

Unit 2: Expressions, Equations & Functions

Content Area: **Mathematics**
Course(s): **Generic Course, Accelerated Math 7**
Time Period: **1st Marking Period**
Length: **8 weeks**
Status: **Published**

Unit Overview

In this unit, students will explore the characteristics of expressions. They will write and evaluate numeric and algebraic expressions and equations and inequalities. Students will solve multi-step equations and inequalities using mathematical properties including the associative, commutative and distributive. Students will also explore linear equations, linear relationships and functions.

Transfer

Students will be able to independently use their learning to solve real world problems involving...

- situations requiring multiple-step equations
- combining like terms to simplify
- using the Distributive Property

Use mathematical expressions, equations, inequalities and graphs to represent and solve real world problems.

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...

- Various methods can be used to solve equations and the solution to an equation can be checked by substituting into the original equation.
- The point at which lines intersect is the solution to the system with those lines.
- Equations can be solved using different properties.
- Sometimes there is more than one step to solve in an equation.

- Inequalities are used when solving for real life application problems.
- Properties of functions and their graphs are similar but not identical.
- Slope-intercept form is an easy way of graphing functions.

Essential Questions

Students will keep considering...

- Chapter 4:
 - What are numeric and algebraic expressions and how are they evaluated?
 - How do you use properties to solve equations and inequalities?

- Chapter 5:
 - What is meant by the slope of a line, and how can knowing a line's slope help to graph a line and find parallel and perpendicular lines?
 - How can the value of an unknown variable be found?

- Chapter 6:
 - What is meant by the slope of a line, and how can knowing a line's slope help to graph a line and identify proportional relationships?

- Chapter 7:
 - What is a function?
 - How are functions represented?
 - What can a relationship between numbers tell about a problem?

Application of Knowledge and Skill

Students will know. . .

- Students will identify constants, coefficients, and variables in an algebraic expression.
- Students will use the distributive property and combine like terms to simplify algebraic expressions, equations and inequalities.
- Students will evaluate algebraic expressions when each variable is assigned a value using substitution and the order of operations
- Students will examine commutative and associative properties of different equations.

- Students will solve multi-step equations involving different techniques.
- Students will be able to graph a line given different forms of the equation.
- Students will be able to describe how slope relates to horizontal and vertical lines.
- Students will be able to graph systems of linear equations or to find a solution.
- Students will understand what a function is and its corresponding graph.
- Students will compare properties of different functions and relate the information to real world situations.

Students will be skilled at...

Students will be skilled at...

- Combining Like Terms
- Rewriting Expressions Using the Distributive Property
- Identifying Equivalent Expressions
- Equivalent Expressions Within A Context
- Solving Multi-Step Problems with Rational Numbers
- Writing Two-Step Equations
- Solving Two-Step Equations
- Using Two-Step Equations to Solve Problems
- Writing Two-Step Inequalities
- Solving Two-Step Inequalities
- Using Two-Step Inequalities to Solve Problems
- Understanding Linear Equations
- Linear Equations with Rational Numbers
- Linear Equations and The Distributive Property
- Determining the Number of Solutions
- Graphing Proportional Relationships
- Constant of Proportionality in Different Representations
- Comparing Proportional Relationships in Different Forms
- Defining Slope
- Interpreting Y-intercepts and Slope
- Calculating Slope
- Investigating Horizontal and Vertical Lines
- Deriving the Equation $y = mx + b$
- Working with Negative Slopes
- Linear Equations in Standard Form
- Introduction to Functions
- Domain and Range
- Identifying Functions
- Equations of Functions
- Functions in Tables, Graphs, and Equations
- Interpreting Graphs of Functions
- Comparing Different Representations of Functions
- Linear Functions

- Writing Linear Functions

Academic Vocabulary

addition property of equality	addition property of inequality	additive identity property	algebra
algebraic expression	analyze	arithmetic sequence	associative property
axis	bivariate data	clustering	coefficient
division property of equality	commutative property	compare	constant
constant of proportionality	constant rate of change	constant of variation	continuous data
coordinate plane	counter example	decrease	define a variable
dependent variable	direct rate of change	discrete data	distributive property
division property of inequality	domain	elimination	equation
equivalent equations	equivalent expressions	example	factor
factored form	function	function table	functional relationship
graph	graph interpret	graph of a function	identity
increase	independent variable	inequality	infinite
initial	input/output	integer	intersect
Intersecting lines	like terms	line	linear
linear equation	linear expression	linear relationship	Linear/non-linear functions
model	monomial	multiplication property of equality	multiplication property of inequality
multiplicative identity property	Multiplicative Inverse	multiplicative property of zero	nonlinear
null set	ordered pairs/coordinate plane	origin	outlier
parallel	point proportional relationship	point-slope form	positive/negative association
property	quadratic function	qualitative graph	qualitative quantity
range	rate of change	rational number	relationship
sequence	similar	simplest form	simultaneous equations
sketch	slope, rise, run	slope-intercept form	solution
standard form	substitution	subtraction property of equality	subtraction property of inequality
system of linear equations	table	term	triangle
two-step equation	two-step inequality	unit rate	value
variable	vertical	x-intercept	y-intercept

Learning Goal 1

Students will use properties of operations to add, subtract, factor, and expand linear expressions with rational coefficients.

