

CURRIKI ALGEBRA UNIT 1

Solve Equations and Inequalities in One Variable.

Lesson 1.4: Algebra Inequalities

Unit 1 Relationships Between Quantities and Reasoning with Equations

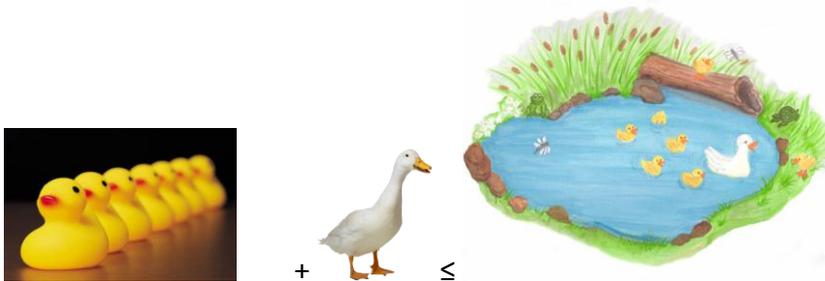
The first four lessons (1.1 - 1.4) provide the instruction and practice that supports the culminating project.

Lesson 1.4: Algebra Inequalities

In this lesson we focus on solving equations and inequalities in one variable.

This lesson addresses algebraic inequalities such as this real life situation:

Problem: Amount of food for a family of seven ducks + another neighbor duck \leq maximum amount of food available in the pond where they live



(Pond picture from www.prekfurniture.com)

Common Core State Standards by Cluster:

Grade Level	Cluster	CCS Standard
9	Create equations that describe number relationships	A.CED.1
9	Solve equations and inequalities in one variable	A.REI.3

Lesson Preparation and Resources for Teachers

TE_Inequalities Vocabulary Page Introduces specialized mathematics vocabulary with definitions.

TE_Adding Inequalities Teacher Edition (contains solutions for teachers)

TE_Subtracting Inequalities Teacher Edition (contains solutions for teachers)

TE_Dividing Inequalities Teacher Edition (contains solutions for teachers)

TE_Multiplying Inequalities Teacher Edition (contains solutions for teachers)

[Demonstration Video by Sal Khan](#) that focuses on solving inequalities in Algebra (teacher resource and instructional resource) We recommend that teachers view this short, 10 minute video prior to this lesson. It provides valuable background information about algebraic inequalities.

[Multiplying in inequalities](#) problems and solutions for practice (Instructional resource on Curriki)

[Dividing](#) in inequalities problems and solutions for practice (Instructional resource on Curriki)

[Subtracting](#) in inequalities problems and solutions for practice (Instructional resource on Curriki)

[Adding](#) in inequalities problems and solutions for practice (Instructional resource on Curriki)

[Dealing with Imbalance](#), a lesson plan for teaching inequalities using distances by mathercize (teacher resource)

[TE How Many Miles Can Lisa Ride?](#) A Mathercize activity by [Luke Lang](#). Lisa wants to go on a bike ride, but her parents tell her she must stay within city limits. How far from her home are the locations she can visit? The City limits are marked with dots on the map. (Instructional resource on Curriki)

Instructional Materials for Students (print one copy for each student)

SE_Vocabulary Student Worksheet

SE_Focus Question: How Far Can Lisa Ride?

SE_ Adding Inequalities Student Edition (Worksheet for students to write out solutions)

SE_Subtracting Inequalities Student Edition (Worksheet for students to write out solutions)

SE_Multiplying Inequalities Student Edition (Worksheet for students to write out solutions)

SE_Dividing Inequalities Student Edition (Worksheet for students to write out solutions)

SE_Inequalities Assessment sheet

[Introduction to Linear Inequalities](#) (On-line Curriki practice activity)

Time: 50-minute session

Lesson Objectives:

Students will be able to:

- Practice solving equations and inequalities in one variable.
- Practice solving linear inequalities using addition, subtraction, multiplication and division.

Lesson Content:

1. Background Building Activity for Students (10 minutes)

a. Vocabulary Building

Print out one copy of the Vocabulary Page for each student.

