

# Representing Practical Situations with Inequalities

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- Strand:** Patterns, Functions, and Algebra
- Topic:** Representing a practical situation with a linear inequality in one variable.
- Primary SOL:** 6.14 The student will
- a) Represent a practical situation with a linear inequality in one variable.

**Materials:**

1. Inequality Cards (attached)
2. Number Cards (attached)
3. Number line for display
4. Number line markers (e.g., two-color counters, small bits of paper)
5. Give or Take a Few activity sheet (attached)
6. Number Line handout (attached)

**Vocabulary**

*number line* (earlier grades)

*absolute value, inequalities, integers* (6.3, 6.14)

**Student/Teacher Actions: What should students be doing? What should teachers be doing?**

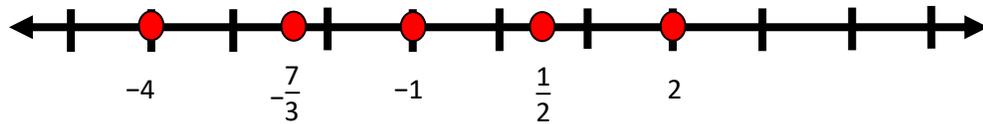
The concepts involved in graphing inequalities on a number line are directly connected to the concepts contained in SOL 6.3; therefore, it is highly recommended to use SOL 6.3 as the basis for teaching students about graphing inequalities on a number line.

Another way to introduce the idea is through a balance/scale to help students understand the difference between equality/inequality. If you present a scale with objects on both sides and they are balanced, then the students should understand that this means that the two sides are equal; however, if one side goes down or up, then that represents an inequality.

You can practice giving students expressions and drawing a scale to demonstrate if it would be tilted or balanced.

1. Distribute an Inequality Card to each student with each inequality (greater than, less than, greater than or equal to, less than or equal to, and equal). Open the lesson by displaying different combinations of two Number Cards (some have been provided; however, you should make some of your own as well) side-by-side and having students respond by holding up one of their Inequality Cards. The number cards you display should contain a mixture of whole numbers, integers, rational numbers, and simple expressions. Encourage students to respond and stick to their answer, but challenge them also to defend their responses. This part of the lesson will allow students to display their understanding of integers, fractions, decimals, and the four operations (SOL 6.2, 6.3, 6.6).
2. Display a number line and begin placing the number cards in the appropriate locations on it. If necessary, remind students about directions on a number line: values decrease

when moving to the left and increases when moving to the right. Using the numbers on the number line, begin questioning students about how to represent certain areas of the number line without listing each value. For example, show the following numbers on the number line:



Have students use inequality symbols ( $<$  or  $>$ ) to name three relationships that describe the placement of these numbers on the number line. Ask students whether 2 is greater than only the numbers listed. When they answer no, ask what other numbers 2 is greater than. Ask students to come up with a way to show that 2 can be *strictly* greater than any number among a set of many numbers. If they have difficulty with this concept, ask questions leading them to the use of a variable representing “any number.” This discussion should enable them to arrive at the expression  $2 > x$ .

3. Ask students whether there is another way to express  $2 > x$  with a different inequality. This should lead them to the expression  $x < 2$ . Make sure to explain that  $x$  represents *all* values that are less than 2. Also, re-emphasize that the order and the symbol direction matter in inequality expressions and that there are solutions that can be stated for the inequality.
4. Distribute the Give or Take a Few activity sheet and explain each of the symbols that describe relationships between numbers. Have students develop a class definition for each symbol and then create a practical example for each to list in the chart. For example, consider the following practical situation, “John was younger than Susan. Susan was 10 years old.” If  $j$  represents John, the inequality would be  $j < 10$ . It is important to have the conversation with the students about how practical situations might represent limitations based on the context. In the given situation, John could not be a negative age, so he must be zero or older; however, while students need to understand practical situation limitation, they should not be writing compound inequalities like  $0 \leq j < 10$ .
5. When going over the definitions, give specific attention on  $\leq$  and  $\geq$ . Explain that in the expression  $x < 2$ , every number less than 2 makes the expression true. Ask them whether 2 can ever be less than 2 and whether 2 can ever be greater than 2. The symbols  $<$  and  $>$  may be used only for numbers that are strictly less than or greater than 2, not for 2 itself, which is the number that acts as a “boundary.” On the other hand, the symbols  $\leq$  and  $\geq$  include the “boundary” number—therefore, *every* number on the number line.
6. Explain the following steps for graphing an inequality on a number line, using  $x < 2$  as an example:
  - Locate the boundary on the number line.

