

Applications of Algebra 1 Curriculum 2023-2024



Approved by the Academy for Urban Leadership Board of
Trustees

April 2023

Founded in 2010 in Perth Amboy, New Jersey, the Academy for Urban Leadership Charter School is one of Middlesex County's comprehensive Public Charter Schools that serves students in seventh through twelfth grades. The school operates under the terms of a charter granted by the New Jersey Department of Education. AUL offers an advanced academic track and AP courses.

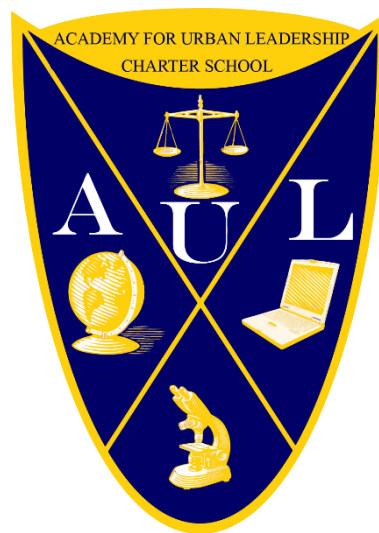
AUL has designed its curriculum to focus on Four Academies which include Applied Science, Law/Public & Safety, Business & Technology and Human Development. Students are given an opportunity to explore interests and take courses related to their chosen field, proving students with an opportunity to utilize knowledge in their everyday life.

MISSION STATEMENT OF ACADEMY FOR URBAN LEADERSHIP CHARTER SCHOOL:

To employ an educational design and experience that merges the highest standards of academic excellence while fostering convictions and commitment to social and economic justice.

Goals:

- Provide each student the resources necessary to excel to his/her maximum ability
- Prepare students for success in post-secondary education
- Prepare students with the skills for the workforce
- Prepare students to be leaders in this community
- Prepare students for their civic responsibilities and instill values of good citizenship



UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 1 Applications of Algebra 1
TARGET COURSE/GRADE LEVEL: Applications of Algebra 1	SUGGESTION TIMEFRAME: 10 days Instructional Time
TOPIC: Number Sense	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

To work with radicals and integer exponents.

-To know that there are numbers that are not rational and approximate them by rational numbers.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

I WIDA : CAN DO Descriptors - Key Uses Edition (2016)

WIDA : Grades 9-12

Key Use of Recount

Reading Level 1 - Entering

Process recounts by:

Matching key content-related terms and ideas to images, graphs, icons, or diagrams [Show details](#)

WIDA : ELP Standards (2007)

WIDA : Grades 9-12

ELP Standard 3: The Language of Mathematics

SPEAKING

Example Topics: Problem solving

Level 1 - Entering: Exchange key words involved in problem solving from models and visual support in L1 or L2 with a partner

NJ: 2014 SLS: Science

NJ: Grades 6-8

MS-ETS1 Engineering Design

Performance Expectations

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

NJSLS-S: Disciplinary Core Ideas

NJSLS-S: 9-12

ESS3: Earth and Human Activity

ESS3.C: Human Impacts on Earth Systems

The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)

P21: 21st Century Student Outcomes

P21: K-12

Learning & Innovation Skills

Make Judgements and Decisions

Interpret information and draw conclusions based on the best analysis

ESSENTIAL QUESTIONS:

1. How can quantities help determine financial situations?
2. How can placing quantities in order help make scientific decisions?
3. How can quantities be used through data analysis and categorizations?
4. How do you use order of operations to evaluate an expression?
5. How do you write an expression to represent a real-world situation?
6. How can you use scientific notation to express very large quantities?
7. How can you use scientific notation to express very small quantities?
8. How do you add, subtract, multiply, and divide using scientific notation?
9. Which part of the fractional exponent is the same for all parts of the example?
10. Which part of the exponent determines the power to which the base is related?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS

N-Q.A. Reason quantitatively and use units to solve problems.

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.

2. Define appropriate quantities for the purpose of descriptive modeling.

3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

A-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.

★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. 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

N-RN.A. Extend the properties of exponents to rational exponents. 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 $(5^{1/3})^3 = 5^{(1/3) \cdot 3}$ to hold, so $(5^{1/3})^3$ must equal 5.

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

8.EE.A.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9 , and determine that the world population is more than 20 times larger.

8.EE.A.4 Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

21st century skills

NJ: 2020 SLS: Career Readiness, Life Literacies, and Key Skills

NJ: End of Grade 12

9.3 – Career & Technical Education (CTE): Science, Technology, Engineering & Mathematics Career Cluster®
Engineering & Technology Career Pathway (ST-ET)

9.3.ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST-ET.5 Apply the knowledge learned in STEM to solve problems.

