

AP Calculus AB · Chain Rule, Implicit Differentiation and Inverse Functions · Worksheet

Common Core AP Calculus AB Unit 3 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

This ap calculus chain implicit worksheet gives 24 problems on chain rule, implicit differentiation and inverse functions, ordered from easy to hard, with a separate answer key.

These 24 problems practice the chain rule, implicit differentiation, derivatives of inverse and inverse trig functions, and second derivatives, as described in AP Calculus AB Unit 3. They move from single compositions to mixed procedures.

The last six problems place the ideas in tables, graphs and real settings. Show every step and keep the units.

AP Calculus ABCommon Core: AP Calculus AB Unit 3

AP Calculus Chain Implicit Worksheet: problems 1-5

Problem 1: Power of a linear function

Find $\frac{d}{dx}(3x+1)^5$.

Problem 2: Square root of a linear function

Find the derivative of $y = \sqrt{4x-7}$.

Problem 3: Sine of a multiple

Find $\frac{d}{dx}\sin(5x)$.

Problem 4: Exponential with a power

Find the derivative of $y = e^{x^2}$.

Problem 5: Log of a quadratic

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

AP Calculus Chain Implicit Worksheet: problems 6-10

Problem 6: Cube of cosine

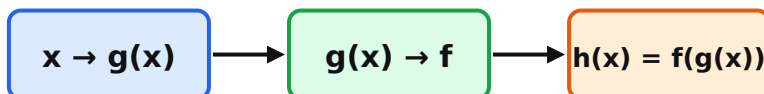
Find the derivative of $y = \cos^3 x$.

Problem 7: Product with a chain

Find $f'(x)$ for $f(x) = x(x^2+3)^4$. Factor the result.

Problem 8: Composite from given values

Let $h(x) = f(g(x))$. It is known that $g(1) = 2$, $g'(1) = 5$, $f(2) = 7$ and $f'(2) = -4$. Find $h(1)$ and $h'(1)$.

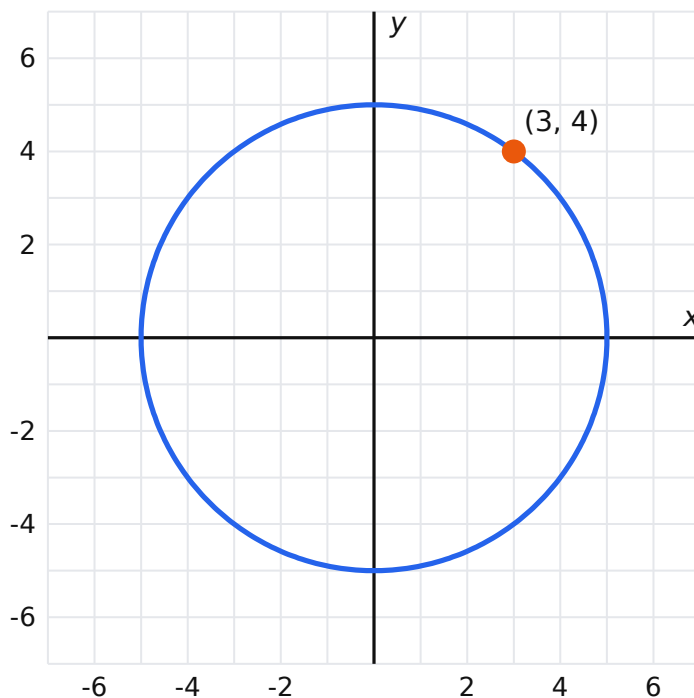


Values flow through g first, then f .

Problem 9: Slope on a circle

The circle $x^2 + y^2 = 25$ is shown.

- Find $\frac{dy}{dx}$.
- Write an equation of the tangent line at $(3, 4)$.



Circle of radius 5 with the point $(3, 4)$.

Problem 10: Implicit slope with a mixed term

Find the slope of the curve $x^2 + xy + y^2 = 7$ at the point $(1, 2)$.

