

AP Calculus AB - The Chain Rule - Worksheet

Common Core AP CALC AB 3.1 · maths-pdf.fr/en/

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

These 22 problems practice the chain rule for composite functions, including powers, trig, exponential and logarithmic layers (AP Calculus AB, topics 3.1). The early problems build the basic skill, and each one uses a different function or situation so that no two feel alike.

Later problems use three layers, the chain rule inside products and quotients, tables of values and real situations such as cooling coffee and a pendulum. 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 3.1**

Exercise 1 - Power of a linear function

Differentiate $f(x) = (3x+2)^5$.

Exercise 2 - Power of a quadratic

Differentiate $f(x) = (x^2-4x)^3$.

Exercise 3 - Square root of a linear function

Differentiate $f(x) = \sqrt{5x-1}$.

Exercise 4 - Reciprocal power

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

Exercise 5 - Sine of a multiple

Differentiate $f(x) = \sin 4x$.

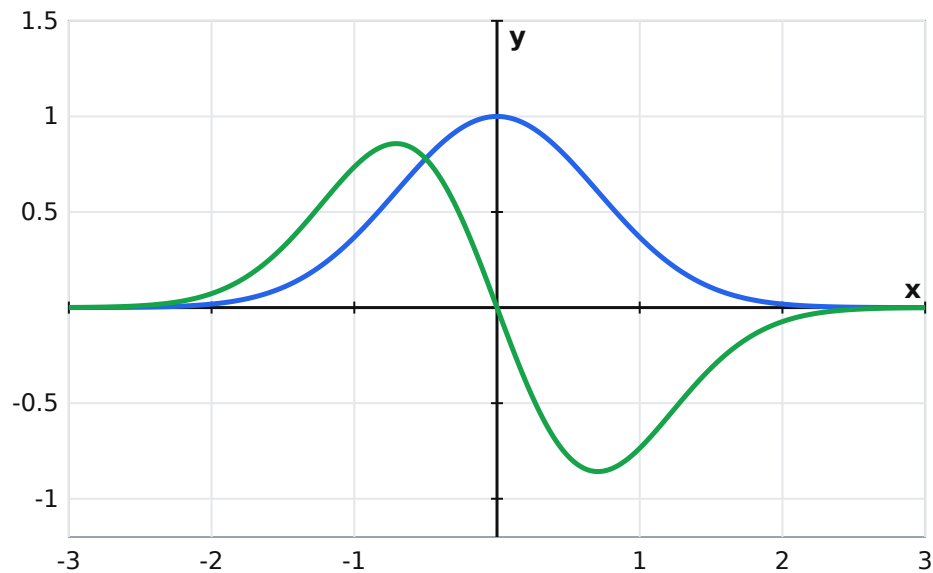
Exercise 6 - Cosine of a power

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

Exercise 7 - Exponential with a multiple

Differentiate $f(x) = e^{3x}$.

Exercise 8 - Bell curve



The bell curve e^{-x^2} and its derivative.

Differentiate $f(x) = e^{-x^2}$ and explain why the derivative is zero at $x=0$.

Exercise 9 - Log of a linear function

Differentiate $f(x) = \ln(5x+2)$.

Exercise 10 - Log of a quadratic

Differentiate $f(x) = \ln(x^2+1)$.

Exercise 11 - Sine squared

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

Exercise 12 - Tangent of a multiple

Differentiate $f(x) = \tan 3x$.

Exercise 13 - Sine of an exponential

Differentiate $f(x) = \sin(e^x)$ and $g(x) = e^{\sin x}$.

Exercise 14 - Three layers

Differentiate $f(x) = \cos^3(2x)$.

Exercise 15 - Chain inside a product

Differentiate $f(x) = x^2\sqrt{x^2+1}$.