Science & Mathematics Career Pathway (ST-SM)

9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

NJ: 2014 SLS: 21st Century Life and Careers

NJ: All Grades

Career Ready Practices

Career Ready Practices

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity

<p>Content: What information do students need to know?</p> <ul style="list-style-type: none"> • Learned strategies to write rational numbers as decimals. • Understood that decimals either terminate or repeat. • Identified rational numbers as numbers that can be written in the form a/b where a and b are integers and $b \neq 0$. • Performed calculations with rational numbers. • Compared and ordered rational numbers. Showed fluency involved with whole number exponents through writing expressions with whole number exponents. • Evaluated square roots and cube roots of rational numbers 	<p>Process: What will students be able to do with the information?</p> <p>Students will understand that there are rational and irrational numbers. Students will build fluency with square roots and cube roots by classifying a whole number as a perfect square, a perfect cube, both, or neither. Students will apply the rules of integer exponents to simplify expressions and to solve problems. Students will write numbers in scientific notation and perform the operations of addition, subtraction, multiplication, and division</p>
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Modifications:

Special Education	ESL	At-risk	Gifted and Talented
<p>IEPs: All of the (Section 504), but not limited to:</p> <ul style="list-style-type: none"> • Modified content based on the student's ability level (e.g., reading level, expectation of writing) • Modified tests and quizzes (e.g., using only key concepts, using appropriate reading level) • Assignments of modified length when appropriate (e.g., essay questions, reading, responses) • Assignments with modified number of choices (e.g., limit choices, but not content) • Leveled texts on students' independent or instructional reading level • Written prompts to guide thinking and completion of tasks/writing • Teacher adapted curriculum 	<ul style="list-style-type: none"> • Simplified language • Limited content objectives • Graphic organizers • Reduced text • Limited amount of vocabulary words • Study guides/outlines/and/or wordbanks • Reduced # of multiple choices • Orally read tests • Gestures to emphasize meaning • Oral/visual directions/prompts when necessary • Open book assignments / tests • Dictionary for native language • Videos in native language. • Supplemental materials including use of online bilingual dictionaries, and modified assessments and/or rubric 	<p>504s:</p> <ul style="list-style-type: none"> • Visual and tactile learning (e.g., graphs/charts, manipulatives, hands on activities, reference videos) • Clear directions • Study guides • Assignments broken down into segments of shorter tasks • Reduced homework or classwork • Tests with modified content and/or format • Alternate/ modified assignments and/or projects • Modified texts and/or audiovideo materials • Behavior management support • Adjusted class schedules or grading • Orally administered assessments • Pre-approved nurse's office visits and accompaniment to visits 	<ul style="list-style-type: none"> • Enhanced set of introductory activities • Active teaching/learning opportunities • Authentic components • Higher level questions • Interest-based extension activities • Centers, stations and contracts • Whole group enrichment explorations • Related talent development opportunities. • Leveled Assessments • Enrichment worksheets

<ul style="list-style-type: none"> • Scaffolding assignments (thinkpair-share, cooperative learning groups, teacher think alouds) • Chunked material • Guided questions and note 			
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INSTRUCTION

CONTENT VOCABULARY:

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Formative Assessments -

- Analyzing Student Work - information can be learned from students' homework and classwork. This is especially so if the students are required to explain their thinking.
- Round Robin Charts This strategy involves passing charts among groups to assess understanding. Once every group has worked on every chart, responses are discussed as a class.
- Strategic Questioning -Higher-order questions require more in-depth thinking from the students. They can help the teacher discern the level and extent of the students' understanding.
- Think- Pair- Share - The instructor asks a question, and students write down their answers. Students are then placed in pairs to discuss their responses. Teachers are able to move around the classroom and listen to various discussions. It lets them gain valuable insight into levels of understanding.
- 3–2–1 Countdown 3 things you didn't know before; 2 things that surprised you about this topic; 1 thing you want to start doing with what you've learned
- Classroom Polls (using various apps so responses just seen by teachers)
- Exit/Admit Tickets - students write down an accurate interpretation of the main idea behind the lesson taught that day. Admit tickets are done at the very beginning of the class. Students may respond to questions about homework, or on the lesson taught the day before.

Summative

- Tests/ Quizzes • Quartiles • End-of unit projects or assignments • Link it Benchmarks – departmental benchmark given at the end of MP1 and MP3. Uniform MC and open ended questions are embedded into assessments.

