Factor trinomials of the form $x^2 + bx + c$. (A.SSE.A.1a)
- Factor trinomials of the form $ax^2 + bx + c$. (A.SSE.A.1a)
- Factor perfect square trinomials and the difference of two squares. (A.SSE.A.1a,1b,2)
- Factor higher degree polynomials by grouping. (A.SSE.A.1a,1b,2)
- Factor polynomials completely. (A.SSE.A.1a)
- Graph quadratic functions of the form $y = ax^2 + bx + c$. (F.IF.B.4, F.IF.C.7a,8a,9, F.BF.B.3)
- Define irrational numbers; estimate square roots. (N.RN.B.3)
- Rewrite expressions involving radicals and rational exponents. (N.RN.A.2)
- Simplify radical expressions including sums, difference, products and quotients. (N.RN.A.2)
- Build an understanding of operations with rational and irrational numbers. (N.RN.B.3)
- Solve quadratic equations by graphing and using square roots (A.REI.B.4b, N.Q.A.2, A.APR.B.3, A.CED.A.1,4)
- Solve quadratic equations by factoring (A.REI.B.4b, A.SSE.B.3a, A.CED.A.1, F.IF.C.8a)
- Solve quadratic equations by completing the square (A.REI.B.4a, N.Q.A.3, A.REI.A.1, A.REI.B.4b, A.CED.A.1, A.SSE.A.1a,1b, A.SSE.B.3b, F.IF.C.8a)
- Use completing the square to convert from standard to vertex form of a quadratic equation.
- Derive the quadratic formula by completing the square and recognize when there are no real solutions. (A.REI.B.4)
- Solve quadratic equations using the quadratic formula and determine the nature and number of solutions (A.REI.B.4a,4b, N.Q.A,3, A.CED.A.1)
- Solve quadratic equations in one variable using a variety of methods [including inspection (e.g. $x^2 = 81$), factoring, completing the square, and the quadratic formula]. (A.REI.B.4)
- Solve systems of linear and quadratic equations (A.REI.C.7, A.REI.D.11, A.CED.A.3)

Unit Overview

Unit 4 focuses on operations with polynomials including addition, subtraction, multiplication, and factoring. Students will be able to factor various forms of the quadratic equation. Students will be able to simplify radicals. Students will be able to solve quadratics using square roots, completing the square, and the quadratic formula. Students will be able to identify the number and type of solutions using the discriminant. Students will build on their knowledge of graphing quadratics functions by graphing in standard form. They will also be able to solve systems containing linear and quadratic equations.

Standard Number(s)

A.APR.A.1 - Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

A.APR.B.3 - Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

A.CED.A.1 - Create equations and inequalities in one variable and use them to solve problems.

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

A.CED.A.3 - Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

A.CED.A.4 - Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

A.REI.A.1 - Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A.REI.B.4a - Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

A.REI.B.4b - Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives non-real solutions.

A.REI.B.7 - Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the parabola $y = x^2 + 4x + 3$.

A.REI.D.11 - Explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, absolute value, and exponential functions.

A.RN.A.2 - Rewrite expressions involving radicals and rational exponents using the properties of exponents.

A.RN.B.3 - Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

A.SSE.A.1a - Interpret parts of an expression, such as terms, factors, and coefficients.

A.SSE.A.1b - Interpret complicated expressions by viewing one or more of their parts as a single entity.

A.SSE.A.2 - Use the structure of an expression to identify ways to rewrite it.

A.SSE.3 - Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

A.SSE.B.3a - Factor a quadratic expression to reveal the zeros of the function it defines.

A.SSE.B.3b - Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

F.BF.B.3 - Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

F.IF.B.4 - For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

F.IF.C.7a - Graph linear and quadratic functions and show intercepts, maxima, and minima.

F.IF.C.8a - Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

F.IF.C.9 - Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

N.Q.A.2 - Define appropriate quantities for the purpose of descriptive modeling.

N.Q.A.3 - Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

8.1.12.CS.4 - Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.DA.1 - Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.

