



### Introduction

An inequality is a mathematical sentence that shows the relationship between two quantities using these signs:  $>$ ,  $\geq$ ,  $<$ ,  $\leq$ , or  $\neq$ .

Solving inequalities is similar to solving equations, but there are some important differences. One big difference occurs when you multiply or divide by a negative number. In this activity, you will practice solving linear inequalities and explore these differences using algebraic and graphing techniques.

### Problem 1 – A Simple Inequality

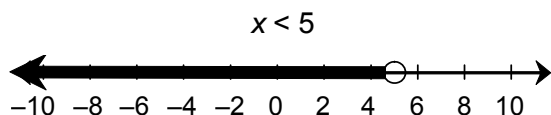
On page 1.3, use the slider to change the value of  $x$ . Answer the questions about the inequality  $x \leq 4$ .

1. List three values of  $x$  that makes the inequality statement *true*.
2. List three values of  $x$  that makes the inequality statement *false*.
3. What result occurred when  $x = 4$ ? Explain.

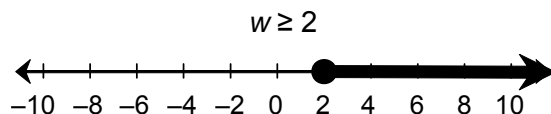
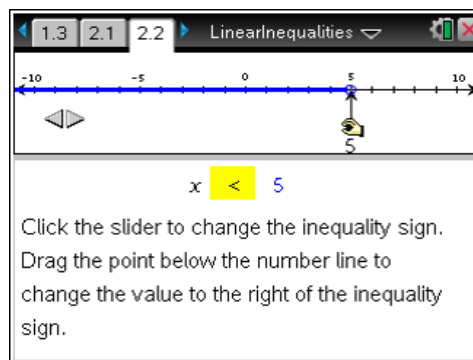
### Problem 2 – Graphing a Simple Inequality

The following examples compare how the graph of an inequality looks on paper and on the handheld.

#### Examples



The open circle at 5 means that  $x = 5$  is not a solution to the inequality. Since  $x$  is less than 5, shade to the left of the circle.



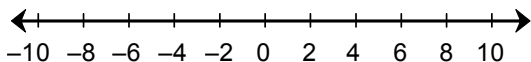
The closed circle at 2 means that  $x = 2$  is a solution to the inequality. Since  $w$  is greater than or equal to 5, shade to the right of the circle.

4. Compare the graphs of  $x > 2$  and  $x \geq 2$ . Explain how they differ.

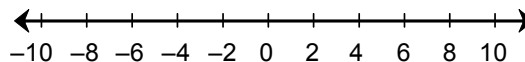


Graph each inequality using the handheld. Sketch the graphs here.

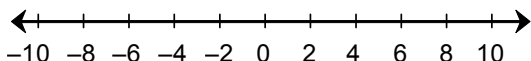
5.  $a > 5$



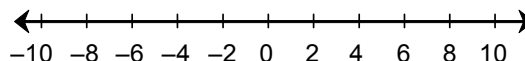
6.  $b < -2$



7.  $z \geq -2$



8.  $y \leq 0$



### Problem 3 – Solving Inequalities Using Addition and Subtraction

To solve an inequality using addition or subtraction:

- Add or subtract the same number to both sides of the inequality, just as you did with equations.

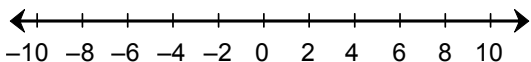
#### Examples

$$\begin{aligned}x - 3 &> 5 \\x - 3 + 3 &> 5 + 3 \\x &> 8\end{aligned}$$

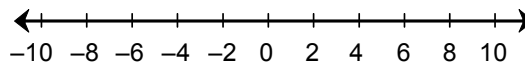
$$\begin{aligned}x + 6 &\leq 10 \\x + 6 - 6 &\leq 10 - 6 \\x &\leq 4\end{aligned}$$

Solve each inequality. Use the handheld to compare the original inequality with the solution. Then sketch the graph of the solution.

