

AP Calculus AB · Definition of the Derivative and Basic Rules · Worksheet

Common Core AP Calculus AB Unit 2 · mathovore.fr

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This ap calculus derivative rules worksheet gives 20 problems on definition of the derivative and basic rules, ordered from easy to hard, with a separate answer key.

These 20 problems cover AP Calculus AB Unit 2: average and instantaneous rates of change, the limit definition, differentiability, the power, sum, product and quotient rules, and derivatives of trig, exponential and logarithmic functions.

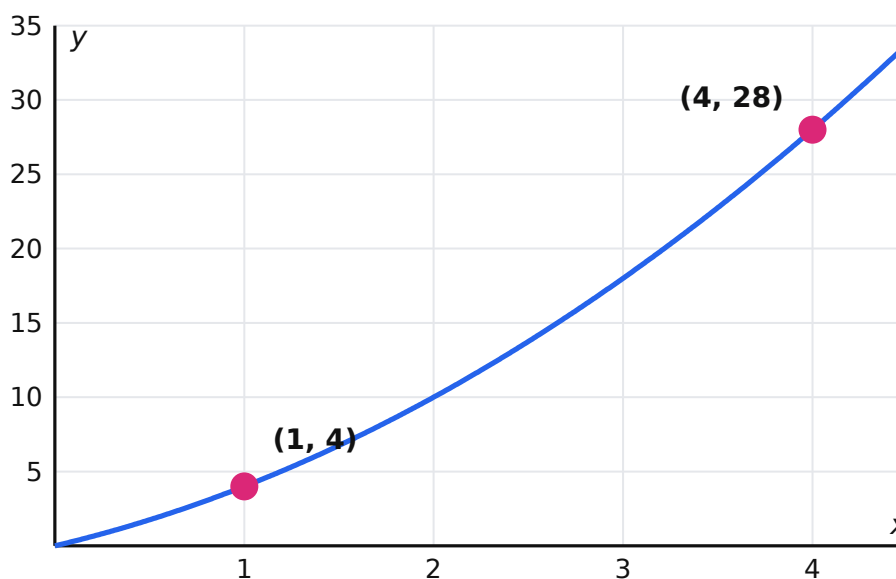
They run from easy to hard and finish with applications such as projectile height, marginal cost and drug concentration. Show every step, and simplify only when asked.

AP Calculus ABCommon Core: AP Calculus AB Unit 2

AP Calculus Derivative Rules Worksheet: problems 1-5

Problem 1: Average rate of change

The graph of $f(x) = x^2 + 3x$ is shown. Find the average rate of change of f on $[1, 4]$, and write what it represents on the graph.



Graph of f .

Problem 2: Derivative at a point by definition

Use the limit definition to find each derivative.

- a. $f'(3)$ for $f(x) = x^2$
- b. $f'(2)$ for $f(x) = x^2 + 4x$

Problem 3: Limit definition for a function

Let $f(x) = 2x^2 - 5x$. Use the limit definition to find $f'(x)$, then evaluate $f'(1)$.

Problem 4: Definition with a reciprocal

Apply the definition of the derivative as a limit to differentiate $g(x) = \frac{2}{x-1}$.

Problem 5: Power rule

Differentiate each function.

- a. $f(x) = x^8$
- b. $f(x) = 6x^5$
- c. $f(x) = \frac{3}{x^2}$
- d. $f(x) = \sqrt[3]{x}$

AP Calculus Derivative Rules Worksheet: problems 6-10

Problem 6: Sum and constant multiple rules

Let $f(x) = 4x^3 - 7x^2 + 5x - 9$. Find $f'(x)$, evaluate $f'(2)$, and find every x where $f'(x) = 5$.

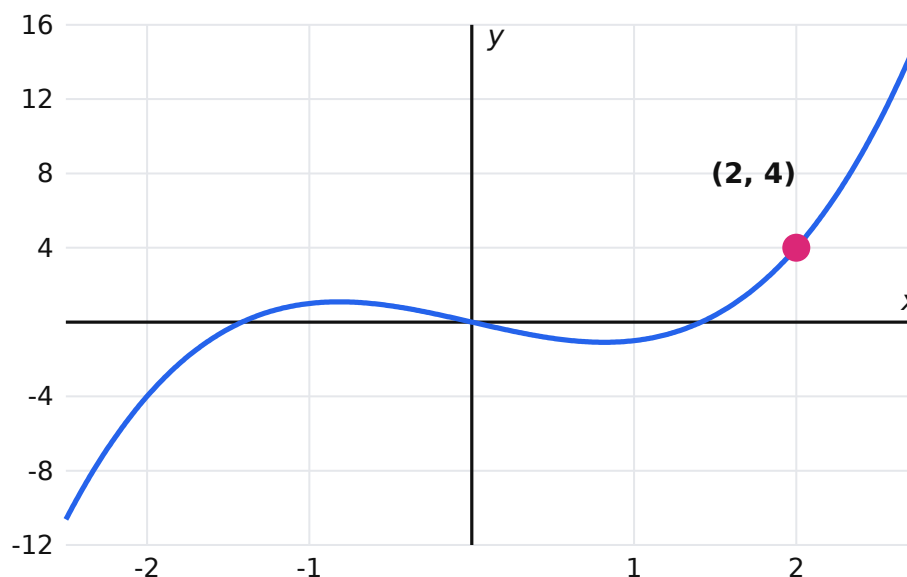
Problem 7: Derivatives of sin, cos, e^x and $\ln x$

Find the derivative.

