Using and solving formulas

Why do we need to be able to do this?

A formula is an equation that expresses the relationship between quantities. For example, a formula might tell you how to convert between degrees Fahrenheit and degrees Celcius, or between British pounds and Canadian dollars, or it might tell you how to find the volume of a cone. Formulas appear often in math and science classes, as well as in real life. You need to know how to use them

What should you be able to do?

Understand the meanings of the letters in the formula. Formulas often have several letters in them. Some of the letters might stand for constants, others for variables. You need to know what all the letters stand for in order to use the formula. The letters are usually identified when the formula is introduced, but they may not be repeated. Pay attention to the units – they can help you keep track of the quantities, too.

Use a formula to compute a quantity. The point of formulas is to be able to compute quantities from related quantities. The process is simple enough – plug in known numbers for those letters and do some algebra.

Example. The formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$, where r is the radius of the sphere. So the volume of a sphere that is 3 inches in diameter (pay attention, now) is $V = \frac{4}{3}\pi (1.5)^3 = 4.5\pi$ cubic inches. In this formula, π is a letter standing for a constant, about 3.14. It is common to leave π in the answer rather than using a decimal approximation.

Solve a formula for one of the variables. Formulas express a relationship between quantities. But which quantity you're interested in might change from situation to situation. It's often helpful to solve a formula for one of the variables – this gives you a new formula that expresses the same relationship but with a different focus.

Example. The formula for the velocity of a dropped object is $v = gt$, where v stands for velocity (in distance per time units), g is the gravitational constant, and t stands for time elapsed since we dropped the object. This formula expresses the relationship between the time since we dropped it and how fast the object is going. Suppose we are interested in a formula that will tell us how long it takes for a dropped object to reach a certain velocity? Then we can solve this same formula for t: $t = \frac{v}{g}$. The letters still mean all the same things, but now we can use it to find out how long it will take for our object to reach a certain speed. (In order for these formulas to work, our object needs to be falling in a vacuum. If we factor in air resistance, we get more complicated formulas.)