## Englewood Public School District <br> Algebra II <br> First Marking Period

## Unit 1: Linear and Quadratic Functions

Overview: During this unit, students will review the concepts of linear equations and inequalities, functions, systems of linear equations, and be introduced to the concept of quadratic functions and systems.

Time Frame: 43 to 47 Days

## Enduring Understandings:

- You can use variables to represent variable quantities in real world situations and in patterns.
- The properties that apply to real numbers also apply to the variables that represent them.
- Properties can be used to solve an equation or inequality by finding increasingly simpler equations or inequalities which have the same solution as the original equation or inequality.
- Linear functions can be represented using either slope-intercept, point slope, or standard form.
- You can use the values of $a, h$, and $k$ in the standard vertex form of an absolute value function to determine how the parent function has been transformed.
- The equation of a trend line or line of best fit can be used to model that cluster in a linear pattern.
- The point of intersection of the graphs of functions is the solution to the system $y=f(x), y=g(x)$.
- If the equations of two systems are equivalent then a solution of the system that is easier to solve is also a solution of the more difficult system.
- The matrix row operations of adding rows and multiplying a row by a constant are equivalent to addition and multiplication properties of equality.
- The vertex form of a quadratic function shows the vertex of a parabola. Standard form is calculator ready. Both forms give additional information.
- Any quadratic function is possibly a stretch or compression, a reflection, and/or a translation.
- The real solutions of a quadratic equation show the zeros of the related quadratic function and the x-intercepts of its graph.


## Essential Questions:

- How do variables help you model real world situations?
- How can you use the properties of real numbers to simplify algebraic expressions?
- How do you sole an equation or inequality?
- Does it matter which form of a linear equation you use?
- How do you use transformations to help graph absolute value functions?
- How can you model data with a linear function?
- How does representing functions graphically help you solve a system of equations?
- How does writing equivalent equations help you solve a system of equations?
- How are properties of equality used in the matrix solution of a system of equations?
- What are the advantages of a quadratic equation in vertex form or standard form?
- How is any quadratic function related to the parent function?
- How are the real solutions of a quadratic equation related to the graph of the related quadratic function?

| Standards | Topics and Objectives | Activities | Resources | Assessments |
| :---: | :---: | :---: | :---: | :---: |
| MP1, MP2, MP3, MP4, MP5, MP6, MP7, MP8 <br> N-CN.A. 1 Know there is a complex number $i$ such that $i^{2}$ $=-1$, and every complex number has the form $a+b i$ with $a$ and $b$ real N-CN.A. 2 Use the relation $i^{2}=$ -1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers <br> N-CN.C. 7 Solve quadratic equations with real coefficients that have complex solutions <br> N-CN.C. 8 Extend polynomial identities to the complex numbers. For example, rewrite $x^{2}+4$ as $(x+2 i)(x-2 i)$ 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-SSE.A.1a, b Interpret expressions that represent a quantity in terms of its context. <br> A-SSE.A. 2 Use the structure of an expression to identify ways | Topics <br> Expressions, Equations, Inequalities, Functions, Graphs, Linear Systems, Quadratic Functions and Equations <br> Twenty-First Century Themes and Skills include: <br> - The Four C's <br> - Global awareness <br> - Financial, economic, business and entrepreneurial literacy <br> Objectives <br> Students will <br> - Identify and describe patterns <br> - Graph and order real numbers <br> - Identify properties of real numbers <br> - Simplify and evaluate algebraic expression <br> - Solve equations <br> - Solve problems by writing equations <br> - Solve and graph inequalities <br> - Write and solve compound inequalities <br> - Write and solve equations | Standards Solution Common Core Number \& Quantity Lessons: <br> - Expanding the Number System <br> - No Such Thing as No Solution <br> - What's Real? <br> Standards Solution Common Core Algebra Lessons: <br> - Systems of Linear and Quadratic Equations <br> - Linear Programming <br> - Solving Systems of Equations and Inequalities <br> - Solving a Quadratic Equation <br> Standards Solution Common Core Functions Lessons: <br> - Function Domains and Ranges <br> - Graphing a Variety of Functions <br> - Interpreting Functions <br> Completing the Square https://www.illustrativemath ematics.org/contentstandards/HSN/CN/C/7/task s/1690 | Pearson Realize Chapters 1, 2, <br> 3, and 4 <br> Standards Solution Common <br> Core Lessons <br> Illustrative Mathematics https://www.illustrativemathem atics.org/ <br> National Library of Virtual <br> Manipulatives <br> http://nlvm.usu.edu/ <br> Alabama Learning Exchange http://alex.state.al.us/search.php <br> ?fa_submit=ALLPLANS <br> Arizona Math Flipbook <br> http://www.azed.gov/azcommo ncore/files/2012/11/high- <br> school-ccss-flip-book-usd-2592012.pdf <br> NYC Department of Education http://schools.nyc.gov/default.ht m <br> Mathematics Assessment <br> Project <br> http://map.mathshell.org/ <br> Worksheets for every topic: http://kutasoftware.com/free. | Formative <br> Assessments: <br> Textbook Pages 25, 53, <br> 54, 89, 127, 128, 156, <br> 187, 188, 224, 268, 269 <br> Math journal <br> (NJSLSA.R1, <br> NJSLSA.W2) <br> Summative <br> Assessments: <br> Multiple choice / short answer assessments (CRP2, CRP4, CRP8) <br> Chapter quizzes/tests <br> - Pearson Realize <br> - MathXL <br> Grade 11 Algebra II <br> Common Core <br> Assessment 1, Standards Solution <br> Benchmark <br> Assessment: <br> Common Formative <br> Assessment <br> Alternative <br> Assessments: |



