Homework for Test #2 on Derivatives Test 2 - Wed. 9/23?

HW #5 due Friday, 9/11
- 2.1 #1-23 odd Find the derivative by the limit process
- 2.1 #29-32 all find the equation of the tangent line
- 2.1 #61-69 odd Use the alternate form to find the derivative
- 2.1 #71-79 odd Describe x-values where the function is differentiable (given graph)

HW #6 due Monday, 9/14
- 2.2 #3-51 odd Find the derivative using the basic derivative rules
- 2.2 #91-94 all; 101, 102 use the derivative to solve rate of change word problem
- 2.3 #1-53 odd, 63-69 odd, Product and quotient rules

HW #7 due Wed. 9/16
- 2.3 #75-81 all, 83-91 odd, 109-115 all Rates of change, second derivatives
- 2.4 #7-33 odd, 47-81 odd Chain rule

HW #8 due Tues. 9/22

HW #9 due Wed. 9/23
- 5.1 #45-61 odd, 71 Logarithmic functions
- 5.4 #39-57 odd Exponential functions
- 5.5 #41-55 odd Log and exp functions with other bases
- 5.8 #41-59 odd Inverse trig functions

Recommended:
Work through intuitive exercises on **Khan Academy**:
- Slope of secant lines
- Tangent lope is limiting value of secant slope
- Derivative intuition
- Visualizing derivatives
- Graphs of functions and their derivatives
- The formal and alternate form of the derivative
- Derivatives 1
- Recognizing slopes of curves
- Power rule
- Special derivatives

13. $F(x) = 5x^3 + 4x^2 - 6$

$f'(x) = \boxed{15x^2 + 8x}$

14. $f(x) = (5x)\sin x$

$f'(x) = \boxed{5\sin x + 5x\cos x}$

15. $f(x) = \dfrac{2x}{x-1}$

$f'(x) = \boxed{\dfrac{2(x-1) - 2x(1)}{(x-1)^2}} = \dfrac{-2}{x^2 - 2x + 1}$

16. $f(x) = \sqrt{x} - \dfrac{1}{x^4} + \dfrac{1}{\sqrt[3]{x}}$

$= x^{1/2} - x^{-4} + x^{-1/3}$

$f'(x) = \boxed{\tfrac{1}{2}x^{-1/2} + 4x^{-5} - \tfrac{1}{3}x^{-4/3}}$

Power Rule:

$\frac{d}{dx}[x^n] = nx^{n-1}$ d/dx [c]=0

Constant Multiple Rule:

$\frac{d}{dx}[cf(x)] = c\frac{d}{dx}[f(x)]$

Sum & Difference:

$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$

Product Rule:

$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$

Quotient Rule:

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

Chain Rule:

$\frac{d}{dx}[f(g(x))] = f'(g(x))g'(x)$

$\frac{d}{dx}[a^x] = a^x \ln a$

$\frac{d}{dx}[\log_a x] = \frac{1}{x \ln a}$

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

$\frac{d}{dx}[\ln x] = \frac{1}{x}$

Trig Functions:

$\frac{d}{dx}[\sin x] = \cos x$ $\frac{d}{dx}[\tan x] = \sec^2 x$ $\frac{d}{dx}[\sec x] = \sec x \tan x$

$\frac{d}{dx}[\cos x] = -\sin x$ $\frac{d}{dx}[\cot x] = -\csc^2 x$ $\frac{d}{dx}[\csc x] = -\csc x \cot x$

$$f(x) = (\sec x)(5^{\sin x})$$

$$f'(x) = (\sec x)' \cdot 5^{\sin x} + (\sec x)(5^{\sin x})'$$

$$= \boxed{(\sec x \tan x) \cdot 5^{\sin x} + (\sec x) \cdot 5^{\sin x} \cdot \ln 5 \cdot \cos x}$$

