CHAIN RULE

Note Title 2/28/2014

IE GIVEN $y = (1+x)^4$ FIND THE DERIVATIVE

SOLN

$$y = 1 + 4x + 6x^2 + 4x^3 + x^4$$

$$\frac{dy}{dx} = 4 + 12x + 12x^2 + 4x^3$$

IE $y = (1+x)^{27}$ FIND $\frac{dy}{dx}$

THE CHAIN RULE

GIVEN $y = (f(x))^n$ $\frac{dy}{dx} = n(f(x))^{n-1} \cdot f'(x)$

* DERIVATIVE OF THE OUTSIDE TIMES DERIVATIVE OF THE INSIDE

EG $y = (3 + x^3)^{27}$

$$\frac{dy}{dx} = \frac{d}{dx}(3 + x^3)^{27}$$

$$\frac{dy}{dx} = 27(3 + x^3)^{26} \cdot (0 + 3x^2)$$

$(3x^2)$

$$\frac{dy}{dx} = 81x^2(3 + x^3)^{26}$$

EG $f(x) = \sqrt[3]{1 + 2x^2 + 6x}$

SOLN

$$f(x) = (1 + 2x^2 + 6x)^{\frac{1}{3}}$$

$$f'(x) = \frac{1}{3}(1 + 2x^2 + 6x)^{-\frac{2}{3}} \cdot (4x + 6)$$

$$f'(x) = \left(\frac{4}{3}x + 2\right)\left(1 + 2x^2 + 6x\right)^{-\frac{2}{3}}$$

IE $f(x) = (3x + 6x^2)^3 (4x+1)^4$

SOLN

$g(x) = (3x + 6x^2)^3$

$g'(x) = 3(3x+6x^2)^2(3 + 12x)$

$g'(x) = (9 + 36x)(3x+6x^2)^2$

$h(x) = (4x+1)^4$

$h'(x) = 4(4x+1)^3(4)$

$h'(x) = 16(4x+1)^3$

$f'(x) = g'(x)\,h(x) + h'(x)\,g(x)$

$f'(x) = \underbrace{(9 + 36x)(3x+6x^2)^2}_{g'(x)}\underbrace{(4x+1)^4}_{h(x)} + \underbrace{16(4x+1)^3}_{h'(x)}\underbrace{(3x+6x^2)^3}_{g(x)}$

DE $f(x) = \dfrac{(2x+3)^2}{(x+1)^3}$

Solve $g(x) = (2x+3)^2$ $\qquad g'(x) = 2(2x+3)(2)$

$g'(x) = 4(2x+3)$

$h(x) = (x+1)^3$ $\qquad h'(x) = 3(x+1)^2$

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

$$f'(x) = \frac{4(2x+3)(x+1)^{\cancel{3}} - 3\cancel{(x+1)^2}(2x+3)^2}{(x+1)^{\cancel{6}4}}$$

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

Hw pg 159 # 1-17 odd, 65-67