

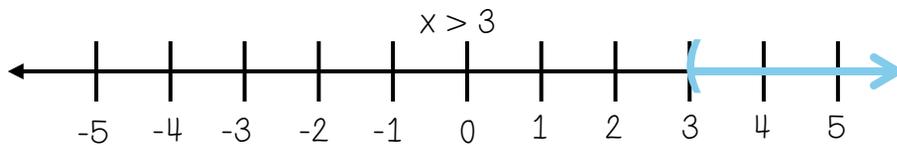
Graph Inequalities on the Number Line *notes*

Graph Inequalities

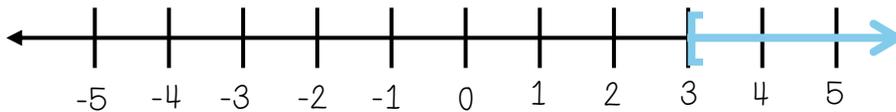
Do you remember what it means for a number to be a solution to an equation? A solution of an equation is a value of a variable that makes a true statement when substituted into the equation.

What about the solution of an inequality? What number would make the inequality $x > 3$ true? x could be 4, or it could be 5, or it could be 100! Any number greater than 3 is a solution to the inequality $x > 3$.

We can show solutions to the inequality $x > 3$ on the number line by shading in all the numbers to the right of 3, to show that all numbers greater than 3 are solutions. Because the number 3 itself is not a solution, we put open parentheses at 3.



The graph of the inequality $x \geq 3$ is very much like the graph of $x > 3$, but since 3 is a solution to $x \geq 3$, we must show it on the graph. We do that by using a bracket. To recap, a parentheses means the number is NOT included in the solution, and a bracket means that the number IS included in the solution.



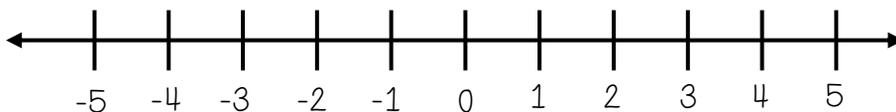
Example

Graph on the number line.

a) $x \leq 1$

b) $x < 5$

c) $x > -1$



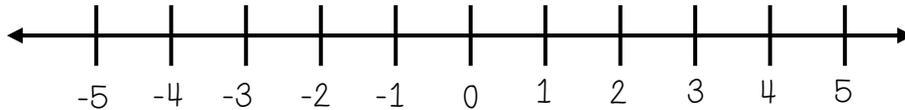
Your Turn

Graph on the number line.

a) $x \leq 1$

b) $x \leq 2$

c) $x > 3$

**Interval Notation**

We can also use interval notation to represent inequalities. In the inequality $x > 3$, it means all numbers greater than three. There is no upper end to the solution to this inequality. In interval notation, we express $x > 3$ as $(3, \infty)$. The inequality $x \leq 1$ in interval notation is $(-\infty, 1]$.

Parentheses and open circles show that the value is NOT included. Brackets and closed circles show that the value IS included.

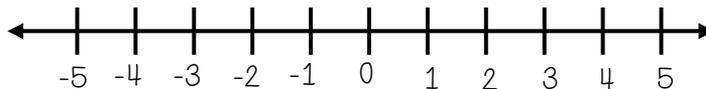
Example

Graph on the number line and write in interval notation.

a) $x \geq -3$

b) $x < 2.5$

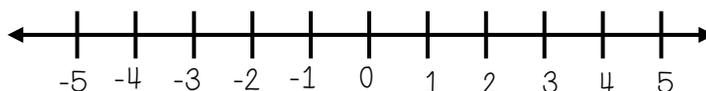
c) $x \leq -3/5$

*Your Turn!*

a) $x > 2$

b) $x \leq -1.5$

c) $x < -2/3$



Solve Inequalities Using Subtraction & Addition Properties *notes*

Solve Inequalities: Addition & Subtraction

The Subtraction and Addition Properties of Equality state that if two quantities are equal, when we add or subtract the same amount from both quantities, the results will be equal.

Similar properties hold true for inequalities. If you add or subtract the same number on both sides, your inequality will remain true. We can use these properties to solve inequalities much like we do equations:

| | |
|--|---------------------|
| $x + 4 > 9$ | |
| Subtract 5 from both sides to isolate x. | $x + 4 - 4 > 9 - 4$ |
| Simplify. | $x > 5$ |

Example

Solve the inequality, graph the solution on the number line, and write the solution in interval notation.

$$x - \frac{1}{2} \leq \frac{5}{8}$$

Your Turn!

$$f - \frac{3}{4} \geq \frac{1}{3}$$

$$g + \frac{2}{3} < \frac{1}{3}$$

Solve Inequalities Using Multiplication & Division Properties *notes*

Solve Inequalities: Multiplication & Division

The Division and Multiplication Properties of Equality state that if two quantities are equal, when we multiply or divide the same amount from both quantities, the results will be equal (as long as we don't divide by 0).

