

# Grade Six Chapter 8 - Algebra: Equations and Inequalities

## Overview & Support

### Standards:

#### **Reason about and solve one-variable equations and inequalities.**

- 6.EE.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
- 6.EE.7 Solve real-world and mathematical problems by writing and solving equations of the form  $x + p = q$  and  $px = q$  for cases in which  $p$ ,  $q$  and  $x$  are all nonnegative rational numbers.
- 6.EE.8 Write an inequality of the form  $x > c$  or  $x < c$  to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form  $x > c$  or  $x < c$  have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

### Suggested Resources:

- 6th Grade California Math Frameworks

<https://cpb-us-w2.wpmucdn.com/blogs.egusd.net/dist/3/1081/files/2015/09/Grade-6-13p8rai.pdf>

- Robert Kaplinsky - Open Middle

<http://www.openmiddle.com/category/grade-6/>

### Strategies for Chapter:

- estimation to check the reasonableness of solutions
- substitution
- bar models/tape diagrams
- modeling with algebra tiles
- number line graphs
- equation/Number Talks
- build equations/equivalent expressions with algebra tiles
- discuss and identify equations and describe what their parts represent
- translating word problems

### Manipulatives:

algebra tiles

algebra mats

number lines

tape diagrams/bar models

### Vocabulary:

equation

inequality

substitution

values

solution of an equation

solution of an inequality

true

set

the inequality symbols

is less than

is greater than

is equal to

addition property of equality

inverse operations

multiplication property

## Color Coding:

**Green (G)** - The lesson accurately reflects the Framework standard(s).

**Yellow (Y)** - This lesson includes notes to refer to while planning the lesson.

**Red (R)** - This lesson does not accurately reflect the Framework standard(s). Skip the lesson. Skip the lesson.

## Essential Question:

How can you use equations and inequalities to represent situations and solve problems?

## Lesson-by-Lesson Overview:

Lesson #, Standard	Title	Materials	Vocab	Notes
	Show What You Know		<b>Review Words:</b> Algebraic expressions Numbers Numerical expressions Operations variables <b>Preview Words:</b> Addition property of equality Equation Inequality Inverse operations Solution of an equation Subtraction property of equality	Introduce Unit Vocabulary
<b>8.1</b> <b>G</b> 6.EE.5	Solutions of Equations		Equation, Solution of an equation, variable, true	Read About the Math in the Chapter 8 TE on pg. 307A for a deeper understanding of what it means for a number to be a solution to an equation.  Remind the students that the number that is represented by the variable <b>must</b> make the equation true. The number is called the solution of the equation.
<b>8.2</b> <b>Y</b> 6.EE.7	Write Equations	Bar Model/ Tape diagrams	Equation Expression Variable Constant coefficient	Have students brainstorm different words for each operation to help them when translating from an algebraic equation to a verbal

				<p>expression. Have different students share how they described the equations in different ways that mean the same.</p> <p>***Read the EL Strategy Restate Activity. Consider doing this activity with the whole class.</p> <p>***Read the About the Math on pg. 311A in the Ch. 8 TE on how to correct misconceptions of expression/equations that include subtraction and division.</p> <p>A Bar Model (Tape Diagram) can be used to help students model the equation before they write the equations.</p>				
<p><b>8.3</b> <b>Y</b> 6.EE.7</p>	<p>Model and Solve Addition Equations</p>	<p>Algebra tiles Whiteboard/ math board</p>	<p>Algebra tiles X tiles Constant/ones tiles</p>	<p>Modeling is an essential skill to deepen conceptual understanding.</p> <p>Students will use rectangular tiles to represent <math>x</math>, and a square tile to represent 1.</p> <p>***You could also teach students how to draw a diagram from the model.</p> <div data-bbox="1052 1325 1520 1457" data-label="Image"> </div>				
<p><b>8.4</b> <b>G</b> 6.EE.7</p>	<p>Solve Addition and Subtraction Equations</p>	<p>Algebra tiles Whiteboard/ math board</p>	<p>Subtraction property of equality, inverse operations, addition property of equality</p>	<p>A Bar Model (Tape Diagram) can be used to help students model the equation <b>before</b> they write the equations.</p> <p>From the Framework:</p> <div data-bbox="1052 1696 1520 1850" data-label="Complex-Block"> <p><b>Examples: Solving Equations of the Form <math>p + x = q</math> and <math>px = q</math></b> 6.EE.7A</p> <p>1. Joey had 26 game cards. His friend Richard gave him some more, and now Joey has 100 cards. How many cards did Richard give to Joey? Write an equation and solve your equation.</p> <p><b>Solution:</b> Since Richard gave him some more cards, we let <math>n</math> represent the number of cards that Richard gave Joey. This means he now has <math>26 + n</math> cards. But the number of cards Joey has is 100, so we get the equation <math>26 + n = 100</math>. Using the relationship between addition and subtraction, we see that <math>n = 100 - 26 = 74</math>, which means that his friend gave him 74 cards. This equation can be represented with a tape-like diagram:</p> <table border="1" data-bbox="1198 1801 1365 1843"> <tr> <td colspan="2">100</td> </tr> <tr> <td>26</td> <td><math>n</math></td> </tr> </table> </div>	100		26	$n$
100								
26	$n$							

