



MTH 201 -- Calculus

Module 6A: The Chain Rule

October 12-13, 2020



Agenda for today

- Polling activity over Daily Preparation + Q&A time
- Activity: Practice with composites and the Chain Rule
- Q/A + Feedback time

The fundamental algebraic structure of the function

$$f(x) = \sqrt{x} + \frac{x^2}{x+1} \text{ is}$$

Sum

Product

Quotient

Composite



To 0

Which of these functions is fundamentally a *composite*?

Select all that apply.

$$f(x) = \frac{x}{x^2+1}$$

$$f(x) = \left(\frac{x}{x+1}\right)^3$$

$$f(x) = \sin(x^2)$$

$$f(x) = \sin^2(x)$$

$$f(x) = x^2 \sin(x)$$



To

0

The function $y = \sin^2(x)$ is fundamentally a composite, of the form $y = f(g(x))$. In this case,

$$f(x) = x \text{ and } g(x) = \sin^2(x)$$

$$f(x) = \sin(x) \text{ and } g(x) = x^2$$

$$f(x) = x^2 \text{ and } g(x) = \sin(x)$$

$$f(x) = x^2 \text{ and } g(x) = \sin(x^2)$$



To 0

To find the derivative of $y = \sqrt{x^2 + 1}$:

Simplify $\sqrt{x^2 + 1}$ to $x + 1$ then use the Power and Sum/Difference Rules

Write $y = (\sqrt{x}) \cdot (x^2 + 1)$, then use the Product Rule

Take the derivative of $y = x^2 + 1$ and plug in \sqrt{x} to the result

Take the derivative of $y = \sqrt{x}$ and plug in $x^2 + 1$ to the result

Take the derivative of $y = \sqrt{x}$ and plug in $x^2 + 1$ to the result, then multiply by the derivative of $x^2 + 1$

Take the derivative of $y = x^2 + 1$ and plug in \sqrt{x} to the result, then multiply by the derivative of \sqrt{x}



Practice with composites and the Chain Rule (Jamboard)

To find the derivative of $y = e^{x^2-1}$:

Use the basic rule for the derivative of e^x to get $y' = e^{x^2-1}$

Write $y = e^x \cdot (x^2 - 1)$, then use the Product Rule

Take the derivative of $y = x^2 - 1$ and plug in e^x to the result

Take the derivative of $y = e^x$ and plug in $x^2 - 1$ to the result

Take the derivative of $y = x^2 + 1$ and plug in e^x to the result, then multiply by the derivative of $e^x x$

Take the derivative of $y = e^x$ and plug in $x^2 - 1$ to the result, then multiply by the derivative of $x^2 - 1$



In the followup, you'll be looking at *combinations* of the rules you've learned. When differentiating $y = x^2 e^{x^2-1}$, which differentiation rule would be used *first*?

Basic/elementary rules for power and exponential functions

Sum/Difference Rule

Product Rule

Quotient Rule

Chain Rule

