## Lesson 15: Efficiently Solving Inequalities

Let’s solve more complicated inequalities.

### 15.1: Lots of Negatives

Here is an inequality: $-x\geq -4$.

1. Predict what you think the solutions on the number line will look like.
2. Select **all** the values that are solutions to $-x\geq -4$:
	1. 3
	2. -3
	3. 4
	4. -4
	5. 4.001
	6. -4.001
3. Graph the solutions to the inequality on the number line:
* 

### 15.2: Inequalities with Tables

1. Let's investigate the inequality $x−3>-2$.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * $x$
 | * -4
 | * -3
 | * -2
 | * -1
 | * 0
 | * 1
 | * 2
 | * 3
 | * 4
 |
| * $x−3$
 | * -7
 |  | * -5
 |  |  |  | * -1
 |  | * 1
 |

* 1. Complete the table.
	2. For which values of $x$ is it true that $x−3=-2$?
	3. For which values of $x$ is it true that $x−3>-2$?
	4. Graph the solutions to $x−3>-2$ on the number line:
	+ 
1. Here is an inequality: $2x<6$.
	1. Predict which values of $x$ will make the inequality $2x<6$ true.
	2. Complete the table. Does it match your prediction?

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * + $x$
 | * + -4
 | * + -3
 | * + -2
 | * + -1
 | * + 0
 | * + 1
 | * + 2
 | * + 3
 | * + 4
 |
| * + $2x$
 |  |  |  |  |  |  |  |  |  |

* 1. Graph the solutions to $2x<6$ on the number line:
	+ 
1. Here is an inequality: $-2x<6$.
	1. Predict which values of $x$ will make the inequality $-2x<6$ true.
	2. Complete the table. Does it match your prediction?

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| * + $x$
 | * + -4
 | * + -3
 | * + -2
 | * + -1
 | * + 0
 | * + 1
 | * + 2
 | * + 3
 | * + 4
 |
| * + $-2x$
 |  |  |  |  |  |  |  |  |  |

* 1. Graph the solutions to $-2x<6$ on the number line:
	+ 
	1. How are the solutions to $2x<6$ different from the solutions to $-2x<6$?

### 15.3: Which Side are the Solutions?

1. Let’s investigate $-4x+5\geq 25$.
	1. Solve $-4x+5=25$.
	2. Is $-4x+5\geq 25$ true when $x$ is 0? What about when $x$ is 7? What about when $x$ is -7?
	3. Graph the solutions to $-4x+5\geq 25$ on the number line.
	* 
2. Let's investigate $\frac{4}{3}x+3<\frac{23}{3}$.
	1. Solve $\frac{4}{3}x+3=\frac{23}{3}$.
	2. Is $\frac{4}{3}x+3<\frac{23}{3}$ true when $x$ is 0?
	3. Graph the solutions to $\frac{4}{3}x+3<\frac{23}{3}$ on the number line.
	* 
3. Solve the inequality $3(x+4)>17.4$ and graph the solutions on the number line.
* 
1. Solve the inequality $-3\left(x−\frac{4}{3}\right)\leq 6$ and graph the solutions on the number line.
* 

#### Are you ready for more?

Write at least three different inequalities whose solution is $x>-10$. Find one with $x$ on the left side that uses a $<$.

### Lesson 15 Summary

Here is an inequality: $3(10−2x)<18$. The solution to this inequality is all the values you could use in place of $x$ to make the inequality true.

In order to solve this, we can first solve the related equation $3(10−2x)=18$ to get the solution $x=2$. That means 2 is the boundary between values of $x$ that make the inequality true and values that make the inequality false.

To solve the inequality, we can check numbers greater than 2 and less than 2 and see which ones make the inequality true.

Let’s check a number that is greater than 2: $x=5$. Replacing $x$ with 5 in the inequality, we get $3(10−2⋅5)<18$ or just $0<18$. This is true, so $x=5$ is a solution. This means that all values greater than 2 make the inequality true. We can write the solutions as $x>2$ and also represent the solutions on a number line:



Notice that 2 itself is not a solution because it's the value of $x$ that makes $3(10−2x)$ *​equal* to 18, and so it does not make $3(10−2x)<18$ true.

For confirmation that we found the correct solution, we can also test a value that is less than 2. If we test $x=0$, we get $3(10−2⋅0)<18$ or just $30<18$. This is false, so $x=0$ and all values of $x$ that are less than 2 are not solutions.



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