Given:

$xy^2 + 3x = 2y - 3$

Find:

$\frac{dy}{dx}$

$\frac{d}{dx}[xy^2] + \frac{d}{dx}[3x] = \frac{d}{dx}[2y] - \frac{d}{dx}[3]$

$\underbrace{x \cdot \frac{d}{dx}[y^2] + y^2 \frac{d}{dx}[x]}_{} + 3 = 2\frac{dy}{dx}$

Product Rule

$x \cdot 2y \cdot \frac{dy}{dx} + y^2(1) + 3 = 2\frac{dy}{dx}$

$2xy\frac{dy}{dx} - 2\frac{dy}{dx} = -3 - y^2$

$\frac{dy}{dx}[2xy - 2] = -3 - y^2$

$\frac{dy}{dx} = \frac{-3-y^2}{2xy-2} = \frac{y^2+3}{2-2xy}$

Given:

$\sin(x+y) = e^x$

Find:

$\frac{dy}{dx}$

$\frac{d}{dx}[\sin(x+y)] = \frac{d}{dx}[e^x]$

$\cos(x+y) \cdot \frac{d}{dx}[x+y] = e^x$

$\cos(x+y)[1 + \frac{dy}{dx}] = e^x$

$\cos(x+y) + \cos(x+y)\frac{dy}{dx} = e^x$

$\cos(x+y)\frac{dy}{dx} = e^x - \cos(x+y)$

$\frac{dy}{dx} = \frac{e^x - \cos(x+y)}{\cos(x+y)} = \frac{e^x}{\cos(x+y)} - 1$

Remember

$\frac{d}{dx}[\sin(AT)]$
$= \cos(AT) \cdot \frac{d}{dx}[AT]$

$\frac{d}{dx}[e^{AT}]$
$= e^{AT} \cdot \frac{d}{dx}[AT]$