- Decide whether the circle indicating the point on the line is open or closed. (It is closed if the inequality sign has an equal sign underneath because that means that the number is a possible solution to the inequality).
  - Decide whether values less than or greater than the boundary number will satisfy the expression.
  - Shade the number line on the side of the boundary number that makes the expression true.
7. Emphasize to students that they should not trust the direction of the symbol for shading the number line. If they are unsure, they should choose a test number from each side of the boundary number: whichever test number makes the expression true indicates the side of the number line to shade.
  8. Model graphing  $x < 2$  on the number line, following the steps above. Direct students to shade the entire number line on the correct side of the boundary number and draw a ray (an arrow) at the end of the number line to show that the shading extends beyond the represented portion of the number line. While they are shading, ask them questions to guide their understanding of the shading. It will also be important at this point to help students understand what in a situation will help them determine whether it is “equal to or not” and whether it is greater or less than. Here is a quick guide to help students:

Phrase	Inequality
“a is more than b”	$a > b$
“a is at least b”	$a \geq b$
“a is less than b”	$a < b$
“a is at most b;” or “a is no more than b”	$a \leq b$

Practical situations do not always use the words in the table above. Instead, they might say that something has a maximum/minimum or other key phrases. It is important to give students practical situations that use a variety of methods for them to create the correct inequality statement.

9. Distribute the attached Number Line activity sheet. Give students practical situations for which they need to write an inequality, and have students use the activity sheet to graph them. Include situations that result in open- and closed-circle graphing. Here are some example practical situations:
  - Juan was driving on the highway and noticed the speed limit was 60 miles per hour. He knew that he could drive at most 60 miles per hour.
  - Sierra’s mom took her Christmas shopping and told her to spend at least \$5 on each family member.
  - Brandon had fewer Legos than Christopher. Christopher had 215 Legos. How many Legos could Brandon have had?
  - Maya bought more items at the grocery store than Andrea. Andrea bought seven items. How many items could Maya have bought?

Be sure students give a numerical value that would be a part of the solution set.

10. Close the lesson by having students explain the step-by-step process for graphing inequalities. Pay close attention to make sure they remember the most important points of shading and opening or closing the circle.

### Assessment

- **Questions**

- What are the primary differences between graphing an expression equal to  $x$  (graphing an equality) and graphing an expression including  $x$  and an inequality (graphing an inequality)?
- What does the arrow at the end of a shaded number line indicate?
- What types of practical situations result in greater than or equal to and less than or equal to?
- When does a practical situation use an inequality but have limitations?

- **Journal/writing prompts**

- Describe an occupation that relies on the use of inequalities (approximating amounts).
- A new student has joined our class and is having difficulty with deciding when to use closed or open circles for graphing inequalities. Provide him with a basic rule or hint to assist him when graphing, then write a sentence explaining what the circle has to do with the solution.
- Create practical situations that represent inequalities and explain why they need an inequality.

### Extensions and Connections (for all students)

- Have students do a matching activity in which they match various practical problems involving inequalities with their graphs and/or practical problems with inequalities.
- Have students create a presentation (e.g., digital slideshow, book) that has a practical situation for each type of inequality and the inequality written.

