*Unit 3-4: Linear Relationships & Linear Equations & Systems

Content Area: **Mathematics**
Course(s): **Math - Grade 8**
Time Period: **2nd Marking Period**
Length: **7 weeks**
Status: **Published**

Unit Overview

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

Solve systems of equations algebraically and by graphing.

Transfer

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

- Solve and graph linear relationships and identify a relationship as linear using a table or equation.
- Graph a system of two linear equations, recognizing that the ordered pair for the point of intersection is the -value that will generate the given -value for both equations. Students recognize that graphed lines with one point of intersection (different slopes) will have one solution, parallel lines (same slope, different -intercepts) have no solutions, and lines that are the same (same slope, same -intercept) will have infinitely many solutions.

Meaning

Understandings

Students will understand that

- Unit rates can be explained in graphical representation, algebraic equations, and in geometry through

similar triangles.

- The solution to a system of two linear equations in two variables is an ordered pair that satisfies both equations.
- Some systems of equations have no solutions (parallel lines) and others have infinite solutions (be the same line).

Essential Questions

Students will keep considering...

- How can you communicate mathematical ideas effectively?
- What is equivalence?
- Why is one variable dependent upon the other in relationships?
- What makes a solution strategy both efficient and effective?
- How is it determined if multiple solutions to an equation are valid?
- How does the context of the problem affect the reasonableness of a solution?
- Why can two equations be added together to get another true equation?

Application of Knowledge and Skill

Students will know...

Students will know...

- Understand the characteristics of linear equations in graphs, tables and equations.
- Unit rate of a proportion relates to the slope of a linear line.

Students will be skilled at...

Students will be skilled at...

- Determine whether a relationship is linear.
- Compare graphs, tables, and equations of proportional relationships.
- Graph proportional relationships and interpret the unit rate as the slope.
- Estimate solutions by graphing equations.
- Solve systems by graphing, substitution, or elimination (combination).
- Determine if a system has one solution, no solutions, or many solutions.

- Interpret the solution to a system of equations in context.

Academic Vocabulary

Multiplicative Inverse, properties, two-step equation, null set, identity, linear relationship, constant rate of change, slope, rise, run, direct rate of change, constant of variation, constant of proportionality, y-intercept, slope-intercept form, x-intercept, standard form, point-slope form, system of Linear Equations, Simultaneous equations, Linear equations, Rate of change, Parallel, Substitution, Eliminiation, Intersecting lines, Origin, Axis, compare, coordinate plane, equation, graph interpret, intersect, line, origin, point proportional relationship, similar, slope, table, triangle, unit rate, vertical, Coefficient, distributive property, equation, example, infinite, integer, like, linear, rational number, solution, term, Analyze, decrease, function, functional relationship, graph, increase, initial, linear, model, nonlinear, qualitative, quantity, relationship, sketch, value.

Learning Goal 1

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

CRP.K-12.CRP11	Use technology to enhance productivity.
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.A.3	Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
TECH.8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.

Target 1.1--(Level of difficulty: Retrieval, DOK: 1- Recall)

SWBAT:

Graph a proportional relationship from a story or equation Use the constant of proportionality to discuss data. **(Chapter 4, Lesson 2)**

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-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.8.EE.B	Understand the connections between proportional relationships, lines, and linear equations.

Target 1.2 --(Level of Difficulty: DOK: 2--Skill/Concept)

Scale and label a coordinate axes in order to graph a proportional relationship.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
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 1.3--(Level of Difficulty : DOK: 2--Skills/Concept)

Compare proportional relationships represented in different ways

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
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.

Learning Goal 2

Generalize and interpret the components of a linear equation.

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.

Target 2.1--(Level of difficulty: Comprehension, DOK: 2-Skill/Concept)

SWBAT: Use tables and graphs to find the slope of a line. **(Chapter 4, Lesson 2-4)**

*Defining Slope appears in lesson 4

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-12.4	Model with mathematics.
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 2.2--(Level of difficulty: DOK: 2 -Skill/Concept

Describe and interpret how the slope and y-intercept affect the graph.

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
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.

Target 2.3--(Level of difficulty: Comprehension, DOK: 2-Skill/Concept)

SWBAT:

Graph linear equations using the slope and y-intercept. **(Chapter 7, lesson 9) Found in function chapter (7) and developes the idea in chapter 4**

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-12.4	Model with mathematics.
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.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.

Target 2.4 --(Level of difficulty: Comprehension, DOK: 2-Skill/Concept)

SWBAT: Graph an equation using two points

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-12.4	Model with mathematics.
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.EE.C.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.

Learning Goal 3

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.

CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
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	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

Target 3.1--(Level of difficulty: Comprehension, DOK: 2- Skill/Concept)

1. Solve equations with rational coefficients. **(Chapter 3, Lesson 1-3) *Found within lessons, jumps directly to variables on both sides.**

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
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).

Target 3.3--(Level of difficulty: Comprehension, DOK: 2- Skill/Concept)

Write two-step equations that represent situations. **(Chapter 3, Lesson 7)**

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.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 3.4 (Level of difficulty: Comprehension, DOK: 2- Skill/Concept)

SWBAT: Solve equations with variables on each side. **(Chapter 3, Lesson 4-6)**

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-12.5	Use appropriate tools strategically.
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 4

Learning Goals	• Comprehend that solving a system of equations means finding values of the variables that makes both equations true at the same time. • Coordinate (orally and in writing) graphs of parallel lines and a system of equations that has no solutions. • Create a graph of two lines that represents a system of equations in 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.8.EE.C.8	Analyze and solve pairs of simultaneous linear equations.
MA.8.EE.C.8a	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.
MA.8.EE.C.8b	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
MA.8.EE.C.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.

Target 4.1-- (Level of difficulty: Analysis, DOK: 3- Strategic Thinking)

SWBAT: solve systems of linear equations by graphing. **(Chapter 5, lesson 2) Introduction found in lesson 1**

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-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.8.EE.C.8	Analyze and solve pairs of simultaneous linear equations.
MA.8.EE.C.8a	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.

MA.8.EE.C.8b	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
MA.8.EE.C.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.

Target 4.2 -- (Level of difficulty: Analysis, DOK: 3- Strategic Thinking)

SWBAT: Solve systems of equations algebraically. **(Chapter 5, lesson 3-5) *Lesson 3-Substitution; Lesson 4&5-Elimination**

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-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
MA.8.EE.C.8	Analyze and solve pairs of simultaneous linear equations.
MA.8.EE.C.8a	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.
MA.8.EE.C.8b	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
MA.8.EE.C.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.

Target 4.3 -- (Level of difficulty: Analysis, DOK: 3- Strategic Thinking)

SWBAT: Solve real world mathematical problems using systems of linear equations. **(Chapter 5, Lesson 6)**

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-12.5	Use appropriate tools strategically.
MA.8.EE.C.8	Analyze and solve pairs of simultaneous linear equations.
MA.8.EE.C.8a	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.
MA.8.EE.C.8b	Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.
MA.8.EE.C.8c	Solve real-world and mathematical problems leading to two linear equations in two variables.

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.CRP6	Demonstrate creativity and innovation.	
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.	
CRP.K-12.CRP11	Use technology to enhance productivity.	
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.	

Technology

TECH.8.1.8.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.8.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.

Formative Assessment and Performance Opportunities

Am I Ready assessments

Mid Chapter Checks
Tests
Quizzes
Informal Assessments
Graded Classwork
Surveys
WhiteBoard Activities
Exit tickets
Group activities
Projects
Teacher Observations
Student Interviews
Aleks Assessments
Linkit Assessments

Summative Assessment

Unit Test-found on Linkit
Aleks-Based off percentage
Unit Project
Performance based assessment

Accommodations & Modifications

See Unit Resources below for Specific targeted resources

- Calculators

- Centers

- Computer

- Desmos-use graphing options and activities available for visual practice and observations

- Document Camera for procedural practice

- Example problems with Steps for support

- Extra Time for problem solving

- Graphing Calculators

- Interactive Math Book- Includes various practice problems and formal steps to help walk through problems

- Labeled Coordinate Graph- to help support graphing skills

- Manipulative-Scale with tiles to help with solving equations, Algebra tiles for solving equations

- Modifications as per IEP/504

- Review and Practice

- Small Group Instruction

- Translate the Text

- www.quizlet.com

Unit Resources

Additional resources found in Unit folder

- Aleks online supplement

- ck12.org

- Foldables

- http://illuminations.nctm.org/LessonsList.aspx?grade=3&standard=all

- http://insidemathematics.org/index.php/8th-grade

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

- http://www.achievethecore.org/coherence map

- http://www.illustrativemathematics.org/

- https://www.khanacademy.org/

- Inquiry labs

- Interactive Notebook

- Unit Projects

- www.desmos.com

- www.geogebra.org

- www.quizlet.com

Interdisciplinary Connections

Flight Activity-Allow students to example maps and determine the best possible flight to take due to the distance away from their destination on a map. Discussing intersection points and flight paths that will not intersect. (8.EE.C.8c)

SOC.6.1.8.B	Geography, People, and the Environment
SOC.6.1.8.B.1.b	Analyze the world in spatial terms (e.g., longitude, latitude) using historical maps to determine what led to the exploration of new water and land routes.