

AP Calculus AB - Product Rule, Quotient Rule and Trig Derivatives - Worksheet

Common Core AP CALC AB 2.8, AP CALC AB 2.9, AP CALC AB 2.10 · maths-pdf.fr/en/

Name: _____ Class: _____ Date: ____/____/____

These 22 problems practice the product rule, the quotient rule and the derivatives of $\tan x$, $\cot x$, $\sec x$ and $\csc x$ (AP Calculus AB, topics 2.8, 2.9, 2.10). The early problems build the basic skill, and each one uses a different function or situation so that no two feel alike.

Later problems combine the rules with tangent lines, tables of values, horizontal tangents and situations such as honey revenue and vitamin concentration. Work in pencil, show every step, and check the answer key only after a full attempt.

AP Calculus AB · Common Core State Standards: **AP CALC AB 2.8, AP CALC AB 2.9, AP CALC AB 2.10**

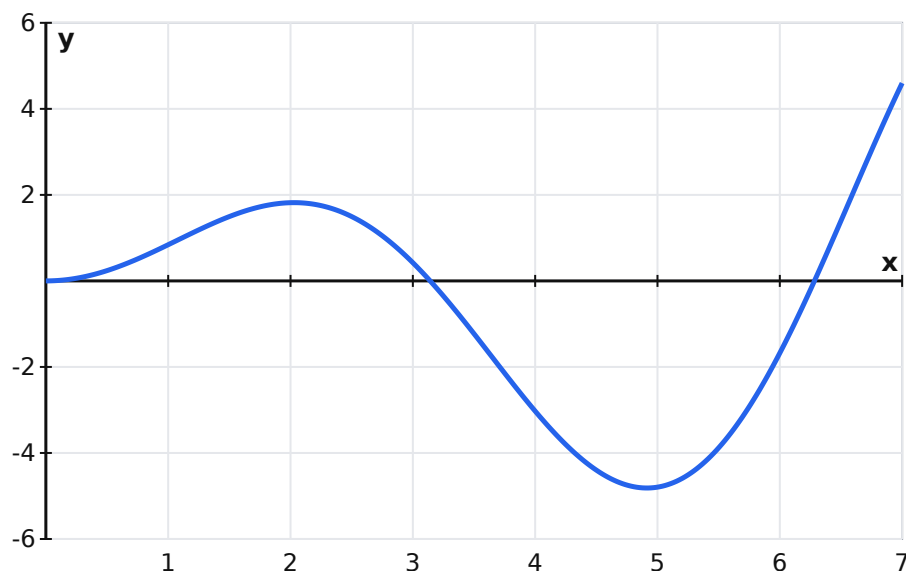
Exercise 1 - Product with an exponential

Differentiate $f(x) = x^2 e^x$.

Exercise 2 - Product of two polynomials

Differentiate $f(x) = (3x+1)(x^2-4)$ using the product rule, and check by multiplying first.

Exercise 3 - Product with sine



The graph of $f(x) = x \sin x$.

Differentiate $f(x) = x \sin x$.

Exercise 4 - Exponential times log

Differentiate $f(x) = e^x \ln x$.

Exercise 5 - Square root times cosine

Differentiate $f(x) = \sqrt{x} \cos x$.

Exercise 6 - Simple quotient

Differentiate $f(x) = \frac{x}{x+1}$.

Exercise 7 - Quotient with a quadratic

Differentiate $f(x) = \frac{x^2+1}{x-3}$.

Exercise 8 - Cosine over a power

Differentiate $f(x) = \frac{\cos x}{x^2}$.

Exercise 9 - Sine over x

Differentiate $f(x) = \frac{\sin x}{x}$.

Exercise 10 - Log over a power

Differentiate $f(x) = \frac{\ln x}{x^3}$.

Exercise 11 - Derivative of tangent

Find $\frac{d}{dx}[\tan x]$ and evaluate it at $x = \frac{\pi}{4}$.

Exercise 12 - Product with tangent

Differentiate $f(x) = x \tan x$.