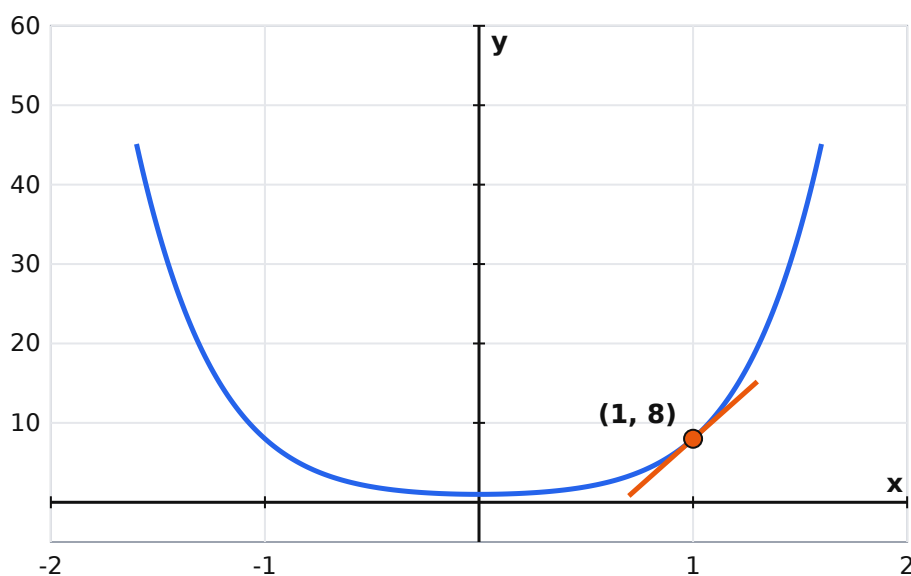
Exercise 16 - Chain inside a quotient

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

Exercise 17 - Composite from a table

Let $h(x) = f(g(x))$. Given $g(1) = 3$, $g'(1) = 2$, $f(3) = 5$ and $f'(3) = -4$, find $h'(1)$.

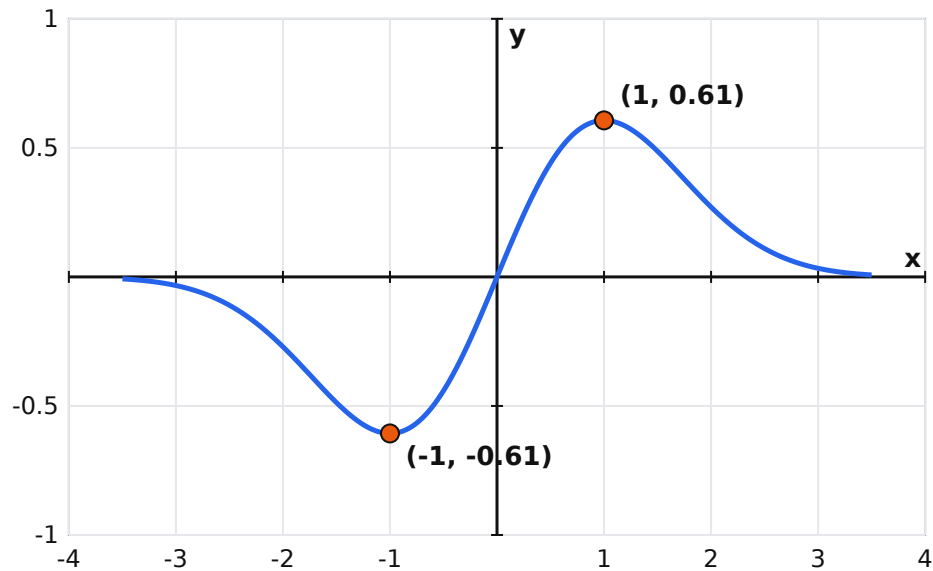
Exercise 18 - Tangent line with the chain rule



The tangent at $x = 1$.

Find the tangent line to $y = (x^2 + 1)^3$ at $x = 1$.

