

In class practice problem

Example

$$h(x) = (3x^2 + 2x - 1)^8 \ln|3x^2 - 2| + e^{4x-1} \log_3|x^2 + 3x - 2|$$

Step 1  $\frac{d}{dx}(\ln|x|) = \frac{1}{x}$  ;  $\frac{d}{dx}(e^x) = e^x$  ;  $\frac{d}{dx}(\log_b x) = \frac{1}{x \ln b}$

Step 2 Take out pieces that can be cleaned up

$$h(x) = (3x^2 + 2x - 1)^8 \ln|3x^2 - 2|$$

Product

$$f = (3x^2 + 2x - 1)^8 \quad g = \ln|3x^2 - 2|$$

$$f' = 8(3x^2 + 2x - 1)^7 (6x + 2) \quad g' = \frac{1}{3x^2 - 2} \cdot 6x$$

$$= (48x + 16)(3x^2 + 2x - 1)^7 \quad \frac{6x}{3x^2 - 2}$$

Step 3 Reassemble:

$$h(x) = \underbrace{(48x + 16)(3x^2 + 2x - 1)^7}_{[f']} * \underbrace{\ln|3x^2 - 2|}_{[g]} + \frac{\underbrace{6x}_{[g]}}{\underbrace{3x^2 - 2}_{[f]}} (3x^2 + 2x - 1)^8$$

Step 4 Next piece:  $e^{4x-1} = 4e^{4x-1}$

Step 5 Next piece:  $\log_3|x^2 + 3x - 2| = \frac{1}{(x^2 + 3x - 2)\ln 3} * (2x + 3)$

Step 6 Put all pieces together:

$$h(x) = (48x + 16)(3x^2 + 2x - 1)^7 * \ln|3x^2 - 2| + \frac{6x}{3x^2 - 2} * (3x^2 + 2x - 1)^8 + 4e^{4x-1} \frac{1}{x^2 + 3x - 2} * (2x + 3)$$