Math 1210 #12
The Chain Rule

The Chain Rule

$$D_x(f(g(x))) = f'(g(x))(g'(x)) \quad \text{or} \quad D_x y = (D_u y)(D_x u)$$

Basically, we differentiate from the 'outside-in.' This is very useful if we need to differentiate something like $f(x) = 3(x^2 - 2x + 1)^{80}$ and you really don't want to multiply it out.

EX 1

If $y = (3x^3 - 4x + 5)^{10}$ find y'

EX 2

If $y = \frac{4}{(2x^7 - 6x^2)^5}$ find y'.

EX 3

Find $f'(x)$:

3a)

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

3b)

$f(x) = \sin(x^3)$

EX 3

(continued) Find $f'(x)$:

3c)

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

3d)

$f(x) = \sin^2(4x)(2x^5 - 3)^3$

We can think of the chain rule as $\frac{dy}{dx} = \frac{dy}{du}\frac{du}{dx}$

EX 4

Find $\frac{dy}{dx}$

4a)

$y = [(2x^2 + 3)\cos(x)]^4$

4b)

$y = \left(-3x + \frac{5}{x}\right)^{-4}$