Physics: Developmental Module
Solving Algebraic Expressions

In physics you often have to rearrange an equation to solve for a variable.

Example 1 – Linear Equations

Solve this equation for t: $v = v_i + at$

The first step is to subtract v_i from each side

$v - v_i = at$

then divide each side by a

$\dfrac{v - v_i}{a} = t$

You must always keep order of operations in mind when solving algebraic expressions.

Example 2 – Quadratic Equations

Solve this equation for t: $y = v_i t + \dfrac{1}{2} at^2$

You probably remember that quadratics can be solved in multiple ways: (1) factoring, (2) using the quadratic formula, and (3) plotting the equation using a graphing calculator and finding the zeros. The method that will be the easiest depends on the coefficients of t and t^2 and the value of y.

Case 1 – when y = 0

For this case the equation is factorable, for example $0 = v_i t + \dfrac{1}{2} at^2$

Can be factored into $0 = (v_i + \dfrac{1}{2} at)t$, so the two solutions are found be setting each factor equal to zero.

Case 2 – when $v_i = 0$

For this case you can just use simple algebra to solve for t. $y = \dfrac{1}{2} at^2$

Case 3 – If none of the coefficients are zero. In this course, you will not see this case. If you did, you would have to use one of the three methods described above.

Example 3 – Expressions with added fractions

You may have to solve an equation like this one: $\dfrac{1}{f} = \dfrac{1}{d_o} + \dfrac{1}{d_i}$

What if you are told that $d_o = 5$ cm, and $f = 10$ cm, and asked to find d_i?

$$\frac{1}{10} = \frac{1}{5} + \frac{1}{d_i}$$

There are a couple of ways you can solve this.
1. You can find a common denominator and solve it by hand.
2. You can use the x^{-1} button on your calculator

Let's look at both ways.

The common denominator is 10, so we can rewrite as:

$$\frac{1}{10} = \frac{2}{10} + \frac{1}{d_i}$$

subtract 2/10 from each side

$$\frac{1}{10} - \frac{2}{10} = \frac{1}{d_i}$$

$$\frac{-1}{10} = \frac{1}{d_i}$$

$d_i = -10 \ cm$

This can be entered in the calculator as:

Enter the number 10, then push the x^{-1} button.
Push the subtract button.
Enter the number 2, then push the x^{-1} button.
Push the equals sign to get the answer.
This answer is $1/d_i$
Press the x^{-1} button again to find d_i