

AP Calculus AB - Fundamental Theorem of Calculus and Antiderivatives - Worksheet

Common Core AP CALC AB 6.4, AP CALC AB 6.5, AP CALC AB 6.6, AP CALC AB 6.7, AP CALC AB 6.8 · maths-pdf.fr/en/

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

These 23 problems practice accumulation functions, both parts of the Fundamental Theorem of Calculus, basic antiderivatives and initial value problems (AP Calculus AB, topics 6.4 to 6.8). 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 accumulation graphs, chain rule versions of the theorem, initial value problems and situations such as a leaking tank and marginal cost. 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 6.4, AP CALC AB 6.5, AP CALC AB 6.6, AP CALC AB 6.7, AP CALC AB 6.8**

Exercise 1 - Polynomial antiderivative

Find $\int (3x^2 - 4x + 5) dx$.

Exercise 2 - Negative powers

Find $\int \left(x^3 + \frac{2}{x^2}\right) dx$.

Exercise 3 - Roots

Find $\int \left(\sqrt{x} + \frac{1}{\sqrt{x}}\right) dx$.

Exercise 4 - Sine and cosine

Find $\int (\sin x - 2\cos x) dx$.

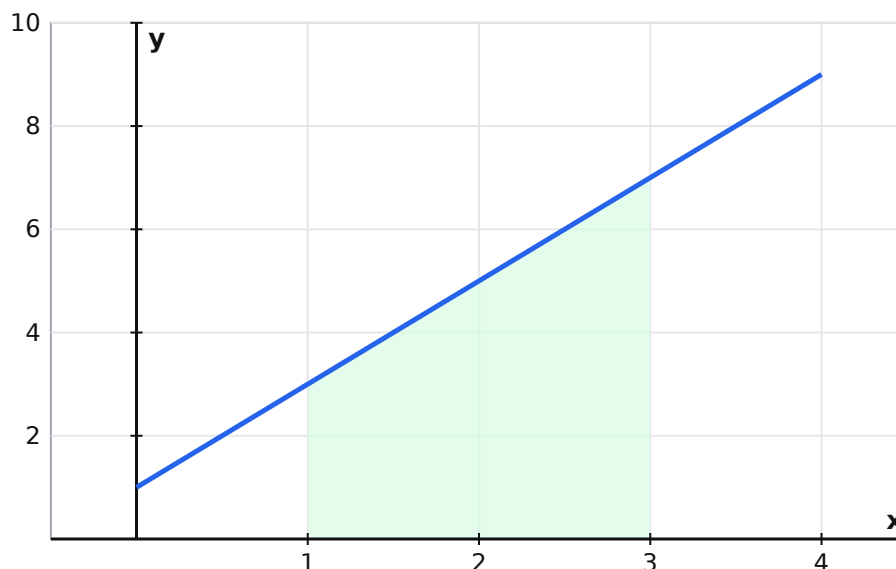
Exercise 5 - Exponential and reciprocal

Find $\int \left(e^x + \frac{3}{x}\right) dx$.

Exercise 6 - Trig and inverse trig forms

Find $\int \sec^2 x \, dx$ and $\int \frac{1}{1+x^2} \, dx$.

Exercise 7 - Definite integral, linear



The area under $2x + 1$ from 1 to 3.

Evaluate $\int_1^3 (2x+1) \, dx$ and check with geometry.

Exercise 8 - Definite integral, cubic

Evaluate $\int_0^2 (x^3 - x) \, dx$.

Exercise 9 - Definite integral, root

Evaluate $\int_1^4 \sqrt{x} \, dx$.

Exercise 10 - Definite integral, sine

Evaluate $\int_0^\pi \sin x \, dx$.

Exercise 11 - Exponential and logarithm integrals

Evaluate $\int_0^1 e^x \, dx$ and $\int_1^e \frac{1}{x} \, dx$.

Exercise 12 - Absolute value

Evaluate $\int_{-1}^2 |x| \, dx$.

Exercise 13 - FTC part 1, direct

Let $F(x) = \int_1^x \sqrt{t^2+3} \, dt$. Find $F'(x)$ and $F'(1)$.

