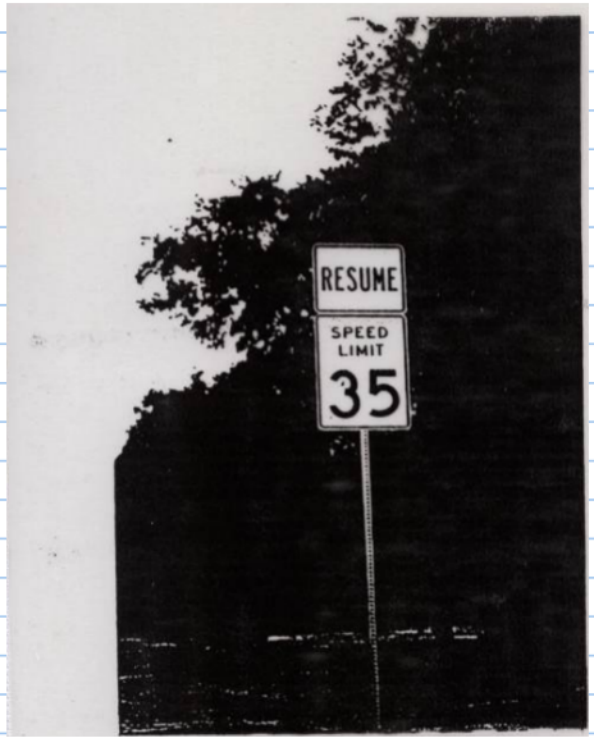
Unit 1:
A.CED.1

Solve Two-Step Inequalities

Objective

Students will be able to create and use inequalities in one variable to solve, graph and justify problems.



You will need to understand inequalities before you can get a driver's license. Look at the picture and write an inequality for the speed limit sign.

You are confronted with mathematical inequalities almost every day, but you may not notice them because they are so familiar.

Think about the following situations: speed limits on the highway, minimum payments on credit card bills, number of text messages you can send each month from your cell phone, and the amount of time it will take to get from home to school.

All of these can be represented as *mathematical inequalities*. And, in fact, you use mathematical thinking as you consider these situations on a day-to-day basis.

Situation	Mathematical Inequality
Speed limit	Legal speed on the highway ≤ 65 miles per hour
Credit card	Monthly payment ≥ 10% of your balance in that billing cycle
Text messaging	Allowable number of text messages per month ≤ 250
Travel time	Time needed to walk from home to school ≥ 18 minutes

When we talk about these situations, we often refer to limits, such as "the speed limit is 65 miles per hour" or "I have a limit of 250 text messages per month." However, we don't have to travel at exactly 65 miles per hour on the highway, or send and receive precisely 250 test messages per month—the limit only establishes a boundary for what is *allowable*. Thinking about these situations as inequalities provides a fuller picture of what is *possible*.

Addition Property of Inequality

If a, b, and c are real numbers, then

$$a < b \quad \text{and} \quad a + c < b + c$$

are equivalent inequalities.

Multiplication Property of Inequality

If a, b, and c are real numbers, then $a < b$ and $ac < bc$ are equivalent inequalities.

Vocabulary

Inequalities: inequality is a statement that compares two expressions that are not strictly equal by using one of the inequality signs.

A ***solution of an inequality*** is a value of the variable that makes the inequality a true statement.

Symbol	Meaning
$<$	is less than
$\leq$	is less than or equal to, at most, no more than
$>$	is greater than, more than
$\geq$	is greater than or equal to, at least
$\neq$	is not equal to

Inequalities are used all the time in the world around us—we just have to know where to look. Figuring out how to interpret the language of inequalities is an important step toward learning how to solve them in everyday contexts.

When you are solving or building these inequalities, it is important to know which inequality symbol you should use. Watch for certain phrases that will tip you off:

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*"	$a \leq b$

Many problems, though, will not explicitly use words like "at least" or "is less than." So how do you figure out which symbol is appropriate in a given situation?

The key is to think about the context of the problem, and to relate the context to one of the situations listed in the table. *Context* refers to the real-life situation is which the problem takes place.

$x \geq 3$

$3 \geq 3$ True

$\geq$ $\leq$  Part of the answer

$3 > 3$

↳ False

$>$ $<$ ( ) NOT part of the answer

M:

Solving an inequality involves exactly the same steps as when solving an equation with the following exception:

If both sides of the inequality are multiplied (or divided) by a negative number, the inequality symbol must be reversed.

$$-\frac{3}{4}x - 3 \geq 9$$

$$+3 \quad +3$$

$$-\frac{4}{3} \cdot -\frac{3}{4}x \geq 12 \cdot -\frac{4}{3}$$

$$x \leq -16$$

1 Example Solve, graph and state the domain.

we do

$$4 + 5x < 19$$

$$-4 \quad -4$$

$$\frac{5x}{5} < \frac{15}{5}$$

$$x < 3$$

Domain: $(-\infty, 3)$

u do

$$7y + 4 \geq -10$$

$$-4 \quad -4$$

$$\frac{7y}{7} \geq \frac{-14}{7}$$

$$y \geq -2$$

Domain: $[-2, \infty)$