AP Calculus 30L Mr. Maxwell Name: ____________________

9.1/ 9.2 Differential equations

(First order - containing first derivative in equation)

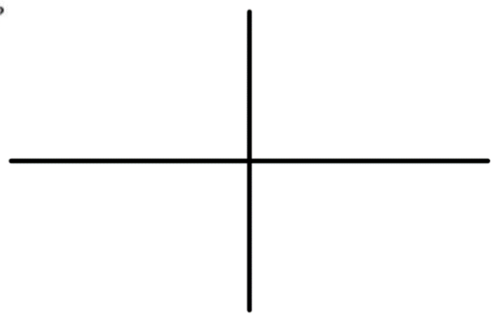
What is a differential equation?

Many of the general laws of nature find their most useful form in equations that involve rates of change. These equations are called **differential equations** because they contain functions and their differential quotients. Some examples of differential equations are:

$$\frac{dy}{dx} = 2x \quad ①$$

$$\frac{dv}{dt} = -9.8 \quad ②$$

$$P' = 3P \quad ③$$



General antiderivatives (indefinite integrals) have +C because the constant is unknown without some initial conditions that are known. Particular antiderivatives can be known with initial conditions present

*We can solve a differential equation (means to find f(x) given f'(x)) when given a set of initial conditions). This will give us the 'particular solution' not just a general one. General = +C, particular gives the actual value for C

9.2 DIFFERENTIAL EQUATIONS WITH INITIAL CONDITIONS

$\frac{ds}{dt} = f'(t) = S'$

In the applications of differential equations in this chapter, we often deal with time-dependent processes where information is available at specific instants, usually the initial instant, $t = 0$.

Example 1 Solve $\frac{ds}{dt} = 2t$, with the initial condition: $s = 3$ when $t = 0$.

"Solve" means to find f(x) given f'(x) in an equation.

Steps:

1. Integrate both sides
2. Insert initial conditions.
3. Solve for C
4. Rewrite complete particular antiderivative function

Eg 2:

Eg 3:

Stewart Text Asn't: ____

Finney Text Asn't: ____