### Strategies for Differentiation

- Give each student an “Inequality Question Card” to use with each graphing problem. The card should feature the following questions/directions:
  - Graph the boundary number.
  - Is the circle open or closed?
  - What is a value to the left of the boundary number?
  - What is a value to the right of the boundary number?
  - Which number—the one on the right or the one on the left—makes the expression true?
  - Shade the number line in that direction and finish the line off with an arrow.
- Provide students with the step-by-step checklist for graphing inequalities.
- Provide students with the quick guide provided in the lesson.
- Partner students to complete the practical situation activity sheet.
- Provide students with a “cue” card with greater than and less than symbols and words.

*Mathematics Instructional Plan – Grade 6*

- Have students represent a practical situation with a linear inequality involving addition/subtraction.

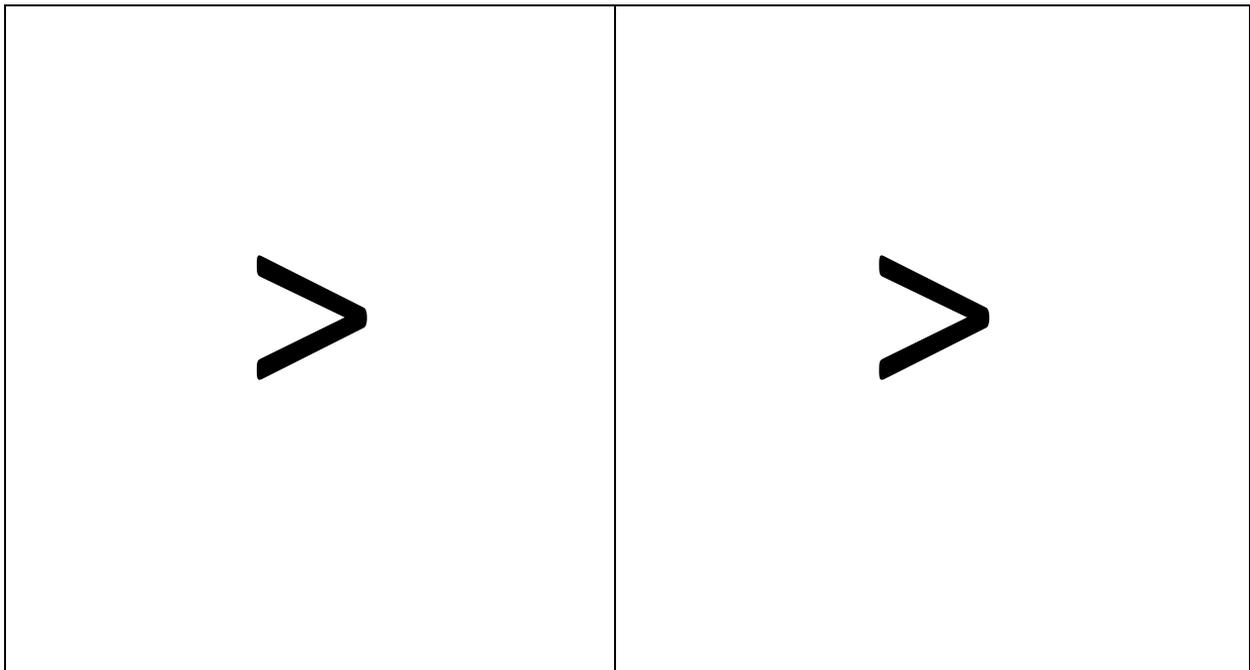
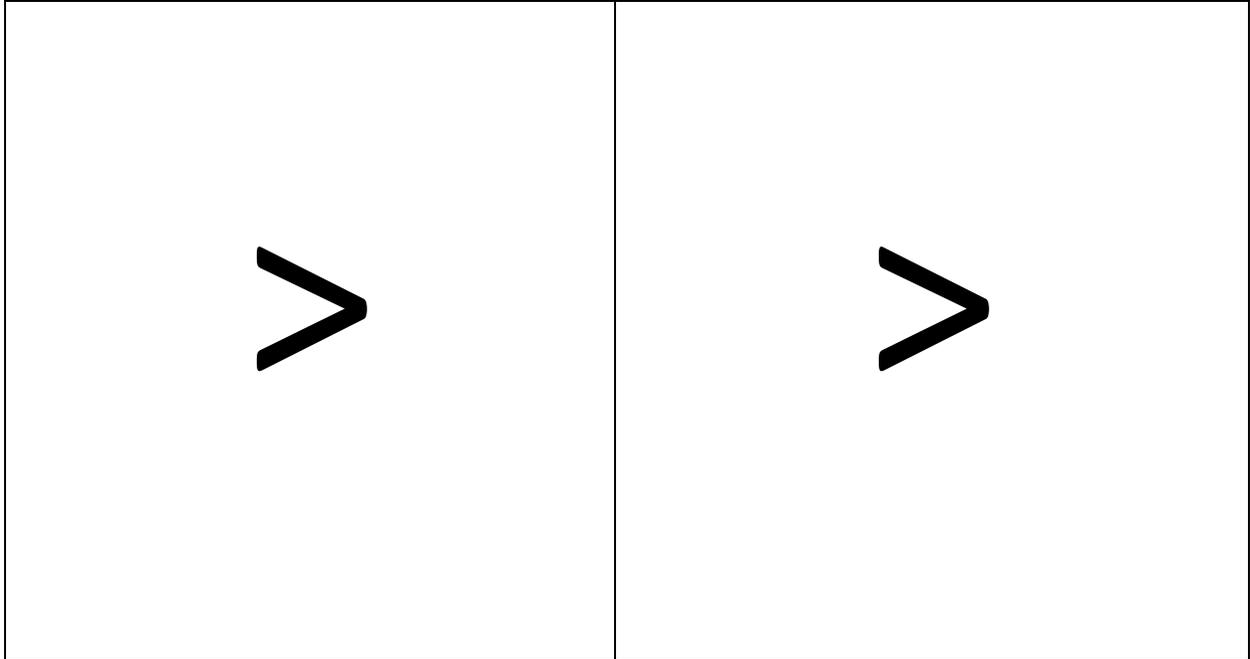
**Note: The following pages are intended for classroom use for students as a visual aid to learning.**

