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

$y = \ln(1+e^x) - \ln(1-e^x)$

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

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

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

$\ln(MN) = \ln M + \ln N$

$\ln M^p = p \ln M$

$\log_a(a^x) = x$

58. $y = \ln e^x$

$y = x$

$y' = \boxed{1}$

$[\ln e^x]' = \frac{1}{e^x} \cdot e^x = 1$

5.5

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

$f'(t) = \frac{(3^{2t})' t - (3^{2t})(t)'}{t^2}$

$= \boxed{\frac{(3^{2t} \cdot \ln 3 \cdot 2)t - 3^{2t}}{t^2}}$

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

$y = \log_{10}\frac{(x+1)(x-1)}{x} = \log_{10}(x+1) + \log_{10}(x-1) - \log_{10} x$

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

5.8

$$\frac{d}{dx}[\arcsin x] = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}[\arctan x] = \frac{1}{1+x^2}$$
$$\frac{d}{dx}[\text{arcsec}\, x] = \frac{1}{|x|\sqrt{x^2-1}}$$
$$\frac{d}{dx}[\arccos x] = \frac{-1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}[\text{arccot}\, x] = \frac{-1}{1+x^2}$$
$$\frac{d}{dx}[\text{arccsc}\, x] = \frac{-1}{|x|\sqrt{x^2-1}}$$

44. $f(x) = \text{arcsec}\, 2x$

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

48. $h(x) = x^2 \arctan x$

$$h'(x) = 2x \arctan x + x^2 \cdot \frac{1}{1+x^2}$$

52. $y = \ln(t^2+4) - \frac{1}{2}\arctan\frac{t}{2}$

$$y' = \frac{1}{t^2+4} \cdot 2t - \frac{1}{2} \cdot \frac{1}{1+(t/2)^2} \cdot \frac{1}{2}$$

56. $y = x \arctan 2x - \frac{1}{4}\ln(1+4x^2)$

$$\frac{d}{dx}[\arcsin x] = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}[\arctan x] = \frac{1}{1+x^2}$$
$$\frac{d}{dx}[\text{arcsec}\, x] = \frac{1}{|x|\sqrt{x^2-1}}$$
$$\frac{d}{dx}[\arccos x] = \frac{-1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}[\text{arccot}\, x] = \frac{-1}{1+x^2}$$
$$\frac{d}{dx}[\text{arccsc}\, x] = \frac{-1}{|x|\sqrt{x^2-1}}$$

$$y' = x \cdot \frac{1}{1+(2x)^2} \cdot 2 + \arctan 2x - \frac{1}{4} \cdot \frac{1}{1+4x^2} \cdot 8x$$

$$= \frac{2x}{1+4x^2} + \arctan 2x - \frac{2x}{1+4x^2} = \arctan 2x$$

5.4 – Find the second derivative

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

$$f'(x) = -(x-2)^{-2} \cdot 1 = \underline{-(x-2)^{-2}} = \frac{-1}{(x-2)^2}$$

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

$f(x) = x^5 - 3x^3 + 2x - 5$

$f'(x) = 5x^4 - 9x^2 + 2$

$f''(x) = 20x^3 - 18x$

$f'''(x) = 60x^2 - 18$

$f^{(4)}(x) = 120x$

$f^{(5)}(x) = 120$

$f^{(6)}(x) = 0$

$f(x) = 38x^{16}$

$f^{(17)}(x) = 0$

find $f''(x)$

82. $f(x) = \sec^2 \pi x = [\sec(\pi x)]^2$

$f'(x) = 2\sec\pi x\,(\sec\pi x \tan\pi x)\cdot\pi$

$= 2\pi\,[\sec(\pi x)]^2 \tan\pi x$

$f''(x) = \left[2\pi[\sec(\pi x)]^2\right]' \tan\pi x + \left[2\pi[\sec(\pi x)]^2\right]\cdot(\tan\pi x)'$

$= 2\pi\cdot 2\pi[\sec(\pi x)]^2 \tan\pi x\cdot\tan\pi x + 2\pi(\sec\pi x)^2\cdot\sec^2\pi x\cdot\pi$

$= \boxed{4\pi^2\sec^2\pi x\tan^2\pi x + 2\pi^2\sec^4\pi x}$

Homework for Test #2 on Derivatives

HW #4 (submitted Fri 12/05)

- 2.1 #1-23 odd Find the derivative by the limit process
- #29-32 all find the equation of the tangent line
- #61-69 odd Use the alternate form to find the derivative
- #71-79 odd Describe x-values where the function is differentiable (given graph)
- 2.2 #3-51 odd Find the derivative using the basic derivative rules
- #91-94 all; 101, 102 use the derivative to solve rate of change word problems

HW #5 (due Fri 12/12)

- 2.3 #1-53 odd, 63-69 odd, 75-81 all, 83-91 odd, 109-115 all Product and quotient rules
- 2.4 #7-33 odd, #47-81 odd Chain rule
- 5.1 #45-61, 71 Logarithmic functions
- 5.4 #39-57 Exponential functions
- 5.5 #41-55 Log and exp functions with other bases
- 5.8 #41-59 Inverse trig functions

QUIZ FRIDAY 12/12