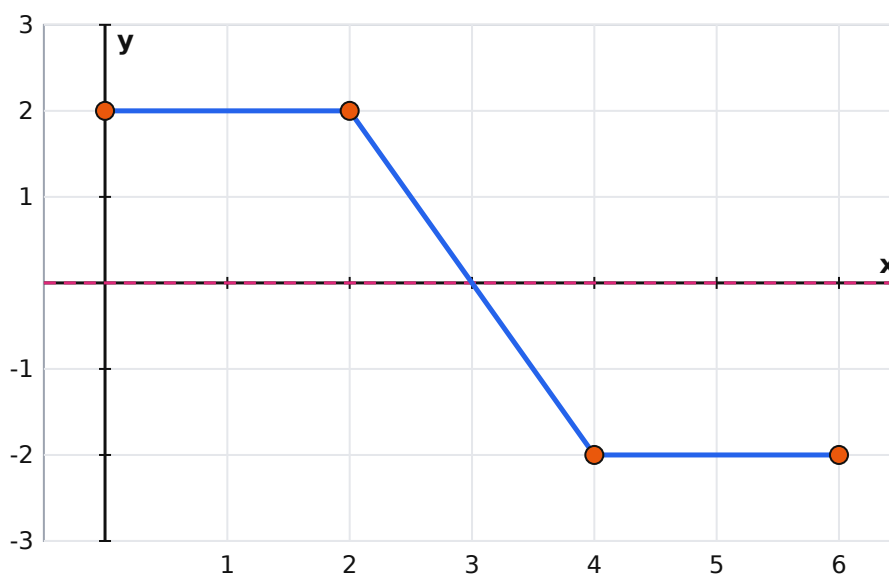
Exercise 14 - FTC part 1, chain rule

Find $\frac{d}{dx} \int_0^{x^2} \cos t \, dt$.

Exercise 15 - FTC part 1, variable lower limit

Find $\frac{d}{dx} \int_x^5 (t^3+1) \, dt$.

Exercise 16 - Accumulation from a graph



The graph of f .

Let $g(x) = \int_0^x f(t) \, dt$ for the graph above. Find $g(2)$, $g(3)$, $g(4)$ and $g(6)$. Where is g largest?

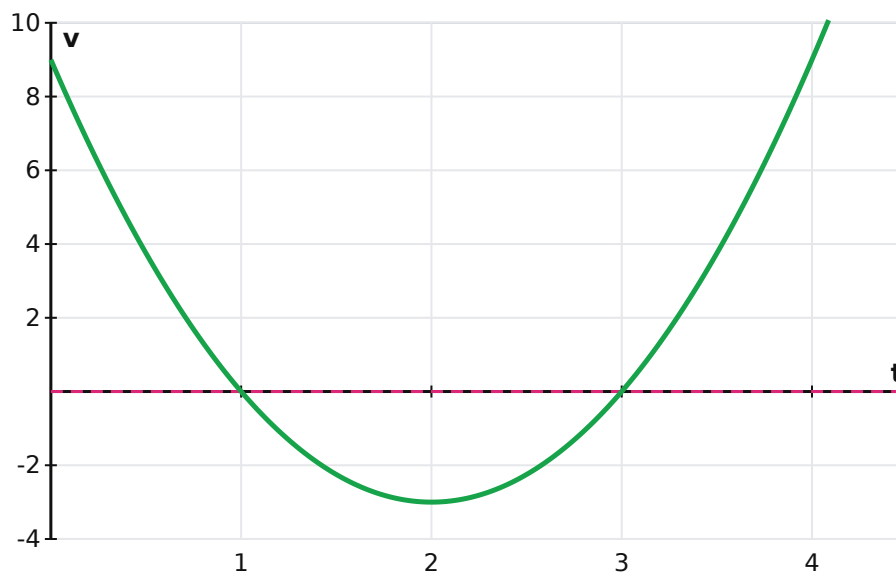
Exercise 17 - Initial value problem

Find f if $f'(x) = 6x^2 - 2$ and $f(1) = 5$.

Exercise 18 - Second-order initial value problem

Find f if $f''(x) = 12x - 6$, $f'(0) = 1$ and $f(0) = 2$.

