2413 9/28 Summary of Differentiating

3 most important derivative rules:

$(fg)' = f'g + fg'$ [Product]

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

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

$dy/dx = (dy/du)(du/dx)$ } [Chain]

Many other rules:

$(f \pm g)' = f' \pm g'$ [Sum/Difference]

$(cf)' = cf'$ [Constant Multiple]

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

$(f^n)' = nf^{n-1}f'$

$(1/f)' = -f'/f^2$ [Reciprocal]

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

$|x|' = \begin{cases} 1 : x > 0 \\ -1 : x < 0 \end{cases} = \frac{|x|}{x} = \frac{x}{|x|}$

2413 9/28

Many other rules:

$$x^r = r x^{r-1} \quad (r \text{ rational})$$

$$(f^r)' = r f^{r-1} f'$$

$$c' = 0 \quad (c \text{ constant}) \qquad [\text{Constant}]$$

$$(a^x)' = a^x \ln a$$

$$(e^x)' = e^x$$

$$(\log_a x)' = \frac{1}{x \ln a}$$

$$(\ln x)' = 1/x$$

} only for $x > 0$

$$(\sin\theta)' = \cos\theta$$

$$(\cos\theta)' = -\sin\theta$$

$$(\tan\theta)' = \sec^2\theta$$

$$(\cot\theta)' = -\csc^2\theta$$

$$(\sec\theta)' = \sec\theta\tan\theta$$

$$(\csc\theta)' = -\csc\theta\cot\theta$$

Trig. reminders:

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\cot\theta = \frac{\cos\theta}{\sin\theta}$$

$$\sec\theta = 1/\cos\theta$$

$$\csc\theta = 1/\sin\theta$$

$$dy/dx = \frac{1}{dx/dy} \qquad [\text{Inverse Function}]$$

$$\frac{dy}{dx} = \frac{dy/dt}{dx/dt}$$

2413 9/28 Practice with chain rule. (and other rules)

$y = \tan(\ln^3 x - \csc\sqrt{x})$; $\frac{dy}{dx} = ?$

$y = 2\cos^5(x)\, 4^{x+3}$; $\frac{dy}{dx} = ?$

$y = \frac{3\sec(2x)}{x^2 + \log_7 \cot x}$; $\frac{dy}{dx} = ?$

$y = 7e^{\left(\frac{x+1}{x-1}\right)} + \cos(e^x)$; $\frac{dy}{dx} = ?$

$y = \left[\sin^3(x^4)\, e^{x^2} + 1\right]^{8/7}$; $\frac{dy}{dx} = ?$

$y = \frac{1}{\sqrt[3]{e^x + \ln(2 + (\sin x)/4)}}$; $\frac{dy}{dx} = ?$

$y = \tan(\ln(\sin(\cos(x))))$; $\frac{dy}{dx} = ?$

$y = \sqrt{1 + \sqrt[3]{1 + \sqrt[4]{x^2}}} - x$; $\frac{dy}{dx} = ?$

$y = e^{e^x}$; $\frac{d^2y}{dx^2} = ?$

$y = 1/(\cos^2(2x) + \sin^2(3x))$; $\frac{d^2y}{dx^2} = ?$