**Lecture Notes · Unit 3 · Lecture 7** AP CED 3.5

# Which Derivative Rule Goes FIRST? | AP Calculus AB 3.5

Tap a blue play button next to a heading to open that part of the video. ▶ Watch the video

new rules today → 0

exam → choosing

which rule goes first?

## PROBLEM 1 OF 8

Let $f(x)=\frac{3}{x}+3^x+e^3$. Find $f'(1)$.

$(x^n)'=nx^{n-1}$
$(a^x)'=a^x\ln a$
$(\text{constant})'=0$

**Solution**

Term by term → where is x?

$\frac{3}{x}=3x^{-1}$ (base)

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

$3^x$ (exponent) → $3^x\ln 3$

$e^3\approx 20,\quad (e^3)'=0$

$f'(x)=-3x^{-2}+3^x\ln 3$

$f'(1)=-3+3\ln 3$

workbook

## PROBLEM 2 OF 8

Let $g(x)=x^2\ln(x^2+1)$. What is $g'(1)$?

(A) 1 (B) $2\ln 2$

(C) $2\ln 2+\frac{1}{2}$ (D) $2\ln 2+1$

$(uv)'=u'v+uv'$
$(\ln u)'=\frac{u'}{u}$

**Solution**

x = 1 → last x

last operation → first rule: product

$\frac{d}{dx}\ln(x^2+1)=\frac{2x}{x^2+1}$

$g'=2x\ln(x^2+1)+x^2\frac{2x}{x^2+1}$

$g'(1)=2\ln 2+1$

workbook

## PROBLEM 3 OF 8

Let $h(x)=\frac{2x+1}{x^2+1}$. Find $h'(1)$.

$\left(\frac{u}{v}\right)'=\frac{vu'-uv'}{v^2}$

**Solution**

Sum below → quotient

$h'(x)=\frac{(x^2+1)\cdot 2-(2x+1)\cdot 2x}{(x^2+1)^2}$

$3 \cdot 2 = 6 \rightarrow \frac{4-6}{4}$

$h'(1) = -\frac{1}{2}$

Workbook

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**PROBLEM 4 OF 8**

Let $k(x) = (x^2 + 1)^5$. Find $k'(1)$.

$(u^n)' = nu^{n-1} \cdot u'$

**Solution**

$(\,)^5 \rightarrow$ chain

$k' = 5(x^2+1)^4 \cdot 2x$

$k'(1) = 5 \cdot 2^4 \cdot 2 = 160$

Workbook

Autopilot

✗ Common mistake

$5 \cdot 2^4 = 80$

✓ Do this

$5(x^2+1)^4 \cdot 2x \rightarrow 160$

AP → missing $u'$

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**PROBLEM 5 OF 8**

The curve $x^3 + y^3 = 6xy$ passes through $(3, 3)$.

Find $\frac{dy}{dx}$ at $(3, 3)$.

$(uv)' = u'v + uv'$

$\frac{d}{dx}y^n = ny^{n-1}\frac{dy}{dx}$

**Solution**

Implicit → $(3, 3)$

$3x^2 + 3y^2\frac{dy}{dx}$

$= 6y + 6x\frac{dy}{dx}$

$27 + 27\frac{dy}{dx} = 18 + 18\frac{dy}{dx}$

$9y' = -9 \rightarrow \frac{dy}{dx} = -1$

Workbook

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**PROBLEM 6 OF 8**

Let $f(x) = x^5 + 2x - 1$, and let $g$ be the inverse function of $f$. What is $g'(2)$?

(A) $\frac{1}{7}$ (B) $\frac{1}{82}$ (C) 7 (D) $\frac{1}{2}$

$g'(b) = \frac{1}{f'(a)}$ where $f(a) = b$

**Solution**

Inverse $f(a) = 2 \rightarrow \frac{1}{f'(a)}$

$a^5 + 2a - 1 = 2 \rightarrow a = 1$

$f'(x) = 5x^4 + 2,\ f'(1) = 7$

$g'(2) = \frac{1}{f'(1)} = \frac{1}{7}$

Workbook

## PROBLEM 7 OF 8

Let $y = \tan^{-1}(x^2)$. Find $\frac{dy}{dx}$ at $x = 1$.

$$\frac{d}{dx}\tan^{-1} u = \frac{u'}{1+u^2}$$

**Solution**

$u = x^2 \rightarrow u'$ on top

$u' = 2x,\ u^2 = x^4$

$$\frac{dy}{dx} = \frac{2x}{1+x^4}$$

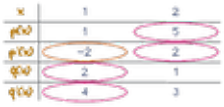
$x = 1 \rightarrow \frac{2}{2} = 1$

workbook

## PROBLEM 8 OF 8

The functions $p$ and $q$ are differentiable; the table gives values.

Let $k(x) = \frac{p(q(x))}{x}$. Find $k'(1)$.



**Solution**

$u = q(x) \rightarrow p(u) \rightarrow$ quotient $\rightarrow$ top: chain

$$k'(x) = \frac{xp'(q(x))q'(x) - p(u)}{x^2}$$

$q(1) = 2$

$k'(1) = p'(2)q'(1) - p(2)$

$2 \cdot 4 - 5 = 3$

$x - 13$

workbook

Next → 3.6 higher-order derivatives

Next: the workbook for this topic (link in the video description). Stuck? Ask in the comments.