

Lesson 4.3

Solving Inequalities Using Multiplication or Division

4.3 Notes

Get out your spiral notebooks!

Essential Question

How can you use multiplication or division to solve an inequality?

Key Idea

Multiplication and Division Properties of Inequality (Case 1)

Words When you multiply or divide each side of an inequality by the same *positive* number, the inequality remains true.

Numbers	$-4 < 6$	$4 > -6$
	$2 \cdot (-4) < 2 \cdot 6$	$\frac{4}{2} > \frac{-6}{2}$
	$-8 < 12$	$2 > -3$

Algebra If $a < b$ and c is positive, then

$$a \cdot c < b \cdot c \quad \text{and} \quad \frac{a}{c} < \frac{b}{c}$$

If $a > b$ and c is positive, then

$$a \cdot c > b \cdot c \quad \text{and} \quad \frac{a}{c} > \frac{b}{c}$$

These properties are also true for \leq and \geq .

Example 1:

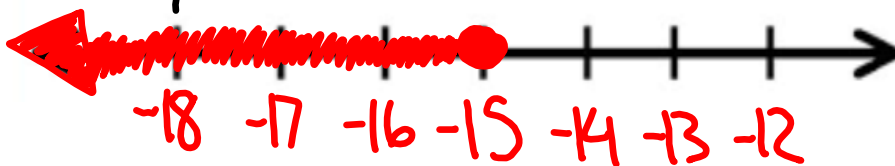
Solve $\frac{x}{5} \leq -3$. Graph the solution.

$$\begin{array}{r} .5 \cdot 5 \\ \hline x \leq -15 \end{array}$$

$$\frac{-18}{5} \leq -3$$

$$-3.6 \leq -3 \quad \checkmark$$

Plug in a "shaded" value to check

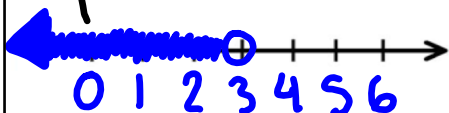


Solve the inequality. Graph the solution.

1. $n \div 3 < 1$

$$\begin{array}{r|l} \cdot 3 & \cdot 3 \\ \hline n & < 3 \end{array}$$

$0 \div 3 < 1$
 $0 < 1 \checkmark$



2. $-0.5 \leq \frac{m}{10}$

$$\begin{array}{r|l} \cdot 10 & \cdot 10 \\ \hline -5 & \leq m \end{array}$$

$m \geq -5$

$-0.5 \leq \frac{-2}{10}$

$-0.5 \leq -0.2 \checkmark$



3. $-3 > \frac{2}{3}p$

$$\begin{array}{r|l} \div \frac{2}{3} & \div \frac{2}{3} \\ \hline -\frac{9}{2} & > p \end{array}$$

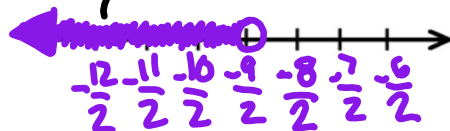
$-\frac{9}{2} > p$

$p < -\frac{9}{2}$

$-3 \cdot \frac{3}{2} = -\frac{9}{2}$

$-3 > \frac{2}{3}(-6)$

$-3 > -4 \checkmark$



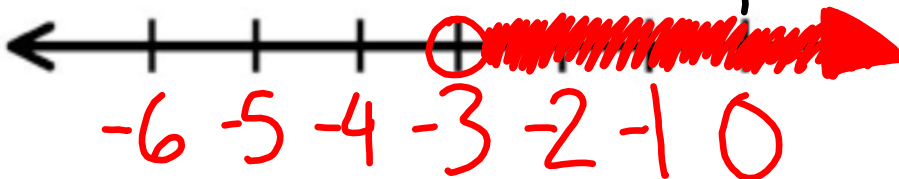
Example 2:

Solve $6x > -18$. Graph the solution.

$$\begin{array}{r|l} \overline{6} & \overline{6} \\ \hline x & > -3 \end{array}$$

$6(0) > -18$

$0 > -18 \checkmark$



Solve the inequality. Graph the solution.

$$4. \frac{4b}{4} \geq \frac{2}{4}$$

$$b \geq \frac{1}{2}$$

$$4(1) \geq 2$$

$$4 \geq 2 \checkmark$$

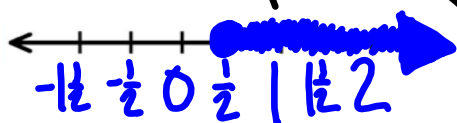
$$5. \frac{12k}{12} \leq \frac{-24}{12}$$

$$k \leq -2$$

$$6. \frac{-15}{2.5} < \frac{2.5q}{2.5}$$

$$-6 < q$$

$$q > -6$$



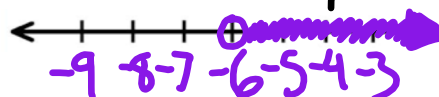
$$12(-3) \leq -24$$

$$-36 \leq -24 \checkmark$$



$$-15 < 2.5(-4)$$

$$-15 < -10$$



Example 3:

Solve $-\frac{3}{2}n \leq 6$. Graph the solution.

$$\frac{-\frac{3}{2}n}{-\frac{3}{2}} \leq \frac{6}{-\frac{3}{2}}$$

$$n \leq -4$$

$$6 \cdot \left(-\frac{2}{3}\right) = -4$$

$$-\frac{3}{2}(-6) \leq 6$$

$$9 \leq 6 \times$$

Huh??? What went wrong?