| A-REI.D. 11 Explain why the | quadratic functions | https://www.illustrativemath |
| :---: | :---: | :---: |
| $x$--coordinates of the points where the graphs of the | - To find common and binomial factors of | ematics.org/contentstandards/HSA/APR/B/2/tas |
| $\text { equations } y=f(x) \text { and } y=g(x)$ | quadratic expressions | ks/787 |
| intersect are the solutions of the equation $f(x)=g(x)$; find | - To factor special quadratic expressions | Planes and Wheat |
| the solutions approximately A-REI.D. 12 Graph the | - To solve quadratic equations by factoring and | https://www.illustrativemath ematics.org/content- |
| solutions to a linear inequality | graphing | standards/HSA/CED/A/1/tas |
| in two variables as a half plane (excluding the boundary in the case of a strict | - To rewrite and solve quadratic equations by completing the square | ks/580 Throwing a Ball |
| inequality), and graph the solution set to a system of | completing the square <br> - To solve quadratic equations using the | https://www.illustrativemath ematics.org/content- |
| linear inequalities in two variables as the intersection of | quadratic formula <br> - To determine the number | $\frac{\text { standards/HSA/CED/A/2/tas }}{\text { ks/437 }}$ |
| the corresponding half-planes F-IF.B. 4 For a function that models a relationship between | of solutions by using the discriminant <br> - To identify, graph, and | How Much Folate? <br> https://www.illustrativemath |
| two quantities, interpret key features of graphs and tables | perform operations with | ematics.org/content- <br> standards/HSA/CED/A/3/tas |
| in terms of the quantities, and sketch graphs showing key | complex numbers <br> - To find complex number solutions of quadratic | $\underline{\mathrm{ks} / 1351}$ Reasoning with Linear |
| features given a verbal description of the relationship | - equations | Reasoning with Linear Inequalities |
| F-IF.B. 5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes | - To solve graphs of systems of linear equations and quadratic equations or quadratic and quadratic equations. | https://www.illustrativemath ematics.org/contentstandards/HSA/REI/A/1/task s/807 |
| F-IF.B. 6 Calculate and interpret the average rate of |  | Using Function Notation https://www.illustrativemath |
| change of a function |  | ematics.org/content- |
| (presented symbolically or as a table) over a specified |  | $\frac{\text { standards/HSF/IF/A/1/tasks/ }}{598}$ |
| interval. Estimate the rate of change from a graph |  | Springboard Dive |
| F-IF.C.7b Graph square root, |  | https://www.illustrativemath |
| cube root, and piecewise-- |  | ematics.org/content- |
| defined functions, including |  | $\frac{\text { standards/HSF/IF/C/8/tasks/ }}{375}$ |
| step functions and absolute value functions |  | 375 |
| F-IF.C. 8 Write a function |  | Transforming the Graph of a |


