

AP Calculus AB · Integration and Accumulation of Change · Test

Common Core AP Calculus AB Unit 6 · mathovore.fr

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

This ap calculus integration test checks integration and accumulation of change in 45 minutes, with 8 questions for a total of 20 points.

This 45-minute test covers AP Calculus AB Unit 6 in free-response style. Questions test Riemann sums from a table, properties of integrals, accumulation functions, the Fundamental Theorem of Calculus, u-substitution, and antidifferentiation after long division. Show your work and include units where asked. The test is worth 20 points.

Test information

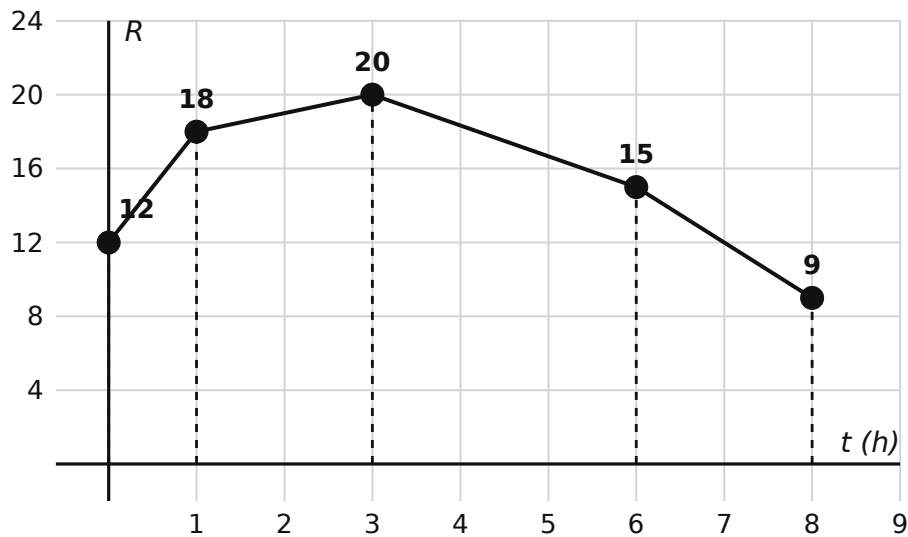
- **Grade:** AP Calculus AB
- **Chapter:** Integration and Accumulation of Change
- **Common Core:** AP Calculus AB Unit 6
- **Time:** 45 minutes
- **Total:** 20 points (Question 1: 3 pts; Question 2: 2 pts; Question 3: 3 pts; Question 4: 2 pts; Question 5: 2 pts; Question 6: 3 pts; Question 7: 3 pts; Question 8: 2 pts)

AP Calculus Integration Test: questions 1-5

Question 1: Estimating from a table (3 points)

Cars enter a parking garage at the rate $R(t)$ cars per hour, where t is the number of hours after 6 A.M. Values of R are measured at five times.

t (hours)	0	1	3	6	8
$R(t)$	12	18	20	15	9



The measured entry rate $R(t)$ in cars per hour.

- Use a left Riemann sum with four subintervals to approximate $\int_0^8 R(t) dt$. (1 point)
- Use a trapezoidal sum with the same four subintervals to approximate $\int_0^8 R(t) dt$. (1 point)
- Explain the meaning of $\int_0^8 R(t) dt$ in the context of the problem. Include units. (1 point)

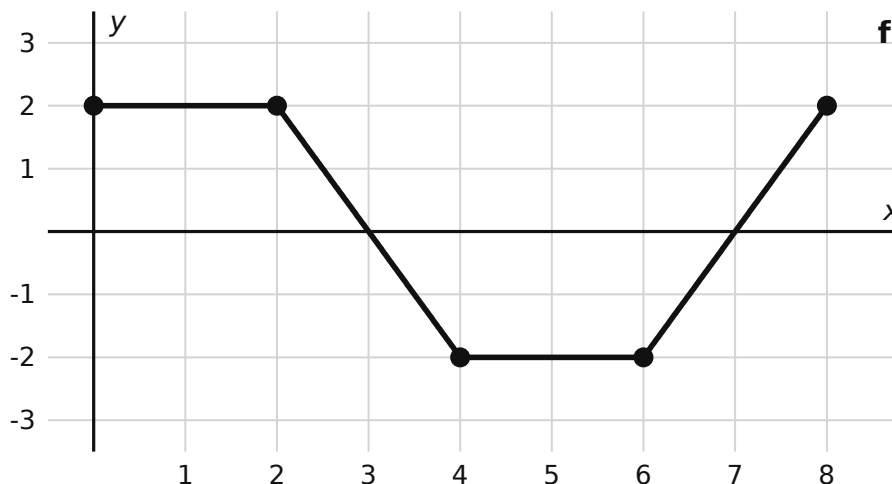
Question 2: Properties of integrals (2 points)

The functions f and g are continuous, with $\int_0^4 f(x) dx = 10$, $\int_4^7 f(x) dx = -3$ and $\int_0^7 g(x) dx = 6$.