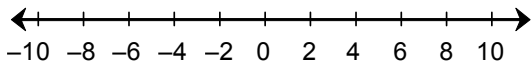
9.  $f - 5 \geq 2$



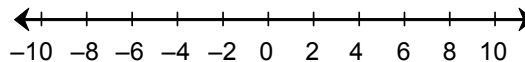
10.  $-4 > g - 2$



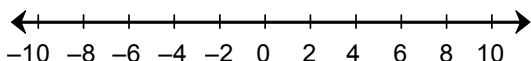
11.  $u + 1 \leq 5$



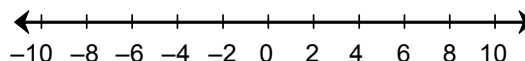
12.  $1 < 8 + v$



13.  $-5 > h - 1$



14.  $-5 \leq 1 + t$





**Problem 4 – Solving Inequalities Using Multiplication and Division**

15. After adding or subtracting a value to both sides of the inequality given to you on page 4.2, was the resulting inequality true or false?

Read through pages 4.3 and 4.4 and answer the question at the bottom of each page. Then complete Exercises 16–30.

16. Consider the inequalities  $4x > 8$  and  $x > 2$ . Are these equivalent inequalities? Explain.
17. Consider the inequalities  $\frac{x}{5} \leq -1$  and  $x \leq -5$ . Are these equivalent inequalities? Explain.
18. Consider the inequalities  $-x > 4$  and  $x > -4$ . Are these equivalent inequalities? Explain.
19. Write an inequality that is equivalent to  $-x > 4$ .

Find the inequality symbol that makes each pair of inequalities equivalent.

20.  $\frac{v}{-4} \geq 2$                        $v$  \_\_\_\_\_  $-8$                       21.  $-\frac{d}{3} < -3$                        $d$  \_\_\_\_\_  $9$
22.  $-2h > -2$                        $h$  \_\_\_\_\_  $1$                       23.  $-5r \leq 10$                        $r$  \_\_\_\_\_  $-2$
24. *Complete this statement:*

If you multiply or divide both sides of an inequality by the same negative number, you must \_\_\_\_\_ the inequality symbol to get an equivalent inequality.



To solve an inequality using multiplication or division:

- Multiply or divide both sides of the inequality by the same number.
- If you multiply or divide by a **negative** number, reverse the inequality symbol.

### Examples

$$-2x > 6$$

$$\frac{-2x}{-2} > \frac{6}{-2}$$

$$x < -3$$

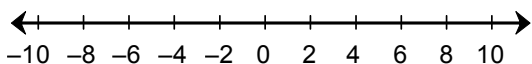
$$\frac{x}{-3} \leq 10$$

$$\frac{x}{-3} \times -3 \leq 10 \times -3$$

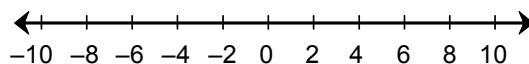
$$x \geq -30$$

Solve each inequality. Use the handheld to compare the original inequality with the solution. Then sketch the graph of the solution.

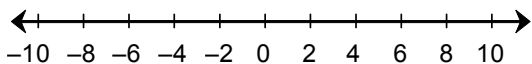
25.  $\frac{c}{4} \geq 1$



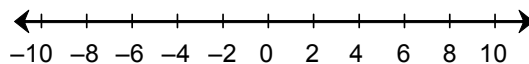
26.  $2 < -\frac{d}{4}$



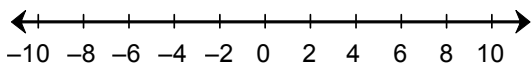
27.  $3w \leq -9$



28.  $20 > -5x$



29.  $18d < -12$



30.  $-\frac{5}{7}g > -5$

