the product rule

example

the product rule

If f and g are differentiable, then

$$\frac{d}{dx}\big(f(x)g(x)\big) = f'(x)g(x) + f(x)g'(x)$$

example

Differentiate the function $f(x) = (x^2+1)(x^3-1)$.

Here we set $f(x) = x^2+1 \implies f'(x) = 2x$

$g(x) = x^3-1 \implies g'(x) = 3x^2$

and use the product rule:

$$\begin{aligned}\frac{d}{dx}\big((x^2+1)(x^3-1)\big) &= 2x(x^3-1) + (x^2+1)3x^2 \\ &= 2x^4 - 2x + 3x^4 + 3x^2 \\ &= 5x^4 + 3x^2 - 2x\end{aligned}$$

the chain rule