# Solving Linear Equations

## of one variable

Solve for $x$: $\qquad 2x - 1 = 5$

The strategy for solving these equations is  . . .

. . . **isolating the variable**.

$$2x - 1 = 5$$
$$+\,1 \qquad +\,1$$
$$2x = 6$$
$$\frac{2x}{2} = \frac{6}{2}$$
$$x = 3$$

We can add or subtract the same number to both sides.

We can multiply or divide the same number to both sides.

Solve:

$$2x - 5 = 8x - 4$$

Here we need to get the variable to one side first . . .

$$2x - 5 = 8x - 4$$
$$\phantom{2x - 5 =} \text{-8}x \quad\quad \text{-8}x$$

Then proceed as before:

$$-6x - 5 = -4$$
$$\phantom{-6x - } +5 \quad\quad +5$$
$$\frac{-6x}{-6} = \frac{1}{-6}$$
$$x = -\frac{1}{6}$$

Some equations require doing some simplification first:

$$5(x - 2) - 4(6 - 2x) = 4 - (3 - 6x)$$

We use the distributive law to break down the parenthesis:

$$5(x - 2) - 4(6 - 2x) = 4 - (3 - 6x)$$

the minus
sign goes with
the 4

$$5x - 10 - 24 + 8x = 4 - 3 + 6x$$

Then combine like terms:

$$5x - 10 - 24 + 8x = 4 - 3 + 6x$$

$$13x - 34 = 1 + 6x$$

And now **solve:**

$$13x - 34 = 1 + 6x$$
$$- 6x \qquad - 6x$$

$$7x - 34 = 1$$
$$+ 34 \quad + 34$$

$$7x = 35$$

$$x = 5$$

What if there are fractions involved?

$$\frac{1}{3}(x - 4) + \frac{2}{5}(3x + 7) = \frac{17}{3}$$

Equations are much easier to solve when there are NO fractions!

Fortunately, you can **multiply to both sides** of equations.

You should multiply to ***cancel the denominators***.

## The LCD of the fractions will do this!

$$\frac{1}{3}(x - 4) + \frac{2}{5}(3x + 7) = \frac{17}{3}$$

The LCD of these fractions is . . . **15**.

Multiply both sides by this LCD:

$$15\left(\frac{1}{3}(x - 4) + \frac{2}{5}(3x + 7)\right) = 15(\frac{17}{3})$$

You can skip the above step and go directly to the distribution:

$$15\left(\frac{1}{3}(x - 4)\right) + 15\left(\frac{2}{5}(3x + 7)\right) = 15(\frac{17}{3})$$

Now cancel the denominators:

$$\frac{5}{\cancel{15}}\left(\frac{1}{\cancel{3}}(x-4)\right) + \frac{3}{\cancel{15}}\left(\frac{2}{\cancel{5}}(3x+7)\right) = \frac{5}{\cancel{15}}(\frac{17}{\cancel{3}})$$

$$5(x-4) + 6(3x+7) = 5(17)$$

Now distribute to break down the parentheses:

$$5(x-4) + 6(3x+7) = 5(17)$$

$$5x - 20 + 18x + 42 = 85$$

And now solve by isolating $x$:

$$23x + 22 = 85$$

$$23x = 63$$

$$x = \frac{63}{23}$$