Derivative Review Sheet

Formula:	Example:
$\frac{d}{dx}(c)=0$	$\frac{d}{dx}(5)=0$
$\frac{d}{dx}(x^n)=nx^{n-1}$	$\frac{d}{dx}(x^3)=3x^{3-1}=3x^2$
$\frac{d}{dx}[k\cdot f(x)]=k\cdot f'(x)$	$\frac{d}{dx}(2x^2)=2(2x^{2-1})=4x$
$\frac{d}{dx}[f(x)\pm g(x)]=f'(x)\pm g'(x)$	$\frac{d}{dx}(x^2+2x) = \frac{d}{dx}x^2+\frac{d}{dx}2x$ $= 2x+2$
$\frac{d}{dx}[f(x)\cdot g(x)]=f(x)\cdot g'(x)+g(x)f'(x)$	$\frac{d}{dx}(x^2\cdot\ln x) = x^2\left(\frac{1}{x}\right)+2x\cdot\ln x$ $= x+2x\cdot\ln x$
$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]=\frac{g(x)f'(x)-f(x)g'(x)}{[g(x)]^2}$	$\frac{d}{dx}\left(\frac{3x+5}{x^2}\right) = \frac{x^2(3)-(3x+5)(2x)}{(x^2)^2}$ $= \frac{3x^2-6x^2-10x}{x^4}$ $= \frac{-3x^2-10x}{x^4}=\frac{-3x-10}{x^3}$
$*\frac{d}{dx}\left[\frac{1}{g(x)}\right]=\frac{-g'(x)}{[g(x)]^2}$	$\frac{d}{dx}\left[\frac{1}{2x+3}\right]=\frac{-2}{(2x+3)^2}$ or using the quotient rule above: $\frac{d}{dx}\left[\frac{1}{2x+3}\right] = \frac{(2x+3)(0)-1(2)}{(2x+3)^2}$ $= \frac{-2}{(2x+3)^2}$
$\frac{d}{dx}(\ln x)=\frac{1}{x}$	
$\frac{d}{dx}a^x=(\ln a)a^x$	$\frac{d}{dx}2^x=(\ln 2)\cdot 2^x$
$*\frac{d}{dx}e^x=e^x$	

*denotes a special case of the preceding rule

‘ denotes the first derivative of the function, or $f'(x)=\frac{d}{dx}f(x)$

General Power Rule: $\frac{d}{dx}[u(x)]^n = n[u(x)]^{n-1} \cdot u'(x)$	1. $\frac{d}{dx}(3x^2+1)^5 = 5(3x^2+1)^4(6x)$ $= 30x(3x^2+1)^4$ 2. $\frac{d}{dx}(x^2+2x+1)^2 = 2(x^2+2x+1)\cdot(2x+2)$ $= (4x+4)(x^2+2x+1)$ $= 4x^3+12x^2+12x+4$
Chain Rule: $\frac{d}{dx} f[g(x)] = f'[g(x)] \cdot g'(x)$	1. $\frac{d}{dx} e^{2x^3+5} = e^{2x^3+5}(6x^2)$ $= 6x^2 e^{2x^3+5}$ 2. $\frac{d}{dx}\ln(x^2-4x+2) = \frac{1}{x^2-4x+2}\cdot(2x-4)$ $= \frac{2x-4}{x^2-4x+2}$

Finding Derivatives Implicitly

Solve for $\frac{dy}{dx}$: $3x^2+y-2 = 0$ $6x+\frac{dy}{dx}-0 = 0$ $6x+\frac{dy}{dx} = 0$ $\frac{dy}{dx} = -6x$	Solve for $\frac{dy}{dx}$: $x^2y-y^2 = 5x$ $\left[x^2\left(\frac{dy}{dx}\right)+y(2x)\right]-2y\left(\frac{dy}{dx}\right) = 5$ $x^2\left(\frac{dy}{dx}\right)-2y\left(\frac{dy}{dx}\right) = 5-2xy$ $\left(\frac{dy}{dx}\right)(x^2-2y) = 5-2xy$ $\left(\frac{dy}{dx}\right) = \frac{5-2xy}{(x^2-2y)}$