Alternative Assessments

- Exploratory activities based on phenomenon
- Gallery walks of student work
- Creative Extension Projects • Build a model of a proposed solution
- Let students design their own flashcards to test each other
- Keynote presentations made by students on the topic
- Performance tasks
- Journal

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

- Computation of Real Numbers
- Absolute Value

- Properties of Real Numbers
- Order of Operations
- Scientific Notation
- Properties of Exponents
- Classifying / Ordering Real Numbers
- Example Tasks Below

Task

A liquid weed-killer comes in four different active ingredients. The accompanying concentration of active ingredient in each bottle and the price of the bottles. Each bottle contains 1 liter of active ingredient and water.

	Concentration	Amount
A	1.04%	64
B	18.00%	32
C	41.00%	32
D	1.04%	24

a. You need to apply a 1% solution of the four bottles in order of best to worst. Which bottle is a better buy than another?

b. The size of your lawn requires a total of 1 liter of active ingredient. Approximately how much would you need to buy of the A bottles? Only the B bottles? Only the C bottles? Only the D bottles?

Supposing you can only buy one type of bottle so that the total cost to you is the lowest. Which bottle is the best application of weed killer?

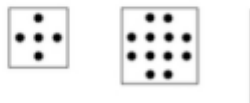
Task

Consider the algebraic expressions

$$(n + 2)^2 - 4$$

a.

Use the figures below to illustrate v



b. Find some ways to algebraically v

Task

In each of the following problem determine whether the given nu cases, it may be impossible to d rational or irrational. Justify you

a. $4 + \sqrt{7}$

b. $\frac{\sqrt{45}}{\sqrt{5}}$

c. $\frac{6}{\pi}$

d. $\sqrt{2} + \sqrt{3}$

e. $\frac{2 + \sqrt{7}}{2a + \sqrt{7}a^2}$, where a is a posi

f. $x + y$, where x and y are irratic

Interdisciplinary Connections: Career Readiness, life Literacies and Key Skills **Content:** Critical Thinking and Problem Solving; **NJSLS#:9.4.12.CT.1**

A human heart beats an average of 80 beats per minute. How many beats is this in an hour? Express your answer in scientific notation.

- How many heartbeats is this in a day? Put your answer in scientific notation.
- About how many heartbeats is this in a year? Put your answer in scientific notation.
- About how many heartbeats is this in 80 years? Put your answer in scientific notation.

Spot Light on:
LGBT and Disabilities Law: N.J.S.A
18A:34-4.35

- **Sally Ride: First American woman in space.**

**Prepared By
Munira Jamali**

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 2 Applications of Algebra 1
TARGET COURSE/GRADE LEVEL: Applications of Algebra 1	SUGGESTION TIMEFRAME: 10 days Instructional Time
TOPIC: Ratios, Percentages, Proportions, and Measurement	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

Analyze and use proportional relationships; Analyze and solve percent proportions; Introduction to functions

3-1 Use ratios and rates to describe the relationships between two quantities. Find equivalent ratios and use unit rates to solve multi-step problems.

3-2 Find unit rates with ratios of fractions. Use unit rates to solve multi-step problems.

3-3 Determine whether quantities are proportional by testing for equivalent ratios.

3-4 Use the constant of proportionality to write equations that represent proportional relationships. Use equations to solve problems involving proportional relationships.

3-5 Use a graph to identify proportions. Interpret a point on a graph of a proportional relationship.

3-6 Explain whether a situation represents a proportional relationship.

4-1 Understand that equivalent rates can be used to find percents. Analyze percents of numbers in a real-world context.

4-2 Construct a percent proportion. Use a percent proportion to find an unknown part, a whole, or a percent.

4-3 Understand the relationship between proportional reasoning and percent. Interpret the results of a percent equation in a real-life scenario.

4-4 Solve real-world problems involving percent change and percent error. Understand the percent equation and the different ways it can be used.

4-5 Understand and calculate markups and markdowns. Relate percent change to percent markup and percent markdown.

4-6 Identify the parts of interest problems and how the values are related. Understand what simple interest is and how it is calculated

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P21: K-12

Learning & Innovation Skills

Make Judgements and Decisions

Interpret information and draw conclusions based on the best analysis

ESSENTIAL QUESTIONS:

1. How can proportional reasoning help me find unknowns in everyday life?
2. How can properties of similarity help me solve measurement problems?
3. When quantities have different measurements, how can they be compared?
4. How do you use ratios, proportions, percents, differences, and scales to make comparisons?
5. How does scaling ratios help when finding missing parts of equivalent ratios?
6. How do you rewrite a percent as a simplified fraction?
7. How are percentages related to proportional relationships?
8. How can solving percentages be applied to real world situations?
9. How can surface area and volume of two-dimensional figures be applied when solving real-world problems?
10. How can you derive the formulas for circumference, area, and volume?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS

7.RP.A. Analyze proportional relationships and use them to solve real-world and mathematical problems.

1. Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1/2}{1/4}$ miles per hour, equivalently 2 miles per hour. 2. Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p , the relationship between the total cost and the number of items can be expressed as $t = pn$. d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate. 3. Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.

7.EE.A.2 Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. For example, $a + 0.05a = 1.05a$ means that "increase by 5%" is the same as "multiply by 1.05."

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

G-GMD.A.1 Give an informal argument for the formulas for the circumference of a circle and the volume and surface area of a cylinder, cone, prism, and pyramid.

G-GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems

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Career Ready Practices

Career Ready Practices

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity

Content: What information do students need to know?

Find equal ratios

Ratio reasoning

Rates Proportional relationships

Process: What will students be able to do with the information?

3-1 Equivalent ratios and unit rates can be used to compare ratios and solve problems.

3-2 A unit rate can be easier to use to solve problems than a ratio of fractions.

3-3 Quantities in a proportional relationship can be described by equivalent ratios.

3-4 Equations in the form of $y=kx$, where k is the constant of proportionality, can be used to represent proportional relationships and solve problems.

3-5 The graph of a proportional relationship is a straight line through the origin.

3-6 By recognizing proportional quantities, you can use what you know about proportional relationships to solve problems.

4-1 Equivalent ratios can be used to find the percent of a number. Percent is a ratio out of 100 that relates the ratio of two quantities.

4-2 The part divided by the whole and the percent divided by 100 are equivalent ratios.

4-3 Proportional reasoning can be used to develop the percent equation, which in turn, can be used to find the percent, part or whole.

4-4 Both the percent change and percent error involve finding the ratio of a difference of two values to one of those values

4-5 A markup is the same as a percent increase, a markdown is the same as a percent decrease. The method used to calculate percent change can be used to calculate markups and markdowns.

4-6 Each value in the annual simple interest formula corresponds to a value in the percent equation.

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INSTRUCTION

CONTENT VOCABULARY:

proportional relationship, proportion, constant of proportionality, function , percent equation, percent change, percent error, markup, markdown, percent markup, percent markdown, interest rate, principal, simple interest

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

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Alternative Assessments

- Exploratory activities based on phenomenon
- Gallery walks of student work
- Creative Extension Projects • Build a model of a proposed solution
- Let students design their own flashcards to test each other
- Keynote presentations made by students on the topic
- Performance tasks
- Journal

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Activity Description:

- Computing unit rates.
- Converting rates and percentages.
- Finding the constant of proportionality.
- Determining proportional relationships.
- Using proportional relationships to solve problems.

Use percentages to solve ratios and percentage problems.

- Use geometric measurements in one and two dimensions
- Apply geometric formulas to solve real life context problems
- Example tasks below.

Task

The price of a gallon of apple cider is \$7.00.
An 8.46-ounce juice box is \$2.39.



- Suppose the juice was instead packaged in 8.46-ounce boxes. What is the cost per gallon of the juice?
- Suppose the cider was instead packaged in 8.46-ounce boxes. What is the cost per eight 8.46-ounce boxes?
- Peter wants to have at least a gallon of juice. Which product is the better deal?
- State the unit rate(s) you used to compare the two products in your answer to Question c.

Task

Historically, different people have defined a year. For example, an Egyptian year is 365 days long, a Julian year is 365.25 days long, and a Gregorian year is 365.2425 days long.

- What is the difference, in seconds, between a Julian year and a Gregorian year?
- What is the percent decrease, to the nearest percent, from a Julian year to a Gregorian year?
- How many fewer days are there in 400 years of the Julian calendar than there are in 400 years of the Gregorian calendar?

Tennis Balls in a Can

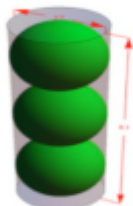
Tags: MP 4

Alignments to Content Standards: G-GMD.B.4 G-MG.A.1

Student View

Task

The official diameter of a tennis ball, as defined by the International Tennis Federation, is at least 2.575 inches and at most 2.700 inches. Tennis balls are sold in cylindrical containers that contain three balls each. To model the container and the balls in it, we will assume that the balls are 2.7 inches in diameter and that the container is a cylinder the interior of which measures 2.7 inches in diameter and $3 \times 2.7 = 8.1$ inches high.