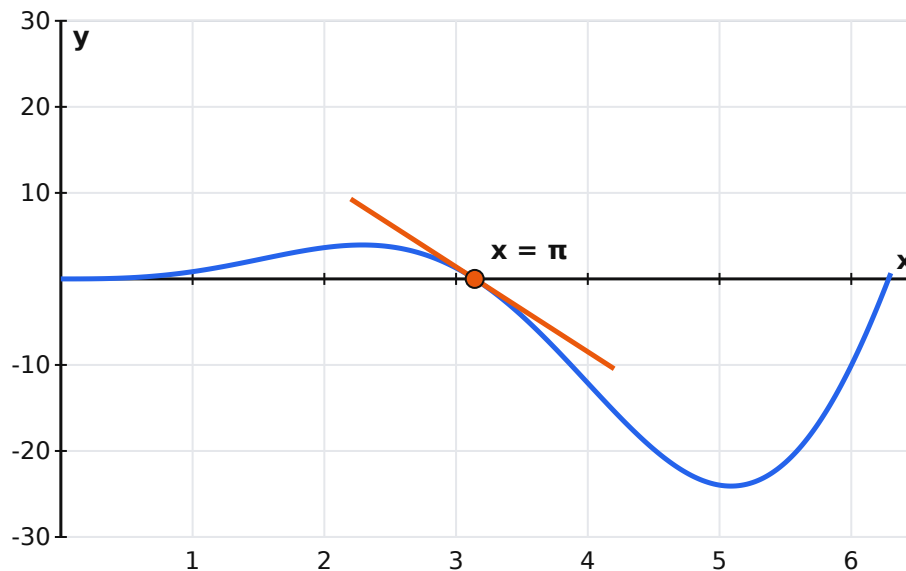
Exercise 13 - Secant at a point

Find $\frac{d}{dx}[\sec x]$ and evaluate it at $x = \frac{\pi}{3}$.

Exercise 14 - Cotangent and cosecant

Differentiate $f(x) = \cot x + \csc x$.

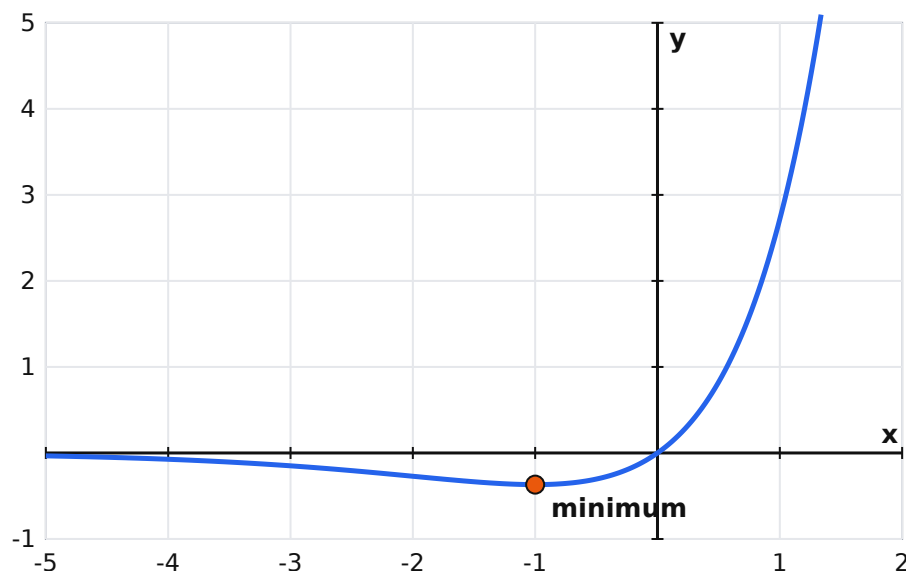
Exercise 15 - Tangent line with a product



The tangent to $x^2 \sin x$ at $x = \pi$.

Find the tangent line to $f(x) = x^2 \sin x$ at $x = \pi$.

