

Differentiation Rules at a Glance

1. Constant Multiples:

$$\frac{d}{dx}(cf(x)) = cf'(x)$$

2. Sums:

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

3. Differences:

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

4. Product Rule:

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

5. Quotient Rule:

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{f'(x)g(x) - f(x)g'(x)}{(g(x))^2}$$

6. Chain Rule:

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

Abominations - Avoid Like the Plague!

- ‘The derivative of a product is the product of derivatives’

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

- ‘The derivative of a quotient is the quotient of derivatives’

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{f'(x)}{g'(x)}$$

- ‘The derivative of a composition is the composition of derivatives’

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

- ‘There is a sum in the chain rule’

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

- ‘There is a plus in the quotient rule’

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{f'(x)g(x) + f(x)g'(x)}{(g(x))^2}$$

- ‘Forgetting $g(x)$ in the argument of f' in the chain rule’

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