- Lying on its side, the container passes through an X-ray scanner in an airport. If the material of the container is opaque to X-rays, what outline will appear? With what dimensions?
- If the material of the container is partially opaque to X-rays and the material of the balls is completely opaque to X-rays, what will the outline look like (still assuming the can is lying on its side)?
- The *central axis* of the container is a line that passes through the centers of the top and bottom. If one cuts the container and balls by a plane passing through the central axis, what does the intersection of the plane with the container and balls look like? (The intersection is also called a *cross section*. Imagine putting the cut surface on an ink pad and then stamping a piece of paper. The stamped image is a picture of the intersection.)
- If the can is cut by a plane parallel to the central axis, but at a distance of 1 inch from the axis, what will the intersection of this plane with the container and balls look like?
- If the can is cut by a plane parallel to one end of the can—a horizontal plane—what are the possible appearances of the intersections?
- A cross-section by a horizontal plane at a height of $1.35 + w$ inches from the bottom is made, with $0 < w < 1.35$ (so the bottom ball is cut). What is the area of the portion of the cross section inside the container but outside the tennis ball?
- Suppose the can is cut by a plane parallel to the central axis but at a distance of w inches from the axis ($0 < w < 1.35$). What fractional part of the cross section of the container is inside of a tennis ball?

Interdisciplinary Connections: Career Readiness, life Literacies and

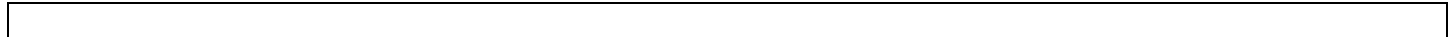
Key Skills Content: Critical Thinking and Problem Solving; **NJSLS#:9.4.12.CT.1**

A rectangle is 4 times as long as it is wide. If the length is increased by 4 inches and the width is decreased by 1 inch, the area will be 60 square inches. What were the dimensions of the original rectangle?

Spot Light on:

LGBT and Disabilities Law: N.J.S.A 18A:34-4.35

● **Ben Barres: Neuroscience Pioneer, Gender Champion**



Prepared By
Munira Jamali

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 3 Applications of Algebra 1
TARGET COURSE/GRADE LEVEL: Applications of Algebra 1	SUGGESTION TIMEFRAME: 10 days Instructional Time
TOPIC: Expressions and Equations (Modeling and Solving)	CHAPTERS COVERED:
UNIT SUMMARY/ UNIT RATIONALE: Learning Goals: Topic 5- Generate equivalent expressions. Topic 6- Solve problems using equations and inequalities Topic 7- Analyze and Solve Linear Equation	
INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING: I WIDA : CAN DO Descriptors - Key Uses Edition (2016) WIDA : Grades 9-12 Key Use of Recount Reading Level 1 - Entering Process recounts by: Matching key content-related terms and ideas to images, graphs, icons, or diagrams Show details WIDA : ELP Standards (2007) WIDA : Grades 9-12 ELP Standard 3: The Language of Mathematics SPEAKING Example Topics: Problem solving Level 1 - Entering: Exchange key words involved in problem solving from models and visual support in L1 or L2 with a partner NJ: 2014 SLS: Science NJ: Grades 6-8 MS-ETS1 Engineering Design Performance Expectations MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. NJSL-S: Disciplinary Core Ideas NJSL-S: 9-12 ESS3: Earth and Human Activity ESS3.C: Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3) P21: 21st Century Student Outcomes P21: K-12 Learning & Innovation Skills Make Judgements and Decisions Interpret information and draw conclusions based on the best analysis	
ESSENTIAL QUESTIONS: 1. How do you write an expression to represent a real-world situation? 2. How do you write equations? 3. How can you use a problem solving plan to solve a problem?	

4. How do you represent functions as rules and tables?
5. How do you find ratios and write and solve proportions?
6. How do you solve proportions using cross products?
7. How can quantities help determine financial situations?
8. How can placing quantities in order help make scientific decisions?
9. How can quantities be used through data analysis and categorizations?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS

A-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.★ a. Interpret parts of an expression, such as terms, factors, and coefficients. b. 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-REI.A Understand solving equations as a process of reasoning and explain the reasoning 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. 2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

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.

21st Century Skills, 21ST CENTURY LIFE AND CAREER and TECHNOLOGY Standards:

21st century skills

NJ: 2020 SLS: Career Readiness, Life Literacies, and Key Skills

NJ: End of Grade 12

9.3 – Career & Technical Education (CTE): Science, Technology, Engineering & Mathematics Career Cluster®
Engineering & Technology Career Pathway (ST-ET)

9.3.ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.

9.3.ST-ET.5 Apply the knowledge learned in STEM to solve problems.

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9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

NJ: 2014 SLS: 21st Century Life and Careers

NJ: All Grades

Career Ready Practices

Career Ready Practices

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity

Content: What information do students need to know?

Read, write, and interpret algebraic expressions
Identify equivalent expressions
Evaluate graphs, tables, and number lines
Analyze equivalent expressions and solve multi-step equations using the Distributive Property
Apply proportional reasoning to solve problems.

Process: What will students be able to do with the information?