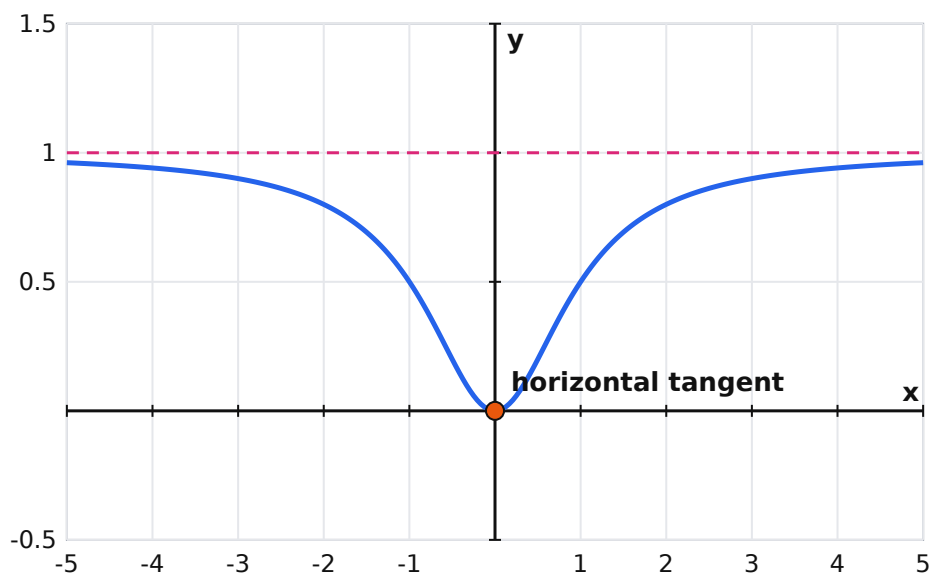
Exercise 16 - Horizontal tangent



The graph of $f(x) = xe^x$.

Find where $f(x) = xe^x$ has a horizontal tangent.

Exercise 17 - Quotient and a horizontal tangent



The graph of $f(x) = x^2/(x^2 + 1)$.

Differentiate $f(x) = \frac{x^2}{x^2+1}$ and find where the tangent is horizontal.

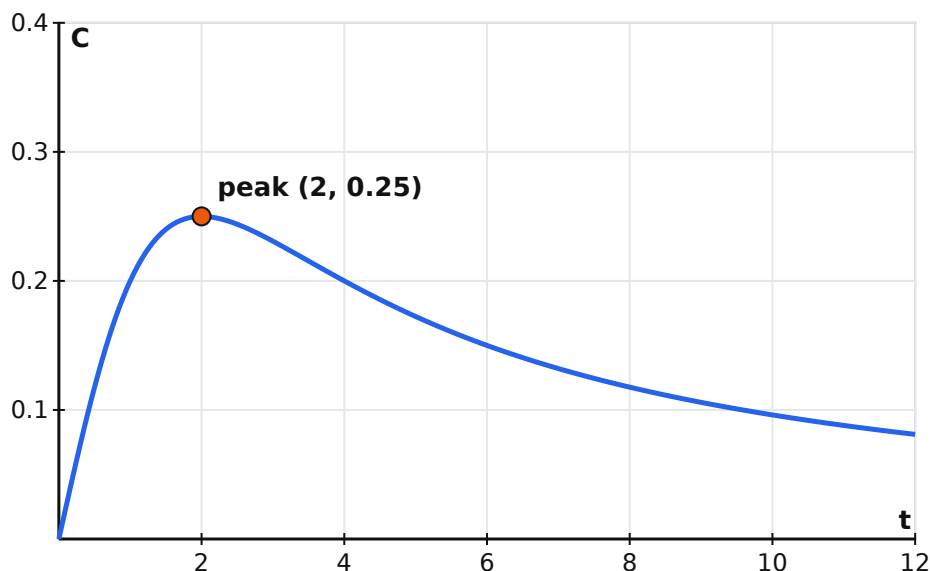
Exercise 18 - Using a table of values

Suppose $f(2)=3$, $f'(2)=-1$, $g(2)=4$ and $g'(2)=5$. Find $(fg)'(2)$ and $\left(\frac{f}{g}\right)'(2)$.

Exercise 19 - Revenue growth

A farmers market stand sells $q(t) = 200 - 4t$ jars of honey per week at a price of $p(t) = 10 + 0.5t$ dollars per jar, where t is the number of weeks since opening. The revenue is $R(t) = p(t) q(t)$. Find $R'(4)$ and interpret it.

Exercise 20 - Peak concentration



Medicine concentration over time.

The concentration of a vitamin in the blood in mg/L is $C(t) = \frac{t}{t^2 + 4}$ after t hours. Find $C'(t)$ and the time when the concentration is largest.

Exercise 21 - Three factors

Differentiate $f(x) = x^2 e^x \sin x$.

Exercise 22 - Proving the tangent derivative

Use the quotient rule on $\tan x = \frac{\sin x}{\cos x}$ to show that $(\tan x)' = \sec^2 x$.