Example:

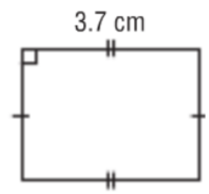
Seven percent of a number is 56.7.

a) Write, then solve an equation to determine the number.

b) Check the solution.

Example:

A rectangle has a length 3.7 cm and a perimeter 13.2 cm.



a) Write an equation that can be used to determine the width of the rectangle.

b) Solve the equation.

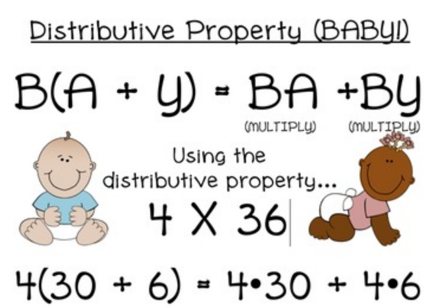
c) Verify the solution.

Solving Equations Involving the Distributive Property

$3.7 \times 2 = 7.4$

Example:

Solve each of the following equations using the distributive property.



a) $2(3.7 + x) = 13.2$

$7.4 + 2x = 13.2 - 7.4$

$\frac{2x}{2} = \frac{5.8}{2}$

$x = 2.9$

b) $\frac{6}{1.5} = \frac{1.5(x - 6)}{1.5}$

$4 = x - 6$

$4 + 6 = x$

$x = 10$

$10 = x$

c) $\frac{3(x - 5)}{3} = \frac{2}{3}$

$x - 5 = \frac{2}{3}$

$x = \frac{2}{3} + 5$

$x = \frac{2}{3} + \frac{5}{1}\left(\frac{3}{3}\right)$

$x = \frac{2}{3} + \frac{15}{3} = \frac{17}{3}$

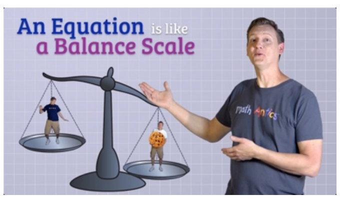
$x = 5.\overline{6}$

Section 6.2 – Solving Equations Using Balance Strategies

To solve an equation, we need to isolate the variable, which means get it by itself.

In the last section we used inverse operations. That method only works, however, when the variable occurs only once in the equation.

Another way to isolate the variable is to use a **balance strategy**.

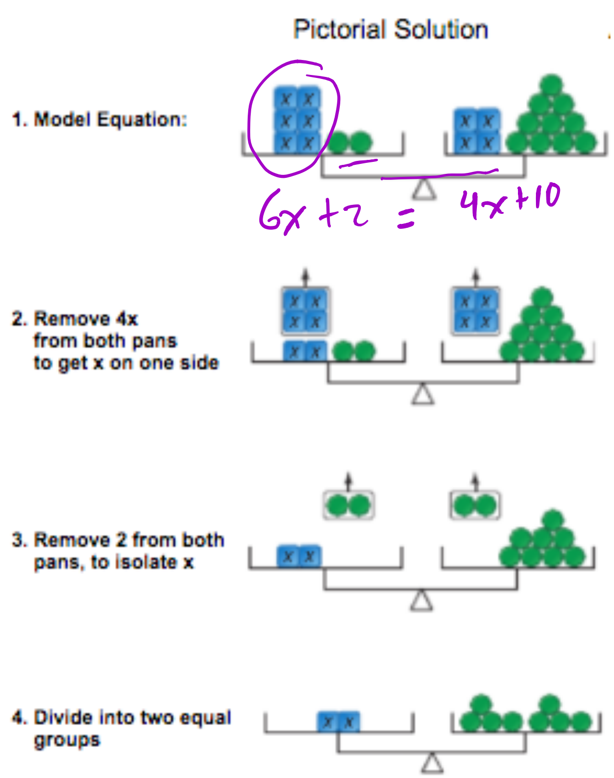


To keep the scale "balanced", **whatever we do to one side of the "scale"/equation, we must do to the other side**.

To solve, we need to get the variable on one side of the equal sign and the constant term on the other.

Modelling Equations with Variable on Both Sides

For example, let's look at the following equation: $6x + 2 = 10 + 4x$



you do

Algebraic Solution

$6x + 2 = 10 + 4x$

$6x - 4x = 10 - 2$

$\frac{\cancel{2}x}{\cancel{2}} = \frac{8}{2}$

$x = 4$

We cannot use a balance scale model when any term in the equation is negative.