- Find $\int_0^7 f(x) dx$. (1 point)
- Find $\int_0^7 (3f(x) - g(x) + 2) dx$. (1 point)

Question 3: Accumulation from a graph (3 points)

The graph of f consists of line segments and is shown on $[0, 8]$. Let $g(x) = \int_0^x f(t) dt$.



The graph of f on $[0, 8]$.

- Find $g(6)$. (1 point)
- Find $g'(5)$. (1 point)
- Find the value of x in $[0,8]$ at which g has its absolute maximum. Justify your answer. (1 point)

Question 4: Fundamental Theorem evaluation (2 points)

Evaluate $\int_1^4 \left(3\sqrt{x} + \frac{2}{x^2}\right) dx$. Show the antiderivative you use.

Question 5: Substitution (2 points)

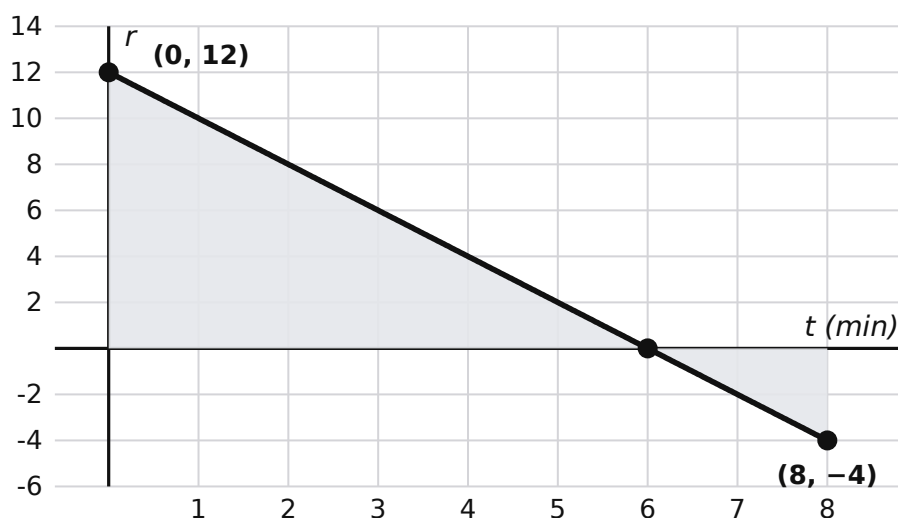
Find each integral.

- $\int_e^4 4x(x^2-5)^3 dx$ (1 point)
- $\int_1^e \frac{(\ln x)^2}{x} dx$ (1 point)

AP Calculus Integration Test: questions 6-8

Question 6: Water in a tank (3 points)

A tank contains 30 gallons of water at time $t=0$ minutes. Water enters the tank at the rate $r(t)=12-2t$ gallons per minute for $0 \leq t \leq 8$ (a negative rate means water is being pumped out).



The rate $r(t) = 12 - 2t$ on $[0, 8]$.

- Write an expression for $V(t)$, the number of gallons in the tank at time t , and simplify it. (1 point)

- b. At what time t is the amount of water in the tank greatest? Justify your answer, and find the maximum amount. (1 point)
- c. Find $V(8)$. Is the amount of water increasing or decreasing at $t = 8$? Explain. (1 point)

Question 7: Division and completing the square (3 points)

Find each integral.

- a. $\int \frac{x^2-1}{x+3} dx$ (2 points)
- b. $\int \frac{1}{x^2+6x+10} dx$ (1 point)

Question 8: Differentiating an integral (2 points)

Let $G(x) = \int_1^{x^2} (t+3) dt$.

- a. Find $G'(x)$. (1 point)
- b. Find $G'(2)$. (1 point)

How to use this ap calculus integration test

Take this ap calculus integration test without notes, then grade it with the test answer key out of 20 points.

