$[x^n]' = nx^{n-1}$

$[cf(x)]' = c \cdot f'(x)$

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

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

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

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

$[e^x]' = e^x$

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

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

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

$[\sin x]' = \cos x$

$[\cos x]' = -\sin x$

$[\tan x]' = \sec^2 x$

$[\cot x]' = -\csc^2 x$

$[\sec x]' = \sec x \tan x$

$[\csc x]' = -\csc x \cot x$

$\frac{d}{dx}[\arcsin x] = \frac{1}{\sqrt{1-x^2}}$

$\frac{d}{dx}[\arctan x] = \frac{1}{1+x^2}$

$\frac{d}{dx}[\operatorname{arcsec} x] = \frac{1}{|x|\sqrt{x^2-1}}$

$\frac{d}{dx}[\arccos x] = \frac{-1}{\sqrt{1-x^2}}$

$\frac{d}{dx}[\operatorname{arccot} x] = \frac{-1}{1+x^2}$

$\frac{d}{dx}[\operatorname{arccsc} x] = \frac{-1}{|x|\sqrt{x^2-1}}$

$\arcsin x = \sin^{-1} x$

2.4 The Chain Rule, cont.

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

$f'(x) = \boxed{-\frac{3}{4}(2-9x)^{-3/4} \cdot (-9)} = \frac{27}{4(2-9x)^{3/4}}$

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

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

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

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

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

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

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

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

$\frac{1}{t^2} = t^{-2}$

$\sqrt[n]{x} = x^{1/n}$

$x^{-n} = \frac{1}{x^n}$

5.4

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

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

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

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

$\ln \frac{a}{b} = \ln a - \ln b$

$\ln(ab) = \ln a + \ln b$

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

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

$y' = \boxed{1}$

$\boxed{\log_a(a^x) = x}$

5.5

$$[a^{f(x)}]' = a^{f(x)} \cdot \ln a \cdot f'(x)$$

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

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

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

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

$$[a^x]' = \lim_{h \to 0} \frac{a^{x+h} - a^x}{h}$$

$$= \lim_{h \to 0} \frac{a^x a^h - a^x}{h}$$

$$= \lim_{h \to 0} \frac{a^x (a^h - 1)}{h}$$

$$\frac{d}{dx}[a^x] = \lim_{h \to 0} a^x \frac{(a^h - 1)}{h} \to \ln a$$

$$= a^x \cdot \ln a$$

5.8

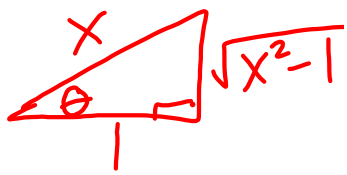
$$\frac{d}{dx}[\arcsin x] = \frac{1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}[\arctan x] = \frac{1}{1+x^2}$$
$$\frac{d}{dx}[\operatorname{arcsec} x] = \frac{1}{|x|\sqrt{x^2-1}}$$
$$\frac{d}{dx}[\arccos x] = \frac{-1}{\sqrt{1-x^2}}$$
$$\frac{d}{dx}[\operatorname{arccot} x] = \frac{-1}{1+x^2}$$
$$\frac{d}{dx}[\operatorname{arccsc}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

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

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

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

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



$\sec\theta = x$

$\operatorname{arcsec} x = \theta$

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

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

Homework for Test 2 on Derivatives - Monday, 12/16

Homework #4 (submitted Fri. 12/6)

- 2.1 #1-23odd — Find the derivative by the limit process
- 2.1 #29-32all — Find the equation of the tangent line
- 2.1 #61-69odd — Use the alternate form to ind the derivative
- 2.1 #71-79odd — Describe the x-values where the function is differentiable (given a graph)
- 2.2 #3-51 odd — Find derivative using basic rules
- 2.2 #91-94; 101,102 — Use derivative to solve rate of change word problems
- 2.3 #1-53odd, 63-69odd, 75-81all, 83-91odd, 109-115all — Product and quotient rules

Homework #5 (due Fri. 12/13)

- 2.4 #7-33odd; 47-81odd — 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**