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## Inequality Cards

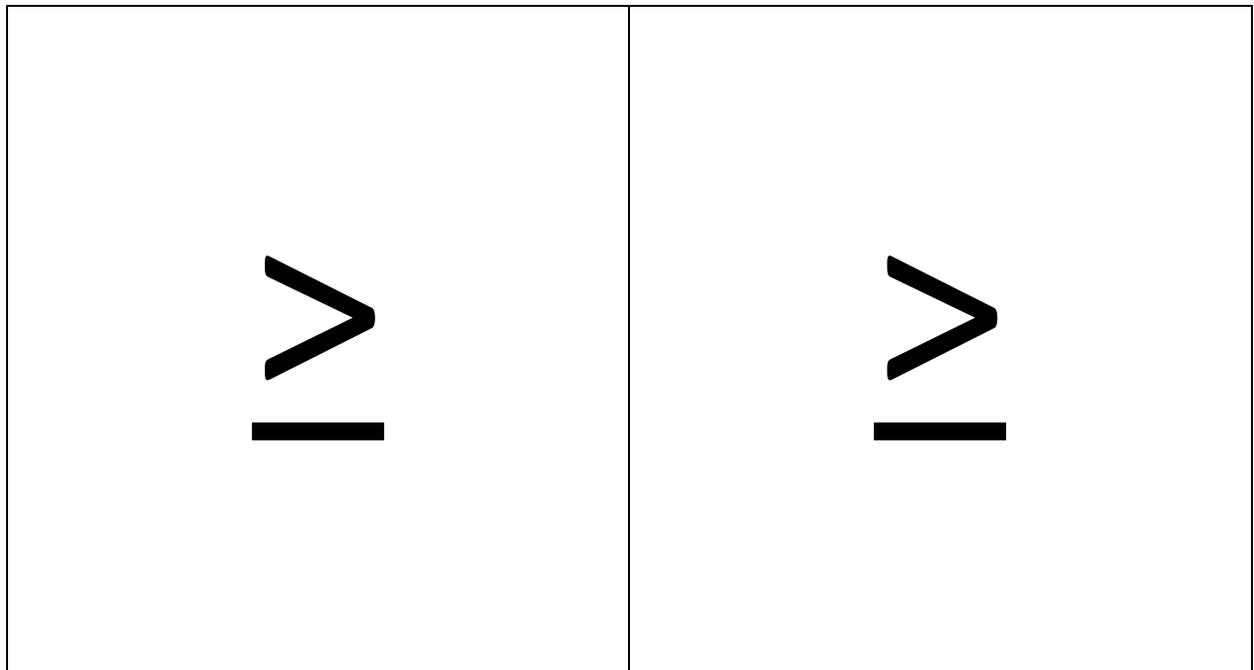
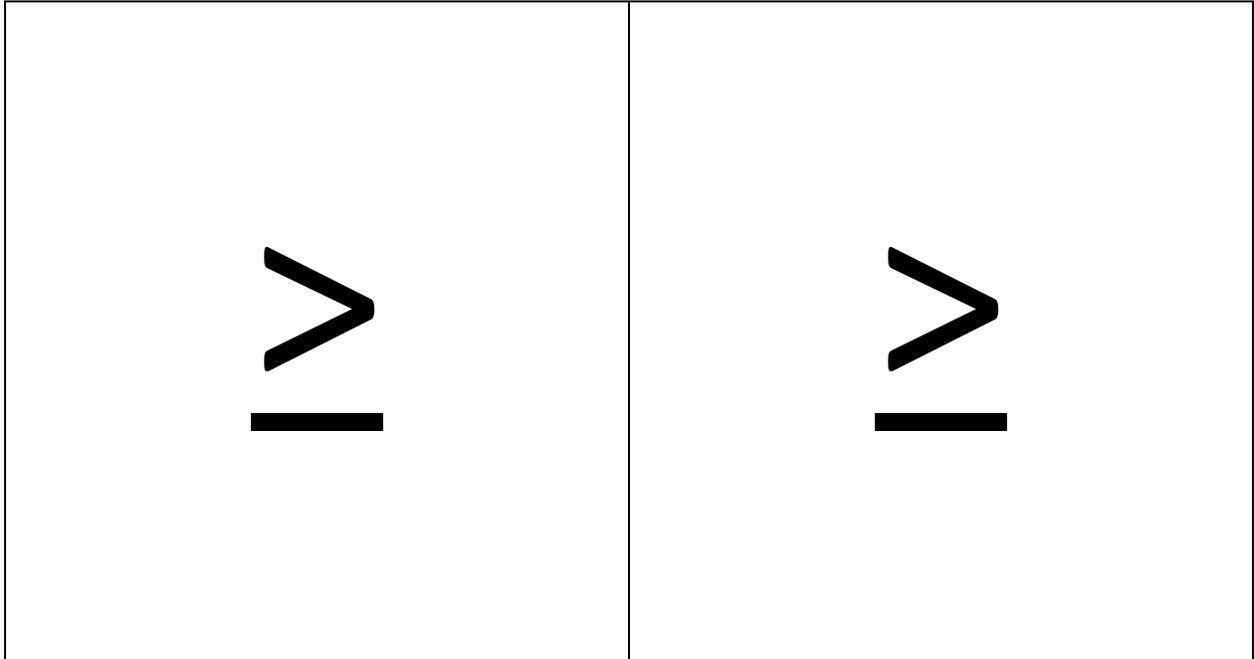
### Greater Than

Print on card stock and cut out.