Rewrite expressions in different forms in a problem context to demonstrate how quantities are related.

Target #1.1 -- DOK: 2 Skill/Concept

SWBAT Evaluate simple algebraic expressions.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
MA.7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Target #1.2 -- DOK: 2 Skill/Concept

SWBAT Apply the distributive property to rewrite algebraic expressions.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
MA.7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Target #1.3 -- DOK: 2 Skill/Concept

SWBAT Identify equivalent expressions.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.
MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
MA.7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.

Target #1.4 -- DOK: 2 Skill/Concept

SWBAT Create and interpret equivalent expressions within a context.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
MA.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.

Target #1.5 -- DOK: 3 Strategic Thinking

SWBAT: Assess, represent, and solve real-world problems using multiple step equations involving rational numbers.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number

line diagram.

MA.7.NS.A.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
MA.7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
MA.7.EE.B.4	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.

Target #1.6 -- DOK: 2 Skills/Concept and 3 Strategic Thinking

SWBAT Write and solve a 2-step equation within realworld or mathematical context.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers.
MA.7.EE.B.4a	Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
MA.7.EE.B.4b	Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p , q , and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.

Target #1.7 -- DOK: 2 Skill/Concept and 3 Strategic Thinking

SWBAT Writing 2-step inequalities to represent a real-world or mathematical context.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.

MA.7.EE.B.4a	Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
MA.7.EE.B.4b	Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p , q , and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.

Learning Goal 2

Linear equations in one variable can have one solution, infinitely many solutions, or no solutions.

Write and solve two-step equations and solve equations with variables on both sides.

Target #2.1 -- DOK: 2 Skill/Concept

SWBAT Solve equations with rational coefficients.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y .
MA.8.EE.C.7	Solve linear equations in one variable.
MA.8.EE.C.7b	Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

Target #2.2 -- DOK: 2 Skill/Concept

SWBAT Determine the number of solutions to an equation.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.

MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.8.EE.C.7	Solve linear equations in one variable.
MA.8.EE.C.7a	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).

Learning Goal 3

Understand the connections between proportional relationships, lines, and linear equations.

Target #3.1 -- DOK: 1 Recall

SWBAT:

Identify proportional and nonproportional linear relationships by finding a constant rate of change.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.
MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

Target #3.2 -- DOK: 2 Skill/Concept

SWBAT Use tables and graphs to find the slope of a line.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

Target #3.3 -- DOK: 2 Skill/Concept

SWBAT Graph an equation using x - and y - intercepts.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.
MA.8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.
MA.8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .
MA.8.G.A.4	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

Target #3.4 -- DOK: 2 Skill/Concept

SWBAT Derive the equation $y = mx + b$ and work with negative slopes.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.
MA.8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b .

Learning Goal 4

Define, evaluate and compare functions.

Target #4.1 -- DOK: 2 Skill/Concept

SWBAT Represent relations using tables and graphs.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.

MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.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.

Target #4.2 -- DOK: 2 Skill/Concept

SWBAT Determine whether a relation is a function and find function values and complete function.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.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.
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

Target #4.3 -- DOK: 2 Skill/Concept

SWBAT: Determine whether a function is linear or non-linear.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.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.
MA.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.

Target #4.4 -- DOK: 3 Strategic Thinking

SWBAT: Find and interpret the rate of change and initial value of a function.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the

solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.8.F.A.2	Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.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.
MA.8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

21st Century Life and Careers and Technology (IN PROGRESS)

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.
TECH.8.1.8.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.8.E.CS4	Process data and report results.
TECH.8.1.8.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.

Formative Assessment and Performance Opportunities

- Exit/Admit ticket
- Kahoot
- My Favorite No
- Strategic questioning
- Student-Teacher conference

- Think-Pair-Share

Summative Assessment

- LinkIt!
- Portfolio
- Project
- Quiz
- Test

Accommodations & Modifications

- Adaptive Practice (cK-12 modality)
- Algebra tiles
- Base-10 blocks
- Calculator/Graphing calculator
- Centers
- Fraction Tiles
- Modifications as per IEP/504
- PLIX (cK-12 modality)
- Small group instruction
- To challenge students, ask them to write expressions with multiple levels of parentheses that can be simplified using the distributive property

Unit Resources

See also *Unit 2: Expressions, Equations and Functions* Folder in Curriculum Portal

- ALEKS
- cK-12.org
- NJCTL - New Jersey Center for Teaching and Learning
- NJSLA released items
- NJSLS

Interdisciplinary Connections

Real world applications where the creation of equations/functions is necessary to determine financial gains and losses. (MA.8.F.A.2)

PFL.9.1.8.B.2

Construct a simple personal savings and spending plan based on various sources of income.

PFL.9.1.8.B.8

Develop a system for keeping and using financial records.