- a. $f(x) = 3\sin x - 2\cos x$
- b. $f(x) = 5e^x + 2\ln x$
- c. $g(x) = e^x + \sin x$; then find $g'(0)$
- d. $h(x) = 4\ln x - x^3$; then find $h'(1)$

Problem 8: Tangent line

The graph of $f(x) = x^3 - 2x$ is shown. Write an equation of the tangent line at $x = 2$.



Graph of f .

Problem 9: Horizontal tangent lines

At which points does the graph of $f(x) = 2x^3 - 3x^2 - 12x + 1$ have a horizontal tangent line? Give both coordinates of each point.

Problem 10: Product rule

Find the derivative. Do not simplify part (a) before checking it.

- $f(x) = (x^2 + 1)(x^3 - 4x)$
- $f(x) = x^2 \sin x$
- $f(x) = e^x \ln x$

AP Calculus Derivative Rules Worksheet: problems 11-15

Problem 11: Quotient rule

Find the derivative.

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

Problem 12: Derivatives of tan, sec, csc and cot

Find the derivative.

- $f(x) = \tan x$; then evaluate $f'\left(\frac{\pi}{4}\right)$
- $f(x) = 3 \sec x$

c. $f(x) = 2 \cot x + \csc x$

Problem 13: Estimate derivatives from a table

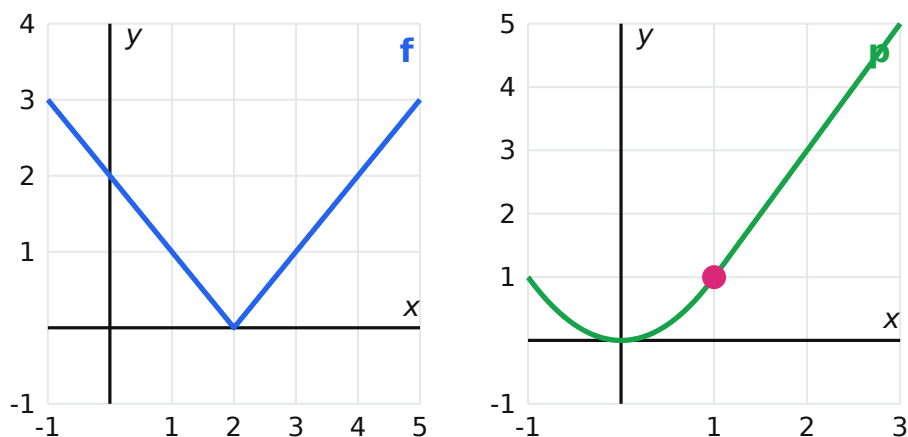
Selected values of a differentiable function f are shown.

x	1	1.5	2	2.5	3
$f(x)$	2.0	3.1	5.0	7.7	11.0

- Find the average rate of change of f on $[1, 2]$.
- Estimate $f'(2)$ using the values at $x = 1.5$ and $x = 2.5$.
- Use your estimate to write an equation of the tangent line at $x = 2$.

Problem 14: Is it differentiable?

Two graphs are shown: $f(x) = |x - 2|$ and $p(x) = x^2$ for $x \leq 1$, $p(x) = 2x - 1$ for $x > 1$.