<p><b>8.5</b> <b>Y</b> 6.EE.7</p>	<p>Model and Solve Multiplication Equations</p>	<p>Algebra tiles Whiteboard/ math board</p>	<p>Algebra tiles X tiles Constant/ones tiles inverse operations, equal groups</p>	<p>Modeling is an essential skill to deepen conceptual understanding.</p> <p>Algebra tiles can be used to model and solve equations that involve multiplication. ***Continue to reinforce drawing a diagram from the model.</p>
<p><b>8.6</b> <b>Y</b> 6.EE.7</p>	<p>Solve Multiplication and Division Equations</p>	<p>Algebra tiles Whiteboard/ math board</p>	<p>division property of equality, multiplication property of equality reciprocal</p>	<p>Reinforce the concept by continuing to use algebra tiles for multiplication equations.</p> <p>Tape diagram/bar models can also be used to help students solve equations. ***Continue to reinforce drawing a diagram from the model.</p> <p>View Common Errors on pg. 328 in Ch. 8 TE. Remind students the process of dividing by a fraction means multiplying the dividend by the <i>reciprocal</i> of the fraction. ***You may choose to review practicing dividing whole numbers by fractions to reinforce this concept.</p>
<p><b>8.7</b> <b>G</b> 6.EE.7</p>	<p>Problem Solving: Equations with Fractions</p>	<p>Algebra tiles Whiteboard/ math board</p>		<p>Read About the Math on pg. 331A in Ch. 8 TE. It covers some strategies for students who find solving equations with fractions difficult.</p> <p>Use estimation for reasonableness</p> <p>Use algebra tiles and bar model/tape diagram to help students solve equations.</p> <p>See the Framework for more explanation. <a href="https://cpb-us-w2.wpmucdn.com/blogs.egusd.net/dist/3/1081/files/2015/09/Grade-6-13p8rai.pdf">https://cpb-us-w2.wpmucdn.com/blogs.egusd.net/dist/3/1081/files/2015/09/Grade-6-13p8rai.pdf</a></p>

**Mid-Chapter Checkpoint: This is an opportunity to review/reinforce models for solving.**

<p><b>8.8</b> <b>Y</b> 6.EE.5</p>	<p>Solutions of Inequalities</p>	<p>whiteboards</p>	<p>Inequality, solutions of an inequality, inequality symbols <math>&lt;</math>, <math>&gt;</math>, <math>\leq</math>, <math>\geq</math>, is less than, is greater than, is less than or equal to, is less than or equal to, Set of solutions</p>	<p>Discuss the difference between equations and inequalities.</p> <p>Students should recognize that there is more than one solution for each inequality.</p> <p>View Common Errors on pg. 338 in Ch. 8 TE. <i>Students may not include the number that is equal in the solution set when working with <math>\leq</math>, <math>\geq</math>.</i></p> <p><b>Overall, you want the students to be able to generalize that the solution to <math>\_\_\_\_\_ &gt; 650</math> includes all numbers that are greater than 650, such as 651, 678, 700, 8,000, etc.</b></p>
<p><b>8.9</b> <b>Y</b> 6.EE.8</p>	<p>Write Inequalities</p>	<p>Table from Reteach 8.9 is a good reference tool. **8 index cards if creating the sorting activity, per group</p>		<p>Students should identify what each part of the inequality represents in order to write an inequality from word situation.</p> <p>Show all four of the inequality symbols. (inequality symbols: <math>&lt;</math>, <math>&gt;</math>, <math>\leq</math>, <math>\geq</math>, is less than, is greater than, is less than or equal to, is less than or equal to)</p> <p>P. 343: #7 could be turned into a sorting activity. Write the inequalities and descriptions on separate index cards. Have student groups physically match them up. A question similar to this is on the Ch. 8 Test.</p>
<p><b>8.10</b> <b>Y</b> 6.EE.8</p>	<p>Graph Inequalities</p>	<p>Number line</p>	<p>Number Line</p>	<p>Compare graphs of equation solutions to inequality solutions. (Open/empty point does not include the plotted value and closed/filled point does include the plotted value, plotted point only, one value, versus point with a ray extending to the left</p>

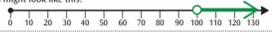
or right, includes those values and beyond.)

Left is the lesser (decreasing) direction while the right is the greater (increasing) direction.

Examples: Inequalities of the Form  $x < c$  and  $x > c$  6.EE.8.A

1. A class must raise more than \$100 to go on a field trip. Let  $m$  represent the amount of money in dollars that the class raises. Write an inequality that describes how much the class needs to raise. Represent this inequality on a number line.

Solution: Since the amount of money,  $m$ , needs to be greater than 100, the inequality is  $m > 100$ . A number line diagram for this might look like this:



## Ch. 8 Test

### Reteach Options (1 day)

Reteach standards from this unit to help meet students' need. Some ideas for reteach activities are listed below:

- Math centers or math games focused on unit standards
- Small group instruction focused on a single standard
- Whole group instruction focused on a single standard
- My Favorite No – Rewrite student work with an error and work as a class to identify positives in the work and areas that need to be revised
- Select 1 – 3 problems to resolve in their groups and discuss whole class. We want new learning to occur on this day that helps students over misconceptions.
- Complete the “Performance Task” from Go Math! In the Assessment Book in small groups. Share strategies and discuss whole class.
- Use the Reteach activities based on standards that need intervention.