

Pre-Algebra Curriculum – Grade 8
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.

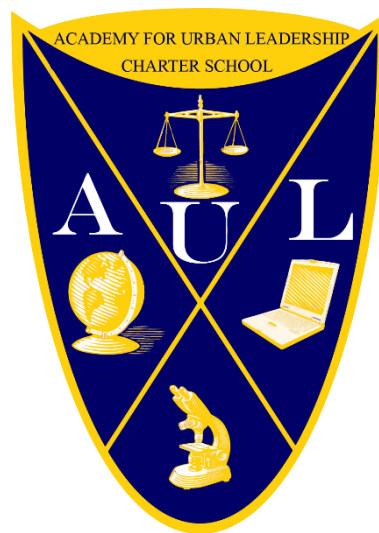
AUL has designed its curriculum to focus on Four Academies which include Applied Science, Law/Public & Safety, Business & Technology and Human Development. Students are given an opportunity to explore interests and take courses related to their chosen field, proving students with an opportunity to utilize 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 – Exponents, Irrational Numbers, and Linear Equations
TARGET COURSE/GRADE LEVEL: 8 th Grade	SUGGESTION TIMEFRAME: 2-4 weeks
TOPIC: Irrational Numbers	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

There are different types of real numbers. The students have learned about natural (counting) numbers, whole numbers, integers, and rational numbers. For this unit, they will be introduced to irrational numbers. These types of numbers are crucial in many areas. Moreover, they will be used more often when they get into high school and beyond.

During the unit, they will need to know the difference between rational and irrational numbers. Also, they will be introduced to special types of irrational numbers. For example, square roots where the solution is not perfect.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Science: Square roots are utilized in some scientific formulas. The students will see what happens when the solution is irrational.

ESSENTIAL QUESTIONS:

- What are irrational numbers?
- What are the different types of irrational numbers?
- How do you approximate an irrational number?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

- **8.NS.A.1** Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually and convert a decimal expansion which repeats eventually into a rational number.
- **8.NS.A.2** Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

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

- **9.2.12.CAP.2:** Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- **9.3.ST.2:** Use technology to acquire, manipulate, analyze, and report data
- **9.3.ST.6:** Demonstrate technical skills needed in a chosen STEM field.
- **9.3.ST-SM.1:** Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
- **9.3.ST-SM.2:** Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
- **9.3.ST-SM.3:** Analyze the impact that science and mathematics has on society.
- **9.4.ST-SM.4:** Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data
- **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.CI.3:** Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).

- **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.DC.7:** Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a)
- **9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- **9.4.12.TL.2:** Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data
- **CRP1:** Act as a responsible and contributing citizen and employee.
- **CRP2:** Apply appropriate academic and technical skills.
- **CRP4:** Communicate clearly and effectively and with reason.
- **CRP5:** Consider the environmental, social and economic impacts of decisions.
- **CRP6:** Demonstrate creativity and innovation
- **CRP8:** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9:** Model integrity, ethical leadership and effective management.
- **CRP11:** Use technology to enhance productivity.
- **CRP12:** Work productively in teams while using cultural global competence.

Content: What information do students need to know?

- What are irrational numbers
- How to round irrational numbers
- Convert repeating rational decimals to fractions
- Compare rational numbers.

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

- Numbers that are not rational are called irrational
- Every number has a decimal expansion
- Show that rational numbers have decimal expansions that either terminate in zeros or repeats eventually
- Convert a repeating decimal to a rational number
- Estimate the value of irrational numbers using rational approximations
- Use rational approximations of irrational numbers to compare their size
- Use rational approximations of irrational numbers to locate them on a number line

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
<ul style="list-style-type: none"> ● Break long term assignments into more manageable segments ● Partial credit for missing or incomplete work ● Modify the pace of instruction to allow for additional 	<ul style="list-style-type: none"> ● Provide additional time to complete assessments and assignments. ● Model and use gestures to aid in understanding ● Model tasks by giving one or two examples before releasing students to 	<ul style="list-style-type: none"> ● Provide additional time to complete assignments and assessments ● Provide extra resources (extra questions, videos, etc.) for better understanding ● Require student to attend tutoring for extra assistance 	<ul style="list-style-type: none"> ● Provide project related to the unit topic ● Offer more challenging questions on assignments and assessments ● Allow student to assist a classmate so they can understand the concept.

