THE CHAIN RULE

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THEOREM

$$(f \circ g)'(x) = f'(g(x))g'(x)$$

In $\frac{d}{dx}$ notation if $y = g(x)$ and $z = f(y)$,

$$\frac{dz}{dx} = \frac{dz}{dy}\frac{dy}{dx}$$

EXAMPLE

EXAMPLE

Calculate the derivative of $\sin(x^2)$

EXAMPLE

EXAMPLE

Calculate the derivative of

$$\left(\frac{x}{x+1}\right)^2$$

DIFFERENTIATING INVERSE FUNCTIONS

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THEOREM

$$(f^{-1})'(y) = \frac{1}{f'(x)} \text{ where } y = f(x)$$

In $\frac{d}{dx}$ notation, $\frac{dx}{dy} = \frac{dy}{dx}$

EXAMPLE

EXAMPLE

Let $g(y) = \sqrt{y}$ for $y > 0$

EXAMPLE

EXAMPLE

Calculate the derivative of $g(y) = \ln y$ for $y > 0$

EXAMPLE

EXAMPLE

Calculate the derivative of $g(y) = \arcsin(y)$ for $y \in (-1, 1)$