Review the five math-specific vocabulary words on the attached vocabulary page with the whole class prior to the warm up problem. Ask students to write out examples of each vocabulary term.

b. Warm up problem

Students work in pairs. Each student produces an example problem. Students take turns in pairs to present their problem to each other to solve. They discuss the process. Call students back to the whole group to discuss the problem and ask a couple of pairs to explain the process they used to solve it. They should go to the board and write out the question and explain how they solved it.

2. Focus Question based on today's lesson (25 minutes)

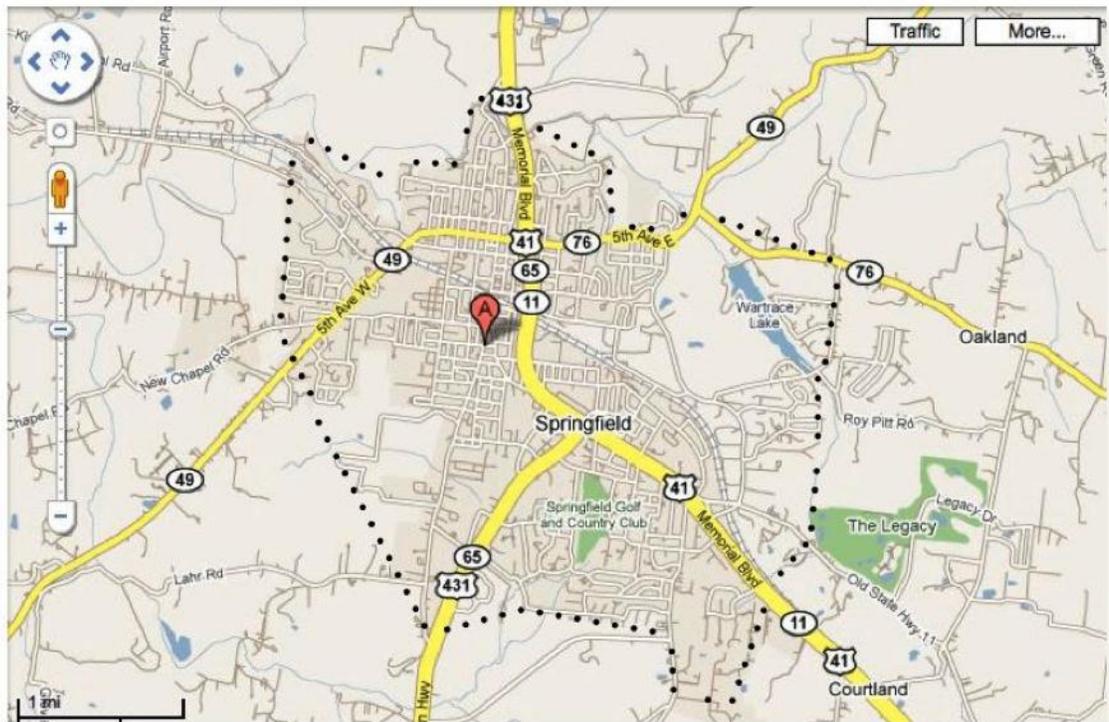
Today's focus question (Write it on the board.):

How many miles can Lisa ride?