<p>processing time</p> <ul style="list-style-type: none"> • Allow for repetition and/or clarification of directions, as needed • Provide study guides, if available • Provide class notes, if available 	<p>work independently</p> <ul style="list-style-type: none"> • Allow students to use eDictionaries • Speak clearly and naturally, and try to enunciate words, especially their ending sounds • Provide sensory supports • Provide graphic supports • Provide interactive supports • Allow to alternate seating for proximity to peer helper or teacher as necessary • Provide wait-time sufficient for ESL students who are trying to translate terms while formulating an explanation • Check for understanding consistently 	<ul style="list-style-type: none"> • Change seating assignment to work with a student with better understanding 	
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INSTRUCTION

CONTENT VOCABULARY:

- Rational number
- Irrational number
- Square root
- Pi

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

- Formative
 - Questions asked during class
 - Homework assignments
- Summative
 - Homework assignments
 - Quiz(zes)
 - Unit test

- Alternative
 - Activity distinguishing irrational and rational numbers
 - Activity comparing different irrational number

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

- Self-made instructional material coming from the following resources
 - Larson PreAlgebra

Technology resources:

- Chromebook
- Desmos (calculator and graphing)
- Edulastic (summative assessments)
- Google Classroom
- YouTube
- Khan Academy
- Purple Math

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 1 – Exponents, Irrational Numbers, and Linear Equations
TARGET COURSE/GRADE LEVEL: 8 th Grade	SUGGESTION TIMEFRAME: 2-5 weeks
TOPIC: Exponents and Powers of 10	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

The students have been working with the basics to exponents. For this unit, they will learn the different properties of exponents to create equivalent forms. This includes when two exponential expressions are multiplied or divided. In addition, they will work with negative exponents. They will understand when an exponent is negative, it means use the reciprocal of given exponential term and turn the exponent positive.

In addition, they will perform operations using an integer power of 10 to estimate different types of quantities. Finally, they will be reintroduced to scientific notation and perform operations with them.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Science: Scientific notation is utilized in different science courses. For example, in Chemistry, Avogadro’s number is a big number that needs to be written in scientific notation.

Social Studies: The power of 10 can be used to estimate the population of a different types of land masses.

Business: Exponents are used in the financial world. For example, exponents are used for compound interest.

ESSENTIAL QUESTIONS:

- What properties are there when it comes to performing operations with exponents?
- How can you perform calculations with numbers written in scientific notation?
- How can integers power of 10 utilized to estimate multiplications with large numbers?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

- **8.EE.A.1** Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.
- **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.

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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).
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- **CRP2:** Apply appropriate academic and technical skills.
- **CRP4:** Communicate clearly and effectively and with reason.
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- **CRP11:** Use technology to enhance productivity.
- **CRP12:** Work productively in teams while using cultural global competence.

Content: What information do students need to know?

- What operations can be performed on integer exponents
- How can the power of 10 be used to estimate the product of two numbers

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

- Know the properties of integer exponents
- Determine whether two numerical expressions involving integer exponents are equivalent

<ul style="list-style-type: none"> • How are numbers written in scientific notation computed 	<ul style="list-style-type: none"> • Generate equivalent expressions using the properties of exponents • Estimate a very large or very small number as a single digit times an integer power of ten • Express how many times larger one quantity is compared to another when written as a single digit times an integer power of ten • Add, subtract, multiply, and divide numbers expressed in scientific notation • Add, subtract, multiply, and divide numbers where one is expressed in decimal notation and the other is expressed in scientific notation • Choose appropriate units to represent measurements of very large or very small quantities • Interpret scientific notation generated by technology as a number multiplied by a power of ten
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Modifications:			
Special Education	ESL	At-risk	Gifted and Talented
<ul style="list-style-type: none"> • Break long term assignments into more manageable segments • Partial credit for missing or incomplete work • Modify the pace of instruction to allow for additional processing time • Allow for repetition and/or clarification of directions, as needed • Provide study guides, if available • Provide class notes, if available 	<ul style="list-style-type: none"> • Provide additional time to complete assessments and assignments. • Model and use gestures to aid in understanding • Model tasks by giving one or two examples before releasing students to work independently • Allow students to use eDictionaries • Speak clearly and naturally, and try to enunciate words, especially their ending sounds • Provide sensory supports • Provide graphic supports 	<ul style="list-style-type: none"> • Provide additional time to complete assignments and assessments • Provide extra resources (extra questions, videos, etc.) for better understanding • Require student to attend tutoring for extra assistance • Change seating assignment to work with a student with better understanding 	<ul style="list-style-type: none"> • Provide project related to the unit topic • Offer more challenging questions on assignments and assessments • Allow student to assist a classmate so they can understand the concept.