5-1 Algebraic expressions can be used to represent and solve problems in real-world contexts.
5-2 Rearranging or combining like terms does not change the value of an expression
5-3 All like terms must be combined in order for expressions to be simplified.
5-4 Expanded expressions represent an equivalent way to represent the original expression.

5-5 The Distributive Property and common factors are used to factor expressions.

5-6 The same rules apply for coefficients and constants when adding expressions.

5-7 Add the inverse when subtracting expressions.

5-8 Understanding mathematical structure is important for solving deeper, unconventional expressions.

6-1 Equations with more than one operation can be used to represent a situation.

6-2 One and two-step equations are both solved by using the properties of equality.

6-3 The Distributive Property can be used to solve equations in the form $p(x + q) = r$.

6-4 Solving inequalities with addition and subtraction is the same as solving equations.

The inverse relationship between addition and subtraction is used to isolate the variable.

6-5 Solving inequalities with multiplication and division is very similar to solving equations. In an inequality, when multiplying or dividing by a negative value, the inequality symbol is reversed.

6-6 To solve a two-step inequality, add or subtract the constant, and then multiply or divide to isolate the variable.

6-7 Multi-step inequalities, like two-step inequalities, have more than one step and more than one operation

7-1 Combining like terms that are on one side of the equation makes it easier to solve for the variable by using inverse operations.

7-2 To solve a linear equation that has variable terms on both sides of the equation, first use inverse operations to move all variable terms to one side of the equation and constant terms to the other. Then, isolate the variable.

7-3 The distributive property is an important tool for simplifying expressions and combining like terms.

7-4 Equations with one variable can have zero, one, or infinite many solutions.

7-5 Proportional relationships can be represented using different models, including graphs, tables, and equations.

7-6 Slope is a measure of the steepness of a line and is equal to the rate of change between quantities. In a proportional relationship, slope is the same as the unit rate and the constant of proportionality.

7-7 The slope, constant of proportionality, and unit rate are equal for proportional relationships.

7-8 The y-intercept of a line is the y-coordinate of the point where the graph crosses the y-axis. Its meaning depends on the context of the graph. 7-

9 The slope-intercept form for a linear equation, $y=mx+b$, gives information to sketch a graph of the line. And it indicates that the point (0,b) is on the graph of the line and shows the slope of the line is m.

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
<p>IEPs: All of the (Section 504), but not limited to:</p> <ul style="list-style-type: none"> • Modified content based on the student's ability level (e.g., reading level, expectation of writing) • Modified tests and quizzes (e.g., using only key concepts, using appropriate reading level) • Assignments of modified length when appropriate (e.g., essay questions, reading, responses) • Assignments with modified number of choices (e.g., limit choices, but not content) • Leveled texts on students' independent or instructional reading level • Written prompts to guide thinking and completion of tasks/writing • Teacher adapted curriculum • Scaffolded assignments (thinkpair-share, cooperative learning groups, teacher think alouds) • Chunked material 	<ul style="list-style-type: none"> • Simplified language • Limited content objectives • Graphic organizers • Reduced text • Limited amount of vocabulary words • Study guides/outlines/ and/or wordbanks • Reduced # of multiple choices • Orally read tests • Gestures to emphasize meaning • Oral/visual directions/prompts when necessary • Open book assignments / tests • Dictionary for native language • Videos in native language. • Supplemental materials including use of online bilingual dictionaries, and modified assessments and/or rubric 	<p>504s:</p> <ul style="list-style-type: none"> • Visual and tactile learning (e.g., graphs/charts, manipulatives, hands on activities, reference videos) • Clear directions • Study guides • Assignments broken down into segments of shorter tasks • Reduced homework or classwork • Tests with modified content and/or format • Alternate/ modified assignments and/or projects • Modified texts and/or audiovideo materials • Behavior management support • Adjusted class schedules or grading • Orally administered assessments • Pre-approved nurse's office visits and accompaniment to visits 	<ul style="list-style-type: none"> • Enhanced set of introductory activities • Active teaching/learning opportunities • Authentic components • Higher level questions • Interest-based extension activities • Centers, stations and contracts • Whole group enrichment explorations • Related talent development opportunities. • Leveled Assessments • Enrichment worksheets

<ul style="list-style-type: none"> • Guided questions and note 			
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INSTRUCTION

CONTENT VOCABULARY:
 Commutative Property of Addition, Commutative Property of Multiplication, Distributive Property, equivalent expressions, expanded form, factored form, properties of equality, roots

