Math 1210 #23
Differential Equations

A **differential equation** is an equation that contains a derivative. We will need to integrate both sides, at some point, to 'undo' the derivative.

EX 1

Find the equation of the curve that goes through the point $(2, -4)$ and whose slope at any point on the curve is $3x$.

EX 2

$\frac{dy}{dx} = \sqrt{\frac{x}{y}}$ $y = 4$ when $x = 1$

EX 3

$\frac{dy}{dx} = -y^2(x^2 + 2)^4 X$ through (0,1)

EX 4

The acceleration of an object moving along a coordinate line is $a(t) = 18(t-3)^{-3}$ in meters per second per second.

4a)

If the velocity at $t = 0$ is 4 meters per second, find the velocity 2 seconds later.

4b)

If the initial position is -3 m , find an equation for the position of the object at time, t.

Example:

$$\frac{dy}{dx} = \frac{x^2}{y}$$

Solution:

$$\begin{aligned} ydy &= x^2 dx \\ \int ydy &= \int x^2 dx \\ \frac{1}{2}y^2 &= \frac{1}{3}x^3 + C \\ y^2 &= \frac{2}{3}x^3 + C \\ y &= \pm\sqrt{\frac{2}{3}x^3 + C} \end{aligned}$$