	<ul style="list-style-type: none"> ● Provide interactive supports ● Allow to alternate seating for proximity to peer helper or teacher as necessary ● Provide wait-time sufficient for ESL students who are trying to translate terms while formulating an explanation ● Check for understanding consistently 		
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INSTRUCTION

CONTENT VOCABULARY:

- Integer exponents
- Product property
- Quotient property
- Estimate
- Power of 10
- Scientific notation

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

- Formative
 - Questions asked during class
 - Homework assignments
- Summative
 - Homework assignments
 - Quiz(zes)
 - Unit test
- Alternative
 - Activity involving Science and scientific notation

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

- Self-made instructional material coming from the following resources
 - Larson PreAlgebra
 - Apex

Technology resources:

- Chromebook
- Desmos (calculator and graphing)
- Edulastic (summative assessments)
- Google Classroom

- YouTube
- Khan Academy
- Purple Math

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 1 – Exponents, Irrational Numbers, and Linear Equations
TARGET COURSE/GRADE LEVEL: 8 th Grade	SUGGESTION TIMEFRAME: 2-5 weeks
TOPIC: Linear Equations and Square Roots	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

The students gain more practice with solving linear equations, as this is an important concept with high school mathematics. However, in 8th grade, the solutions they will be dealing with are now rational. Students need to understand there is always a possibility the solution will be some form of fraction or decimal.

Also, the students will be introduced to solving one-step equations that involve square roots. This plays a key role when it comes to Geometry with finding the volume of cones, cylinders, and spheres. In this course, they will focus on this along with real-world situations that utilize volume. As to high school mathematics, solving equations using square roots come into play starting with Solving Quadratic Equations in Algebra I and many other types of equations in Algebra II.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Science: Linear equations is common in this subject. They can be used to find the quantity of an item based Square roots are in some scientific formulas. This also pertains to square roots. A great example is Einstein's Theory of Relativity ($E = mc^2$).

Social Studies: Linear equations can be used to determine, for example, the difference of the number of different groups of people that died during a war.

Business: Linear equations and square roots are used in many ways. This includes determining how much a company needs to earn in order to profit.

ESSENTIAL QUESTIONS:

- What steps are used to solve different types of linear equations?
- How can equations with an x^2 term be solved?
- How can you find a specific dimension of a cone, cylinder, or sphere given the volume and another dimension?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

- **8.EE.C.7** Solve linear equations in one variable.
 - Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).
 - Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

- **8.EE.A.2** Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
- **8.G.C.9** Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

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- **9.4.12.CI.3:** Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
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- **9.4.12.TL.2:** Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data

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- **CRP9:** Model integrity, ethical leadership and effective management.
- **CRP11:** Use technology to enhance productivity.
- **CRP12:** Work productively in teams while using cultural global competence.

Content: What information do students need to know?

- How to solve linear equations
- How to take the square root of a number
- Find the volume of a cone, cylinder, or sphere

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

- A linear equation in one variable can result in one solution, infinitely many solutions, or no solution
- Show which of these outcomes is the case by transforming the original equation into the form $x = a$, $a = a$, or $a = b$
- Solve linear equations in one variable with rational number coefficients, including equations that require expanding expressions using the

	<p>distributive property and combining like terms</p> <ul style="list-style-type: none"> ● Use square root and cube root symbols to represent solutions to equations in the form $x^2 = p$ and $x^3 = p$ ● Evaluate square roots of small perfect squares and cube roots of small perfect cubes ● $\sqrt{2}$ is an irrational number ● Apply the formulas for volume of a cone, cylinder, or sphere in a real-world context ● Calculate the volume of a cone, cylinder, or sphere ● Find a missing dimension of a cone, cylinder or sphere given its volume
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Modifications:			
Special Education	ESL	At-risk	Gifted and Talented
<ul style="list-style-type: none"> ● Break long term assignments into more manageable segments ● Partial credit for missing or incomplete work ● Modify the pace of instruction to allow for additional processing time ● Allow for repetition and/or clarification of directions, as needed ● Provide study guides, if available ● Provide class notes, if available 	<ul style="list-style-type: none"> ● Provide additional time to complete assessments and assignments. ● Model and use gestures to aid in understanding ● Model tasks by giving one or two examples before releasing students to work independently ● Allow students to use eDictionaries ● Speak clearly and naturally, and try to enunciate words, especially their ending sounds ● Provide sensory supports ● Provide graphic supports ● Provide interactive supports ● Allow to alternate 	<ul style="list-style-type: none"> ● Provide additional time to complete assignments and assessments ● Provide extra resources (extra questions, videos, etc.) for better understanding ● Require student to attend tutoring for extra assistance ● Change seating assignment to work with a student with better understanding 	<ul style="list-style-type: none"> ● Provide project related to the unit topic ● Offer more challenging questions on assignments and assessments ● Allow student to assist a classmate so they can understand the concept.

