

# Inequalities with Addition and Subtraction

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## CHAPTER

## 1

# Inequalities with Addition and Subtraction

Here you'll learn how to use addition and subtraction to find the solutions to one-step inequalities.

Suppose your favorite baseball team had  $w$  wins last year, and this year it vows to win 10 more games. It also promises that the number of its wins this year will be greater than or equal 85. Could you determine how many wins the team had last year? In this Concept, you'll learn to solve inequalities such as the one representing this scenario by using addition and subtraction.

## Guidance

### Inequalities Using Addition or Subtraction

To solve inequalities, you need some properties.

**Addition Property of Inequality:** For all real numbers  $a$ ,  $b$ , and  $c$ :

*If  $x < a$ , then  $x + b < a + b$ .*

*If  $x < a$ , then  $x - c < a - c$ .*

The two properties above are also true for  $\leq$  or  $\geq$ .

Because subtraction can also be thought of as “**add the opposite**,” these properties also work for subtraction situations.

Just like one-step equations, the goal is to **isolate the variable**, meaning to get the variable alone on one side of the inequality symbol. To do this, you will cancel the operations using inverses.

### Example A

*Solve for  $x$ :  $x - 3 < 10$ .*

**Solution:** To isolate the variable  $x$ , you must cancel “subtract 3” using its inverse operation, addition.

$$\begin{aligned}x - 3 + 3 &< 10 + 3 \\x &< 13\end{aligned}$$

Now, check your answer. Choose a number less than 13 and substitute it into your original inequality. If you choose 0, and substitute it you get:

$$0 - 3 < 10 = -3 < 10$$

What happens at 13? What happens with numbers greater than 13?

### Example B

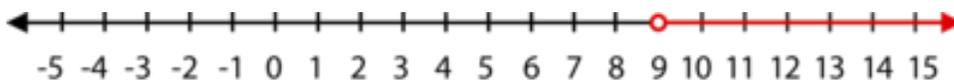
*Solve for  $x$ :  $x + 4 > 13$ .*

**Solution:**

Subtract 4 from both sides of the inequality.  
Simplify.

$$\begin{aligned}x + 4 &> 13 \\x + 4 - 4 &> 13 - 4 \\x &> 9\end{aligned}$$

The solution is shown below in a graph:

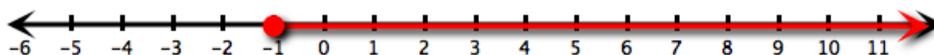
**Example C**

Solve for  $x$ :  $x + \frac{2}{3} \geq -\frac{1}{3}$ .

**Solution:**

Subtract  $\frac{2}{3}$  from both sides of the inequality.  
Simplify.

$$\begin{aligned}x + \frac{2}{3} &\geq -\frac{1}{3} \\x + \frac{2}{3} - \frac{2}{3} &\geq -\frac{1}{3} - \frac{2}{3} \\x &\geq -1\end{aligned}$$

**Video Review****MEDIA**

Click image to the left or use the URL below.

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**Guided Practice**

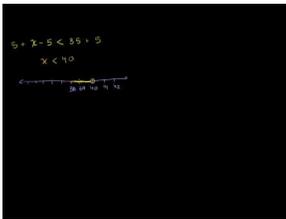
Solve for  $y$ :  $5.6 > y - 3.4$ .

**Solution:**

	$5.6 > y - 3.3$
Add 3.3 to both sides of the inequality.	$5.6 + 3.3 > y - 3.3 + 3.3$
Simplify.	$8.9 > y$

**Explore More**

Sample explanations for some of the practice exercises below are available by viewing the following video. Note that there is not always a match between the number of the practice exercise in the video and the number of the practice exercise listed in the following exercise set. However, the practice exercise is the same in both. [CK-12 Basic Algebra: Inequalities Using Addition and Subtraction](#) (7:48)

**MEDIA**

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Solve each inequality and graph the solution on a number line.

1.  $x - 1 > -10$
2.  $x - 1 \leq -5$
3.  $-20 + a \geq 14$
4.  $x + 2 < 7$
5.  $x + 8 \leq -7$
6.  $5 + t \geq \frac{3}{4}$
7.  $x - 5 < 35$
8.  $15 + g \geq -60$
9.  $x - 2 \leq 1$
10.  $x - 8 > -20$
11.  $11 + q > 13$
12.  $x + 65 < 100$
13.  $x - 32 \leq 0$
14.  $x + 68 \geq 75$
15.  $16 + y \leq 0$

**Mixed Review**

16. Write an equation containing  $(3, -6)$  and  $(-2, -2)$ .
17. Simplify:  $|2 - 11 \times 3| + 1$ .

18. Graph  $y = -5$  on a coordinate plane.
19.  $y$  varies directly as  $x$ . When  $x = -1$ ,  $y = \frac{4}{5}$ . Find  $y$  when  $x = \frac{16}{3}$ .
20. Rewrite in slope-intercept form:  $-2x + 7y = 63$ .