Physics 174 22 January, 2007
Problem Solving with Algebra

Many students are a little uncomfortable with mathematics. Despite this fact, we will have to use mathematics in this class from time to time. Some students might find this little handout helpful.

Algebra is a method of solving equations for some quantity. For example, how would you solve the following equation for y?

$$x = 3y^2 + 2b$$

The trick is to just remember that if you do the same things to both sides of an equality, it is still an equality. You can:

- add or subtract
- multiply or divide
- take the square or square root (or cube, or fourth power ...)
- exponentiate or take the logarithm

To solve the equation above, I must first subtract 2b from both sides of the equation:

$$x - 2b = 3y^2$$

I can then divide by 3:

$$y^2 = (x-2b)/3$$

Finally, if I take the square root of both sides, I am left with

$$|y| = [(x-2b)/3]^{1/2}$$

To solve a physics or astronomy problem, it is usually necessary to set it up first.

For example: A barrel contains 40 gallons of water, but it has a leak; it loses 5 gallons every hour. How long will it be before the barrel is empty?

You can just look and see the answer is 40/5 = 8 hours. But let's take a closer look and see how we got this.

First, let's define some variables.

G = the total number of gallons of water G = 40
L = the leakage rate (in gallons per hour) L = 5
T = the time it takes to lose all the water (in hours)

Clearly,

$$G = LT.$$

If this seems a little hasty, look at the units. On the left, we have gallons. On the right, we have (gallons/hour) × hours = gallons.