	seating for proximity to peer helper or teacher as necessary <ul style="list-style-type: none"> ● Provide wait-time sufficient for ESL students who are trying to translate terms while formulating an explanation ● Check for understanding consistently 		
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INSTRUCTION

CONTENT VOCABULARY:

- Linear equations
- Distributive Property
- Inverse operation
- Distribute the negative
- Square root
- Rational number
- Irrational number
- Volume
- Cone
- Cylinder
- Sphere

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

- Formative
 - Questions asked during class
 - Homework assignments
- Summative
 - Homework assignments
 - Quiz(zes)
 - Unit test
- Alternative
 - Activity involving volume of cones, cylinders, and spheres
 - Finding the volume of each solid
 - Finding the missing dimension

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

- Self-made instructional material coming from the following resources
 - Larson PreAlgebra
 - Apex

Technology resources:

- Chromebook
- Desmos (calculator and graphing)
- Edulastic (summative assessments)

- Google Classroom
- YouTube
- Khan Academy
- Purple Math

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 2 – Pythagorean Theorem, Congruence, and Similarity
TARGET COURSE/GRADE LEVEL: 8 th Grade	SUGGESTION TIMEFRAME: 3-5 weeks
TOPIC: Pythagorean Theorem	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

The Pythagorean Theorem plays an integral role in Geometry. There are many uses to the theorem. However, for this course, the main reason for it is to find the length of a side of a right triangle given the length of two other sides. In addition, this can be used on the coordinate plane to find the length of a line segment. Using the Pythagorean Theorem to do this is easier for students as, at times, the students can be confused with the Distance Formula.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Science: The Pythagorean Theorem is used with circuits to find the total impedance of a given circuit.

Social Studies: This concept is used more to talk about the history of the Greek mathematician Pythagoras.

ESSENTIAL QUESTIONS:

- What is the Pythagorean Theorem?
- What are the uses for the Pythagorean Theorem?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

- **8.G.B.6** Explain a proof of the Pythagorean Theorem and its converse.
- **8.G.B.7** Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
- **8.G.B.8** Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

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Content: What information do students need to know?

- How to find the square root of a number
- Properties of right triangles
- The Pythagorean Theorem states that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides
- How to utilize the Pythagorean theorem in real-world situations

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

- Explain a proof of the Pythagorean Theorem
- Explain a proof of the converse of the Pythagorean Theorem
- Apply the Pythagorean Theorem to find the distance between two points in a coordinate system
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in two-dimensional figures
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in three-dimensional figures
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world problems

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
<ul style="list-style-type: none"> ● Break long term assignments into more manageable segments ● Partial credit for missing or incomplete work 	<ul style="list-style-type: none"> ● Provide additional time to complete assessments and assignments. ● Model and use gestures to aid in understanding 	<ul style="list-style-type: none"> ● Provide additional time to complete assignments and assessments ● Provide extra resources (extra questions, videos, etc.) for 	<ul style="list-style-type: none"> ● Provide project related to the unit topic ● Offer more challenging questions on assignments and assessments ● Allow student to assist a

<ul style="list-style-type: none"> • Modify the pace of instruction to allow for additional processing time • Allow for repetition and/or clarification of directions, as needed • Provide study guides, if available • Provide class notes, if available 	<ul style="list-style-type: none"> • Model tasks by giving one or two examples before releasing students to work independently • Allow students to use eDictionaries • Speak clearly and naturally, and try to enunciate words, especially their ending sounds • Provide sensory supports • Provide graphic supports • Provide interactive supports • Allow to alternate seating for proximity to peer helper or teacher as necessary • Provide wait-time sufficient for ESL students who are trying to translate terms while formulating an explanation • Check for understanding consistently 	<p>better understanding</p> <ul style="list-style-type: none"> • Require student to attend tutoring for extra assistance • Change seating assignment to work with a student with better understanding 	<p>classmate so they can understand the concept.</p>
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INSTRUCTION