## Greater Than or Equal To

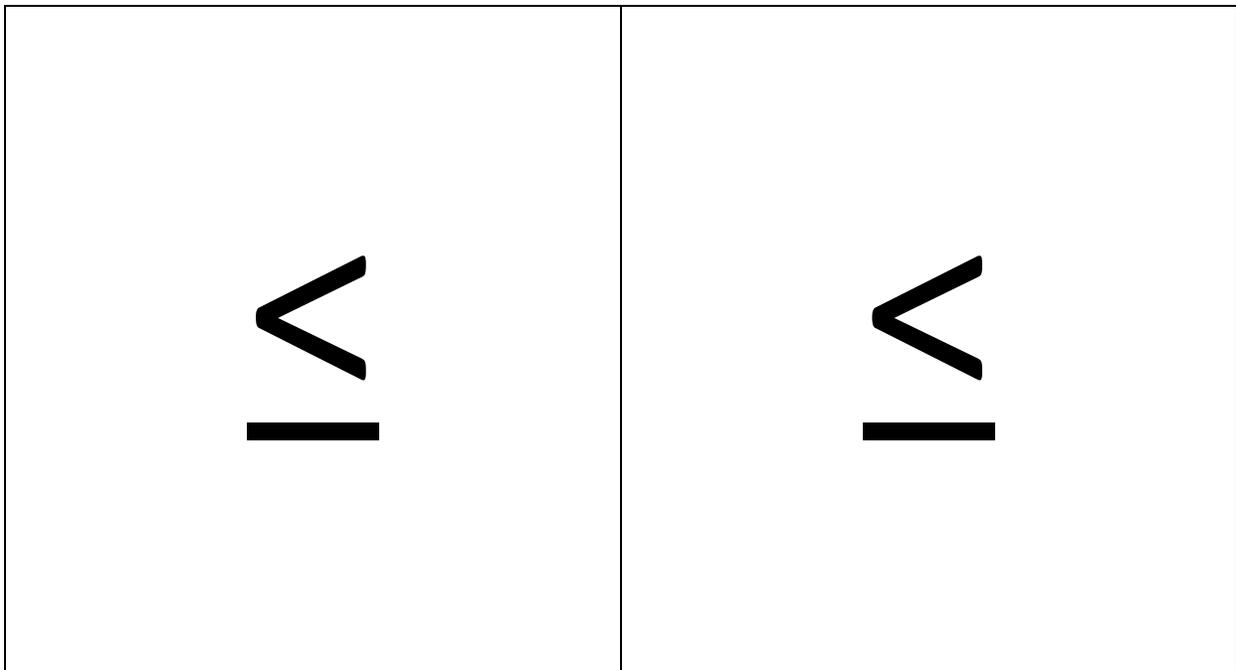
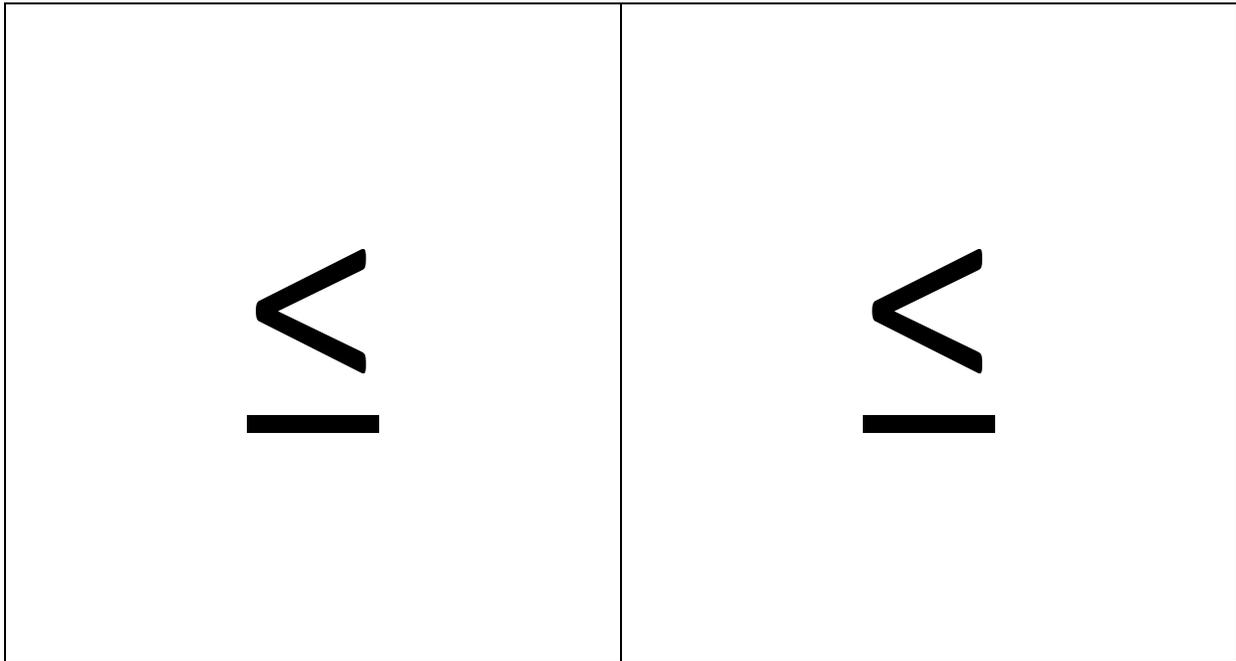
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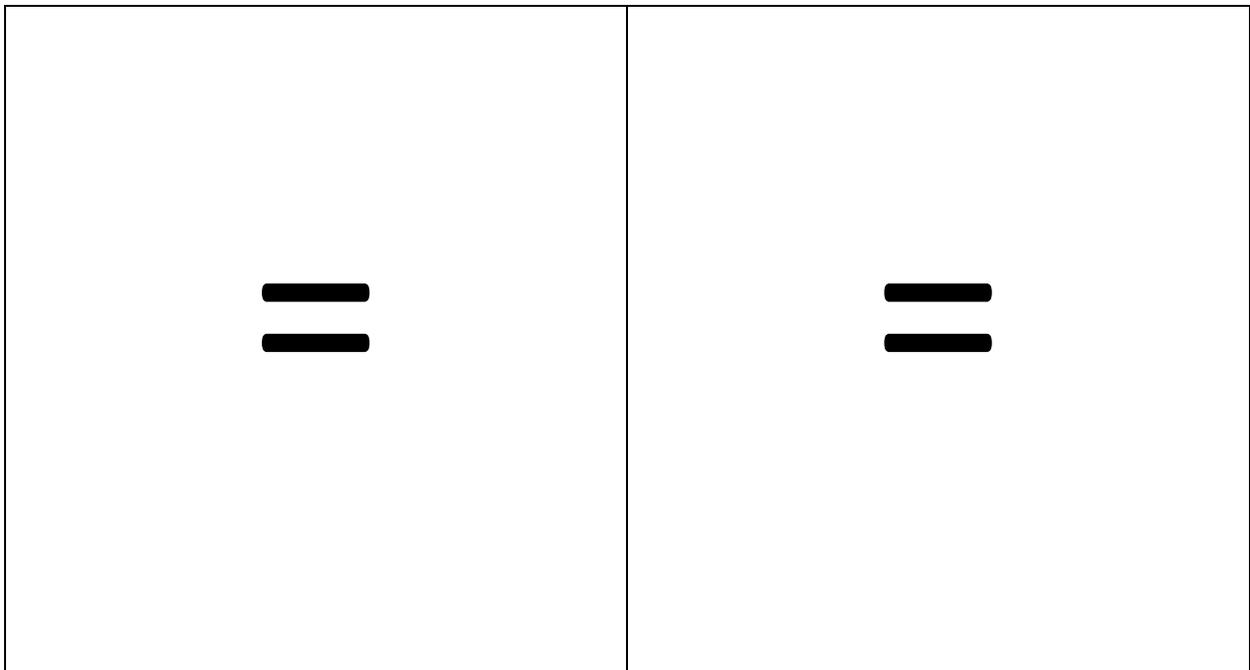
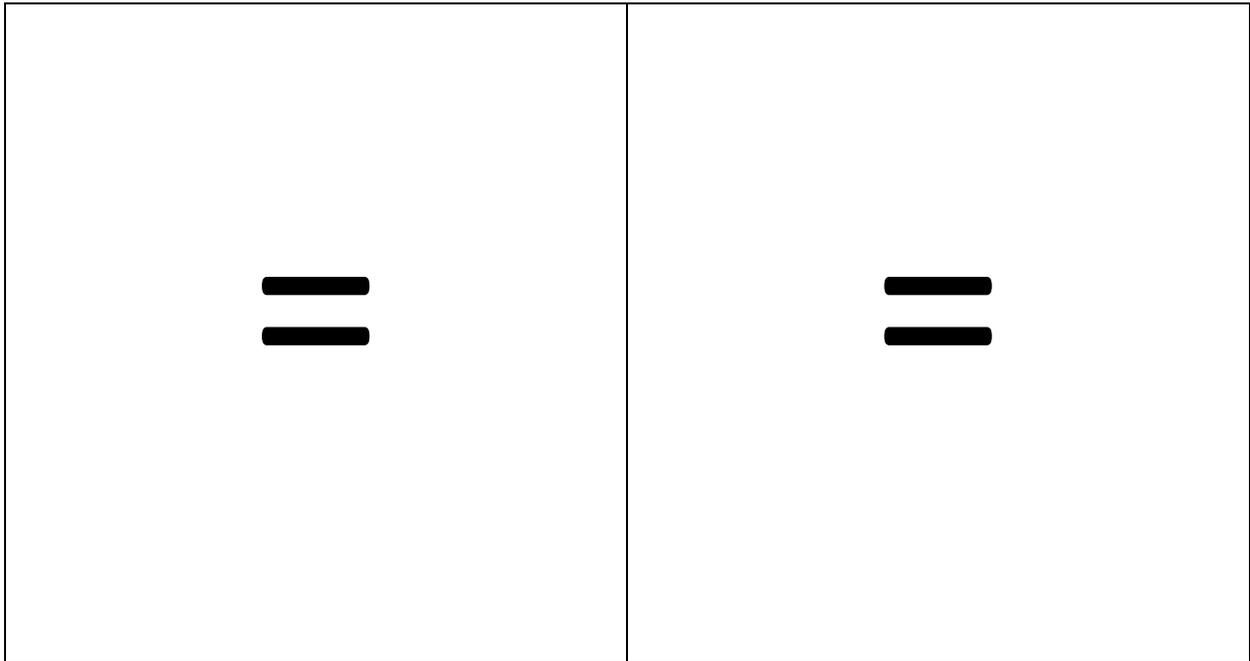
## Less Than or Equal To

Print on card stock and cut out.



## Equal To

Print on card stock and cut out.



Number Cards

$3\frac{2}{5} - 2\frac{1}{2}$	$-1$	$\frac{2}{3}$
$\frac{7}{10}$	$-100$	$3 \cdot \frac{4}{9}$
$3\frac{1}{4} \div \frac{2}{3}$	$-1,000$	$0.75$
$11.21 - 3.31$	$7$	$1.25 \div 2.5$

## Give or Take a Few

Name \_\_\_\_\_ Date \_\_\_\_\_

Below are the symbols used to describe the relationships between numbers. Write the class definition of each symbol, and then list the class example of each.

Symbol	Definition	Practical Situation Example
$=$		
$\neq$		
$<$		
$>$		
$\leq$		
$\geq$		

List the steps for graphing inequalities. Add more bullets, if necessary.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_

## Number Lines