8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

9.4.12.CI.1 - Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

9.4.12.CT.2 - Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a)

NJSLSA.SL1 - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

HS-ETS1-2 - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

RST.9-10.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.7 - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

WHST.9-10.4 - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10 - Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.9-10.7 - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Intended Outcomes - {Essential Questions}

- How can you rewrite a polynomial as a product of its factors?
- What are like terms and how do you combine them?
- What is a polynomial and how do you rewrite a polynomial in standard form?
- What is a square root and how do you simplify square roots?
- How do you solve a quadratic linear system and what does the solution represent?
- How do you convert a quadratic equation to vertex form?
- How do you graph a quadratic function in standard form?
- What are the zeros of a function.
- How are the properties of real numbers related to polynomials?

- How can you solve a quadratic equation?

Enduring Understandings

- Students will use their knowledge of factoring to solve quadratics.
- Students will apply their knowledge of solving equations to solve systems of quadratic linear systems.
- Students will know how to solving quadratic equations and when to use each method.
- Students will know how to graph quadratic equations in standard form.
- Students will know how to simplify and factor polynomial expressions.
- Students will know how to simplify radical expressions.
- Students will know how to identify if solutions to a quadratic equation are real, rational or irrational.
- Students will know how to use completing the square to convert to vertex form as well as solve equations.

In this unit plan, the following 21st Century themes and skills are addressed.

| Check all that apply. 21 st Century Themes | | Indicate whether these skills are E -Encouraged, T -Taught, or A -Assessed in this unit by marking E, T, A on the line before the appropriate skill. 21 st Century Skills | |
|--|---|---|---------------------------------------|
| <input type="checkbox"/> | Global Awareness | <input type="checkbox"/> E | Creativity and Innovation |
| <input type="checkbox"/> | Environmental Literacy | <input type="checkbox"/> E,T,A | Critical Thinking and Problem Solving |
| <input type="checkbox"/> | Health Literacy | <input type="checkbox"/> E | Communication |
| <input type="checkbox"/> | Civic Literacy | <input type="checkbox"/> E | Collaboration |
| <input checked="" type="checkbox"/> | Financial, Economic, Business, and Entrepreneurial Literacy | | |

Student Learning Targets/Objectives (Students will know/Students will understand)

- Students will know how to solve quadratic equations by factoring, quadratic formula, square roots, completing the square and graphically.
 - Students will know how to solve quadratic linear systems.
 - Students will know the properties of real numbers and extend them to polynomials.
 - Students will comprehend if a quadratic equation has real, rational or irrational solutions.
 - Students will be able to simplify radical expressions.
 - Students will be able to graph quadratic equations in standard form and convert to standard form by completing the square.
 - Students will be able to factor and simplify polynomial expressions.
1. Seeing structure $39^2 = (40 - 1)^2$, $(56)(64) = (60 + 4)(60 - 4)$
 1. Seeing structure $a^4 - b^4 = (a^2)^2 - (b^2)^2$.
 2. Seeing structure $x^2 - 2x + 1 - y^2 = (x - 1)^2 - y^2$.

3. Determine all integral values of k for which $x^2 + kx + 15$ can be factored over the set of binomials with integral coefficients.
4. Find the two negative integers k of least absolute value for which $x^2 + x + k$ can be factored.
5. Given $3y + 2$ is a factor of $21y^2 - y + c$, find the value of the constant c .
6. If $r^2 + s^2 = 12$ and $rs = 2$, find the value of $(r + s)^2$; find the positive value of $r + s$.
7. Drag and drop each of the following quadratic equations into the appropriate category that describes its solutions.
 - $x^2 - 2x + 3 = 0$
 - $x^2 + 7x - 5 = 0$
 - $9x^2 + 12x + 4 = 0$
 - $x^2 + 4x - 60 = 0$

No real solutions

One real solution

Two real solutions

8. Since opening day, attendance at Pool A has increased steadily, while attendance at Pool B first rose then fell. Equations modeling the daily attendance y at each pool are shown below, where x is the number of days since opening day. On what day(s) was the attendance the same at both pools? What was the attendance?

