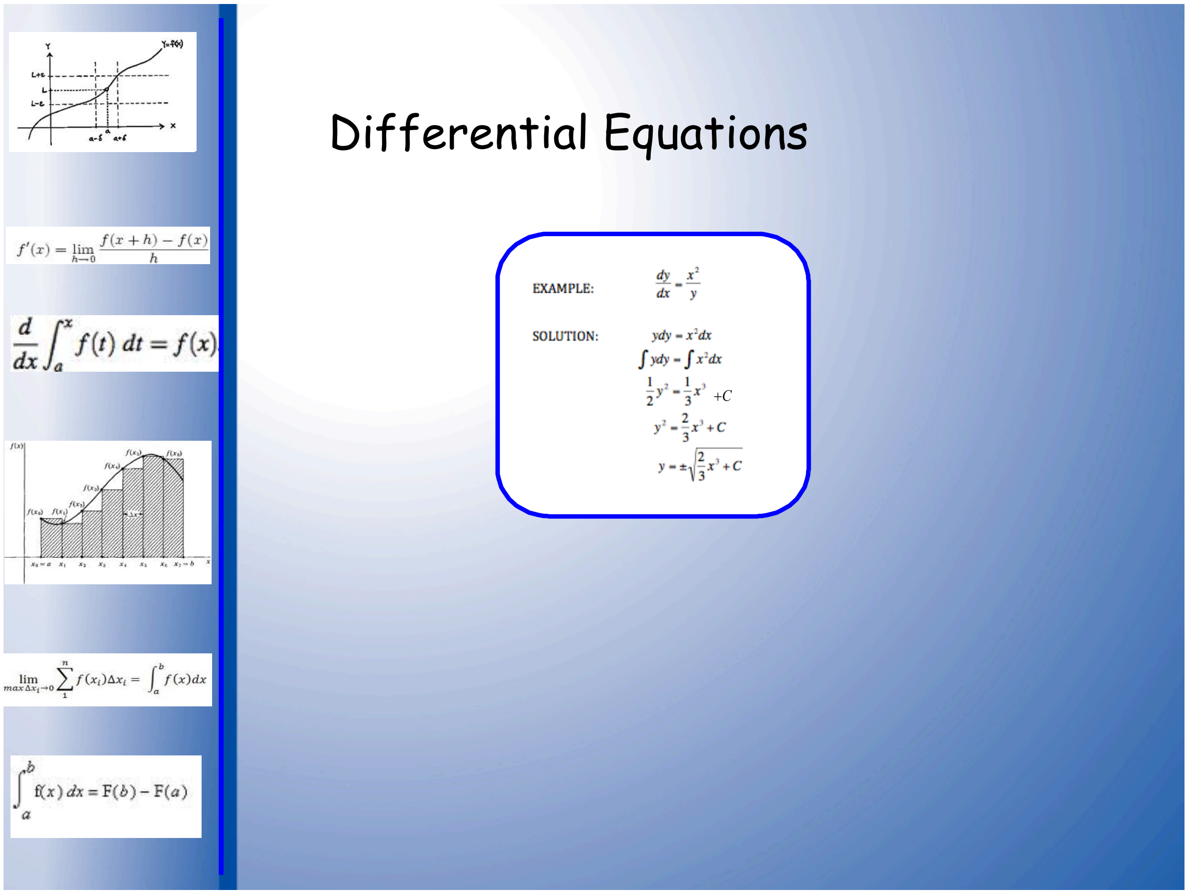
23 Differential Equations



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 $\frac{dy}{dx}=-y^2\left(x^2+2\right)^4 X$ *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.

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

b) 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:

$$y\,dy = x^2\,dx$$
$$\int y\,dy = \int x^2\,dx$$
$$\frac{1}{2}y^2 = \frac{1}{3}x^3 + C$$
$$y^2 = \frac{2}{3}x^3 + C$$
$$y = \pm\sqrt{\frac{2}{3}x^3 + C}$$