Derivation

- $f(x) = -x^2 + 3x - 1$

↳ $f'(x) = -2x + 3$

- $f(x) = \sqrt{x} + 3x^2 - \frac{2}{x}$.

↳ $f'(x) = \frac{1}{2\sqrt{x}} + 6x - 2x - \frac{1}{x^2}$

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

↳ $f'(x) = 3x + 3 - \frac{2}{x^3}$

$$\left(\frac{1}{x^n}\right)' = \frac{-n}{x^{n+1}}$$

- $f(x) = 4x^3 - 5x^2 + 3x - 1$

↳ $f'(x) = 12x^2 - 10x + 3$

- $f(x) = \frac{3}{x^3} - \frac{1}{x}$.

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

$= -\frac{9}{x^4} + \frac{1}{x^2}$.

$$(u \times v)' = u'v + uv'$$

$$\left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}$$

$$\left(\frac{1}{u}\right)' = -\frac{u'}{u^2}$$

- $f(x) = \dfrac{-4x + 1}{3x - 5}$ (u / v)

$u'(x) = -4$

$v'(x) = 3$

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

$$= \frac{-12x + 20 - 9x + 15}{(3x-5)^2}$$

$$= \frac{-21x + 35}{(3x-5)^2} .$$

- $$f(x) = 4x - 1 + \frac{1}{4-x} .$$

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

- $f(x) = \sqrt{x}(2x+1)$.

$$f'(x) = \frac{1}{2\sqrt{x}}(2x+1) + 2\sqrt{x}$$

- $f(x) = \dfrac{x^2 - 4x + 8}{2x-5}$ (u / v)

$$u'(x) = 2x - 4$$

$$v'(x) = 2.$$

$$f'(x) = \frac{(2x-4)(2x-5) - (x^2-4x+8)\times 2}{(2x-5)^2}$$

$$= \frac{4x^2 - 10x - 8x + 20 - 2x^2 + 8x - 4}{(2x-5)^2}$$

$$= \frac{2x^2 - 10x + 4}{(2x-5)^2}$$

u v

- $f(x) = \sqrt{x}\left(1 - \frac{1}{x}\right)$

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

$$= \frac{1 - 1/x}{2\sqrt{x}} + \frac{\sqrt{x}}{x^2}.$$

• $f(x) = (x+5)(x^2+1)$.

$f'(x) = 1 \times (x^2+1) + (x+5) \times 2x$

$= x^2 + 1 + 2x^2 + 10x$

$= 3x^2 + 10x + 1$,

• $f(x) = \dfrac{2x+5}{x^2+x+3}$.

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

$= \dfrac{2x^2+2x+6-4x^2-12x-5}{(x^2+x+3)^2}$

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

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

$$f'(x) = 5x \frac{-(6x)}{(3x^2+1)^2}$$

$$= \frac{-30x}{(3x^2+1)^2}$$