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

Formative Assessments -

- Analyzing Student Work - information can be learned from students' homework and classwork. This is especially so if the students are required to explain their thinking.
- Round Robin Charts This strategy involves passing charts among groups to assess understanding. Once every group has worked on every chart, responses are discussed as a class.
- Strategic Questioning -Higher-order questions require more in-depth thinking from the students. They can help the teacher discern the level and extent of the students' understanding.
- Think- Pair- Share - The instructor asks a question, and students write down their answers. Students are then placed in pairs to discuss their responses. Teachers are able to move around the classroom and listen to various discussions. It lets them gain valuable insight into levels of understanding.
- 3–2–1 Countdown 3 things you didn't know before; 2 things that surprised you about this topic; 1 thing you want to start doing with what you've learned
- Classroom Polls (using various apps so responses just seen by teachers)
- Exit/Admit Tickets - students write down an accurate interpretation of the main idea behind the lesson taught that day. Admit tickets are done at the very beginning of the class. Students may respond to questions about homework, or on the lesson taught the day before.

Summative

- Tests/ Quizzes • Quartiles • End-of unit projects or assignments • Link it Benchmarks – departmental benchmark given at the end of MP1 and MP3. Uniform MC and open ended questions are embedded into assessments.

Alternative Assessments

- Exploratory activities based on phenomenon
- Gallery walks of student work
- Creative Extension Projects • Build a model of a proposed solution
- Let students design their own flashcards to test each other
- Keynote presentations made by students on the topic
- Performance tasks
- Journal

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

- Activity Description:**
- Translating Expressions
 - Deductive Reasoning (Properties of Equality)
 - Writing and Solving Equations in One Variable
 - Writing, Solving and Graphing Inequalities in One Variable
 - Example Tasks Below

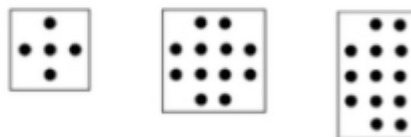
Task

Consider the algebraic expressions below

$$(n + 2)^2 - 4 \quad \text{and}$$

a.

Use the figures below to illustrate why the



b. Find some ways to algebraically verify

Task

Consider the expression

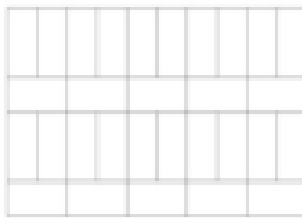
$$\frac{1}{\frac{1}{R_1} + \frac{1}{R_2}}$$

where R_1 and R_2 are positive.

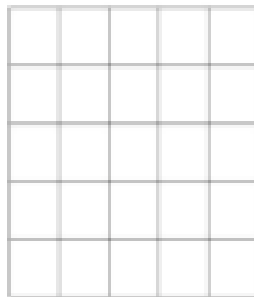
Suppose we increase the value of R_1 while the value of the expression above increases. Explain in terms of the structure of the expression

Task

A tessellation of the plane is an arrangement of polygons which cover the plane without gaps or overlapping. For example, part of a tessellation with rectangles is pictured below:



A tessellation is called *regular* if all polygons in the tessellation are congruent regular polygons and if any two polygons in the tessellation either do not meet, share a vertex only, or share one edge. The checkerboard pattern below is an example of a regular tessellation which can be continued indefinitely in all directions:



In this problem you will discover some very strong restrictions on possible tessellations of the plane, stemming from the fact that each interior angle of an n -sided regular polygon measures $\frac{180(n-2)}{n}$ degrees.

a. Suppose P_n is a regular n -sided polygon and there is a tessellation of the plane by polygons congruent to P_n . Suppose that m of these polygons meet at each vertex in the tessellation. Explain why

$$m \times \left(\frac{180(n-2)}{n} \right) = 360.$$

b. Show that for any such tessellation, we must have $m \geq 3$ and, using part (a), that $n \leq 6$.

c. Using (a) and (b), find all possible pairs (m, n) for a regular tessellation

Task

The following is a student solution to the inequality

$$\begin{aligned}\frac{5}{18} - \frac{x-2}{9} &\leq \frac{x-4}{6} \\ \frac{5}{18} - \frac{x-2}{9} &\leq \frac{x-4}{6} \\ \frac{5}{18} - \frac{2}{2} \frac{x-2}{9} &\leq \frac{3}{3} \frac{x-4}{6} \\ \frac{5}{18} - \frac{2x-2}{18} &\leq \frac{3x-4}{18} \\ 5 - (2x-2) &\leq 3x-4 \\ 5 - 2x + 2 &\leq 3x-4 \\ 7 - 2x &\leq 3x-4 \\ -5x &\leq -11 \\ x &\leq \frac{11}{5}\end{aligned}$$

a. There are two mathematical errors in this work. Identify each mathematical error that occurred and explain why it is incorrect.

The first mathematical error occurred going from

Why it is incorrect:

The second mathematical error occurred going from

_____.

Why it is incorrect:

b. How would you help the student understand the error?

c. Solve the inequality correctly.