See next slide...

Key Idea

Multiplication and Division Properties of Inequality (Case 2)

Words When you multiply or divide each side of an inequality by the same negative number, the direction of the inequality symbol must be reversed for the inequality to remain true.

Numbers	$-4 < 6$	$4 > -6$
	$-2 \cdot (-4) > -2 \cdot 6$	$\frac{4}{-2} < \frac{-6}{-2}$
	$8 > -12$	$-2 < 3$

Algebra If $a < b$ and c is negative, then

$$a \cdot c > b \cdot c \quad \text{and} \quad \frac{a}{c} > \frac{b}{c}$$

If $a > b$ and c is negative, then

$$a \cdot c < b \cdot c \quad \text{and} \quad \frac{a}{c} < \frac{b}{c}$$

These properties are also true for \leq and \geq .

Solve the following inequalities. Graph the solutions.

7. $\frac{x}{-3} > -4$

$$\begin{array}{l} \cdot(-3) \quad \cdot(-3) \\ \hline x > -12 \\ -3 > -4 \checkmark \end{array}$$



8. $0.5 \leq -\frac{y}{2}$

$$\begin{array}{l} \cdot(-2) \quad \cdot(-2) \\ \hline -1 \geq y \\ y \leq -1 \end{array}$$

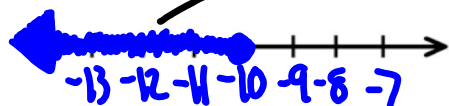
$$\begin{array}{l} 0.5 \leq -\frac{(-2)}{2} \\ 0.5 \leq -(-1) \\ 0.5 \leq 1 \end{array}$$



9. $-12 \geq \frac{6}{5}m$

$$\begin{array}{l} \cdot\frac{5}{6} \quad \cdot\frac{5}{6} \\ \hline -10 \geq m \\ m \leq -10 \end{array}$$

$$\begin{array}{l} -12 \geq \frac{6}{5}(-12) \\ -12 \geq -14.4 \checkmark \end{array}$$



10. $-\frac{2}{5}h \leq -8$

$$\begin{array}{l} \cdot(-\frac{5}{2}) \quad \cdot(-\frac{5}{2}) \\ \hline h \geq 20 \end{array}$$

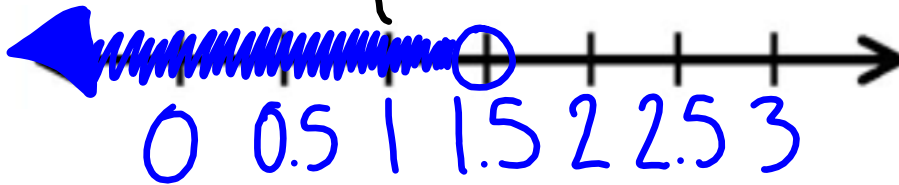
$$\begin{array}{l} -\frac{2}{5}(22) \leq -8 \\ -8.8 \leq -8 \checkmark \end{array}$$



Example 4:Solve $-3z > -4.5$. Graph the solution.

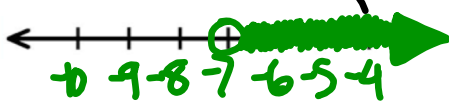
$$\begin{array}{r|l} -3 & -3 \\ \hline z & < 1.5 \end{array}$$

$$\begin{aligned} -3(1) &> -4.5 \\ -3 &> -4.5 \checkmark \end{aligned}$$



Solve the inequality. Graph the solution.

$$\begin{array}{r|l} -5 & 35 \\ \hline z & > -7 \end{array} \quad \begin{aligned} -5(-4) &< 35 \\ 20 &< 35 \checkmark \end{aligned}$$



$$\begin{array}{r|l} -2 & -9 \\ \hline a & < 4.5 \end{array} \quad \begin{aligned} -2(3) &> -9 \\ -6 &> -9 \checkmark \end{aligned}$$



$$\begin{array}{r|l} -1.5 & 3n \\ \hline n & > -0.5 \end{array} \quad \begin{aligned} -1.5 &< 3(1) \\ -1.5 &< 3 \checkmark \end{aligned}$$



$$\begin{array}{r|l} -4.2 & -0.7w \\ \hline w & \geq 6 \end{array} \quad \begin{aligned} -4.2 &\geq -0.7(9) \\ -4.2 &\geq -6.3 \checkmark \end{aligned}$$