CONTENT VOCABULARY:

- Right triangle
- Square
- Square Root
- Leg
- Hypotenuse
- Pythagorean Theorem
- Coordinate system
- Two- and Three-Dimensional Figures

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

- Formative
 - Questions asked during class
 - Homework assignments
- Summative
 - Homework assignments
 - Quiz(zes)
 - Unit test
- Alternative
 - Activity involving the utilization of the Pythagorean Theorem
 - With different shapes
 - Real-world situations

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

- Self-made instructional material coming from the following resources
 - Larson PreAlgebra
 - Apex

Technology resources:

- Chromebook
- Desmos (calculator and graphing)
- Edulastic (summative assessments)
- Google Classroom
- YouTube
- Khan Academy
- Purple Math

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 3 – Linear Relationships and Functions
TARGET COURSE/GRADE LEVEL: 8 th Grade	SUGGESTION TIMEFRAME: 3-5 weeks
TOPIC: Functions	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

Functions play a vital role in mathematics. Students will understand there are relationships in Mathematics when you are dealing with two variables. In addition, in regards to graphing, there is always that relationship between the input x and the output y . However, in regards to functions, in order to be declared a function, each input must have only one output. Otherwise, it is not recognized as a function. The students will also be graphing these functions for better illustration. Also, they will be describing the graph of the function (increasing or decreasing, linear or non-linear) depending on what the situation is.

In addition, the students will be focusing more on linear functions where they will be introduced to the slope-intercept form $y = mx + b$. However, they will not be working on finding the slope in this unit.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Science: Illustrating data based on experiments and analyzing the trend of the data.

Social Studies: Illustrating the trend of given historical data

Business: Illustrating how well a company is doing with sales and determine possible future values of profit.

ESSENTIAL QUESTIONS:

- What are relations and functions?
- How can you determine if a relation is a function?
- How can you describe the graph of a given function?
- What is the difference of linear and nonlinear functions?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

- **8.F.A.1** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
- **8.F.B.5** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
- **8.F.A.3** Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points $(1, 1)$, $(2, 4)$ and $(3, 9)$, which are not on a straight line.*

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

- **9.2.12.CAP.2:** Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- **9.3.ST.2:** Use technology to acquire, manipulate, analyze, and report data
- **9.3.ST.6:** Demonstrate technical skills needed in a chosen STEM field.
- **9.3.ST-SM.1:** Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
- **9.3.ST-SM.2:** Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
- **9.3.ST-SM.3:** Analyze the impact that science and mathematics has on society.
- **9.4.ST-SM.4:** Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data
- **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.CI.3:** Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- **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.DC.7:** Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a)
- **9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)

- **9.4.12.TL.2:** Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data
- **CRP1:** Act as a responsible and contributing citizen and employee.
- **CRP2:** Apply appropriate academic and technical skills.
- **CRP4:** Communicate clearly and effectively and with reason.
- **CRP5:** Consider the environmental, social and economic impacts of decisions.
- **CRP6:** Demonstrate creativity and innovation
- **CRP8:** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9:** Model integrity, ethical leadership and effective management.
- **CRP11:** Use technology to enhance productivity.
- **CRP12:** Work productively in teams while using cultural global competence.

Content: What information do students need to know?

- Functions are relations where each input has exactly one output
- Graphs of functions are the set of ordered pairs containing the input and output of the function
- Analyzing graphs help show the progression of the function
- Linear functions are written in slope-intercept form
- The graphs of functions can be either straight or curved

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

- A function is a rule that assigns to each input exactly one output
- The graph of a function is the set of ordered pairs consisting of an input and the corresponding output
- Describe qualitatively the functional relationships between two quantities by analyzing a graph
- Sketch a graph that exhibits the qualitative features of a function given a verbal description
- The equation $y = mx + b$ defines a linear function
- Interpret a set of points forming a straight line as the graph of a linear function
- Graph linear equations
- Give examples of nonlinear functions

Modifications:

Special Education	ESL	At-risk	Gifted and Talented
<ul style="list-style-type: none"> ● Break long term assignments into more manageable segments ● Partial credit for missing or incomplete work ● Modify the pace of instruction to allow for additional processing time 	<ul style="list-style-type: none"> ● Provide additional time to complete assessments and assignments. ● Model and use gestures to aid in understanding ● Model tasks by giving one or two examples before releasing students to work independently 	<ul style="list-style-type: none"> ● Provide additional time to complete assignments and assessments ● Provide extra resources (extra questions, videos, etc.) for better understanding ● Require student to attend tutoring for extra assistance ● Change seating assignment to 	<ul style="list-style-type: none"> ● Provide project related to the unit topic ● Offer more challenging questions on assignments and assessments ● Allow student to assist a classmate so they can understand the concept.

