DO NOW

Find the derivative of:

$f(x) = \tan^3(5x) = (\tan(5x))^3$

$y' = 3u^2 \quad y = u^3 \quad u = \tan v \quad v = 5x$

$f'(x) = 3(\tan(5x))^2 \cdot \sec^2(5x) \cdot 5$

$f'(x) = 15\tan^2(5x)\sec^2(5x)$

3.4 The Chain Rule - Day 4

Recall: $\frac{d}{dx}[e^x] = e^x$

New rules:

$\frac{d}{dx}[e^u] = e^u \cdot u'$

$\frac{d}{dx}[\ln x] = \frac{1}{x}$

$\frac{d}{dx}[\ln u] = \frac{1}{u} \cdot u' = \frac{u'}{u}$

$\frac{d}{dx}[e^{4x}]$

$e^{4x} \cdot 4$

$4e^{4x}$

Find the derivative.

1. $f(x) = e^{3x^2}$

$y = e^u \quad u = 3x^2$

$f'(x) = e^{3x^2} \cdot 6x$

$f'(x) = 6xe^{3x^2}$

2. $f(x) = e^{\sin x}$

$f'(x) = e^{\sin x} \cdot \cos x$

$f'(x) = (\cos x)e^{\sin x}$

3. $f(x) = \ln(2x)$

$f'(x) = \frac{1}{2x} \cdot 2$

$f'(x) = \frac{2}{2x}$

$f'(x) = \frac{1}{x}$

$\frac{d}{dx}[\ln u] = \frac{u'}{u}$

4. $f(x) = \ln(x^2 + 1)$

$f'(x) = \frac{2x}{x^2+1}$

5. $f(x) = x \ln x$

*product rule

$f'(x) = x \cdot \frac{1}{x} + \ln x \cdot 1$

$f'(x) = 1 + \ln x$

6. $f(x) = (\ln x)^3$

$y = u^3 \quad u = \ln x$

$f'(x) = 3(\ln x)^2 \cdot \frac{1}{x}$

$f'(x) = \frac{3(\ln x)^2}{x}$

Recall Properties of Logarithms

1. $\ln xy =$ $\ln x + \ln y$
2. $\ln \frac{x}{y} =$ $\ln x - \ln y$
3. $\ln x^z =$ $z(\ln x)$

***These properties can be used to make differentiation a little easier.

7. $y = \ln\sqrt{x+1}$

$y = \ln(x+1)^{1/2}$

$y = \frac{1}{2}\ln(x+1)$

$y' = \frac{1}{2}\cdot\frac{1}{x+1}$

$y' = \frac{1}{2(x+1)}$

8. $g(x) = \ln\frac{x(x^2+1)^2}{\sqrt{2x^3-1}}$

$g(x) = \ln[x(x^2+1)^2] - \ln\sqrt{2x^3-1}$

$g(x) = \ln x + \ln(x^2+1)^2 - \ln(2x^3-1)^{1/2}$

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

$g'(x) = \frac{1}{x} + 2\cdot\frac{2x}{x^2+1} - \frac{1}{2}\cdot\frac{6x^2}{2x^3-1}$

$g'(x) = \frac{1}{x} + \frac{4x}{x^2+1} - \frac{3x^2}{2x^3-1}$

HOMEWORK

pg 161 - 162; 33 - 36, 61 - 91