$(x^n)' = nx^{n-1}$; $(a^x)' = a^x \cdot \ln a$

$$f(x) = \frac{(x^2 \ln x)}{\sin x}$$

$$f'(x) = \frac{(\sin x)(x^2 \ln x)' - (x^2 \ln x)(\sin x)'}{(\sin x)^2}$$

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

$$f(x) = \sqrt[3]{\sin^2(\ln(4x^9))} = \left[(\sin[\ln(4x^9)])^2 \right]^{1/3}$$

$$= (\sin[\ln(4x^9)])^{2/3}$$

$$f'(x) = \boxed{\frac{2}{3}(\sin[\ln(4x^9)])^{-1/3} \cdot \cos[\ln(4x^9)] \cdot \frac{1}{4x^9} \cdot 36x^8}$$

$$f(x) = 5^{\sqrt[3]{4\log_2(3x^2-4x)}}$$

$$f'(x) = \boxed{5^{\sqrt[3]{4\log_2(3x^2-4x)}} \cdot \ln 5 \cdot \frac{1}{3}\left(4\log_2(3x^2-4x)\right)^{-2/3} \cdot 4 \cdot \frac{1}{\ln 2\,(3x^2-4x)} \cdot (6x-4)}$$

$[a^x]' = a^x \ln a$

2.4 The Chain Rule, cont.

18. $f(x) = -3\sqrt[4]{2-9x}$ $= -3(2-9x)^{1/4}$

$f'(x) = \boxed{\frac{-3}{4}(2-9x)^{-3/4} \cdot (-9)}$

32. $h(t) = \left(\frac{t^2}{t^3+2}\right)^2$

$h'(t) = \boxed{2\left(\frac{t^2}{t^3+2}\right) \cdot \frac{(t^3+2)\cdot 2t - (3t^2)(t^2)}{(t^3+2)^2}}$

50. $h(x) = \sec x^2$ $= \sec(x^2)$

$h'(x) = \boxed{[\sec(x^2)\tan(x^2)] \cdot 2x}$

60. $g(t) = 5\cos^2 \pi t$ $= 5[\cos \pi t]^2$

$g'(t) = \boxed{10\cos \pi t\,(-\sin \pi t)\cdot \pi}$

$= -5\pi \sin 2\pi t$

66. $y = \sin \sqrt[3]{x} + \sqrt[3]{\sin x}$ $= \sin(x^{1/3}) + (\sin x)^{1/3}$

$y' = \boxed{\cos(x^{1/3}) \cdot \frac{1}{3}x^{-2/3} + \frac{1}{3}(\sin x)^{-2/3} \cdot \cos x}$

5.4

46. $g(t) = e^{-3/t^2}$ $= e^{-3t^{-2}}$

$g'(t) = \boxed{e^{-3t^{-2}} \cdot (6t^{-3})}$

48. $y = \ln\left(\frac{1+e^x}{1-e^x}\right) = \ln(1+e^x) - \ln(1-e^x)$

$y' = \frac{1}{1+e^x}\cdot(e^x) - \frac{1}{1-e^x}\cdot(-e^x)$

$= \boxed{\frac{e^x}{1+e^x} + \frac{e^x}{1-e^x}}$

58. $y = \ln e^x = x$

$y' = \boxed{1}$

$\log_a MN = \log_a M + \log_a N$

$\log_a \frac{M}{N} = \log_a M - \log_a N$

$\log_a(M+N) \neq$

$\log_a(M-N) \neq$

$\log_a(b^p) = p\cdot\log_a b$

$(\log_a b)^p \neq$

<u>5.5</u>

46. $f(t) = \frac{3^{2t}}{t} = (3^{2t})(t^{-1})$

$f'(x) = \boxed{(3^{2t}\cdot\ln 3\cdot 2)(t^{-1}) + (3^{2t})(-t^{-2})}$

54. $y = \log_{10}\frac{x^2-1}{x} = \log_{10}(x^2-1) - \log_{10} x$

$y' = \frac{1}{\ln 10(x^2-1)}\cdot 2x - \frac{1}{(\ln 10)(x)}$

$y' = \boxed{\frac{2x}{(x^2-1)\ln 10} - \frac{1}{x\ln 10}}$

$[x^n]' =$

$[cf(x)]' =$

$[f(x) \pm g(x)]' =$

$[f(x)g(x)]' =$

$\left[\frac{f(x)}{g(x)}\right]' =$

$[f(g(x))]' =$

$[e^x]' =$

$[a^x]' =$

$[\ln x]' =$

$[\log_a x]' =$

$[\sin x]' =$

$[\cos x]' =$

$[\tan x]' =$

$[\cot x]' =$

$[\sec x]' =$

$[\csc x]' =$

$[\arcsin x]' =$

$[\arctan x]' =$

$[\operatorname{arcsec} x]' =$

$[\arccos x]' =$

$[\operatorname{arccot} x]' =$

$[\operatorname{arccsc} x]' =$