<ul style="list-style-type: none"> ● Allow for repetition and/or clarification of directions, as needed ● Provide study guides, if available ● Provide class notes, if available 	<ul style="list-style-type: none"> ● Allow students to use eDictionaries ● Speak clearly and naturally, and try to enunciate words, especially their ending sounds ● Provide sensory supports ● Provide graphic supports ● Provide interactive supports ● Allow to alternate seating for proximity to peer helper or teacher as necessary ● Provide wait-time sufficient for ESL students who are trying to translate terms while formulating an explanation ● Check for understanding consistently 	<p>work with a student with better understanding</p>	
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INSTRUCTION

CONTENT VOCABULARY:

- Relation
- Function
- Relationship
- Increasing
- Decreasing
- Linear Function
- Non-Linear Function
- Straight Line

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

- Formative
 - Questions asked during class
 - Homework assignments
- Summative
 - Homework assignments

- Quiz(zes)
- Unit test
- Alternative
 - Activity introducing functions using tables and graphs
 - Activity analyzing a function
 - Activity illustrating the difference between linear and non-linear functions

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

- Self-made instructional material coming from the following resources
 - Larson PreAlgebra
 - Apex

Technology resources:

- Chromebook
- Desmos (calculator and graphing)
- Edulastic (summative assessments)
- Google Classroom
- YouTube
- Khan Academy
- Purple Math

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 3 – Linear Relationships and Functions
TARGET COURSE/GRADE LEVEL: 8 th Grade	SUGGESTION TIMEFRAME: 3-5 weeks
TOPIC: Systems of Linear Equations	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

Systems of Linear Equations has many uses. Interestingly enough, some of the word problems the students work with in the Linear Equations unit can be solved using Systems of Linear Equations. These types of equations are best used when you need to find the value of two quantities with related situations.

The students will be introduced to Systems of Linear Equations and shown that the solution for them are the intersection of their graphs. They will also prove the coordinate of the intersection satisfies both equations together. Besides solving them graphically, they will also learn how to solve them algebraically using either substitution or elimination. Finally, they will deal with special situations where there are none or infinite solutions.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Science: Systems of Linear Equations can be used to determine the amount of ohms in two similar circuits.

Business: Systems of Linear Equations can be used to determine the number of children and adult tickets they sold on two different weeks, as long as they know how much they made each week and how much each ticket is worth.

ESSENTIAL QUESTIONS:

- What are systems of linear equations?
- What ways can you solve systems of linear equations?
- Why do some systems of linear equations have either no or infinitely many solutions?

- How are systems of linear equations utilized in the real world?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

- **8.EE.C.8** Analyze and solve pairs of simultaneous linear equations.
 - Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
 - Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.
 - Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

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

- **9.2.12.CAP.2:** Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- **9.3.ST.2:** Use technology to acquire, manipulate, analyze, and report data
- **9.3.ST.6:** Demonstrate technical skills needed in a chosen STEM field.
- **9.3.ST-SM.1:** Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
- **9.3.ST-SM.2:** Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
- **9.3.ST-SM.3:** Analyze the impact that science and mathematics has on society.
- **9.4.ST-SM.4:** Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data
- **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.CI.3:** Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- **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.DC.7:** Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a)
- **9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- **9.4.12.TL.2:** Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data

- **CRP1:** Act as a responsible and contributing citizen and employee.
- **CRP2:** Apply appropriate academic and technical skills.
- **CRP4:** Communicate clearly and effectively and with reason.
- **CRP5:** Consider the environmental, social and economic impacts of decisions.
- **CRP6:** Demonstrate creativity and innovation
- **CRP8:** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9:** Model integrity, ethical leadership and effective management.
- **CRP11:** Use technology to enhance productivity.
- **CRP12:** Work productively in teams while using cultural global competence.

Content: What information do students need to know?