Pool A : $y = 28x + 4$

Pool B : $y = -x^2 + 39x + 64$
9. Students will utilize the grading feature through Pearson realize to develop a digital portfolio of their progress
10. Students will utilize advanced calculators such as TI-84 in order to solve problems too difficult to calculate by hand.
11. Students will use data tables to create prototype equations and test those equations (ie. exponential equations - growth and decay)

Chapter Quizzes and Tests
 Final Exam*
 Communicator Activities
 Classroom Clickers Activities
 True-False Sorts Activities
 Student Questioning Activities
 Classroom Warm-Up Activities

Teaching and Learning Activities

| | |
|---|---|
| <p><i>Activities</i></p> | <p>Quadratic equations and their graphs – Interactive applet http://www.slu.edu/classes/maymk/GeoGebra/QuadEqn.html</p> <p>Algebra Tiles http://illuminations.nctm.org/ActivityDetail.aspx?ID=216 Interactive algebra tiles to help students solve, substitute, multiply, and factor</p> <p>Egg Launch Contest http://illuminations.nctm.org/LessonDetail.aspx?ID=L738 An activity using data from an egg launch to compare quadratic functions</p> <p>Proof Without Words: Completing the Square http://illuminations.nctm.org/ActivityDetail.aspx?ID=132 A proof of the completing the square formula</p> |
| <p><i>Differentiation Strategies and Activities</i></p> | <ul style="list-style-type: none"> ● Use of communicators. ● Kahoot/Socrative/Plickers activities. ● Online assessments. ● Flipped Classroom. ● Use of formative and summative assessments. ● Partner and group work/projects. ● Mixed ability groups. <p>Differentiation Strategies for Special Education Students Differentiation Strategies for Gifted and Talented Students Differentiation Strategies for ELL Students Differentiation Strategies for At Risk Students</p> |
| <p><i>Honors</i></p> | <ul style="list-style-type: none"> ● Students must be able to use higher-order thinking skills to perform multi-step tasks to show a deep understanding of the content. ● Students should be able to provide a detailed written explanation of the concept to show deep comprehension of a given topic. ● Students should be able to apply their learning to interdisciplinary projects. activities or applications. |

Resources

- Classzone.com
- ExploreLearning.com
- Graphing Calculator
- Algebra tiles
- Communicators
- LCD Projector & Document Camera
- Textbook Resources
- Khan Academy

Wayne School District Curriculum Format

| | |
|---|---|
| Content Area/ Grade Level/ Course: | Mathematics 8/9 Algebra 1 |
| Unit Plan Title: | Unit 5: Exponent Properties and Exponential Growth and Decay |
| Time Frame | 20 days |

Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10

- Multiply powers with the same base. (N.RN.A.1)
- Raise a power to a power; raise a product to a power. (N.RN.A.1)
- Simplify expressions involving zero and negative integral exponents. (N.RN.A.1,2)
- Divide powers with the same base; raise a quotient to a power. (N.RN.A.1)
- Create and interpret functions modeling exponential growth and decay. (F.IF.C.8b, F.LE.A.1c, F.LE.B.5, A.CED.A.2, A.SSE.A.1b, A.SSE.B.3c)
- Solve exponential equations. (A.CED.A.1)
- Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CI.1
- Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.CT.2

Unit Overview

Unit 5 further builds on their knowledge of exponential rules and properties. Students will show mastery in applying the properties of exponents to simplify expressions. Students will be able to move between radical and rational exponential forms, and solve equations. Students will be able to solve simple exponential equations. They will also be able to write and solve exponential growth and decay problems that have representation in the real-world.

Standard Number(s)

- A.CED.A.1** - Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions
- A.CED.A.2** - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- A.SSE.A.1b** - Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .*
- A.SSE.B.3c** - Use the properties of exponents to transform expressions for exponential functions. *For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
- F.IF.8b** - Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)12^t$, $y = (1.2)^t/10$, and classify them as representing exponential growth or decay.
- F.LE.A.1c** - Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- F.LE.B.5.** - Interpret the parameters in a linear or exponential function in terms of a context
- N.RN.A.1** - Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.*
- N.RN.A.2** - Rewrite expressions involving radicals and rational exponents using the properties of exponents.