| defined by an expression in | Function |
| :---: | :---: |
| different but equivalent forms | https://www.illustrativemath |
| to reveal and explain different properties of the function | ematics.org/content- <br> standards/HSF/BF/B/3/tasks/ |
| F-IF.C. 9 Compare properties | $\underline{742}$ |
| of two functions each |  |
| represented in a different way | Function Transformations |
| (algebraically, graphically, | http://nlvm.usu.edu/en/nav/fr |
| numerically in tables, or by | ames_asid_329_g_4_t_2.ht |
| verbal descriptions | $\underline{\text { ml }}$ ?open=activities\&from=c |
| P-BP, B. 3 Identify the effect on | ategory g 4_t_2.html |
| the graph of replacing $f(x)$ by |  |
| $f(x)+k, k f(x), f(k x)$, and $f(x+$ | Discover the Roots of a |
| $k$ ) for specific values of $k$ | Polynomial Function |
| (both positive and negative); | http://alex.state.al.us/lesson |
| find the value of $k$ given the graphs. Experiment with | view.php?id=27664 |
| cases and illustrate an | Parent Functions and Their |
| explanation of the effects on | Children |
| the graph using technology. | http://alex.state.al.us/lesson |
|  | view.php?id=30033 |
|  | Investigating Parabolas in Standard Form |
|  | http://alex.state.al.us/lesson_ |
|  | view.php?id=24121 |
|  | Solving Quadratic Equations http://map.mathshell.org/less |
|  | ons.php?unit=9250\&collecti |
|  | on=8 |
|  | Sorting Equations and |
|  | Identities |
|  | http://map.mathshell.org/less |
|  | ons.php?unit=9210\&collecti |
|  | $\underline{\text { on }=8}$ |
|  | Representing Quadratic |
|  | Functions Graphically |
|  | http://map.mathshell.org/less |
|  | ons.php?unit=9245\&collecti |
|  | on=8 |


|  | Everything you need to <br> know about math journals: <br>  <br>  <br>  <br> $\frac{\text { https://thecornerstoneforte }}{\text { achers.com/math-journals } /}$ <br> (NJSLSA.R1, <br> NJSLSA.W2) <br>  <br> Additional texts: <br> $\underline{\text { www.newsela.com }}$ <br> $\underline{\text { www.readworks.org }}$ |
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## Key Vocabulary:

Absolute value, algebraic expression, compound inequality, like terms, literal equation, term, variable, correlation, direct variation, domain, function, linear equation, range, relation, slope, dependent system, equivalent systems, independent systems, linear systems, matrix, matrix element, row operation, system of equations, axis of symmetry, complex number, discriminant, greatest common factor, imaginary number, parabola, Quadratic Formula, quadratic function, standard form, vertex form, zero of a function

## Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered. Additional staff should be included so all students can fully participate in the standards associated with this curriculum.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA https://www.wida.us/standards/CAN_DOs/

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure. Student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges.

| English Language Learners: | Special Education: | At-Risk: | Gifted and Talented: |
| :---: | :--- | :--- | :--- |
| $\bullet$ - Teaching modeling | $\bullet$ Utilize modifications \& | $\bullet$ Use visual demonstrations, | • Inquiry based instruction |

- Peer modeling
- Word walls
- Give directions in small steps and in as few words as possible
- Provide visual aids
- Group similar problems together
- Repeat directions when necessary
- Provide a vocabulary list with definitions
- Use of alge-tiles when needed
- Use of number line when needed
accommodations delineated in the students' IEP
- Work with paraprofessional
- Work with a partner
- Shorten assignments to focus on mastery or key concepts
- Maintain adequate space between desks
- Keep workspaces clear of unrelated materials
- Provide fewer problems to attain passing grades
- Tape a number line to the student's desk
- Create a math journal that they can use during class, on assignments and (if teacher allows) on assessments
- Provide extra time to complete a task when needed
- Provide definitions of different graphs / charts with illustrations
- Allow tests to be taken in a separate room
- Allow students to use a calculator when appropriate
- Divide test into small sections of similar questions or problems
- Use of alge-tiles when needed
- Use of number line when needed
illustrations and models
- Give directions / instructions verbally and in simple written format
- Peer support
- Increased one - on - one time
- Teachers may modify instructions by modeling what the student is expected to do
- Instructions may be printed out in large print and hung up for the students to see during the time of the lesson
- Review behavior expectations and make adjustments
- Create a math journal that they can use during class, on assignments and (if teacher allows) on assessments
- Allow students to complete an independent project as an alternative test
- Use of alge-tiles when needed
- Use of number line when needed
- Independent study
- Higher order thinking skills
- Adjusting the pace of the lessons
- Real world scenarios
- Student driven instruction
- Allow students to complete an independent project as an alternative test


## Interdisciplinary Connections: ELA

NJSLSA.R1. Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content

## $21^{\text {st }}$ Century Standards

9.2.12.C.1: Review career goals and determine steps necessary for attainment.
9.2.12.C.2: Modify Personalized Student Learning Plans to support declared career goals.
9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.
9.3.ST-ET.5: Apply the knowledge learned in STEM to solve problems.

## Career Ready Practices:

CRP2: Apply appropriate academic and technical skills
CRP4: Communicate clearly and effectively and with reason
CRP6: Demonstrate creativity and innovation
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them
CRP11: Use technology to enhance productivity
Technology Standards:
8.1.12.A.3: Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
$\square$ Additional (Identified by PARCC Model Content Frameworks)