Another strategy is to use **algebra tiles.**

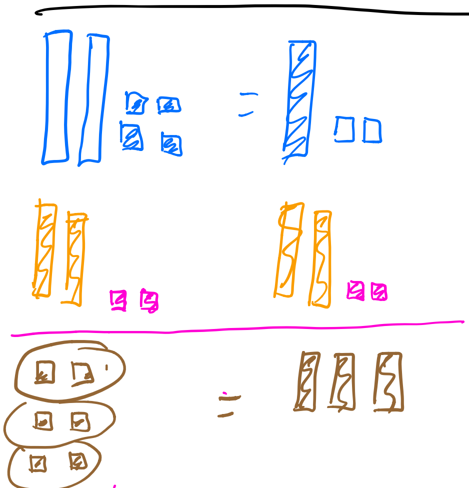
Solving Equations Using Algebra Tiles

To solve an equation using algebra tiles we must isolate the variable tiles and then identify zero pairs.

For example, let's look at the following equation: $-2x + 4 = x - 2$

Will review Wednesday

Algebra Tiles	Algebraically
LS = RS	$-2x+4=x-2$
	$4+2=1x+2x$
	$\frac{6}{3}=\frac{3x}{3}$
	$2=x$



LS RS

$-2x+4=x-2$

$+2x \qquad +2x$

$4=3x-2$

$+2 \qquad +2$

$6=3x$

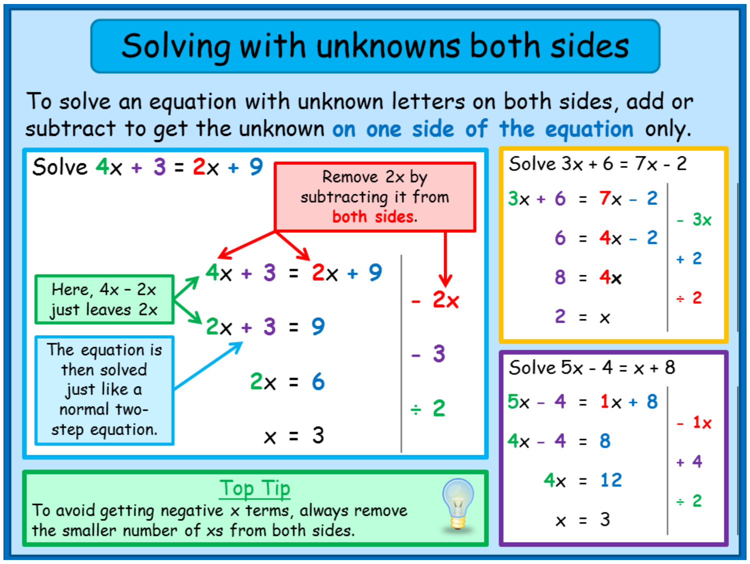
$2=x$

last step = grouping

Algebra tiles, however, is not an efficient method to use when equations involve large number or fractions and/or decimals.

We need to think algebraically!

Solving Equations with Variables on Both Sides



Example:

Solve each of the following algebraically.

***Remember that the goal is to get the variable on one side of the equation and the numbers on the other side of the equation!**

