Calc 1 Worksheet 4: All Differentiation Rules

Basic derivative formulas		
$(x^n)' = nx^{n-1}$ (for any constant n)	$(\sqrt{x})' = \frac{1}{2\sqrt{x}}$	
$(e^x)' = e^x$	$(b^x)' = (\ln b)b^x$ (for any $b > 0$)	$(\ln x)' = \frac{1}{x}$
$(\sin x)' = \cos x$	$(\cos x)' = -\sin x$	

Use the chain rule to find the derivatives of the following functions:

1. $f(x) = \sqrt{\frac{1+x^2}{1-x^2}}$

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

$$= \frac{1}{2}\sqrt{\frac{1-x^2}{1+x^2}} \cdot \frac{2x(1-x^2)+2x(1+x^2)}{(1-x^2)^2} = \frac{1}{2}\sqrt{\frac{1-x^2}{1+x^2}} \cdot \frac{4x}{(1-x^2)^2}$$

2. $f(x) = e^{3x}\tan x$

$$f'(x) = (e^{3x})'\tan x + e^{3x}(\tan x)'$$

$$= 3e^{3x}\tan x + e^{3x}\sec^2 x$$

$$= e^{3x}(3\tan x + \sec^2 x)$$

3. $f(x) = 2^{x\cos x}$

$$f'(x) = (\ln 2)\cdot 2^{x\cos x}\cdot(x\cos x)'$$

$$= (\ln 2)2^{x\cos x}\cdot(\cos x - x\sin x)$$

4. $f(x) = [\ln(5x+\sin(5x))]^6$

$$f'(x) = 6[\ln(5x+\sin(5x))]^5 \cdot [\ln(5x+\sin(5x))]'$$

$$= 6[\ln(5x+\sin(5x))]^5 \cdot \frac{1}{5x+\sin(5x)} \cdot (5x+\sin(5x))'$$

$$= 6[\ln(5x+\sin(5x))]^5 \cdot \frac{1}{5x+\sin(5x)} \cdot (5+5\cos x)$$