Due Mon. 4/10 (8th)

- 2.4 #7-33 odd; 43-89 odd — Chain rule
- 5.1 #41-59 odd; 69,71 — Logarithmic functions

Due Wed 4/11 (8th)/Thurs 4/12 (7th)

- 5.4 #33-51 odd; 59, 61 — Exponential functions
- 5.5 #37-69 odd — Log and exp functions with other bases
- 5.6 #39-63 odd — Inverse trig functions

Quiz: Wed 4/12 (8th)/ Thurs 4/13 (7th)

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

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

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

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

Power Rule:

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

Product Rule:

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

Constant Multiple Rule:

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

Quotient Rule:

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

Sum & Difference:

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

Chain Rule:

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

Trig Functions:

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

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

$$\left[2^{f(x)}\right]' = 2^{f(x)} \ln 2 \cdot f'(x)$$

$$\left[[f(x)]^2\right]' = 2 \cdot f(x) \cdot f'(x)$$

$$\left[2^{([f(x)]^2)}\right]' = 2^{[f(x)]^2} \ln 2 \cdot 2f(x) \cdot f'(x)$$

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

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

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

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

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

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

$f(x) = 5^{\sqrt[3]{4\log_2(3x^2-4x)}} = 5^{(4\log_2(3x^2-4x))^{1/3}}$

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

2.4 The Chain Rule, cont.

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

$f'(x) = -3\left(\frac{1}{4}(2-9x)^{-3/4}\right)\cdot(-9)$ ← you can stop here

$f'(x) = \frac{27}{4}(2-9x)^{-3/4}$ ← or you can simplify

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

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

$h'(t) = \frac{2t^2}{t^3+2}\cdot\frac{2t^4+4t-3t^4}{(t^3+2)^2} = \frac{2t^2(4t-t^4)}{(t^3+2)^3}$

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

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

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

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

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

$y' = \left(\cos(\sqrt[3]{x})\cdot\frac{1}{3}x^{-2/3}\right) + \left(\frac{1}{3}(\sin x)^{-2/3}\cdot\cos x\right)$

5.4

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

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

5.8

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

$f'(x) = \frac{1}{|2x|\sqrt{(2x)^2-1}}\cdot 2 = \boxed{\frac{2}{|2x|\sqrt{4x^2-1}}}$

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

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

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

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

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