1. Recall Two Versions of the Chain Rule

(Leibniz:) $y=f(u)$, $u=g(x)$

$$\frac{dy}{dx}=\frac{dy}{du}\cdot\frac{du}{dx}$$

(Newton:) $h(x)=f(g(x))$

$$h'(x)=f'(g(x))\cdot g'(x)$$

mini examples: $h(x)=\tan(2x^3)$; $h(x)=(x+\sin(x))^5$

$y=\cos(u)$, $u=8x+1$

*finish probs from Fri.

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

- If $h(x)=[g(x)]^n$, then $h'(x)=n[g(x)]^{n-1}\cdot g'(x)$.
- If $h(x)=\sin(g(x))$, then $h'(x)=\cos(g(x))\cdot g'(x)$.
- $\frac{d}{dx}[\cos(u)]=-\sin(u)\cdot\frac{du}{dx}$
- $K(x)=h(f(g(x)))$, $K'(x)=h'(f(g(x)))\cdot f'(g(x))\cdot g'(x)$.

3. $h(x)=\frac{2x(2x+1)^5}{\cos(2x+1)}$

* goal: Demonstrate a method for managing complication.

$$h'(x)=\frac{\cos(2x+1)\cdot\boxed{\frac{d}{dx}\left[2x(2x+1)^5\right]}-2x(2x+1)^5\cdot\boxed{\frac{d}{dx}\left[\cos(2x+1)\right]}}{\cos^2(2x+1)}$$

quotient rule w/ placeholders

$$=\frac{\cos(2x+1)\left[2(2x+1)^5+2x\cdot\boxed{\frac{d}{dx}\left[(2x+1)^5\right]}\right]-2x(2x+1)^5(-\sin(2x+1)\cdot 2)}{\cos^2(2x+1)}$$

prod. rule w/ placeholder

$$=\frac{\cos(2x+1)\left(2(2x+1)^5+2x(5(2x+1)^4(2))\right)+4x(2x+1)^5\sin(2x+1)}{\cos^2(2x+1)}$$

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

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

$x = 0, \pm 2$

5. Use the table below to evaluate the derivatives of the given functions at the indicated vaue.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
-1	2	-2	0	1
0	1	2	3	4
1	-1	-2	1	-4
2	0	4	3	5

(a) $h(x) = f(g(x) - 2x)$ at $a = 2$.

$h'(x) = f'(g(x)-2x)(g'(x)-2)$

$h'(2) = f'(g(2)-4)\cdot(g'(2)-2)$

$= f'(3-4)(5-2) = f'(-1)\cdot 3 = -2\cdot 3 = \boxed{-6}$

(b) $k(x) = \left(\dfrac{f(x)}{g(x)}\right)^2$ at $a = 1$

$= \dfrac{(f(x))^2}{(g(x))^2} = (f(x))^2\cdot(g(x))^{-2}$

$k'(x) = 2\cdot f(x)\cdot f'(x)\cdot(g(x))^{-2} + (f(x))^2\cdot(-2)\cdot(g(x))^{-3}\cdot g'(x)$

$k'(1) = 2\cdot f(1)\cdot f'(1)\cdot(g(1))^{-2} + (f(1))^2(-2)(g(1))^{-3}g'(1)$

$= 2\cdot(-1)(-2)(1)^{-2} + (-1)^2(-2)(1)^{-3}(-4) = 4 + 8 = \boxed{12}$