Worksheet #10: The Chain Rule

Generalized Derivative Formulas:

$$\frac{d}{dx}[\sin(u)]=\cos(u)\frac{du}{dx} \qquad \frac{d}{dx}[\cos(u)]=-\sin(u)\frac{du}{dx}$$

$$\frac{d}{dx}[\tan(u)]=\sec^2(u)\frac{du}{dx} \qquad \frac{d}{dx}[\cot(u)]=-\csc^2(u)\frac{du}{dx}$$

$$\frac{d}{dx}[\sec(u)]=\sec(u)\tan(u)\frac{du}{dx} \qquad \frac{d}{dx}[\csc(u)]=-\csc(u)\cot(u)\frac{du}{dx}$$

Power Rule: $\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1}f'(x)$ or $\frac{d}{dx}[u(x)]^n = n[u(x)]^{n-1}\frac{du}{dx} = nu^{n-1}\frac{du}{dx}$

Exponent Rule: $\frac{d}{dx}e^{f(x)} = e^{f(x)}f'(x)$ or $\frac{d}{dx}\left[e^{u(x)}\right] = e^{u(x)}\frac{du}{dx}$

Chain Rule: $[f(g(x))]' = f'(g(x))\cdot g'(x)$ or $\frac{d}{dx}[y(u)] = \frac{dy}{du}\frac{du}{dx}$

1. Find $\frac{dy}{dx}$ for the following: a. $y=\tan^4(x)$ b. $y=(x^3+4x+2)^{50}$ c. $y=e^{\sin x}$

2. Find $g'(x)$ for the following: a. $g(x)=4\sin^3(2x^5)$ b. $g(x)=2\cos^2(3\sqrt{x})$

3. Find $\frac{d}{dx}[\sin^3(\csc(5x^2))]$.

4. Find $\frac{dy}{dx}$ for the following: a. $y=[(x^4+\sqrt{x})\cot(x^3+4)]^{-5}$ b. $y=\left(\frac{3e^{x^2}}{\tan(x)}\right)^3$