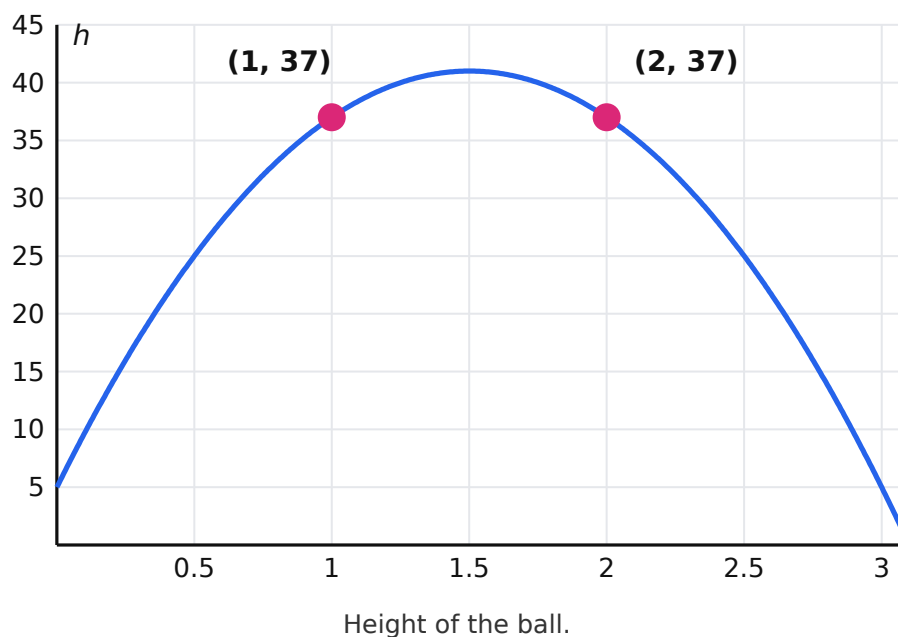


Graphs of f and p .

- Is f differentiable at $x = 2$? Use one-sided slopes.
- Show that p is differentiable at $x = 1$ and find $p'(1)$.

Problem 15: Height of a ball

A ball is thrown upward and its height in feet after t seconds is $h(t) = -16t^2 + 48t + 5$.



- Find the average velocity on $[1, 2]$.
- Find the velocity at $t = 1$.
- Find the time and height at the top of the flight.

AP Calculus Derivative Rules Worksheet: problems 16-20

Problem 16: Marginal cost of bicycles

A shop pays $C(x) = 0.02x^2 + 3x + 500$ dollars to build x bicycle helmets. Find $C'(100)$ and interpret it. Then compare it with $C(101) - C(100)$.

Problem 17: Learning curve

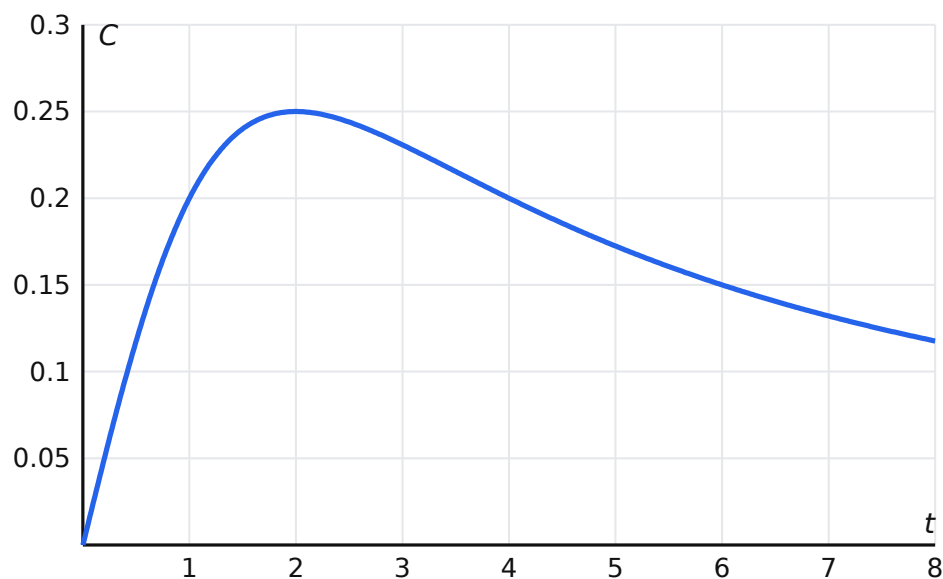
After t hours of practice ($t \geq 1$), a typing student scores $S(t) = 40 + 15 \ln t$ words per minute. Find $S'(t)$, then $S'(5)$ and $S'(10)$, and explain what the change says about practice.

Problem 18: Revenue growth

A store sells $q(t) = 300 - 4t$ scarves per day at a price of $p(t) = 20 + 0.5t$ dollars, where t is days since a promotion began. Revenue is $R(t) = p(t)q(t)$. Find $R'(10)$ and interpret it.

Problem 19: Concentration of a medicine

The concentration of a medicine in the blood is $C(t) = \frac{t}{t^2 + 4}$ mg/L, t hours after a dose.



Concentration over time.

- Find $C'(t)$.
- Find $C'(1)$ and interpret it.
- At what time is the concentration greatest, and what is the maximum?

Problem 20: Derivatives from a table of values

Values of two differentiable functions are shown.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
2	3	-1	5	4

Find the derivative at $x=2$ of each function.

- $h(x) = f(x)g(x)$
- $k(x) = \frac{f(x)}{g(x)}$
- $m(x) = 2f(x) - 3g(x)$

How to use this ap calculus derivative rules worksheet

Print this ap calculus derivative rules worksheet as a PDF, solve every problem on paper, then compare with the answer key.

