

Englewood Public School District
Algebra 1
Third Marking Period

Unit 3: Exponential Functions, Polynomials, and Quadratic Functions

Overview: During this unit, students will investigate properties with exponents, exponential functions, polynomials and factoring, and quadratics and quadratic functions.

Time Frame: 43 to 47 Days

Enduring Understandings:

- *Numbers between 0 and 1 can be represented using negative exponents.*
- *The properties of exponents can be used to simplify expressions using exponents.*
- *Exponential functions can be represented by the general equation $y = ab^x$; these types of equations can be used to model exponential growth or decay.*
- *Algebraic expressions can be represented in many ways. When expressions are added, subtracted, multiplied, divided, or factored, you replace one expression with an equivalent expression.*
- *The properties of real numbers are the basic laws of Algebra.*

Essential Questions:

- *How can you represent numbers less than 1 using exponents?*
- *How can you simplify expressions involving exponents?*
- *What are the characteristics of exponential functions?*
- *Can two algebraic expressions that appear to be different be equivalent?*
- *How are properties of real numbers related to polynomials?*
- *What are the characteristics of quadratic functions?*
- *How can you solve quadratic equations?*
- *How can you use functions to model real world situations?*

Standards	Topics and Objectives	Activities	Resources	Assessments
MP1, MP2, MP3, MP5, MP6, MP7, MP8	Topics	Standards Solution Common Core Number and Quantity Lessons:	Pearson Realize Chapters 7, 8, and 9	Formative Assessments: Textbook Page 446, 479–480, 510, 539–540, 575, 607–608
N-RN.A.1 Explain how the definition of the meaning of rational exponents follows from extending the	Exponential functions and quadratic equations	<ul style="list-style-type: none"> • Rational Exponents 	Standards Solution Common Core Lessons	
	Twenty-First Century Themes and Skills include:	Standards Solution	Illustrative Mathematics	Math journal

<p>properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.</p> <p>N-RN.A.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p> <p>A-SSE.A.1a, b Interpret expressions that represent a quantity in terms of its context.</p> <p>A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it.</p> <p>A-SSE.B.3c Use the properties of exponents to transform expressions for exponential functions.</p> <p>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.</p> <p>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.</p> <p>A-CED.A.1 Create equations and inequalities in</p>	<ul style="list-style-type: none"> • The Four C's • Global awareness • Financial, economic, business and entrepreneurial literacy <p>Objectives</p> <p>Students will</p> <ul style="list-style-type: none"> • Define and use zero and negative exponents • Learn the rules for multiplying and dividing powers • Investigate and explore exponential growth and decay functions • Add, subtract, multiply, and factor polynomials • Use commutative, associative, and distributive properties to manipulate polynomials • Graph quadratic functions on the coordinate plane and use the discriminant to determine the number of intercepts • Solve quadratic equations by factoring, completing the square, graphing, and using the quadratic formula • Will decide if linear, quadratic, or exponential functions accurately model data • Use quadratic functions to model real world data. 	<p>Common Core Algebra Lessons:</p> <ul style="list-style-type: none"> • Population Growth and Decay • Solving a Quadratic Equation • Finding the Greatest Investment • Construction Stations <p>Standards Solution Common Core Functions Lessons:</p> <ul style="list-style-type: none"> • Linear vs Exponential <p>Evaluating a Special Algebraic Expression https://www.illustrativemathematics.org/content-standards/HSN/RN/A/1/tasks/1823</p> <p>Evaluating Exponential Expressions https://www.illustrativemathematics.org/content-standards/HSN/RN/A/1/tasks/1866</p> <p>Extending the Definitions of Exponents https://www.illustrativemathematics.org/content-standards/HSN/RN/A/1/tasks/385</p> <p>Equivalent Expressions https://www.illustrativemathematics.org/</p>	<p>https://www.illustrativemathematics.org/</p> <p>National Library of Virtual Manipulatives http://nlvm.usu.edu/</p> <p>Alabama Learning Exchange http://alex.state.al.us/search.php?fa_submit=ALLPLANS</p> <p>Arizona Math Flipbook http://www.azed.gov/azcomoncore/files/2012/11/high-school-ccss-flip-book-usd-259-2012.pdf</p> <p>NYC Department of Education http://schools.nyc.gov/default.htm</p> <p>Mathematics Assessment Project http://map.mathshell.org/</p> <p>Texas Instruments https://education.ti.com/en/us/home</p> <p>Desmos https://teacher.desmos.com/</p> <p>Worksheets for every topic: http://kutasoftware.com/free.html (CRP2, CRP4, CRP8, 9.3.ST.2, 9.3.ST-ET.5)</p> <p>Algebra assessments,</p>	<p>(NJSLSA.R1, NJSLSA.W2, NJSLSA.L1, SL.9-10.4, NJSLSA.L6, 9.2.12.C.1, 9.2.12.C.2)</p> <p>Summative Assessments: Multiple choice / short answer assessments (CRP2, CRP4, CRP8)</p> <p>Chapter quizzes/tests</p> <ul style="list-style-type: none"> • Pearson Realize • MathXL <p>Grade 9 Algebra I Common Core Assessment III, Standards Solution</p> <p>Benchmark Assessment: Common Formative Assessment</p> <p>Alternative Assessments: Learning centers: each learning center focuses on a different type of problem (9.3.ST.2, 9.3.ST-ET.5)</p> <p>Create posters illustrating the main objectives of the unit (CRP6)</p>
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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.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.

