Unit 06 - Systems of Linear Equations and Inequalities

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **20 days**
Status: **Published**

General Overview, Course Description or Course Philosophy

In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

In this unit students will develop an understanding of the methods in which systems of equations and inequalities with two variables can be used to model problem situations as well as develop skills in the graphic and symbolic methods needed to solve those systems.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Essential Questions:

- What applications require solving simultaneous linear equations?
- How can you recognize a linear equations in two variables written in standard form (Ax + By = C)?
- How can a linear equation in the form Ax + By = C have infinitely many solutions (x, y) and why is the graph of those solutions is always a straight line?
- How is an equation in the form Ax + By = C equivalent to the form y = mx + b for linear equations?
- What skills are needed in solving a linear equation in two variables when graphing and when using algebraic methods?
- How is the solution of a system of linear equations equivalent to finding values of the variables that will simultaneously satisfy all equations in the system?
- What methods can be used to find the solution of a systems of linear equations? How can graphing the solutions of separate equations; writing the system of equations in equivalent y = mx + b form; or using combinations of the system to eliminate one variable be used?
- How does a system of linear equations in the form Ax + By = C and Dx + Ey = F have exactly one solution (which is the intersection point of the lines represented by the equations)? How does a system of linear equations have infinitely many solutions(which is represented by a single line for both equations)? How does a system of linear equation have no solution (which is represented by two parallel lines)?
- When is the graphing method or the symbolic method the most efficient way to find the solution to a particular system of linear equations?
- How can fluency with symbol manipulation in solving systems of linear equations be increased?
- How can problems that involve systems of linear equations be solved?
- How can you develop the skill of solving a linear inequality in two variables by graphing and symbolic methods?

- How can you develop the skill in solving systems of linear inequalities by graphing solutions of each inequality and finding the region of feasible points that satisfy both inequalities; and solving inequalities to find pairs of numbers that satisfy both inequalities?
- How can the choice between graphing and symbolic methods to efficiently find the region of feasible points to a particular system of linear inequalities be determined?
- How can problems that involve linear inequalities or systems of linear inequalities be solved?

Enduring Understandings:

- The solution to a linear equation is a point or set of points which will make the equation true.
- Properties of operations with numbers can be applied to variables.
- Solutions to a system of two linear equations are points that will make both equations true.
- Solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs.
- Graphing linear equations will enable one to estimate solutions.
- Equations need to be examined for similarities and differences to facilitate finding solutions. *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.*
- A system of linear equations can be used to solve problems when two or more equations that represent constraints on the variables in a situation are identified.
- The solution to a system of linear equations can be found graphically or algebraically. Analyzing the equations and the situation can help determine which strategy is most appropriate to apply.
- The strategies for solving linear equations, linear inequalities and systems of linear equations can be extended to solving systems of linear inequalities.

CONTENT AREA STANDARDS

8.NS

A. Know that there are numbers that are not rational and approximate them by rational numbers

8.EE

A. Work with radicals and integer exponents

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

C. Analyze and solve linear equations and pairs of simultaneous linear equations

8.F

A. Define, evaluate and compare functions

B. Use functions to model relationships between quantities

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.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
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.
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.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

9.1.8.PB.6: Construct a budget to save for short-term, long term, and charitable goals. There are strategies to decrease and manage expenses. 9.1.8.PB.7: Brainstorm techniques that will help decrease expenses including comparison shopping, negotiating, and day-to-day expense management.

LA.K-12.NJSLSA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.K-12.NJSLSA.SL1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
LA.K-12.NJSLSA.SL4	Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.
LA.K-12.NJSLSA.SL5	Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
CS.K-12.3	Recognizing and Defining Computational Problems
CS.K-12.5	Creating Computational Artifacts

CS.K-12.6	Testing and Refining Computational Artifacts
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will 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.

Procedural Knowledge

Students will be able to:

- Analyze and solve real-world and mathematical problems leading to two linear equations in two variables.
- Solve simple cases of two linear equations in two variables by inspection.
- Estimate solutions of two linear equations in two variables by graphing the equations.
- Solve systems of two linear equations in two variables algebraically.

EVIDENCE OF LEARNING

Alternate Assessments

- Portfolios
- Verbal Assessment (instead of written)
- Multiple choice
- Modified Rubrics

- Performance Based Assessments

Benchmark Assessments

- BOY Diagnostic Snapshot Assessment
- MP1 Quarterly Assessment
- MP2 Quarterly Assessment
- MP3 Quarterly Assessment
- MP4 Quarterly Assessment
- EOY Diagnostic Snapshot Assessment

Formative Assessments

Mathematical Reflections

Check Up 1

Check Up 2

Self Assessment Take-Home Questions

Delta Math Assignments

Summative Assessments

Partner Quiz

Teacher created assessments (both test generator and teacher generated questions)

OnCourse generated assessments

Delta Math teacher created assessments

Unit Project - Planning a City

RESOURCES (Instructional, Supplemental, Intervention Materials)

Instructional Materials

- CMP3 Unit - It's In the System - Investigations 1, 2, 3(3.1 and 3.2)
- https://www.savvasrealize.com/ (teacher and student recourses)
- delta math

Supplemental/Intervention Materials

- https://www.khanacademy.org/
  - Systems of linear equations
  - Linear inequalities
- https://illuminations.nctm.org/
  - There has to be a system for this sweet problem
  - Supply and Demand
- https://www.illustrativemathematics.org/
  - Unit 8.4 Lessons 10-16

INTERDISCIPLINARY CONNECTIONS

Cost Analysis and Profit

Travel (travel time, gas mileage, etc)

Use technology to analyze company productivity (excel/google sheets tables and graphs)

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.