1. Recall Two Versions of the Chain Rule

$\boxed{A}$ $\frac{d}{dx}\left[f(g(x))\right] = f'(g(x))\cdot g'(x)$

$\boxed{B}$ $y = f(u)$, $u = g(x)$ $\quad \frac{dy}{dx} = \frac{dy}{du}\cdot\frac{du}{dx}$

2. Understanding what the "formulas" in the book are trying to communicate:

Example: From §3.5,

$\frac{d}{dx}[\sec(x)] = \sec(x)\tan(x)$

In § 3.6 we see

- $\frac{d}{dx}\left[\sec(g(x))\right] = \sec(g(x))\cdot\tan(g(x))\cdot g'(x)$
- $\frac{d}{dx}\left[\sec(u)\right] = \sec(u)\tan(u)\cdot\frac{du}{dx}$

Just writing out the Chain Rule in a very specific case

$y = \sec(3x)$; $y' = \sec(3x)\tan(3x)\cdot 3$

3. (Some additional independent practice) Find the derivatives.

(a) $f(x) = (\sec(3x) + \csc(2x))^5$

$$f'(x) = 5\left(\sec(3x) + \csc(2x)\right)^4\cdot\left(3\sec(3x)\tan(3x) - 2\csc(2x)\cot(2x)\right)$$

(b) $g(x) = \frac{\cot(x^2+1)}{x^3+1}$

$$g'(x) = \frac{(x^3+1)(-\csc^2(x^2+1)(2x)) - \cot(x^2+1)(3x^2)}{(x^3+1)^2}$$

(c) $h(x) = (2x-1)^3(2x+1)^5$

$$h'(x) = \underbrace{3(2x-1)^2(2)}_{f'}\underbrace{(2x+1)^5}_{g} + \underbrace{(2x-1)^3}_{f}\cdot\underbrace{5\cdot(2x+1)^4(2)}_{g'}$$

If time permits, point out what would happen if the "3" was a "-3"

4. Find all x-values where the tangent to $f(x) = (x^2-4)^3$ is horizontal.

$f'(x) = 3(x^2-4)^2(2x) = 6x(x^2-4)^2 = 0$

So $x = 0$ or $x^2 - 4 = 0$.

$x^2 - 4 = 0$ when $x^2 = 4$ or $x = \pm 2$

$f' = 0$.

Answer: $f(x)$ has a horizontal tangent when $x = -2, 0, 2$.