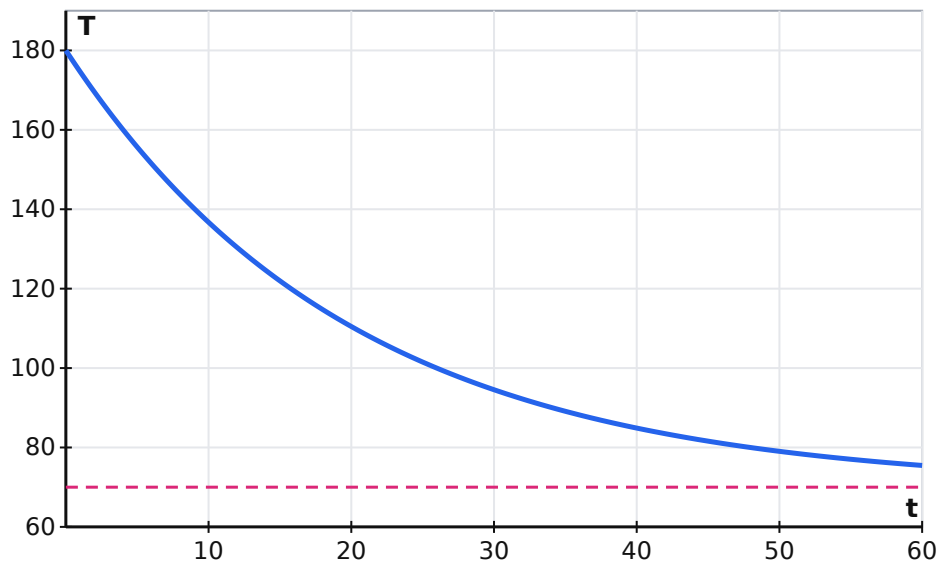
Exercise 19 - Horizontal tangents



The graph of $f(x) = x e^{-x^2/2}$.

Find where $f(x) = x e^{-x^2/2}$ has a horizontal tangent.

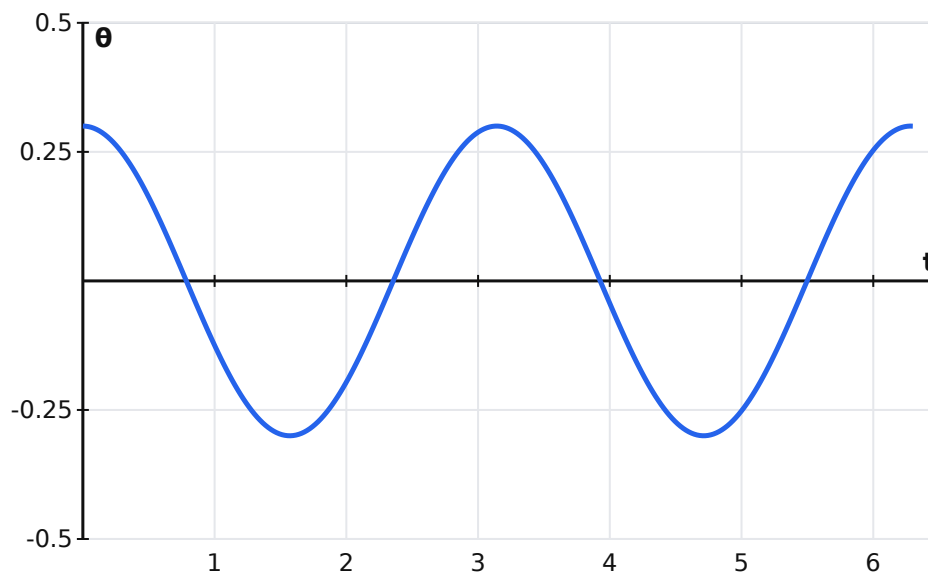
Exercise 20 - Cooling coffee



Cooling coffee: temperature in $^{\circ}\text{F}$ after t minutes.

The temperature of Priya's coffee in $^{\circ}\text{F}$ is $T(t) = 70 + 110e^{-0.05t}$ after t minutes. Find $T'(10)$ and interpret it.

Exercise 21 - Pendulum



Pendulum angle in radians.

A pendulum's angle in radians is $\theta(t) = 0.3\cos 2t$ after t seconds. Find the angular velocity $\theta'(t)$ and evaluate it at $t = \frac{\pi}{4}$.

Exercise 22 - Nested radicals

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