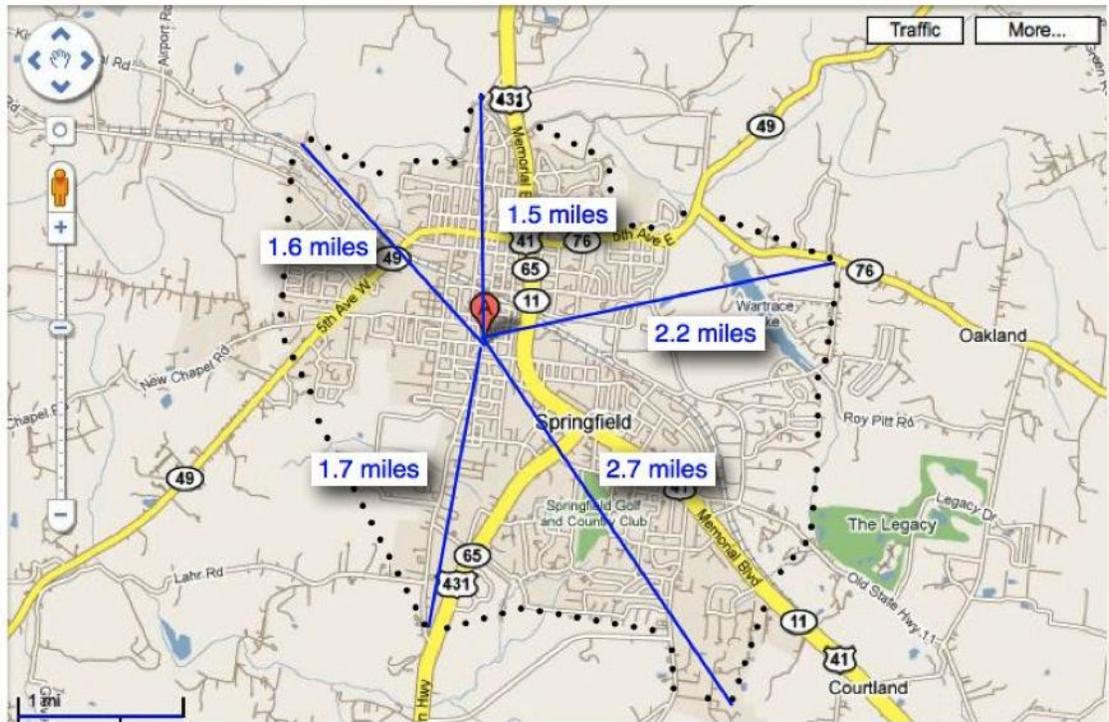
a. Whole class activity

Describe all the points marked below. Draw these number lines (from [How Many Miles Can Lisa Ride?](#) A Mathercize question by [Luke Lang.](#))

Lisa wants to go on a bike ride, but her parents tell her she must stay within city limits. How far from her home are the locations she can visit? The City limits are marked with dots on the map.



Students measure on the board, or you can print the map out for them.



The map shows distances. We want students to read and understand that the question is asking for a RANGE of values. That range is equal to or less than (≤ 2.7 miles and equal to or greater than (≥ 1.5 miles.

Answer: Lisa can travel to distances in town that are less than or equal to 2.7 miles from her home ($d \leq 2.7$ miles from her home)

1. Give students time to think the question through individually
2. Ask students to share with their partner and try to answer the question together while preparing to present to the whole group
3. Whole group presentation and discussion:
Call on student pairs to come to the board to draw the distances from Lisa's home to the edges of the city limits and provide the formula for the solution.
(Formula: $d \leq 2.7$ miles from Lisa's home)

b. Small Group Practice activity (Teacher checks for understanding by observing students while they work in groups.)

Ask students to work in groups of four (two sets of pairs) to practice addition, subtraction, multiplication, and division of inequalities.

Teacher starts the activity with the whole class by explaining the solution steps for these practice questions at the board:

Addition of Inequalities:

Solve: $-5 + x \leq 15$

Solution:

$$-5 + x \leq 15$$

$$\cancel{-5} + \cancel{5} + x \leq (15 + 5)$$

$$x \leq 20$$

Subtraction of Inequalities:

Solve: $5 + x \leq 15$

Solution:

$$5 + x \leq 15$$

$$\cancel{5} - \cancel{5} + x \leq (15 - 5)$$

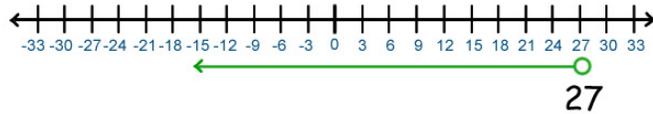
$$x \leq 10$$

Graphs of Inequalities

Graph the inequality $5 + 22 > x$

$$5 + 22 > x$$

$$27 > x$$



Student groups will use the five (addition, subtraction, multiplication, division, and graphing) *Inequalities Student Practice Sheets* to record their answers. Each group should choose 3 problems to solve together. They should decide the best steps to solve the problem and record those steps in the answer section of the worksheets. (Note that the remaining problems will be assigned as homework.)

