

4.3 Solving Inequalities Using Multiplication or Division

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 .

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 .

Take this true statement for example:

Add 3 to each side, is the statement still true?

Subtract 3 from each side, is the statement still true?

Multiply by 3 on each side, is the statement still true?

Divide by 3 on each side, is the statement still true?

Multiply by -3 on each side, is the statement still true?

Divide by -3 on each side, is the statement still true?

$$6 < 12$$

$$9 < 15 \checkmark$$

$$3 < 9 \checkmark$$

$$18 < 36 \checkmark$$

$$2 < 4 \checkmark$$

$$-18 < -36 \Rightarrow -18 > -36$$

$$-2 < -4 \Rightarrow -2 > -4$$

Use this to help you remember:

Are you negative? Are you MAD?
Then FLIP the inequality and you'll be glad! 😊

Solve each inequality. Graph the solution.

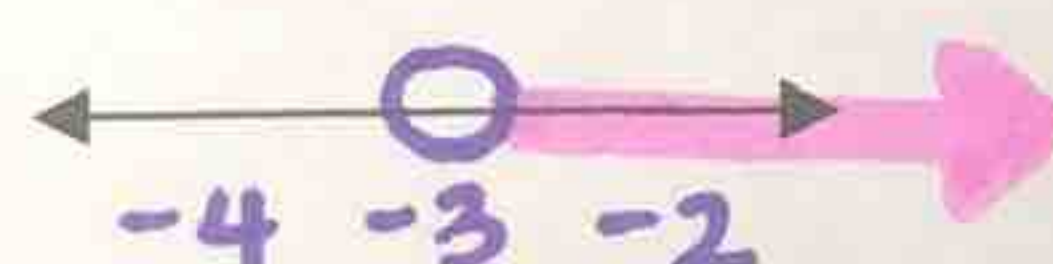
Ex 1: $\left(\frac{5}{1}\right) \frac{x}{5} \leq -3(5)$

$$x \leq -15$$



Ex 2: $\frac{6x}{6} > \frac{-18}{6}$

$$x > -3$$

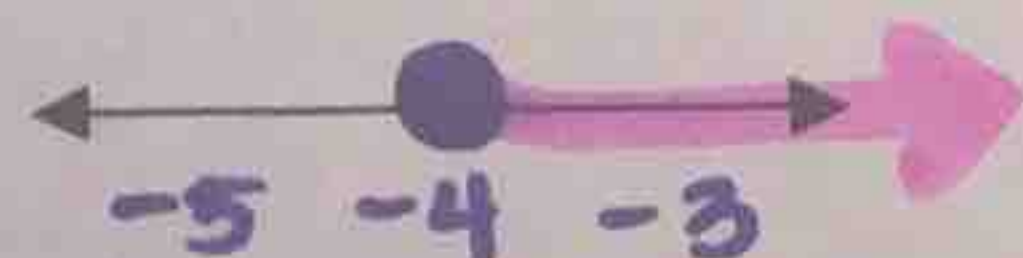


Ex 3: $-\frac{3}{2}n \leq 6 \div -\frac{3}{2}$

$$n \geq \frac{6}{1} \cdot -\frac{2}{3}$$

$$n \geq -4$$

negative
& MAD!



Ex 4: $\frac{-4.5}{-3} < \frac{-3z}{-3}$

$$1.5 > z$$

$$z < 1.5$$

negative
& MAD!

variable
needs to
come first!



Try These:

Solve and graph the inequalities.

(1) $n \div 3 < 1$

$n < 3$

(2) $4b \geq 2$

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

(3) $\frac{x}{-3} > -4$

$x < 12$

(4) $-5z < 35$

$z > -7$

(5) $-0.5 \leq \frac{m}{10}$

$m \geq -5$

(6) $12k \leq -24$

$k \leq -2$

(7) $0.5 \leq -\frac{y}{2}$

$y \leq -1$

(8) $-2a > -9$

$a < \frac{9}{2}$

$a < 4\frac{1}{2}$

(9) $-3 > \frac{2}{3}p$

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

$p < -4\frac{1}{2}$

(10) $-15 < 2.5q$

$q > -6$

(11) $-12 \geq \frac{6}{5}m$

$m \leq -10$

(12) $-1.5 > -3n$

$n > -0.5$

(13) $-\frac{2}{5}h \leq -8$

$h \geq 20$

(14) $-4.2 \geq -0.7w$

$w \geq 6$

(15) $-5.2 \geq -2w$

$w \geq 2.6$