When you are done with your homework you should be able to…

- Find the derivative of a composite function using the Chain Rule.
- Find the derivative of a function using the General Power Rule.
- Simplify the derivative of a function using algebra.
- Find the derivative of a trigonometric function using the Chain Rule.

Theorem: The Chain Rule

If $y = f(u)$ is a differentiable function of u and $u = g(x)$ is a differentiable function of x, then $y = f(g(x))$ is a differentiable function of x and

$$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx} \text{ or } \frac{d}{dx}\left[f(g(x))\right] = f'(g(x))\,g'(x).$$

Use the methods learned in 2.2 and 2.3 to evaluate the derivative of the following functions. Then find the derivative using the Chain Rule.

1. $y = (2-x)^3$

"old way" Chain Rule

2. $f(x) = \sin 2x$

"old way" Chain Rule

3. $h(t)=\dfrac{\sqrt{t}}{\sqrt{t}-1}$

"old way" Chain Rule

Theorem: The General Power Rule

If $y=\left[u(x)\right]^n$, where u is a differentiable function of x and n is a rational number, then

$$\frac{dy}{dx}=n\left[u(x)\right]^{n-1}\cdot\frac{du}{dx} \text{ or } \frac{d}{dx}\left[u^n\right]=nu^{n-1}u'.$$

4. Complete the table.

$y=f(g(x))$	$u=g(x)$	$y=f(u)$
$y=\left(8x^2-3\right)^{25}$		
$y=\tan\dfrac{\pi x}{3}$		
$y=\csc^2 x$		
$y=\dfrac{5}{\sqrt{x^2+6}}$		

Find the derivative of the following functions.

5.

a. $h(t)=\frac{1}{t}$

b. $h(t)=\frac{1}{t^2+2t-1}$

6.

a. $y=\sec x$

b. $y=\sec 2x$

c. $y=\sec^2 x$

d. $y=\sec x^2$

7.

a. $y = x^5$

b. $y = \left(2x^3 - 5\right)^5$

8.

a. $y = \sqrt{x}$

b. $y = \sqrt{\cos x}$

9. $f\left(x\right) = x^2\left(2 - x\right)^{2/3}$

10. $f(x)=\sqrt{\dfrac{1}{2x^3+15}}$

11. $h(x)=x\sin^2 4x$

12. $f(x)=\cot\sqrt[3]{x}-\sqrt[3]{\cot x}$

13. Find the equation of the tangent line at $t=1$ for the function $s(t)=\left(9-t^2\right)^{2/3}$.