a) $7.4 + 4x = 2x + 13.2$

$4x - 2x = 13.2 - 7.4$

$\frac{\cancel{2}x}{\cancel{2}} = \frac{5.8}{2}$

$\boxed{x = 2.9}$

b) $4x + 7 = 21 - 3x$

$4x + 3 = 21 - 7$

$\frac{7x}{7} = \frac{14}{7}$

$\boxed{x = 2}$

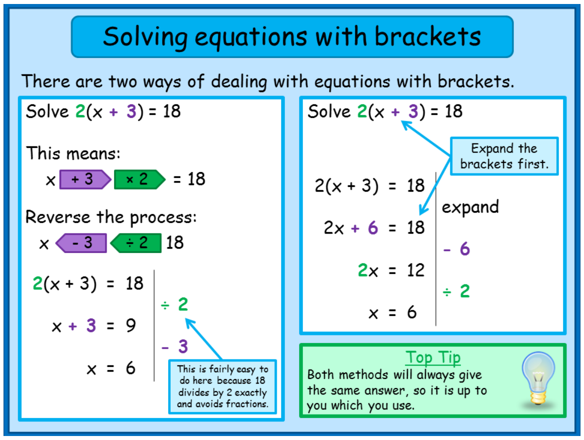
c) $3x + 3 = 5x - 5$

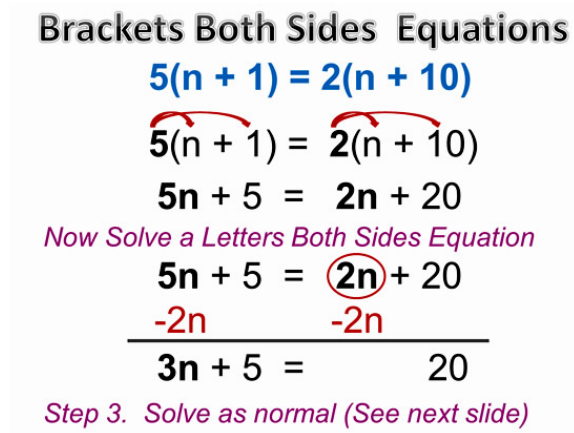
$3 + 5 = 5x - 3x$

$\frac{8}{2} = \frac{2x}{2}$

$\boxed{4 = x}$

Solving Equations with Brackets





Example:

Solve each of the following algebraically.

a) $1.5(x-6)=6$

$\frac{1.5(x-6)}{1.5} = \frac{6}{1.5}$

$x-6=4$

$x=6+4$

$\boxed{x=10}$

b) $3(x-5)=2$

$\frac{3(x-5)}{3} = \frac{2}{3}$

$x-5=\frac{2}{3}$

$x = \frac{2}{3}+5$

$\boxed{x=5\frac{2}{3}}$

c) $4(x-5)=-2(x-2)$

$4x-20=-2x+4$

$\frac{6x}{6} = \frac{24}{6}$

$\boxed{x=4}$ ✓

d) $3(x+1)=5(x-1)$

$3x+3=5x-5$

$\frac{8}{2}=\frac{2x}{2}$

$\boxed{x=4}$

Example:

Two different taxi companies charge the following:

Company A: \$3.00 plus \$0.20 per km ~ $3 + 0.2k$
Company B: \$2.50 plus \$0.25 per km ~ $2.5 + 0.25k$

At what distance will the cost be the same?

a) Model the problem with an equation.

$0.2k + 3 = 0.25k + 2.5$

b) Solve the problem.

$0.2k + 3 = 0.25k + 2.5$
$3 - 2.5 = 0.25k - 0.2k$
$\frac{0.5}{0.05} = \frac{0.05k}{0.05}$
$\rightarrow k = 10$

c) Verify the solution. – you do

$0.2(10) + 3 \stackrel{?}{=} 0.25(10) + 2.5$
$2 + 3 \stackrel{?}{=} 2.5 + 2.5$
$5 = 5$ ✓

Solving Equations with Fractions

The easiest way to solve equations which contain fractions is to **eliminate the denominators**. If we can get rid of all the fractions, the equation will be easier to solve.

We do this by multiplying each term by the whole number you choose. This whole number **must be a common denominator** for all the fractions in the equation.

Solving a Linear Equation Involving Fractions

- Solve the equation:

$$\frac{x}{5} - \frac{1}{2} = \frac{x}{6}$$
$$30\left(\frac{x}{5} - \frac{1}{2}\right) = 30 \cdot \frac{x}{6}$$
$$30 \cdot \frac{x}{5} - 30 \cdot \frac{1}{2} = 30 \cdot \frac{x}{6}$$
$$6x - 15 = 5x$$
$$6x - 5x - 15 = 5x - 5x$$
$$x - 15 = 0$$
$$x - 15 + 15 = 0 + 15$$
$$x = 15$$

- Multiply both sides by the least common denominator 30.
- Be sure to multiply all terms by 30.
- Divide out common factors.
- Subtract 5x to get the x-terms on the left.
- Simplify.

Example:

cover tomorrow

Solve each of the following using algebra.

