WARMUP

Find $f'(x)$

1) $f(x) = 5e^x - 7x^2 + 8e^\pi$ $\quad f'(x) = 5e^x - 14x$

2) $f(x) = 5 \cdot 3^x$ $\quad f'(x) = 5 \cdot (\ln 3) \cdot 3^x$

$f(x) = 5 + 3^x \Rightarrow f'(x) = (\ln 3) \cdot 3^x$

3) $f(x) = (6x-1)(7x+5)$

$f(x) = 42x^2 + 23x - 5$

$f'(x) = 84x + 23$

$f(x) = x^2 e^x$ $\quad \frac{d}{dx}[f(x) \cdot g(x)] \neq f'(x) \cdot g'(x)$

Section 3.3 The Product and Quotient Rules

PRODUCT RULE: $\frac{d}{dx}[\underset{1^{st}}{f(x)} \cdot \underset{2^{nd}}{g(x)}] = \underset{\substack{1^{st}\text{ deriv.} \\ \text{of} \\ 2^{nd}}}{f(x) \cdot g'(x)} + \underset{\substack{2^{nd}\text{ deriv.} \\ \text{of} \\ 1^{st}}}{g(x) \cdot f'(x)}$

ex: $f(x) = \underset{1^{st}}{(6x-1)} \cdot \underset{2^{nd}}{(7x+5)}$

$f'(x) = (6x-1) \cdot 7 + (7x+5) \cdot 6$

$f'(x) = 42x - 7 + 42x + 30$

$f'(x) = 84x + 23$

ex: $f(x) = x^2 e^x$

(1st, 2nd)

$f'(x) = \underbrace{x^2 e^x}_{} + \underbrace{e^x \cdot 2x}_{}$

$f'(x) = xe^x(x + 2)$

$A^2 - B^2$

ex: $f(x) = (x^2 + \sqrt{x})(x^2 - \sqrt{x})$

$= x^4 - x$

$f'(x) = 4x^3 - 1$

The Quotient Rule

$$\frac{d}{dx}\left[\frac{\overset{\text{TOP}}{f(x)}}{\underset{\text{BOT}}{g(x)}}\right] = \frac{g(x)\cdot f'(x) - f(x)\cdot g'(x)}{[g(x)]^2}$$

$$= \frac{\text{BOT}\cdot \text{der TOP} - \text{TOP}\cdot \text{der BOT}}{\text{BOT}^2}$$

ex: $g(x) = \frac{25x^2}{e^x}$ top / bot

$$g'(x) = \frac{e^x \cdot 50x - 25x^2 \cdot e^x}{(e^x)^2}$$

GCF $= e^x \cdot 25x$

$$g'(x) = \frac{25x e^x (2 - x)}{(e^x)^2}$$

$$g'(x) = \frac{25x(2-x)}{e^x}$$

ex: $y = \frac{x^2+5x+2}{x+3}$

$$y' = \frac{(x+3)(2x+5) - (x^2+5x+2)\cdot 1}{(x+3)^2}$$

$$y' = \frac{2x^2+11x+15 - x^2-5x-2}{(x+3)^2}$$

$$y' = \frac{x^2+6x+13}{(x+3)^2}$$

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