To complete this activity, students need to understand the standard forms of equations and what are the constants and coefficients of each type of equation, which they learned in a previous lesson in this unit. At least half the constants and coefficients used must be negative in value. They need to know how to solve equations for inequalities, so that if one value is less than another, the equation must be solved for a value less than the other value. The symbols: $<$, $>$, \leq , \geq must be reviewed prior to this activity.

- c. **Individual activity** (Teacher checks for understanding by observing students while they work in groups.)

Ask students to continue with the activity and to create 5 of their own inequality equations. They may consult the other members of their small group, but each student should complete the task individually. They should use the *Inequalities Student Practice Sheets* to record both their 5 new problems and the solutions/answers.

3. Whole class discussion (10 minutes)

a. Students share solutions

Select a few students to share one of their own equations and to explain how to solve it.

b. Algorithm

Discuss with the whole class the procedure they should use to create and solve equations with an explanation why we use equations.

Suggested Algorithm:

To graph inequalities:

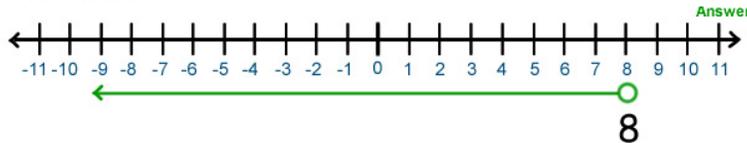
1. Begin by placing a circle (an open circle for $<$ and $>$ and a closed circle for \leq and \geq) on the number line to represent the constant.
2. Draw an arrow to the left for $<$ or \leq OR draw an arrow to the right for $>$ or \geq .
3. To solve inequalities:
 - i. Solve the equation as if the inequality symbol is an equal sign.
 - ii. The only exception is when multiplying or dividing both sides by a negative number, reverse the inequality symbol.

4. Assessment Activity (5 minutes)

Print out a copy of *the Inequalities Assessment* sheet for each student.

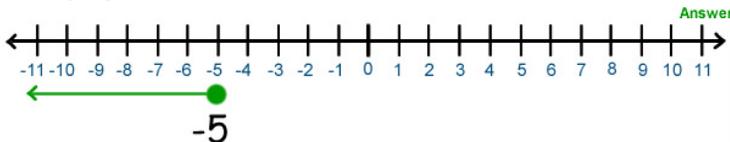
1. Graph the inequality given by this statement: "All real numbers less than 8."

Answer:



2. Graph the following equation: $-5 \geq X$

Answer:



3. Solve: $-5 + X \leq 15$

Answer:

$$-5 + x \leq 15$$

$$-\cancel{5} + \cancel{5} + x \leq (15 + 5)$$

$$x \leq 20$$

4. Solve: $4 + X \leq 10 + 2 \cdot 4$

Answer:

$$4 + x \leq 10 + 2 \cdot 4$$

$$\cancel{4} - \cancel{4} + x \leq (10 + 8 - 4)$$

$$x \leq 14$$

5. Solve: $X \div 5 < -100$

Answer:

$$\frac{x}{5} < -100$$

$$\frac{x \cdot \cancel{5}}{\cancel{5}} < (-100 \cdot 5)$$

$$x < -500$$

5 Extension Activity (Optional)

Students work in pairs at the computer to learn more about algebraic inequalities and how they arise in the real world. As student groups practice these online activities, they will note the real world examples for algebraic inequalities. This site can be found on Curriki.

[Introduction to linear inequalities](#)

Where do inequalities arise in real world? What do the mathematical symbols $>$, $<$, \geq , and \leq represent? Learn all about inequalities in this lesson and learn how to represent inequalities on a number line. (The computer needs *Macromedia Flash Player* to view this lesson.)

6. **Homework assignment for additional independent practice** (Note: This homework assignment can be done during a subsequent class period if you have the time, or it can be done as a homework assignment.)

To reinforce algebraic inequalities understanding, students should complete the remaining problems on their *Inequalities Student Practice Sheets* for homework.