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

[thematics.org/content-standards/HSA/SSE/A/2/tasks/87](https://www.illustrativemathematics.org/content-standards/HSA/SSE/A/2/tasks/87)

Seeing Dots
<https://www.illustrativemathematics.org/content-standards/HSA/SSE/A/2/tasks/21>

Interpreting the Graph
<https://www.illustrativemathematics.org/content-standards/HSF/IF/A/tasks/636>

The Parking Lot
<https://www.illustrativemathematics.org/content-standards/HSF/IF/A/1/tasks/588>

Throwing Horseshoes
<https://www.illustrativemathematics.org/content-standards/HSA/SSE/A/1/tasks/90>

Animal Populations
<https://www.illustrativemathematics.org/content-standards/HSA/SSE/A/1/tasks/436>

Graphing Families of Quadratic Functions
http://alex.state.al.us/lesson_view.php?id=32812

Zero Product Property

interactive, videos, games, lessons, homework:
https://www.opened.com/search?area=mathematics&grade=9&offset=0&resource_type=interactive-assessment
(CRP2, CRP4, CRP8, CRP11, 9.3.ST.2, 9.3.ST-ET.5, 8.1.12.A.3)

Algebra common core worksheets:
<https://www.ixl.com/math/algebra-1>
(CRP2, CRP4, CRP8, 9.3.ST.2, 9.3.ST-ET.5)

Khan Academy – videos, lessons, assessments
www.khanacademy.org
(CRP2, CRP4, CRP8, 9.3.ST.2, 9.3.ST-ET.5, 8.1.12.A.3)

Worksheets / assessment items for all topics based on standards:
http://jmap.org/JMAP_RESOURCES_BY_TOPIC.htm#AI
(CRP2, CRP4, CRP8, 9.3.ST.2, 9.3.ST-ET.5)

graphs showing key features given a verbal description of the relationship.

F-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

F-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

F-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

F-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)

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. Include recognizing even and odd functions from their graphs

http://alex.state.al.us/lesson_view.php?id=32294

Rational Exponents Rock!
http://alex.state.al.us/lesson_view.php?id=32256

Polynomials Divided by Monomials
http://alex.state.al.us/lesson_view.php?id=26404

Exponents and Division
http://alex.state.al.us/lesson_view.php?id=26250

Exponential Growth and Decay
http://alex.state.al.us/lesson_view.php?id=24092

Factoring Fanatic
http://alex.state.al.us/lesson_view.php?id=4152

Evaluating Statements about Radicals
<http://map.mathshell.org/lessons.php?unit=9115&collection=8>

Representing Quadratics Graphically
<http://map.mathshell.org/lessons.php?unit=9245&collection=8>

Solving Quadratic Equations
<http://map.mathshell.org/>

and algebraic expressions for them.

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

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 Fit a function to the data; 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.

[essons.php?unit=9250&collection=8](https://education.ti.com/en/us/activity/detail?id=82675ECB65E74FF29FAC149376CC49E0&ref=/en/us/activity/search/advanced)

Comparing Linear and Exponential Data

<https://education.ti.com/en/us/activity/detail?id=82675ECB65E74FF29FAC149376CC49E0&ref=/en/us/activity/search/advanced>

Modeling with A Quadratic Function

<https://education.ti.com/en/us/activity/detail?id=8199F5A7AD60470082E865BD93FBC3EE&ref=/en/us/activity/search/advanced>

Aussie Fir Tree

<http://schools.nyc.gov/Academics/CommonCoreLibrary/TasksUnitsStudentWork/default.htm>

Everything you need to know about math journals:

<https://thecornerstoneforteachers.com/math-journals/>
(NJSLSA.R1,
NJSLSA.W2,
NJSLSA.L1, SL.9-10.4,
NJSLSA.L6)

Additional texts:

www.newsela.com
www.readworks.org
www.commonlit.org

Key Vocabulary:

Compound interest, decay factor exponential decay, exponential function, exponential growth, geometric sequence, growth factor, binomial, degree of monomial, degree of polynomial, difference of two squares, factor by grouping, monomial, perfect-square trinomial, polynomial, standard form of a polynomial, trinomial, axis of symmetry, completing the square, discriminant, maximum, minimum, parabola, quadratic equation, quadratic formula, root of an equation, vertex

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:

- Teaching modeling
- 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

Special Education:

- Utilize modifications & 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

At-Risk:

- Use visual demonstrations, 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

Gifted and Talented:

- Inquiry based instruction
- 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

<ul style="list-style-type: none"> • Use of alge-tiles when needed • Use of number line when needed 	<ul style="list-style-type: none"> • attain passing grades • Tape a number line to the students 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 	<ul style="list-style-type: none"> • 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 	
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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

NJSLSA.L1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking

SL.9-10.4: Present information, findings and supporting evidence clearly, concisely and logically. The content, organization, development and style are appropriate to task, purpose and audience.

NJSLSA.L6: Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

21st 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.

Major **Supporting** **Additional** (Identified by PARCC Model Content Frameworks)