3.2

Note Title 8/16/2007

Product Rule f & g differentiable.

$$\frac{d}{dx}\left[f(x)g(x)\right] = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$$

(ex.) $f(x) = e^x 3x^2$

$$f'(x) = e^x \cdot 6x + 3x^2 e^x$$
$$= 6xe^x + 3x^2 e^x$$
$$= e^x(3x^2 + 6x)$$

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

Quotient Rule f & g differentiable

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)\frac{d}{dx}f(x) - f(x)\frac{d}{dx}g(x)}{[g(x)]^2}$$

(ex) $y = \dfrac{x^5+7x^3-10x}{x^2+1}$

$$y' = \frac{(x^2+1)(5x^4+21x^2-10) - (x^5+7x^3-10x)(2x)}{(x^2+1)^2}$$

$$= \frac{5x^6+21x^4-10x^2+5x^4+21x^2-10-2x^6-14x^4+20x^2}{(x^2+1)^2}$$

$$= \frac{3x^6+12x^4+31x^2-10}{(x^2+1)^2}$$

Summary of derivatives

$\frac{d}{dx}(c) = 0$ $\quad \frac{d}{dx}(x^n) = nx^{n-1}$ $\quad \frac{d}{dx}(e^x) = e^x$

$\frac{d}{dx}[cf(x)] = cf'(x)$ $\quad (f+g)' = f' + g'$ $\quad \left(\frac{f}{g}\right)' = \frac{gf' - fg'}{g^2}$

$(fg)' = fg' + gf'$ $\quad (f-g)' = f' - g'$