AP Calculus Chain Implicit Worksheet: problems 11-15

Problem 11: Tangent line to a cubic curve

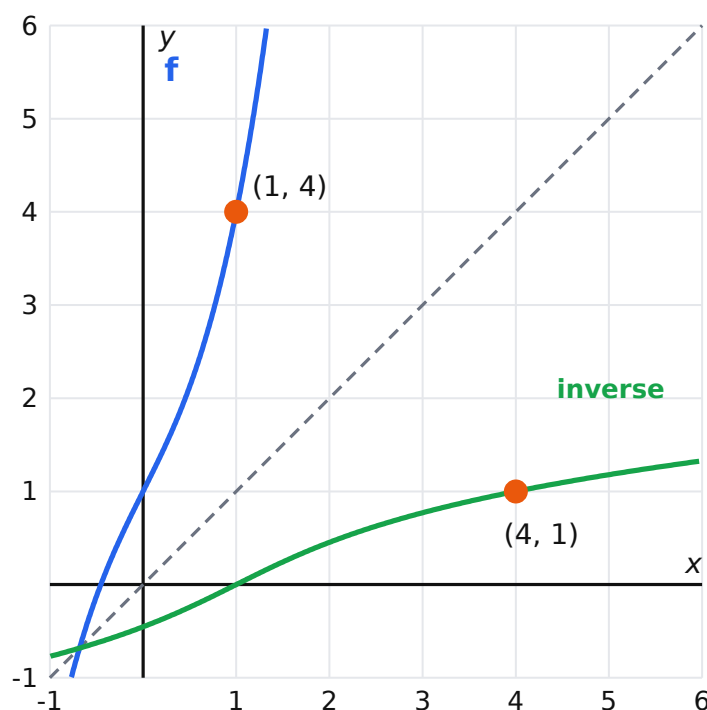
Write an equation of the tangent line to $x^3 + y^3 = 9$ at $(1, 2)$.

Problem 12: Product of x and y terms

Find $\frac{dy}{dx}$ at $(1, 2)$ on the curve $x^2y + y^3 = 10$.

Problem 13: Slope of an inverse function

Let $f(x) = x^3 + 2x + 1$ and let g be its inverse function. Find $g'(4)$.



$f(x) = x^3 + 2x + 1$ and its inverse are mirror images across $y = x$.

Problem 14: Inverse of an exponential sum

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

Problem 15: Arctangent of a multiple

Find $\frac{d}{dx} \tan^{-1}(3x)$.

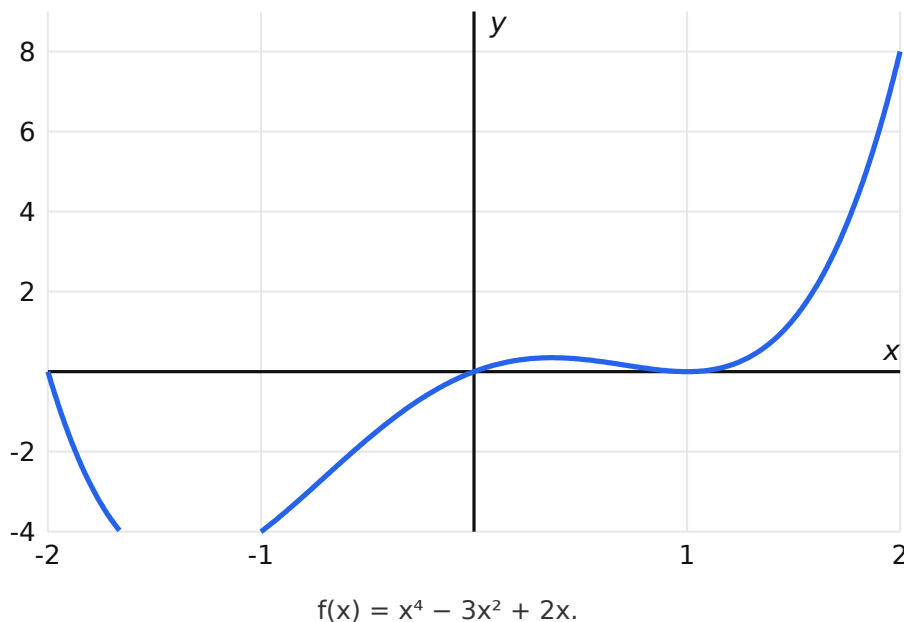
AP Calculus Chain Implicit Worksheet: problems 16-20

Problem 16: Arcsine of a power

Find the derivative of $y = \sin^{-1}(x^2)$.