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

<ul style="list-style-type: none"> • Solutions to systems of linear equations are usually the coordinate of the intersection of their graphs. • It is possible for a system of linear equations to have either none or infinitely many solutions. • Systems of linear equations can be solve either by graphing, substitution, or elimination. 	<ul style="list-style-type: none"> • Solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs • Points of intersection satisfy both equations simultaneously • Solve systems of two linear equations in two variables algebraically • Estimate solutions of two linear equations in two variables by graphing the equations • Determine the number of solutions a system of two linear equations will have based upon inspection • Solve a system of two linear equations modeling real-world and mathematical problems
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Modifications:			
Special Education	ESL	At-risk	Gifted and Talented
<ul style="list-style-type: none"> • Break long term assignments into more manageable segments • Partial credit for missing or incomplete work • Modify the pace of instruction to allow for additional processing time • Allow for repetition and/or clarification of directions, as needed • Provide study guides, if available • Prive class notes, if available 	<ul style="list-style-type: none"> • Provide additional time to complete assessments and assignments. • Model and use gestures to aid in understanding • Model tasks by giving one or two examples before releasing students to work independently • Allow students to use eDictionaries • Speak clearly and naturally, and try to enunciate words, especially their ending sounds • Provide sensory supports • Provide graphic supports • Provide interactive supports 	<ul style="list-style-type: none"> • Provide additional time to complete assignments and assessments • Provide extra resources (extra questions, videos, etc.) for better understanding • Require student to attend tutoring for extra assistance • Change seating assignment to work with a student with better understanding 	<ul style="list-style-type: none"> • Provide project related to the unit topic • Offer more challenging questions on assignments and assessments • Allow student to assist a classmate so they can understand the concept.

	<ul style="list-style-type: none"> ● Allow to alternate seating for proximity to peer helper or teacher as necessary ● Provide wait-time sufficient for ESL students who are trying to translate terms while formulating an explanation ● Check for understanding consistently 		
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INSTRUCTION

CONTENT VOCABULARY:

- Systems of linear equations
- Intersection
- No solutions
- Infinite solutions

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

- Formative
 - Questions asked during class
 - Homework assignments
- Summative
 - Homework assignments
 - Quiz(zes)
 - Unit test
- Alternative
 - Activity using systems of linear equations to create stained glass pictures

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

- Self-made instructional material coming from the following resources
 - Larson PreAlgebra
 - Apex

Technology resources:

- Chromebook
- Desmos (calculator and graphing)
- Edulastic (summative assessments)
- Google Classroom
- YouTube
- Khan Academy
- Purple Math

UNIT OVERVIEW

CONTENT AREA: Mathematics	UNIT: 4 – Linear Models for Scatter Plots and Two-Way Tables
TARGET COURSE/GRADE LEVEL: 8 th Grade	SUGGESTION TIMEFRAME: 3-5 weeks
TOPIC: Scatter Plots and Two-Way Tables	CHAPTERS COVERED:

UNIT SUMMARY/ UNIT RATIONALE:

Scatter plots are an important topic in the world of statistics. They are used to determine the best possible linear equation to fit a given set of data. This concept is used in many subjects for various reasons based on what is being asked.

The students will learn how to construct and interpret scatter plots to visually see if there is some sort of pattern, or correlation. They can be either positive (looks like it is increasing), negative (looks like it is decreasing), or none (data is too spread out). In addition, they will determine if the correlation is linear or not. After plotting the data, they will determine if a given line is the best fit for the given set of data. They will not be computing the line of best fit until Algebra I.

INTERDISCIPLINARY CONNECTIONS / PROBLEM-BASED LEARNING:

Science: Scatter Plots and Two-Way Tables are essential when performing experiments. The data can be used to predict what would happen in the future.

Social Studies: Scatter Plots and Two-Way Tables are used to determine to predict the population of a town.

Business: Scatter Plots and Two-Way Tables are used to determine the potential profit made for an item sold.

ESSENTIAL QUESTIONS:

- What are scatter plots?
- How are scatter plots useful in the real world?
- Why are two-way tables important in real-world situations?

