XRONOS HW12 #4:

$$\frac{d}{dx}\left(\frac{-2\cos(x)}{\ln(x)}\right)$$ *QUOTIENT RULE

$$= \frac{\left[\frac{d}{dx}(-2\cos(x))\right]\ln(x) - (-2\cos(x))\left[\frac{d}{dx}(\ln(x))\right]}{(\ln(x))^2}$$

$$= \boxed{\frac{2\sin(x)\ln(x) + 2\cos(x)\left(\frac{1}{x}\right)}{(\ln(x))^2}}$$

XRONOS HW12 #5:

$$\frac{d}{dx}\frac{(x+1)^2}{\sqrt{x^2+1}}$$ LET $f(x) = \frac{(x+1)^2}{\sqrt{x^2+1}}$, TAKE ln OF BOTH SIDES

$$\ln(f(x)) = \ln\left(\frac{(x+1)^2}{\sqrt{x^2+1}}\right) \Rightarrow \ln(f(x)) = \ln((x+1)^2) - \ln((x^2+1)^{1/2})$$

$$\Rightarrow \ln(f(x)) = 2\ln(x+1) - \frac{1}{2}\ln(x^2+1)$$

↗ TAKE DERIVATIVE OF BOTH SIDES

$$\Rightarrow \frac{1}{f(x)}f'(x) = 2\left(\frac{1}{x+1}\right)\left[\frac{d}{dx}(x+1)\right] - \frac{1}{2}\left(\frac{1}{x^2+1}\right)\left[\frac{d}{dx}(x^2+1)\right]$$

$$\Rightarrow \frac{1}{f(x)}f'(x) = \frac{2}{x+1} - \frac{2x}{2(x^2+1)}$$

$$\Rightarrow f'(x) = f(x)\left[\frac{2}{x+1} - \frac{x}{x^2+1}\right] = \left(\frac{(x+1)^2}{\sqrt{x^2+1}}\right)\left(\frac{2}{x+1} - \frac{x}{x^2+1}\right)$$

$$\Rightarrow \boxed{f'(x) = \left(\frac{(x+1)^2}{\sqrt{x^2+1}}\right)\left(\frac{2}{x+1} - \frac{x}{x^2+1}\right)}$$

XRONOS HW12 #6:

$$\frac{d}{dx}\left(x^{\sin(x)}\right)$$ LET $f(x) = x^{\sin(x)}$, TAKE ln OF BOTH SIDES:

$\ln(f(x)) = \ln(x^{\sin(x)}) \Rightarrow \ln(f(x)) = \sin(x)\ln(x)$

*TAKE DERIVATIVE OF BOTH SIDES:

$$\frac{1}{f(x)} f'(x) = \left[\frac{d}{dx}(\sin(x))\right]\ln(x) + (\sin(x))\left[\frac{d}{dx}(\ln(x))\right]$$

$$\frac{1}{f(x)} f'(x) = \cos(x)\ln(x) + \sin(x)\left(\frac{1}{x}\right)$$

$$f'(x) = f(x)\left[\cos(x)\ln(x) + \sin(x)\left(\frac{1}{x}\right)\right]$$

$$f'(x) = x^{\sin(x)}\left[\cos(x)\ln(x) + \sin(x)\left(\frac{1}{x}\right)\right]$$