

Unit 1 - College and Career Math: Algebra and Functions

Content Area: **Mathematics**
Course(s): **College Math I**
Time Period: **1st Marking Period**
Length: **8 weeks**
Status: **Published**

Unit Overview

This unit investigates the real number system, fundamentals of algebra, linear systems, quadratic equations and functions.

Transfer

Students will be able to independently use their learning to...

Identify and classify the subsets of the real number system.

Perform computational operations and problem solving within the real number system.

Solve multi-stepped equations and inequalities.

Identify and evaluate functions.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- The building blocks of the real number system are the subset systems: *natural, integers, rational and irrational*.

- Exponents are a concise method of representing repeated multiplications.
- The study of algebra uses variables to represent quantities that change, which gives us the flexibility to model far more things in our changing world than when we strictly use fixed values.
- Graphing data almost always makes it easier to understand its significance than simply looking at raw numbers.

Essential Questions

- What is the difference between the different number systems that make up the Real Number System?
- What are some of the advantages of using scientific notation?
- What is the difference between an arithmetic sequence and a geometric sequence?
- What is the difference between evaluating an expression and simplifying an expression?
- How can you tell when an equation is a linear equation?
- What is the difference between the solution set of an inequality and the solution set of an equation?
- What does the slope of a line represent?
- What types of real world problems can be solved using systems of equations?
- What is the difference between a function and a relation?

Application of Knowledge and Skill

Students will know...

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- The building blocks of the real number system are the subset systems: *natural, integers, rational and irrational*.
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- The study of algebra uses variables to represent quantities that change, which gives us the flexibility to model far more things in our changing world than when we strictly use fixed values.
- Graphing data almost always makes it easier to understand its significance than simply looking at raw numbers.

Students will be skilled at...

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- Identifying and classifying the various number systems that make up the Real Number System
- Performing mathematical computations within the Real Number System
- Identifying and applying arithmetic and geometric sequences to real world applications.
- Solving linear equations and inequalities.
- Solving quadratic equations.
- Solving systems of equations.
- Identifying, evaluating and graphing functions.

Academic Vocabulary

divisible	natural numbers	whole numbers
integers	absolute value	sum, difference, product, quotient
order of operations	rational number	numerator
denominator	irrational number	real number
coefficient	radical	base
exponent	sequence	ratio
variable	expression	equation
solution	linear	identity
proportion	origin	coordinates
intercept	slope	system

==> LEARNING GOAL 1.1 - The Real Number System

Identify and classify different number systems and perform mathematical computations within those systems.

Objective 1.1.1 (Number Systems) (level of difficulty: Retrieval)

SWBAT:

(S.1-5)

- Identify and classify the various number systems that make up the Real Number System
- Perform mathematical computations within the Real Number System using the order of operations.

MA.N-RN.B

Use properties of rational and irrational numbers.

MA.N-RN.B.3

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

Objective 1.1.2 (Exponents) (level of difficulty: Retrieval - executing)

SWBAT:

(5.6)

- Perform mathematical computations involving the rules for exponents.
- Use scientific notation in applied problems.

MA.F-IF.C.8b

Use the properties of exponents to interpret expressions for exponential functions.

MA.N-RN.A.1

Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.

MA.N-RN.A.2

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

Objective 1.1.3 (Sequences) (level of difficulty: Retrieval - recognize and execute)

SWBAT:

(5.7)

- Identify and apply arithmetic and geometric sequences to real world applications.

MA.F-BF.A.2

Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.

MA.F-IF.A.3

Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.

MA.F-LE.A.2

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

====> LEARNING GOAL 1.2 - Elementary Algebra

Objective 1.2.1 (Fundamentals of Algebra) (level of difficulty: Retrieval)

MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Objective 1.2.2 (Linear Equations) (level of difficulty: Comprehension)

SWBAT

(6.2-3)

- Solve linear equations.
- Translate verbal expressions into mathematical symbols.
- Solve real world problems using linear equations.

MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MA.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Objective 1.2.3 (Ratio and Proportion) (level of difficulty: Knowledge Utilization, problem solving)

SWBAT

(6.4)

- Solve real world problems using proportions
- solve real world problems using direct variation
- solve real world problems using inverse variation

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Objective 1.2.4 (Linear Inequalities) (level of difficulty: Comprehension)

SWBAT:

(6.5)

- Graph solution sets for simple inequalities
- Solve linear inequalities
- Solve real world problems using inequalities

MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

Objective 1.2.5 (Quadratic Equations) (level of difficulty: Analysis)

SWBAT:

(6.6)

- Multiply binomials
- Factor trinomials
- Solve quadratic equations by factoring
- Solve quadratic equations using the quadratic formula
- Solve real world problems using quadratic equations

MA.A-REI.B.4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
MA.A-REI.B.4b	Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b .

====> LEARNING GOAL 1.3 - Advanced Algebra

Make conjectures and build a logical progression of statements to explore the truth of the conjectures.

Objective 1.3.1 (Cartesian Plane) (level of difficulty: Retrieval - recall and executing)

SWBAT

(7.1)

- Plot points on the Cartesian Plane

- Graph linear equations
- Find Slope
- Find linear equations that describe real world situations

MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
MA.A-REI.D.11	Explain why the x -coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

Objective 1.3.2 (Systems of Linear Equations) (level of difficulty: Comprehension - symbolizing)

SWBAT

(7.2)

- Solve systems of linear equations by graphing/substitution/elimination
- Solve real world problems using systems

MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.A-REI.C.5	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
MA.A-REI.C.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Objective 1.3.3 (Linear Inequalities) (level of difficulty: Comprehension - symbolizing)

SWBAT

(7.4)

- Graph linear inequalities in two variables
- Graph a system of linear inequalities
- Model a real-world situation with a system of linear inequalities.

MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
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Objective 1.3.4 (Functions) (level of difficulty: Retrieval)

SWBAT:

(7.6)

- Identify and evaluate functions
- find the domain and range of functions
- Determine if a graph represents a function

MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

Summative Assessment

Tests, quizzes, End of Unit Benchmark, Projects

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Formative Assessment and Performance Opportunities

Classroom discussion

class/homework

class closure

class openers

group work

presentations

projects

student teacher discussions

Accommodations and Modifications

504 Accommodations

IEPs

challenge problems

heterogeneous grouping

Problems of the week

projects

small group instruction

technology

Unit Resources

- Textbook: Math in Our World, 2nd Edition (McGraw Hill, 2011)
- Kuta Software
- Examview Software

Additional Websites:

- Dan Meyer's 3-Act Math Tasks:
<https://docs.google.com/spreadsheet/pub?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE&output=html>
- NCTM Illuminations Website: Resources for Teaching Math:
<http://illuminations.nctm.org/Default.aspx>
- PARCC Educator Resources: <http://www.parcconline.org/for-educators>
- The Geometer's Sketchpad Resource Center: <http://www.dynamicgeometry.com/>
- Khan Academy: <https://www.khanacademy.org/>

