

# Inequality Expressions

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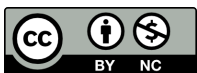
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Printed: March 23, 2015

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## CHAPTER

## 1

## Inequality Expressions

Here you'll learn how to express inequalities in various forms, as well as how to graph inequalities on a number line.

Suppose you're having a party, and you know that the number of people attending will be greater than or equal to 25. How would you write this inequality? If you had to graph the solutions to this inequality on a number line, could you do it? After completing this Concept, you'll not only be able to express inequalities such as this one with a graph, but you'll also be able to look at a graph and determine what inequality it represents.

### Guidance

Verbs that translate into inequalities are:

$>$  "greater than"

$\geq$  "greater than or equal to"

$<$  "less than"

$\leq$  "less than or equal to"

$\neq$  "not equal to"

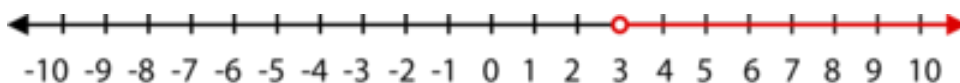
**Definition:** An **algebraic inequality** is a mathematical sentence connecting an expression to a value, a variable, or another expression with an inequality sign.

Solutions to one-variable inequalities can be graphed on a number line or in a coordinate plane.

### Example A

Graph the solutions to  $t > 3$  on a number line.

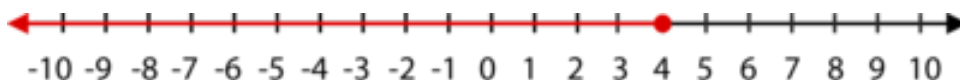
**Solution:** The inequality is asking for all real numbers larger than 3.



You can also write inequalities given a number line of solutions.

### Example B

Write the inequality pictured below.



**Solution:** The value of four is colored in, meaning that four is a solution to the inequality. The red arrow indicates values less than four. Therefore, the inequality is:

$$x \leq 4$$

Inequalities that “include” the value are shown as  $\leq$  or  $\geq$ . The line underneath the inequality stands for “or equal to.” We show this relationship by coloring in the circle above this value on the number line, as in the previous example. For inequalities without the “or equal to,” the circle above the value on the number line remains unfilled.

### Four Ways to Express Solutions to Inequalities

1. Inequality notation: The answer is expressed as an algebraic inequality, such as  $d \leq \frac{1}{2}$ .
2. Set notation: The inequality is rewritten using set notation brackets  $\{ \}$ . For example,  $\{d | d \leq \frac{1}{2}\}$  is read, “The set of all values of  $d$ , such that  $d$  is a real number less than or equal to one-half.”
3. Interval notation: This notation uses brackets to denote the range of values in an inequality.
  - a. Square or “closed” brackets  $[ ]$  indicate that the number is **included** in the solution
  - b. Round or “open” brackets  $( )$  indicate that the number is **not included** in the solution.

Interval notation also uses the concept of infinity  $\infty$  and negative infinity  $-\infty$ . For example, for all values of  $d$  that are less than or equal to  $\frac{1}{2}$ , you could use set notation as follows:  $(-\infty, \frac{1}{2}]$ .

4. As a graphed sentence on a number line.

### Example C

Describe the set of numbers contained by the given set notation for the following:

a)  $(8, 24)$

b)  $[3, 12)$

#### Solution:

$(8, 24)$  states that the solution is all numbers between 8 and 24 but **does not include** the numbers 8 and 24.

$[3, 12)$  states that the solution is all numbers between 3 and 12, **including** 3 but **not including** 12.

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### Guided Practice

Describe and graph the solution set expressed by  $(\infty, 3.25)$ .

#### Solution:

The solution set contains all numbers less than 3.25, not including 3.25.

The graph on the number line is:



### Explore More

1. What are the four methods of writing the solution to an inequality?

Graph the solutions to the following inequalities using a number line.

2.  $x < -3$
3.  $x \geq 6$
4.  $x > 0$
5.  $x \leq 8$
6.  $x < -35$
7.  $x > -17$
8.  $x \geq 20$
9.  $x \leq 3$

Write the inequality that is represented by each graph.

