

3.9 Chain Rule

The Chain Rule covers all functions that are compositions. A composition of functions is a function inside another function. Compositions are in the form $y = f(g(x))$

$y = \sin(\log x)$ is a composition of functions. Outside function, $f(x) = \underline{\hspace{2cm}}$
Inside function, $g(x) = \underline{\hspace{2cm}}$

$y = (3x^2 + 4x + 5)^6$ is a composition of functions. Outside function, $f(x) = \underline{\hspace{2cm}}$
Inside function, $g(x) = \underline{\hspace{2cm}}$

The Chain Rule

For a function in the form $y = f(g(x))$, its derivative is $y' = f'(g(x)) \cdot g'(x)$

REPEAT AFTER ME: "The derivative of the outside(leave the inside alone), times the derivative of the inside."

Ex 1 State the derivative

$$y = (3x^2 + 4x + 5)^6$$

Simplified Factored Form - It doesn't make a whole lot of sense to expand and simplify a derivative. It does however make sense to factor as much as possible and simplify what doesn't.

Ex 2 State the derivative and write in factored form

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

Take derivative

Common Factor

Simplify the rest

Ex 3 State the derivative and write in factored form

$$y = \left(\frac{1 + x^2}{1 - x^2} \right)^{10}$$

Ex 4 State the derivative and write in factored form

$$y = (2x^3 - 3)^3(3x^4 - 1)^{-2}$$