But what about inequalities? Let's look at some examples:

| 10 < 15 | | | |
|-------------------------------|-------------------------------|--------------------------|-----------------|
| Divide both sides by 5. | $\frac{10}{5} ? \frac{15}{5}$ | Multiply both sides by 5 | $10(5) ? 15(5)$ |
| Simplify. | $2 ? 3$ | | $50 ? 75$ |
| Fill in the inequality signs. | $2 < 3$ | | $50 < 75$ |

The inequality signs stayed the same!
What about negative numbers?

| 10 < 15 | | | |
|-------------------------------|-------------------------------|--------------------------|-------------------|
| Divide both sides by 5. | $\frac{10}{5} ? \frac{15}{5}$ | Multiply both sides by 5 | $10(-5) ? 15(-5)$ |
| Simplify. | $-2 ? -3$ | | $-50 ? -75$ |
| Fill in the inequality signs. | $-2 > -3$ | | $-50 > -75$ |

The inequality signs reversed direction!

When we multiply or divide by a positive number, the inequality sign stays the same.

When we multiply or divide by a negative number, the inequality sign reverses.

Example

Solve the inequality, graph the solution on the number line, and write the solution in interval notation.

a) $7x < 42$

b) $-10b \geq 60$

Example

Solve the inequality, graph the solution on the number, and write the solution in interval notation.

$$-20 > \frac{4}{5}x$$

$$\frac{y}{-4} \geq 8$$

your turn

Solve the inequality, graph the solution on the number, and write the solution in interval notation.

$$34x > 68$$

$$12d \geq 72$$

$$-8k < 48$$

$$-7r < -70$$

$$24 \leq \frac{3}{8}b$$

$$-24 > \frac{4}{3}f$$

$$\frac{x}{-12} \leq 15$$

$$\frac{.w}{-8} \leq -16$$

Solve Inequalities That Require Simplifying *notes*

Simplifying Inequalities

Most inequalities take more than one step to solve. You follow the same steps you used to solve general linear equations, you just have to pay close attention and remember to reverse your inequality sign when you multiply or divide by a negative number.

Example

Solve the inequality, graph the solution on the number line, and write the solution in interval notation.

$$4b \leq 9b + 17$$

$$8x + 3(x - 12) > 7x - 28$$

$$8y - 2(5 - y) < 4(y + 9) + 6y$$

$$\frac{1}{3}k - \frac{1}{8}k > \frac{5}{24}k + \frac{3}{4}$$

Your Turn!

$$6y < 10y + 19$$

$$9x + 2(x + 6) > 5x - 24$$

$$9h - 7(2 - h) < 8(h + 11) + 8h$$

$$\frac{2}{5}z - \frac{1}{3}z < \frac{1}{15}z - \frac{3}{5}$$

Translate to an Inequality & Solve *notes*

Translating Inequality

To translate English sentences into inequalities, we need to recognize the phrases that indicate the inequality. Some words are easy, like "more than" or "less than," but others aren't as obvious.

Here are some common phrases that indicate inequalities:

| $>$ | \geq | $<$ | \leq |
|-----------------|-----------------------------|-----------------|--------------------------|
| Is greater than | Is greater than or equal to | Is less than | Is less than or equal to |
| Is more than | Is at least | Is smaller than | Is at most |
| Is larger than | Is no less than | Has fewer than | Is no more than |
| Exceeds | Is the minimum | Is lower than | Is the maximum |

Example

Translate and solve. Then write the solution in interval notation and graph on the number line.

Twelve times x is no more than 96

Thirty less than y is at least 45

Your Turn!

Twenty times x is at most 120

Nine times w is no less than 145

Nineteen less than r is no less than 48

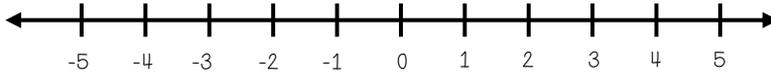
Four more than x is at most 18

Unit 2.7 Solve Linear Inequalities *Practice*

Graph each inequality on the number line.

1. a) $x > 1$

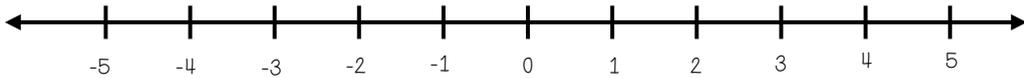
b) $x < -2$



Graph each inequality on the number line and write in interval notation.

2. a) $x \geq 2.5$

b) $x < -2/3$



Solve each inequality, graph the solution on the number line, and write the solution in interval notation.

3. $x - 45 \leq 63$

4. $v + 13 > 4$

5. $x - \frac{11}{12} > \frac{5}{18}$

6. $c + \frac{7}{8} \leq \frac{1}{6}$

7. $6y < 54$

8. $-5g \geq 70$

Unit 2.7 Solve Linear Inequalities *Practice*

Solve each inequality, graph the solution on the number line, and write the solution in interval notation.

9. $-7x < 105$

10. $40 \leq \frac{5}{8}k$

11. $\frac{9}{5}h \leq 36$

12. $\frac{x}{-10} > 30$

13. $9h \geq -36$

14. $5g \leq 8g - 21$

15. $9x + 5(x + 3) < 4x - 35$

16. $6c - 12(3 - c) \geq 9(c - 4) + 9c$

17. $\frac{5}{6}x - \frac{1}{4}x > \frac{7}{12}x + \frac{2}{3}$

18. $-\frac{9}{4}y \geq -\frac{5}{12}$

Name: _____ Date: _____ Period: _____

Unit 2.7 solve Linear Inequalities *Practice*

Translate and solve. Then write the solution in interval notation and graph on the number line.

19. Ninety times x is less than 540

20. Six more than y exceeds 29

21. Twelve less than x is no less than 24

22. Fifteen less than b is at least -8

Answer the following question.

23. Explain why it is necessary to reverse the inequality when solving $-5x > 15$