These are the basic skills we need to solve equations.

Elementary algebra
Class notes
Solving Equations: Review of the Addition and Multiplication Properties (section 3.2)

Equations versus Expressions:

How do equations and expressions differ? Write an example of each and point out the main difference.

Their purposes are quite different. Knowing which you are dealing with helps you know what to do.

What does it mean to solve an equation?

Definition: Linear Equation: an equation that *could be written* in the form $ax + b = c$ where a, b, and c are real numbers (a is said to be non-zero) and x is the variable.

only x terms; no x^2, x^3, etc terms

equal sign

expls: $5x + 3 = 0$ $\quad 4x = 1$ $\quad \frac{1}{2}x - 3 = 1$

$3x + 4x - 5 = 17 + 2x$ $\quad x = -9$

counterexpls: $\sqrt{4x+6} = 3$ $\quad 4x^2 = 1$ $\quad 7x + 5$

We will be *solving* these equations. How is that different from simplifying expressions?

We will change the equation to equivalent equations, step by step, until we get the variable isolated by itself on one side of the equation.

Addition Property of Equality:

If a, b, and c are real numbers, then $a = b$ and $a + c = b + c$ are equivalent equations.

You can add (or subtract) a number to both sides of an equation and the sides are still equal.

expl 1: Solve the following equation. Show the work explicitly to show how the addition property works. Check your answer.

$y - 11 = 3$

Notice how adding 11 to the left side gets rid of the "minus 11" and leaves the y alone.

Multiplication Property of Equality:

If a, b, and c are real numbers, then $a = b$ and $a \cdot c = b \cdot c$ are equivalent equations.

You can multiply a number on both sides of an equation and the sides are still equal.

Also works for division by any *non-zero* number.

If $a = b$, then $\frac{a}{c} = \frac{b}{c}$.

expl 2: Solve the following equation. Show the work explicitly to show how the multiplication property works. Check your answer.

$-6x = 42$

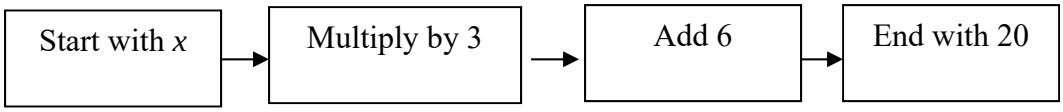
You can think of multiplying by $\frac{-1}{6}$ **or** dividing by -6.

Notice how dividing by -6 on the left side gets rid of the "-6 times" and leaves the x alone.

Worksheet: Solving Linear Equations:

This worksheet helps you understand why we perform the steps we do to solve an equation. It involves looking at an equation and thinking about what happened to the variable to get it into the equation (called a verbal model), and then simply undoing those steps. We concentrate on equations with one instance of the variable, but what we learn can be applied to more complicated equations. Solutions are also available.

For instance, let's say we want to solve the equation $3x + 6 = 20$. The verbal model that describes this equation is below.



So if we undo these operations (in reverse order) we should be able to uncover the x. Remember we'll do these reverse operations to both sides of the equation. While we uncover the x on the left side, the solution will form on the right.

Again and again, we will use these properties to solve equations. The most important thing to keep in mind is that if you do something to one side of an equation, you must do that same thing to the other side.

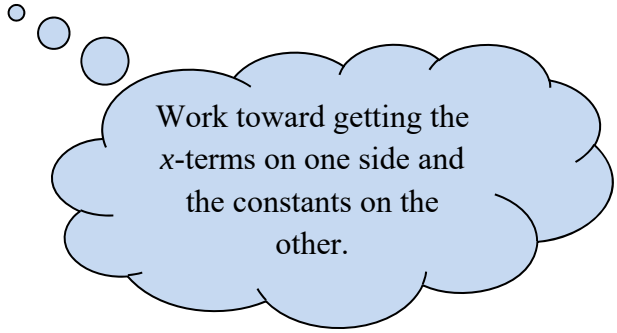
expl 3: Solve the following equation. Check your answer.

$3x + 5 = 20$

What do we do when there is more than one instance of the variable?

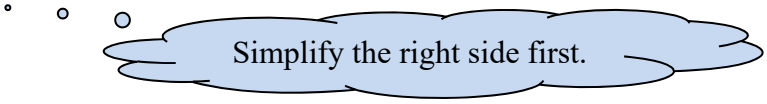
expl 4: Solve the following equation. Show the work explicitly to show how the addition and multiplication properties are used. Check your answer.

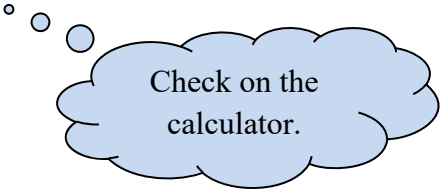
$7x + 7.3 = 9x$



expl 5: Solve the following equation. Show the work explicitly to show how the addition and multiplication properties are used. Check your answer.

$27 = 4(3y + 2) - 4y + 3$





expl 6: Solve the following equation. Show the work explicitly to show how the addition and multiplication properties are used. Check your answer.

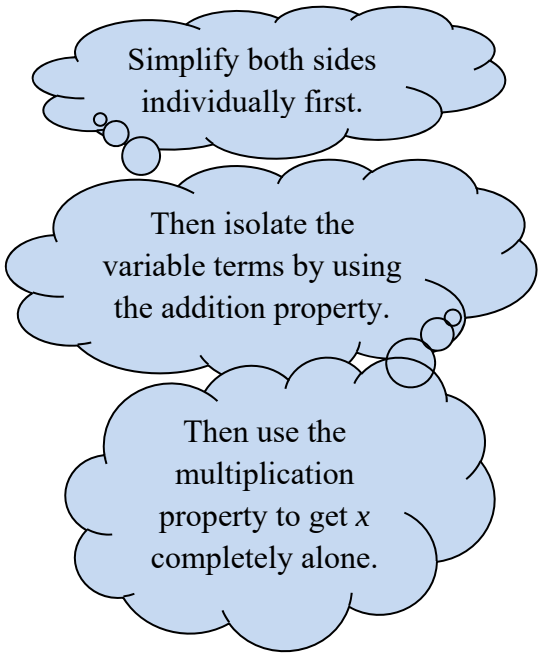
$\frac{2}{3}r = -6$

expl 7: Solve the following equation. Show the work explicitly to show how the addition and multiplication properties are used. Check your answer.

$\frac{p}{4} = -5$

expl 8: Solve the following equation. Show the work explicitly to show how the addition and multiplication properties are used. Check your answer.

$5x - 4 + 3x = 2x + 5 + 2x$



Using Variables:

expl 9: Write the following phrase as an algebraic expression. Simplify if possible.

subtract 2x + 3 from 5x – 9

expl 10: Convert the phrase to algebra and simplify if possible. Let x represent the unknown number.

a.) *nine added to triple a number*

b.) *the difference of 5 and a number, added to twice the number*

c.) *the quotient of a number and 6, increased by 8*