Question: What's the difference between linear and nonlinear equations?

A linear equation is an algebraic equation in which each term is either a constant or the product of a constant and (the first power of) a single variable. Linear equations can have one or more variables. A common form of a linear equation in the two variables x and y is $y = ax + b$, where a and b are constants.

Since terms of linear equations cannot contain products of distinct or equal variables, nor any power (other than 1) or other function of a variable, equations involving terms such $xy, \cos(x), x^2, x^{\frac{1}{3}}$ are nonlinear.

Linear statements look like lines when they are graphed and have a constant slope. Nonlinear equations appear curved when graphed and do not have a constant slope. Several methods exist for determining whether an equation is linear or nonlinear, including graphing, solving an equation and making a table of values.

Using a Graph

1. Plot the equation as a graph if you have not been given a graph.
2. Determine whether the line is straight or curved.
3. If the line is straight, the equation is linear. If it is curved, it is a nonlinear equation.

Using an Equation

1. Simplify the equation as closely as possible to the form of y = ax + b.
2. Check to see if your equation has exponents. If it has exponents, it is nonlinear.
3. If your equation has no exponents, it is linear.
4. Graph the equation to check your work. If the line is curved, it is nonlinear. If it is straight, it is linear.

Using a Table

1. Make a table of sample x values and solve for the resulting y values. Choose x values that are a constant numerical distance from each other. For example, put x values of -4, -2, 2 and 4 into the equation and solve for y for each value.
2. Calculate the differences between the y values.
3. If the differences are constant, or the same value, the equation is linear and has a constant slope. If the differences are not the same, the equation is not linear.