LEARNING TARGETS

NEW JERSEY STUDENT LEARNING STANDARDS:

- **8.SP.A.1** Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- **8.SP.A.2** Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.
- **8.SP.A.3** Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*
- **8.SP.A.4** Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have*

assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

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

- **9.2.12.CAP.2:** Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- **9.3.ST.2:** Use technology to acquire, manipulate, analyze, and report data
- **9.3.ST.6:** Demonstrate technical skills needed in a chosen STEM field.
- **9.3.ST-SM.1:** Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
- **9.3.ST-SM.2:** Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
- **9.3.ST-SM.3:** Analyze the impact that science and mathematics has on society.
- **9.4.ST-SM.4:** Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data
- **9.4.12.CI.1:** Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12.prof.CR3a).
- **9.4.12.CI.3:** Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
- **9.4.12.CT.2:** Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12.prof.CR3.a).
- **9.4.12.DC.7:** Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a)
- **9.4.12.IML.3:** Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6.a., 8.1.12.DA.5, 7.1.IH.IPRET.8)
- **9.4.12.TL.2:** Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data

- **CRP1:** Act as a responsible and contributing citizen and employee.
- **CRP2:** Apply appropriate academic and technical skills.
- **CRP4:** Communicate clearly and effectively and with reason.
- **CRP5:** Consider the environmental, social and economic impacts of decisions.
- **CRP6:** Demonstrate creativity and innovation
- **CRP8:** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9:** Model integrity, ethical leadership and effective management.
- **CRP11:** Use technology to enhance productivity.
- **CRP12:** Work productively in teams while using cultural global competence.

Content: What information do students need to know?

- Scatter plots are used to show the trend of a set of data.
- Finding the equation of a line that best fits the data can be used to predict future events.
- Two-way tables can show numerically patterns based on the set of data.

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

- Construct scatter plots
- Interpret scatter plots to investigate patterns of association between two quantities
- Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association
- Straight lines are used to model relationships between two quantitative variables
- Informally fit a straight line for scatter plots that suggest a linear association
- Informally assess the fit of the line for a scatter plot by judging the closeness of the data points to the line

	<ul style="list-style-type: none"> • Interpret the slope and intercept in the context of bivariate measurement data using the equation of a linear model • Two-way tables can be used to show patterns of association in categorical data • Construct a two-way table summarizing data on two categorical variables collected from the same subjects • Interpret a two-way table by identifying joint frequencies and calculating marginal frequencies • Use relative frequencies calculated for rows or columns to describe possible association between the two variables
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Modifications:

Special Education	ESL	At-risk	Gifted and Talented
<ul style="list-style-type: none"> • Break long term assignments into more manageable segments • Partial credit for missing or incomplete work • Modify the pace of instruction to allow for additional processing time • Allow for repetition and/or clarification of directions, as needed • Provide study guides, if available • Provide class notes, if available 	<ul style="list-style-type: none"> • Provide additional time to complete assessments and assignments. • Model and use gestures to aid in understanding • Model tasks by giving one or two examples before releasing students to work independently • Allow students to use eDictionaries • Speak clearly and naturally, and try to enunciate words, especially their ending sounds • Provide sensory supports • Provide graphic supports • Provide interactive supports • Allow to alternate 	<ul style="list-style-type: none"> • Provide additional time to complete assignments and assessments • Provide extra resources (extra questions, videos, etc.) for better understanding • Require student to attend tutoring for extra assistance • Change seating assignment to work with a student with better understanding 	<ul style="list-style-type: none"> • Provide project related to the unit topic • Offer more challenging questions on assignments and assessments • Allow student to assist a classmate so they can understand the concept.

	seating for proximity to peer helper or teacher as necessary <ul style="list-style-type: none"> • Provide wait-time sufficient for ESL students who are trying to translate terms while formulating an explanation • Check for understanding consistently 		
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INSTRUCTION

CONTENT VOCABULARY:

- Scatter plots
- Regression
- Positive regression
- Negative regression
- Outliers
- Linear association
- Nonlinear association
- Line of best fit
- Bivariate data
- Two-way tables
- Categorical data
- Frequency

ASSESSMENTS (BENCHMARK, FORMATIVE, SUMMATIVE, ALTERNATIVE):

- Formative
 - Questions asked during class
 - Homework assignments
- Summative
 - Homework assignments
 - Quiz(zes)
 - Unit test
- Alternative
 - Activity creating scatter plots and finding the line of best fit based on sets of data
 - Activity using two-way tables to find patterns

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

- Self-made instructional material coming from the following resources
 - Larson PreAlgebra
 - Apex

Technology resources:

- Chromebook
- Desmos (calculator and graphing)
- Edulastic (summative assessments)

- Google Classroom
- YouTube
- Khan Academy
- Purple Math

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