Questions on 2.1 or 2.2? We're ready to rock 2.3 in the lecture.

$A \Rightarrow B$

$A = B$

<u>LATE EDITIONS</u>

§2.3

Product Rule

$$(fg)' = f'g + fg' \qquad g(x)\frac{df}{dx} + f(x)\frac{dg}{dx} = f\frac{dg}{dx} + g\frac{df}{dx}$$

Quotient Rule

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

Product Rule Proof $\quad h = fg \Longrightarrow \dfrac{h(x+h) - h(x)}{h}$

$$= \frac{f(x+h)g(x+h) - f(x)g(x)}{h}$$

$$= \frac{f(x+h)g(x+h) - \overbrace{f(x)g(x+h) + f(x)g(x+h)} - f(x)g(x)}{h}$$

$$= \frac{\big(f(x+h) - f(x)\big)g(x+h) + f(x)\big(g(x+h) - g(x)\big)}{h}$$

$$= \frac{f(x+h) - f(x)}{h}g(x+h) + f(x)\frac{g(x+h) - g(x)}{h}$$

$$\xrightarrow{h \to 0} f'(x)g(x) + f(x)g'(x) \quad \blacksquare$$

$$\frac{d}{dx}\Big((x^2+2x+7)(x^5-17x^4+5x^3-11x^2+2x+17)\Big)$$

$$= \overset{f'}{(2x+2)}\overset{g}{(x^5-17x^4+5x-11x^2+2x+7)}$$

$$+ \overset{f}{(x^2+2x+7)}\overset{g'}{(5x^4-68x^3+15x^2-22x+2)}$$

Book Method causes Dain Bramage

Learn my way.

$$\lim(f \pm g) = \lim f \pm \lim g$$

$$\lim(cf) = c\lim f$$

$$\lim(fg) = (\lim f)(\lim g)$$

$$\lim\left(\frac{f}{g}\right) = \frac{\lim f}{\lim g} \quad (\text{if } \lim g \neq 0)$$

$$\lim(f^n) = (\lim f)^n$$

$$\frac{d}{dx}(f+g) = \frac{df}{dx} + \frac{dg}{dx}$$

$$\frac{d}{dx}(fg) = \left(\frac{df}{dx}\right)g + f\left(\frac{dg}{dx}\right)$$

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) = \frac{\left(\frac{df}{dx}\right)(g) - (f)\left(\frac{dg}{dx}\right)}{g^2}$$

~~For~~

$\sqrt{x^2} = |x|$ $\mathcal{D}(\sqrt{x^2}) = \mathbb{R}$

$(\sqrt{x})^2 = x$ $\mathcal{D}(\sqrt{x}^2) = (0, \infty)$

It's implicit that $x \geq 0$

Differentiate the function.

$$y = \frac{8x^2 + 2x + 6}{\sqrt{x}}$$

$f = 8x^2 + 2x + 6$

$g = \sqrt{x} = x^{\frac{1}{2}}$

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

$f' \quad g \quad - \quad f \quad g'$

$$y' = \frac{\left((16x+2)\left(x^{\left(\frac{1}{2}\right)}\right) - \left(8x^2+2x+6\right)\left(\frac{1}{2}x^{-\left(\frac{1}{2}\right)}\right)\right)}{x} \quad \xrightarrow{} g^2$$

$$\boxed{12\sqrt{x} + \frac{1}{\sqrt{x}} - \frac{3}{x\sqrt{x}}}$$

WebAssign's fine with *my* (unsimplified) answer. Only simplify if you *have* to, and this stuff goes a *lot* quicker!

Unless you stop me on Monday, I'm headed to Section 2.4.

We will prove that the derivative of sine is cosine!

It will all hinge on the following fact (which we prove geometrically):

$$\lim_{x \to 0} \frac{\sin(x)}{x} = 1 \; !$$

This fact is probably why I kept writing that Week 3 question the wrong way.

That problem almost gave Phoenix an aneurism, until I fixed it.

That one, we were looking at

$\sin\left(\frac{\pi}{x}\right)$, not $\sin(x)$

$$\sin\left(\frac{\pi}{x}\right) \xrightarrow{x \to 0} \text{Nothing} \qquad \sin(x) \xrightarrow{x \to 0} 0^{*}$$

* Not only does $\sin(x) \xrightarrow{x \to 0} 0$, but it does so at the same rate as $x \xrightarrow{x \to 0} 0$

Yes, it's good when things make sense. And, in a weird way, it's good that they don't make sense when I'm spitting nonsense. That says you're in the pocket.