8.1.12.CS.4 - Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.

8.1.12.DA.1 - Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.

8.1.12.DA.5 - Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

9.1.12.PB.1 - Explain the difference between saving and investing.

9.1.12.CDM.6 - Compute and assess the accumulating effect of interest paid over time when using a variety of sources of credit. (e.g., student loans, credit cards, auto loans, mortgages, etc.).

9.1.12.CDM.7 - Calculate a mortgage payment based on type of loan, down payment, credit score, and loan interest rate.

9.1.12.CDM.8 - Compare and compute interest and compound interest and develop an amortization table using business tools.

9.2.12.CAP.5 - Assess and modify a personal plan to support current interests and postsecondary plans.

9.4.12.CI.1 - Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

9.4.12.CT.2 - Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a)

9.4.12.TL.2 - Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.

NJSLSA.SL1. - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

HS-ETS1-2. - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

RST.9-10.3. - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4. - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.7. - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

WHST.9-10.4. - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10. - Use technology , including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.

WHST.9-10.7. - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Intended Outcomes - {Essential Questions}

- How do you use the properties of exponents to simplify monomial expressions?
- What is the relationship between radicals and rational exponents?
- How do you solve an exponential equation?

- How can you use exponential growth or decay to model real-world situations?
- How do we extend the properties of exponents to rational exponents?

Enduring Understandings

- Model with exponential growth and decay functions.
- Comprehend how to extend the properties of exponents to rational exponents.
- Solve exponential equations by changing the base and using exponent rules.

In this unit plan, the following 21st Century themes and skills are addressed.

| Check all that apply. 21 st Century Themes | | Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill. 21 st Century Skills | |
|--|---|--|---------------------------------------|
| <input type="checkbox"/> | Global Awareness | E | Creativity and Innovation |
| <input type="checkbox"/> | Environmental Literacy | E,T,A | Critical Thinking and Problem Solving |
| <input type="checkbox"/> | Health Literacy | E | Communication |
| <input type="checkbox"/> | Civic Literacy | E | Collaboration |
| X | Financial, Economic, Business, and Entrepreneurial Literacy | | |

Student Learning Targets/Objectives (Students will know/Students will understand)

- Students will be able to solve exponential equations by changing the bases.
- Students will be able to model real-world situations with exponential growth and decay models.
- Students will be able to simplify monomial expressions using exponent rules including with rational exponents.

1. Given $f(x) = 4^x$ and the values of $g(x)$ as shown in the table below.

| | | | | |
|--------|---|----|-----|-----|
| x | 1 | 2 | 3 | 4 |
| $g(x)$ | 5 | 25 | 125 | 625 |

Which function has the greater value when $x = 12$?

2. Find the range of the function

$f(x) = 50(1)^x$ using the domain $\{1, 2, 3, 4, 5\}$. Explain why the definition of the exponential function states

$f(x) = a(b)^x$ where $b \neq 1$.