Problem 17: Second derivative of a polynomial

Let $f(x) = x^4 - 3x^2 + 2x$. Find $f''(x)$, evaluate $f''(2)$, and find the values of x where $f''(x) = 0$.



Problem 18: Second derivative with a product

Find $\frac{d^2y}{dx^2}$ for $y = xe^{2x}$. Factor the result.

Problem 19: Second derivative on a circle

For the circle $x^2 + y^2 = 25$, use $\frac{dy}{dx} = -\frac{x}{y}$ to find $\frac{d^2y}{dx^2}$ at $(3,4)$.

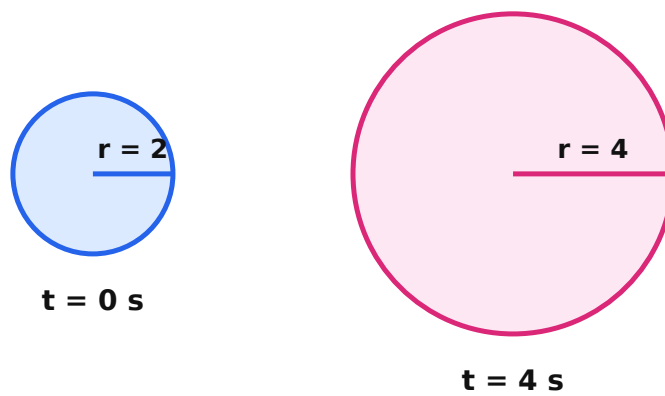
Problem 20: Town population growth

The population of a small town is modeled by $P(t) = 1200e^{0.03t}$ residents, where t is the number of years since 2020. Find $P'(10)$ and interpret it with units.

AP Calculus Chain Implicit Worksheet: problems 21-24

Problem 21: Growing balloon

Sofia inflates a balloon. Its radius in inches is $r(t) = 2 + 0.5t$ after t seconds, and its volume is $V = \frac{4}{3}\pi r^3$. Find the rate of change of the volume at $t = 4$.



The radius grows at 0.5 inch per second, so it doubles from 2 in. to 4 in. in 4 seconds.

Problem 22: Composites from a table

Values of f , g and their derivatives are in the table. Let $h(x) = f(g(x))$ and $k(x) = g(f(x))$. Find $h'(1)$ and $k'(3)$.

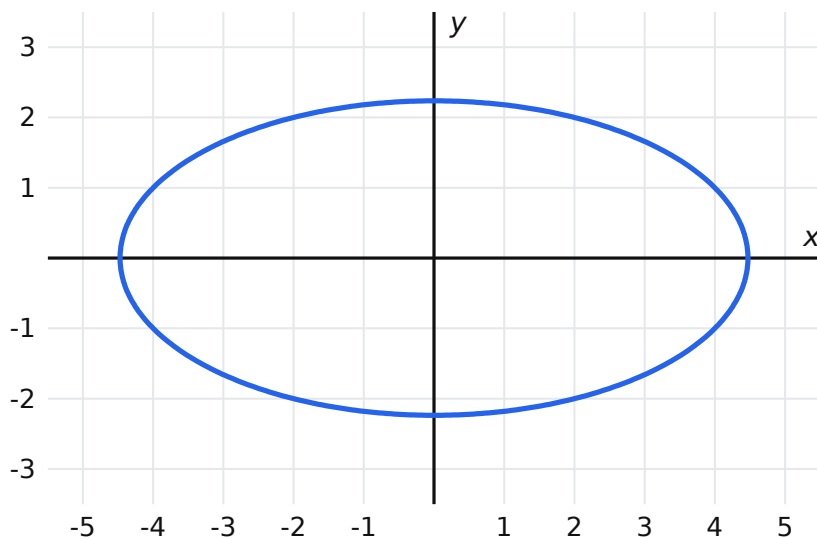
x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	3	2	2	-1
2	1	4	3	5
3	2	-3	1	6

Problem 23: Choosing the procedure

Let $f(x) = \ln x \cdot \sqrt{x^2 + 1}$. Find $f'(x)$ and evaluate $f'(1)$.

Problem 24: Horizontal tangents on an ellipse

A drone flies along the ellipse $x^2 + 4y^2 = 20$ (units in hundreds of feet). Find all points where the tangent line is horizontal.



The ellipse $x^2 + 4y^2 = 20$.

How to use this ap calculus chain implicit worksheet

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