Interdisciplinary Connections: Career Readiness, life Literacies and Key Skills **Content:** Critical Thinking and Problem Solving; **NJSLS#:9.4.12.CT.1**

A retail clothing store advertises the following sale: Shorts are $\frac{1}{2}$ off the original price; pants are $\frac{1}{3}$ off the original price, $\frac{1}{4}$ off the original price (called the discount rate).

- a. If a pair of shoes costs \$40 and is advertised at $\frac{1}{4}$ off the original price, what is the sales price?
- b. At Peter's Pants Palace a pair of pants usually sells for \$33.00. If Peter advertises that the store is having $\frac{1}{3}$ off sale, what is the sale price of Peter's pants?

Spot Light on:
Amistad Law: N.J.S.A. 18A 52:16A-88

● **Percy Lavon Julian: First African-American chemist inducted into the National Academy of Sciences, and the second African-American scientist inducted from any field.**

Prepared By
Munira Jamali

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 4 Applications of Algebra 1
TARGET COURSE/GRADE LEVEL: Applications of Algebra 1	SUGGESTION TIMEFRAME: 16 days Instructional Time
TOPIC: Coordinate Plane and Linear Models	CHAPTERS COVERED:
UNIT SUMMARY/ UNIT RATIONALE: Topic 5- Generate equivalent expressions. Topic 6- Solve problems using equations and inequalities Topic 7- Analyze and Solve Linear Equation	
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ESSENTIAL QUESTIONS: Essential Question/s: 1. How do you find the slope of a line and interpret slope as a rate of change? 2. How do you plot points in a coordinate plane? 3. How do you graph linear equations? 4. How do you use intercepts to graph equations? 5. How do you graph linear equations given in slopeintercept form?	

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS

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

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.

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1st century skills

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Career Ready Practices

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INSTRUCTION**CONTENT VOCABULARY:**

Topic 5: expression, equation

Topic 6: isolate the variable

Topic 7: slope, y-intercept, slope-intercept form

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

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Alternative Assessments

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· Gallery walks of student work

· Creative Extension Projects · Build a model of a proposed solution

· Let students design their own flashcards to test each other

· Keynote presentations made by students on the topic

· Performance tasks

· Journal

INSTRUCTIONAL RESOURCES (ELA – INCLUDE VARIOUS LEVELS OF TEXT):

Activity Description:

• Graphing on the Cartesian Coordinate Plane

• Graphing Relations and Functions

• Graphing Data Graphing Linear Equations in Two Variables

• Example Tasks Below Using Data Displays

Task

John makes DVDs of his friend's shows. His fixed costs, his average cost per DVD, and the total cost of producing x DVDs he produces. The cost of producing x DVDs is given by the function

$$C(x) = 2500 + 10x + 0.05x^2$$

a.

John wants to figure out how much to charge for each DVD. He's not trying to make any money on the DVDs, but he wants to cover his costs. Suppose John made 100 DVDs. How much should he charge for each DVD to cover his costs? How much profit would he make producing this many DVDs? How much profit would he make producing 1,000 DVDs?

b.

John is hoping to make many more than 100 DVDs. Complete the table showing his costs at different production levels.

# of DVDs	0	10	100	1,000
Total Cost				
Cost per DVD				

c.

Explain why the average cost per DVD is always greater than the marginal cost per DVD.

d.

Find an equation for the average cost per DVD as a function of the number of DVDs produced.

Task

A parking lot charges \$0.50 for each half hour and has a daily maximum of \$10.00. Let $C(t)$ be the cost of parking for t minutes.

a. Complete the table below.

t (minutes)	
0	
15	
20	
35	
75	
125	

b. Sketch a graph of C for $0 \leq t \leq 480$.

c. Is C a function of t ? Explain your reasoning.

d. Is t a function of C ? Explain your reasoning.

Interdisciplinary Connections: Career Readiness, life Literacies and Key Skills **Content:** Creativity and Innovation; **NJSLS#:** 9.4.12.CI.1

Tim buys a new computer for his office for \$1200. For tax purposes, he declares a linear depreciation (loss of value) of \$200 per year. Let y be the declared value of the computer after x years. What is the slope of the line that models this depreciation? Find the y -intercept of the line. Write a linear equation in slope-intercept form to model the value of the computer over time. Find the value of the computer after 4.5 years.

Spot Light on:

Holocaust Law: N.J.S.A. 18A:35-28

• **How Many Victims? - "The Holocaust is the best documented case of genocide. Despite this, calculating the exact numbers of individuals who were killed as the result of Nazi policies is an impossible task. There is no single wartime document that spells out how many people were killed."**

Prepared By
Munira Jamali