3. A computer valued at \$1500 loses 20% of its value each year.

- a) Write a function rule that models the value of the computer.
 - b) Find the value of the computer after 3 years.
 - c) In how many years will the value of the computer be less than \$500?
4. Your younger brother agreed to pay you some money because you helped keep him out of trouble. He agreed to show his gratitude by paying you \$0.01 on July 1, \$0.02 on July 2, \$0.04 on July 3, \$0.08 on July 4, and doubling the amount each day for the entire month. How much will he have to pay you on July 31?
 5. A doctor did a six – month study on resting heart rate and exercise in healthy adults. The doctor found that for every 20 minutes of exercise added to a daily routine, the resting heart rate decreased by 1 beat per minute. According to the doctor’s study, what does the resting heart rate depend on?
 6. Solve $4^{6-y} = 256$ for y .
 7. A radioactive isotope has a half – life of 5 days. This means that half the substance decays in 5 days. The exponential model would be $A(t) = A(0.5)^{\frac{t}{5}}$. At what rate does the substance decay each day?
 8. A colony of bacteria decays so that the population t days from now is given by $A(t) = 1000\left(\frac{1}{2}\right)^{\frac{t}{4}}$ where $A(t)$ is the amount in grams and t represents the number of days.
 - a) What does $A(0)$ represent. Indicate units of measure.
 - b) How much will be present in 4 days?
 - c) What is the half – life of the bacteria?
 9. An exponential function passes through the points $(0, 4)$ and $(2, 36)$. Using the exponential model $f(x) = a(b)^x$ where $b \neq 1$, find the values of a and b . Find $f(-2)$.
 10. Project-based learning activity where students utilize exponential growth/decay to track data to make an informed decision on a topic.
 11. Students will utilize the grading feature through Pearson realize to develop a digital portfolio of their progress
 12. Students will utilize advanced calculators such as TI-84 in order to solve problems too difficult to calculate by hand.

Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an **

Chapter Quizzes and Tests

Final Exam*

Communicator Activities

Classroom Clickers Activities

True-False Sorts Activities

Student Questioning Activities

Classroom Warm-Up Activities

| | |
|--|--|
| <p><i>Activities</i></p> | <p>Population and Food Supply http://illustrativemathematics.org/illustrations/645 An activity using exponential growth to solve a real-life problem Trout Pond Exploration http://illuminations.nctm.org/LessonDetail.aspx?ID=L476 An activity analyzing and predicting the population of a trout pond using exponential growth</p> <p>Exploration on exponential growth: https://teacher.desmos.com/activitybuilder/custom/56c7457e11c7724106e683b1</p> <p>Zero and negative exponents: http://www.classzone.com/cz/books/algebra_1_2007_na/resources/applications/animations/explore_learning/chapter_8/dswmedia/8_2_HPSZeroNeg.html</p> <p>Multiplication properties: http://www.classzone.com/cz/books/algebra_1_2007_na/resources/applications/animations/explore_learning/chapter_8/dswmedia/8_1_HPSMultiExpo.html</p> <p>Graphing exponential growth and decay: http://www.classzone.com/cz/books/algebra_1_2007_na/resources/applications/animations/explore_learning/chapter_8/dswmedia/8_6_grow_decay.html</p> |
| <p><i>Differentiation Strategies and Activities</i></p> | <ul style="list-style-type: none"> ● Use of communicators. ● Kahoot/Socrative/Plickers activities. ● Online assessments. ● Flipped Classroom. ● Use of formative and summative assessments. ● Partner and group work/projects. ● Mixed ability groups. <p>Differentiation Strategies for Special Education Students Differentiation Strategies for Gifted and Talented Students Differentiation Strategies for ELL Students Differentiation Strategies for At Risk Students</p> |
| <p><i>Honors</i></p> | <ul style="list-style-type: none"> ● Students must be able to use higher-order thinking skills to perform multi-step tasks to show a deep understanding of the content. ● Students should be able to provide a detailed written explanation of the concept to show deep comprehension of a given topic. ● Students should be able to apply their learning to interdisciplinary projects, activities or applications. |
| <p>Resources</p> | |
| <ul style="list-style-type: none"> ● Classzone.com ● ExploreLearning.com ● Graphing Calculator ● Algebra tiles ● Communicators ● LCD Projector & Document Camera ● Textbook Resources ● Khan academy | |

