

chain rule

$y = f(g(x))$ f outer, g inner

$$dy/dx = f'(g(x)) \cdot g'(x)$$

f' at the inside, not at x !

ex: $y = (3x+1)^2$

out: u^2 in: $3x+1$

$$dy/dx = 2(3x+1)$$

$$dy/dx = dy/du \cdot du/dx$$

$$d/dx \sin(x^2) = \cos(x^2) \cdot 2x$$

$$d/dx e^{5x} = 5e^{5x}$$

$\sqrt{\sin(x^2)}$: 3 layers

$$\rightarrow \cos(x^2) \cdot 2x / 2\sqrt{\sin(x^2)}$$

if lost: name u , v

$$(x^2+1)^{10} \rightarrow 10(x^2+1)^9 \cdot 2x$$

$$\text{implicit: } d/dx y^2 = 2y dy/dx$$

$$\cos(3x) \rightarrow -3 \sin(3x)$$

1. outer + inner

2. f' keeps the inside

3. $\times$ inner'

product vs chain

$x \cdot \sin x \rightarrow$ product

$\sin(x^2) \rightarrow$ chain

$$x^2 e^{3x} = 2x e^{3x}$$

$$1/(x^2+4) = (x^2+4)^{-1}$$

$$\rightarrow -2x / (x^2+4)^2$$

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

$$\rightarrow 2 \sin x \cos x$$

not $\cos^2 x$!

$$d/dx \ln(x^2+1) = 2x/(x^2+1)$$

Moments · Maya — Session 1

Lecture: Calculus I — The Chain Rule (demo) · Exported from Inkling on 2026-09-28

What your final page doesn't show: every correction, gap and breakthrough, and when it happened in the lecture.

■ 01:02 · Breakthrough

Concept

Multiplying the inner derivative

Reading

$dy/dx = 2(3x + 1) \rightarrow dy/dx = 2(3x + 1) \text{ times } 3 = 6(3x + 1)$

What changed

Stopped after the outer derivative and forgot to multiply by the inner derivative, 3.

Lecture

"three x plus one. The outer derivative is two u, so two times three x plus one. Then we multiply by the derivative of the inside, which is three. So the answer is six times three x plus one. A common mistake is to stop..."

Re-explanation

For $y = (3x + 1)^2$, the outer function is u^2 and the inner is $3x + 1$. The outer derivative gives $2(3x + 1)$. That is only half the job: the inside changes three times as fast as x, so you multiply by 3. The answer is $6(3x + 1)$.

Stopping at $2(3x + 1)$ is the most common chain rule mistake.

■ 01:40 · Corrected

Concept

Sine of x squared

Lecture

"a nice way to remember it. Let's do sine of x squared. Outer function sine, inner function x squared. The derivative is cosine of x squared, times two x. Be careful: it is cosine of x squared, not cosine of x, times two x. Now..."

■ 04:10 · Gap

Concept

Chain versus product rule

Lecture

"is for one function plugged into another, like sine of x squared. Ask yourself: is the x sitting inside something, or next to something? Sometimes you need both rules in the same problem. Take x squared times e to the three x. Product rule first:..."

Status

Resolved