

## Chain Rule

dealing with composite functions -

a function within a function  $f(g(x))$   
(see 1<sup>st</sup> set of examples)

the chain rule is taking the product  
of derivatives of the inside &  
outside functions

$$\frac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$$

outside • inside

Ex 1

$$y = (4x^2 + 1)^7$$

inside:  $(4x^2 + 1) = g(x)$   
outside:  $\text{cloud}^7 = f(x)$   
where  $\text{cloud} = 4x^2 + 1$

so  $\frac{d}{dx}$  outside:  $\frac{d}{dx} \text{cloud}^7 = 7 \text{cloud}^6$   
replace  $\text{cloud}$   
 $\frac{d}{dx} = 7(4x^2 + 1)^6$

$\frac{d}{dx}$  inside:  $\frac{d}{dx} (4x^2 + 1) = 8x$

$\therefore \frac{d}{dx} (4x^2 + 1)^7 = 7(4x^2 + 1)^6 \cdot 8x$   
outside • inside

Product

Ex 2

$$y = e^{3x}$$

inside:  $3x$   
outside:  $e^{\text{cloud}}$

where  $\text{cloud} = 3x$

$$\frac{d}{dx} e^{\text{cloud}} = e^{\text{cloud}} = e^{3x}$$

$$\frac{d}{dx} 3x = 3$$

$$\therefore \frac{d}{dx} e^{3x} = 3e^{3x}$$

inside • outside