

## Eye Opener

Solve each equation:

$$10 = v/2$$

$$\frac{\cdot 2 \quad \cdot 2}{20 = v}$$

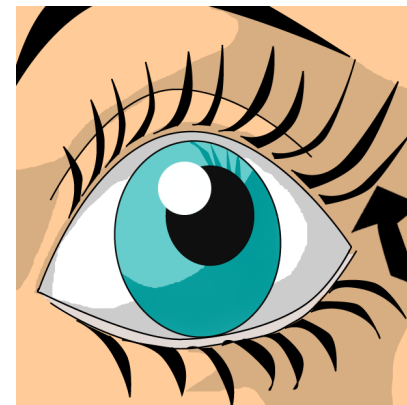
$$\frac{15 = -22y}{-22 \quad -22}$$

$$\frac{-15}{22} = y$$

$$\frac{3}{4}z = -18$$

$$\frac{32 = -24}{3 \quad 3}$$

$$z = -24$$



## Solving Inequalities Using Multiplication and Division

### Essential Understanding:

**You use the Multiplication and Division Properties of Inequality to solve inequalities in much the same way you used the Multiplication and Division Properties of Equality to solve equations.**



## The Multiplication & Division Properties of Inequality:

If  $a > b$  then  $ac > bc$

If  $a < b$  then  $ac < bc$

If  $a < b$  then  $a/c < b/c$

If  $a > b$  then  $a/c > b/c$



Do the multiplication and division properties of inequality apply for all Real Numbers  $a$ ,  $b$ , &  $c$  regardless of sign value?



Since  $6 > 3$  the multiplication property of inequality holds that  $6 * 1/4 > 3 * 1/4$  ?

Agree or disagree?

$$1.5 > .75$$

Since  $3 < 12$  the division property of inequality holds that  $3 / 3 < 12 / 3$

Agree or disagree?

$$1 < 4$$

Since  $-3 < 3$  the multiplication property of inequality holds that  $-3 * -3 < 3 * -3$

Agree or disagree?

$$9 \not< -9$$

Since  $15 < 25$  the division property of inequality holds that  $15 / (-5/3) < 25 / (-5/3)$

Agree or disagree?

$$15 \cdot \frac{-3}{5} < 25 \cdot \frac{-3}{5}$$

$$-9 \not< -15$$

**Inequalities Bill of Rights**

**Article I:** What you do to one side of an inequality you must do to the other

**Article II:** If you add or subtract a positive or negative number to/from both sides of the inequality you DO NOT REVERSE the inequality sign

$$\text{if } a > b \text{ then } a + c > b + c$$

$$\text{if } a < b \text{ then } a + c < b + c$$

$$\text{if } a > b \text{ then } a - c > b - c$$

$$\text{if } a < b \text{ then } a - c < b - c$$

**Article III:** If you multiply or divide both sides of an inequality by a positive number, you DO NOT REVERSE the inequality sign.

$$\text{if } a > b \text{ and } c > 0 \text{ then } ac > bc$$

$$\text{if } a < b \text{ and } c > 0 \text{ then } ac < bc$$

**Article IV:** **If you multiply or divide both sides of an inequality by a negative number, you MUST REVERSE the inequality sign**

$$\text{if } a > b \text{ and } c < 0 \text{ then } ac < bc$$

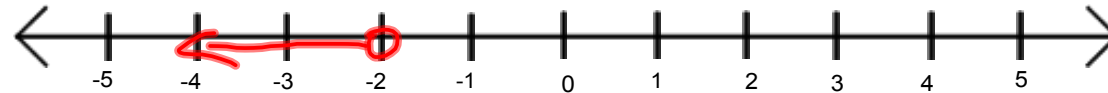
$$\text{if } a < b \text{ and } c < 0 \text{ then } ac > bc$$

Multiplying by a Positive Number

Remember the steps:

1. Distribute
2. Isolate
3. Divide both sides by coefficient
4. Check twice for correct endpoint and shaded region

Solve &amp; Graph:



a)  $x / 2 < -1$

$$\cancel{2} \frac{x}{\cancel{2}} < -1 \cdot 2$$

$$x < -2$$

$$\frac{-2}{2} \leq -1$$

$$-1 = -1$$

Dividing by a Positive Number

Remember the steps:

1. Distribute
2. Isolate
3. Divide both sides by coefficient
4. Check twice for correct endpoint and shaded region

Solve &amp; Graph:



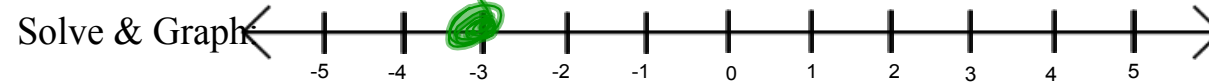
$$\begin{aligned} \text{b) } \frac{5z}{5} &\geq \frac{25}{5} \\ z &\geq 5 \end{aligned}$$

$$\begin{aligned} 6 \cdot 5 \\ 30 &\geq 25 \\ 5 \cdot 5 \\ 25 &= 25 \end{aligned}$$

Multiplying by a Negative Number (**remember to reverse inequality sign**)

Remember the steps:

1. Distribute
2. Isolate
3. Divide both sides by coefficient
4. Check twice for correct endpoint and shaded region



c)  $-\frac{2}{3}x \geq 2$

$-\frac{2}{3} \cdot -\frac{3}{2} \cdot \frac{3}{2} \quad \frac{1}{1} \cdot \frac{3}{2} = \frac{3}{2}$

$x \geq -3$

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

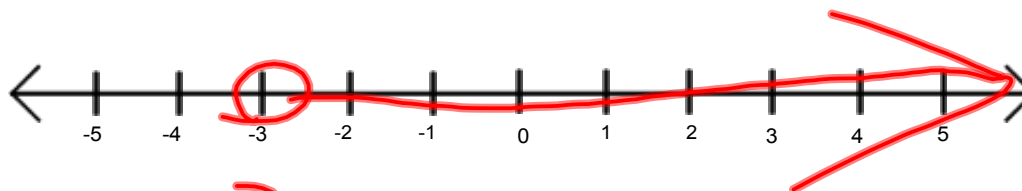
$-\frac{2}{3} \cdot \frac{9}{1} = 6 \quad \frac{-2}{3} \cdot \frac{3}{1} = 2 = 2$

Dividing by a Negative Number (**remember to reverse inequality sign**)

Remember the steps:

1. Distribute
2. Isolate
3. Divide both sides by coefficient
4. Check twice for correct endpoint and shaded region

Solve &amp; Graph:



d)  $.6 > -.2x$

$$.6 > -.2x$$

$$-3 < x$$

$$\begin{array}{r} 3. \\ 2 \overline{) .6} \\ \underline{6} \phantom{0} \\ 0 \end{array}$$

$$-3 \cdot -2 = 6$$

$$.6 = .6$$

Word Problems

$$\# \text{ Items} \cdot \$ \text{ per Item} = \text{Total Cost}$$

e) The student council votes to buy food for a local food bank. A case of 12 jars of spaghetti sauce costs \$13.75. What is the greatest number of cases of sauce the student council can buy if they can spend at most \$216 for this program?

Define variable:

$$x = \# \text{ cases } \$$$

Write inequality:

$$13.75x \leq 216$$

Solve inequality:

$$\frac{13.75x}{13.75} \leq \frac{216}{13.75}$$

Check answer for:

accuracy

~~reasonableness~~~~completeness~~

$$x \leq 15.7$$

15 cases

What was the significance of "12" in this problem?

What if the last sentence had read "What is the greatest number of jars of sauce the student council can buy if they can spend at most \$216 for this program?" How would that have changed this problem?

$$12 \cdot 15$$

More practice:

1.  $b/4 > 1/2$   $\cdot 4$   
 $\cdot 4$   $\frac{1}{2} \cdot 4 = \frac{4}{2} = 2$   
 $b > 2$

2.  $-k/5 > -1$   
 $- \cdot 5 \cdot 5$   $\frac{-k}{-5} > -1 \cdot 5$   
 $+k < -5$

3.  $-2x < -8$   
 $\cdot \frac{-1}{2} = -2$   $x > 4$   
 $-10 < -8 < -5 < -4$

4. Students in the school are selling calendars. They earn \$.40 on each calendar they sell. Their goal is to earn more than \$327. What is the minimum number of calendars they must sell?

$x = \# \text{ calendars}$   
 $\$$

$$.40x \geq 327$$

$$x \geq 817.50$$

$$818$$

$$d + 12$$
$$12 + d$$

product of 12 & sum of  
a number and 3

$$12(x + 3)$$