

C12 - 2.7 - Poly/Root Derivatives Notes

Leibniz

$$\begin{aligned} y &= 9 \\ y' &= 0 \\ y &= 3^2 \\ y' &= 0 \end{aligned}$$

$$\begin{aligned} y &= 2 \\ y &= 2x^0 \\ y' &= 0 \times 2x^{-1} \\ y' &= 0 \end{aligned}$$

$$\begin{aligned} y &= 3x \\ y' &= 3 \\ y &= mx + b \end{aligned}$$

$$\begin{aligned} y &= 3x^1 \\ y' &= 1 \times 3x^0 \\ y' &= 3 \end{aligned}$$

$$\begin{aligned} y &= 3x + 2x \\ y &= 5x \\ y' &= 5 \end{aligned}$$

$$\begin{aligned} y &= 3x + 2x \\ y' &= 3 + 2 \\ y' &= 5 \end{aligned}$$

$$\begin{aligned} y &= -2x + 1 \\ y' &= -2 \end{aligned}$$

$$\begin{aligned} y &= x^2 \\ y' &= 2x^{2-1} \\ y' &= 2x \end{aligned}$$

$$\begin{aligned} y &= x^3 \\ \frac{dy}{dx} &= 3x^{3-1} \\ \frac{dy}{dx} &= 3x^2 \end{aligned}$$

Power Rule

$$\begin{aligned} f(x) &= 2x^3 \\ f'(x) &= 3 \times 2x^{3-1} \\ f'(x) &= 6x^2 \end{aligned}$$

$$\begin{aligned} y &= \frac{x^2}{3} \\ y' &= \frac{1}{3}(2x^1) \\ y' &= \frac{2}{3}x \end{aligned}$$

$$\begin{aligned} y &= \frac{1}{x^2} \\ y &= x^{-2} \\ y' &= -2x^{-3} \\ y' &= \frac{-2}{x^3} \end{aligned}$$

$$\begin{aligned} y &= \frac{1}{x} \\ y &= x^{-1} \\ y' &= -1x^{-2} \\ y' &= \frac{-1}{x^2} \end{aligned}$$

$$\begin{aligned} y &= \sqrt{x} \\ y &= x^{\frac{1}{2}} \\ y' &= \frac{1}{2}x^{-\frac{1}{2}} \\ y' &= \frac{1}{2\sqrt{x}} \end{aligned}$$

$$\begin{aligned} y &= x^{\frac{1}{2}} \\ y' &= \frac{1}{2\sqrt{x}} \end{aligned}$$

$$\begin{aligned} y &= x^{\frac{3}{2}} \\ y' &= \frac{3}{2}x^{\frac{1}{2}} \end{aligned}$$

Step 1

Over

Use less space

$$\begin{aligned} y &= x^4 \\ y' &= 4x^3 \\ y'' &= 12x^2 \\ y''' &= 24x \end{aligned}$$

y = position
 y' = velocity
 y'' = acceleration
 y''' = jerk

Product Rule

$$\begin{aligned} y &= (2x + 1)(3x - 2) \\ y &= 6x^2 - x - 2 \\ y' &= 12x - 1 \end{aligned}$$

FOIL

Circle your Products*

$$\begin{aligned} y &= (2x + 1)(3x - 2) \\ y' &= 2(3x - 2) + 3(2x + 1) \\ y' &= 6x - 4 + 6x + 3 \\ y' &= 12x - 1 \end{aligned}$$

$$\begin{aligned} u &= 2x + 1 \\ u' &= 2 \\ v &= 3x - 2 \\ v' &= 3 \\ y &= uv \\ y' &= u'v + v'u \end{aligned}$$

$$\begin{aligned} & -3x(x^2 + 1) \\ & -3x(x^2 + 1) \\ & -3(x^2 + 1) + 2x(-3x) \\ & -3x(x^2 + 1) \\ & -3(x^2 + 1) + 2x(3x) \\ & -3x(x^2 + 1) \\ & -3(1(x^2 + 1) + 2x(x)) \end{aligned}$$

Quotient Rule

$$\begin{aligned} y &= \frac{x^2}{2x + 1} \\ y' &= \frac{2x(2x + 1) - 2(x^2)}{(2x + 1)^2} \\ y' &= \frac{4x^2 + 2x - 2x^2}{(2x + 1)^2} \\ y' &= \frac{2x^2 + 2x}{(2x + 1)^2} \\ y' &= \frac{2x(x + 1)}{(2x + 1)^2} \end{aligned}$$

$$\begin{aligned} u &= x^2 \\ u' &= 2x \\ v &= 2x + 1 \\ v' &= 2 \\ y &= \frac{u}{v} \\ y' &= \frac{u'v - v'u}{v^2} \end{aligned}$$

$$\begin{aligned} y &= \frac{x^2 + 3x^3}{x} \\ y &= \frac{x^2}{x} + \frac{3x^3}{x} \\ y &= x + 3x^2 \\ y' &= 1 + 6x \end{aligned}$$

Separate Fractions

$$\begin{aligned} y &= \frac{1}{x} \\ y' &= \frac{0 \times x - 1 \times 1}{x^2} \\ y' &= \frac{-1}{x^2} \end{aligned}$$

Not a quotient*!

$$\begin{aligned} y &= \frac{x^3}{2} \\ y &= \frac{1}{2}x^3 \\ y' &= \frac{1}{2}(3x^2) \end{aligned}$$