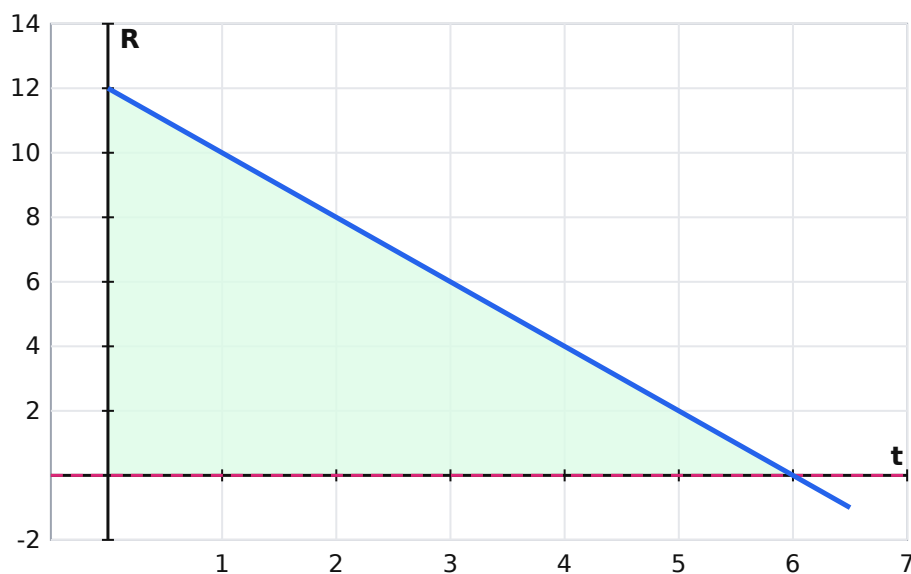
Exercise 19 - Position from velocity



Velocity of a drone along a track.

A drone has velocity $v(t) = 3t^2 - 12t + 9$ ft/s and starts at position $s(0) = 2$. Find $s(t)$ and the position at $t = 4$.

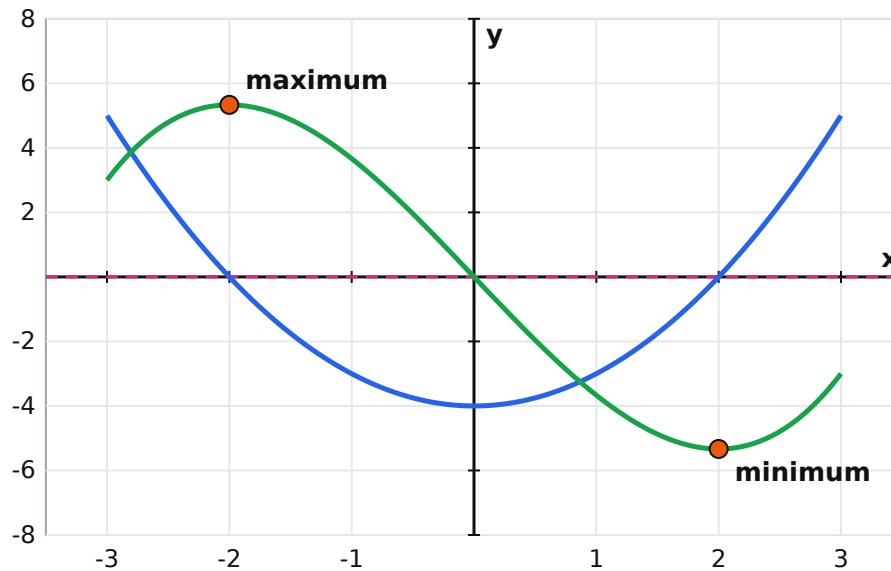
Exercise 20 - Net change of water



Water inflow rate in gallons per minute.

Water enters a tank at rate $R(t) = 12 - 2t$ gallons per minute for $0 \leq t \leq 6$. The tank holds 50 gallons at $t = 0$. How much water is in the tank at $t = 6$?

Exercise 21 - Accumulation function analysis



f and its antiderivative F .

Let $F(x) = \int_0^x (t^2 - 4) dt$. Find where F is increasing, decreasing and has relative extrema.

Exercise 22 - Area with a sign change

Evaluate $\int_0^3 |t^2 - 4| dt$.

Exercise 23 - Total cost from marginal cost

The marginal cost of a skateboard in dollars is $C'(x) = 40 - 0.2x$ when x boards have been made. Find the extra cost of increasing production from 50 to 100 boards.