Wayne School District
Curriculum Format

| | |
|--|---|
| Content Area/ Grade Level/ Course: | Mathematics 8/9 Algebra 1 |
| Unit Plan Title: | Unit 6: Rational Expressions |
| Time Frame | 20 days |
| Anchor Standards/Domain* | *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10 |
| | <ul style="list-style-type: none"> ● Simplify rational expressions stating excluded values. (A.APR.7) ● Multiply and divide rational expressions. (A.APR.7) ● Solve rational equations using cross multiplication. (A.REI.A.2) ● Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CI.1 ● Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.4.12.CT.2 |
| Unit Overview | |
| <p>Unit 6 will reinforce their prior experience with factoring quadratics. Students will demonstrate mastery in factoring expressions through simplifying rational expressions. They will also be able to multiply and divide rational expressions. Students will be able to solve rational expressions.</p> | |
| Standard Number(s) | |
| <p>A.APR.7 - Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.</p> <p>A.REI.A.2- Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p> <p>8.1.12.CS.4 - Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors.</p> <p>9.4.12.CI.1 - Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).</p> <p>9.4.12.CT.2 - Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a)</p> <p>NJLSA.SL1. - Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.</p> <p>HS-ETS1-2. - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.</p> <p>RST.9-10.3. - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.</p> <p>RST.9-10.4. - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.</p> <p>RST.9-10.7. - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.</p> | |

WHST.9-10.4. - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

WHST.9-10. - Use technology , including the Internet, to produce, share, and update writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.

Intended Outcomes - {Essential Questions}

- How and why do you use factoring to simplify rational expressions?
- How can you connect multiplying and dividing fractions and simplifying out factors with real numbers and simplifying rational expressions?
- How can you solve rational equations?
- What is an extraneous solution and how do you check for them?

Enduring Understandings

- Students will be able to simplify rational expressions including multiplication and division.
- Students will be able to solve rational equations using cross multiplication and comprehend how to check for extraneous solutions.

| | | | |
|---------------------------------------|--|--|--|
| <i>Check all that apply.</i> | | <i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i> | |
| 21st Century Themes | | 21st Century Skills | |
| E | Global Awareness | E | Creativity and Innovation |
| | Environmental Literacy | ETA | Critical Thinking and Problem Solving |
| | Health Literacy | E | Communication |
| | Civic Literacy | E | Collaboration |
| E | Financial, Economic, Business, and Entrepreneurial Literacy | | |

Student Learning Targets/Objectives (Students will know/Students will understand)

- Simplify rational expressions with multiplication and division.
- Comprehend what an extraneous solution is and why it occurs.
- Solve rational equations using cross multiplication.
- Students will utilize the grading feature through Pearson realize to develop a digital portfolio of their progress

1. Simplify: $\frac{x^2-8x-9}{x^2-1}$

2. Simplify: $\frac{x+3}{x^2-4x+4} \cdot \frac{x^2-x-2}{x^2+4x+3}$

3. Simplify: $\frac{x^2-3x+2}{25x} \div \frac{x-1}{5x^2}$

4. Students will utilize advanced calculators such as TI-84 in order to solve problems too difficult to calculate by hand.

Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an **

Chapter Quizzes and Tests
 Final Exam*
 Communicator Activities
 Classroom Clickers Activities
 True-False Sorts Activities
 Student Questioning Activities
 Classroom Warm-Up Activities

Teaching and Learning Activities

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| <i>Activities</i> | <p>Multiplying & Dividing Rational Expressions: http://www.classzone.com/cz/books/algebra_1_2007_na/resources/applications/animations/explore_learning/chapter_12/dswmedia/11_5_HPSMultiRational.html</p> |
| <i>Differentiation Strategies and Activities</i> | <ul style="list-style-type: none"> ● Use of communicators. ● Kahoot/Socrative/Plickers activities. ● Online assessments. ● Flipped Classroom. ● Use of formative and summative assessments. ● Partner and group work/projects. ● Mixed ability groups. <p>Differentiation Strategies for Special Education Students Differentiation Strategies for Gifted and Talented Students Differentiation Strategies for ELL Students Differentiation Strategies for At Risk Students</p> |
| <i>Honors</i> | <ul style="list-style-type: none"> ● Students must be able to use higher-order thinking skills to perform multi-step tasks to show a deep understanding of the content. ● Students should be able to provide a detailed written explanation of the concept to show deep comprehension of a given topic. ● Students should be able to apply their learning to interdisciplinary projects, activities or applications. |

Resources

- Classzone.com
- ExploreLearning.com
- Graphing Calculator
- Algebra tiles
- Communicators
- LCD Projector & Document Camera
- Textbook Resources

- khan academy