Finish fillout foldable (to date)

Sometimes it's easier to multiply out and use the power rule rather than the product rule

Ex) Find the derivative of $f(x) = \sqrt{x}\,(4x^2 - 2x)$

Product Rule

1st·der 2nd + 2nd·der 1st

$f'(x) = \sqrt{x}\,(8x - 2) + (4x^2 - 2x)(\frac{1}{2}x^{-\frac{1}{2}})$

$= \sqrt{x}\,8x - 2\sqrt{x} + 2x^{\frac{3}{2}} - x^{\frac{1}{2}}$

$= x^{\frac{1}{2}}8x - 2x^{\frac{1}{2}} + 2x^{\frac{3}{2}} - x^{\frac{1}{2}}$

$= \cancel{8x^{\frac{3}{2}} - 3x^{\frac{1}{2}} + 2x^{3}}$

$= 8x^{\frac{3}{2}} - 2x^{\frac{1}{2}} + 2x^{\frac{3}{2}} - x^{\frac{1}{2}}$

$= 10x^{\frac{3}{2}} - 3x^{\frac{1}{2}}$

vs

Rewrite $f(x) = x^{\frac{1}{2}}(4x^2 - 2x)$

distribute $= 4x^{\frac{5}{2}} - 2x^{\frac{3}{2}}$

$f'(x) = \frac{5}{2}(4)x^{\frac{5}{2}-1} - \frac{3}{2}(2)x^{\frac{3}{2}-1}$

$= 10x^{\frac{3}{2}} - 3x^{\frac{1}{2}}$

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

Quotient Rule

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

$= \dfrac{6x^3 + 2x^2 - (6x^3 + 4x^2 + 2x)}{x^4}$

$= \dfrac{\cancel{6x^3} + 2x^2 - \cancel{6x^3} - 4x^2 - 2x}{x^4}$

$= \dfrac{-2x^2 - 2x}{x^4}$

$= \dfrac{-2\cancel{x}(x+1)}{x^{\cancel{4}3}}$

vs

Rewrite as separate terms using rational exponents

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

$= 3 + \frac{2}{x} + \frac{1}{x^2} = 3 + 2x^{-1} + x^{-2}$

$f'(x) = 0 - 2x^{-2} - 2x^{-3}$

$= \dfrac{-2}{x^2} - \dfrac{2}{x^3}$ or $\dfrac{-2x-2}{x^3}$

Methods
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pg 2

We've been using prime notation; $\{f'(x)\}$

we can use Leibniz notation, $\frac{dy}{dx}$ or $\frac{d}{dx}[f(x)]$

where $\frac{dy}{dx}$ is "the derivative of y with respect to x"

"dy dx"

$\frac{d}{dx}[f(x)]$ "the derivative of f with respect to x"

Ex If $A=\pi r^2$, find $\left.\frac{dA}{dr}\right|_{r=3}$

this means "evaluate"

$$\frac{dA}{dr}[\pi r^2] = 2\pi r$$

$$\left.\frac{dA}{dr}\right|_{r=3} = 2\pi(3) = 6\pi$$

You try

Ex $\frac{ds}{dt}$ if $s(t) = (4t^2-1)^2$

$$\frac{ds}{dt} = (4t^2-1)(4t^2-1)$$

* use either product rule or expand and use power rule

$$s(t) = 16t^4-4t^2-4t^2+1$$

$$= 16t^4-8t^2+1$$

$$\frac{ds}{dt} = 64t^3-16t^2$$

HW 7J 1-18 every 3rd
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