a) $\frac{x}{9} = \frac{3}{1}$

$x \cdot 1 = 3 \cdot 9$

$x = 27$

b) $\frac{2x}{3} = \frac{4x}{5} + 7$

LCD = 15

$15\left(\frac{2x}{3}\right) = 15\left(\frac{4x}{5} + 7\right)$

$\frac{30x}{3} = \frac{60x}{5} + 105$

$10x = 12x + 105$

$-105 = 2x$

$\frac{2x}{2} = \frac{-105}{2}$

$x = -52.5$

c) $\frac{x}{4} + \frac{1}{5} = \frac{1}{2}$

LCD = 20

$20\left(\frac{x}{4} + \frac{1}{5}\right) = \frac{1}{2}(20)$

$\frac{20x}{4} + \frac{20}{5} = \frac{20}{2}$

$5x + 4 = 10$

$\frac{5x}{5} = \frac{6}{5}$

$x = \frac{6}{5}$

$x = 1\frac{1}{5}$

$x = 1.2$

d) $\frac{1}{2}(x-1) = \frac{2}{3}(1-x)$

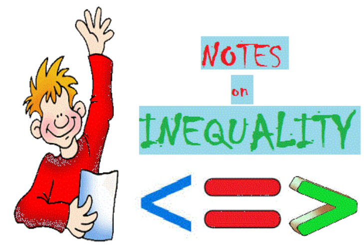
LCD = 6

$\frac{x-1}{2} = \frac{2(1-x)}{3}$

e) $\frac{(2x-3)}{2} = \frac{(-x-1)}{4}$

cross multiply

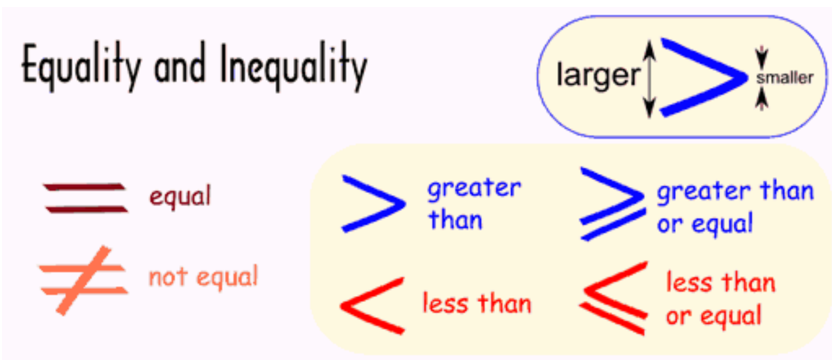
Section 6.3 – Introduction to Linear Inequalities



What are inequalities?

We use inequalities to model a situation that can be described by a range of numbers instead of a single number.

We use specific symbols:



We can use inequalities to represent many real world situations.

For example, which inequality describes the time, t, for which a car could be legally parked?

1) $t > 30$

2) $t \geq 30$

3) $t < 30$

4) $t \leq 30$

you can park for 30 mins
30 is included
∴ 4)

Example:

Define a variable and write an inequality for each situation.

a)

$s \leq 55$

b)

$h \geq 102$

c)

$t < 4$

d)

$a \geq 18$

Writing an Inequality to Describe a Situation

Inequalities –

What do they mean in words?

1 $x <$
- Less than or smaller than
- Fewer than

2 $x \leq$
- Less than or equal to
- No more than
- At most
- A maximum of

3 $x >$
- Greater than or bigger than
- More than

4 $x \geq$
- Greater than or equal to
- No less than
- At least
- A minimum of

Example:

Define a variable and write an inequality to describe each of the following situations.

a) Contest entrants must be at least 18 years old.

$C \geq 18$

b) The temperature has been below −5°C for the last week.

$T < -5$

c) You must have 7 items or less to use the express checkout line at the grocery store.

$i \leq 7$

d) Scientists have identified over 400 species of dinosaurs.

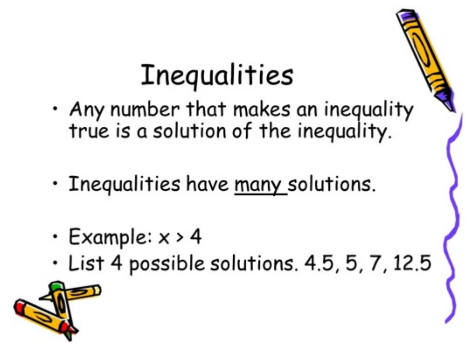
$S > 400$

Determining Whether a Number is a Solution of an Inequality

A **linear equation** is true for only **one** value of the variable.

A **linear inequality** may be true for **many** values of the variable.

The solution of an inequality is any value of the variable that makes the inequality true.



Example:

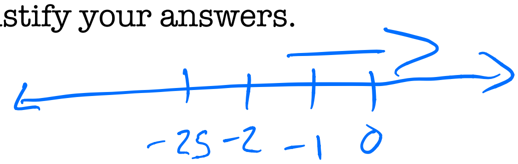
Determine which numbers are a solution of the following inequality.

$$b \geq 3$$

3, 3.01 . . . .

Example:

Is each number a solution to the inequality $x > -2$? Justify your answers.



a) $\cancel{-8}$

b) $\cancel{-2}$

c) 0 ✓ 0 is greater than -2

d) 2 ✓ 2 is greater than -2

e) $\cancel{-2.5}$

f) $\cancel{-3.5}$