

AP Calculus AB · Derivatives in Context: Motion and Related Rates · Test

Common Core AP Calculus AB Unit 4 · mathovore.fr

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

This ap calculus contextual applications test checks derivatives in context: motion and related rates in 45 minutes, with 8 questions for a total of 20 points.

This free-response test covers AP Calculus AB Unit 4. It has eight questions worth 20 points. Show all work, write units with every rate, and justify conclusions. A calculator is allowed for decimal approximations only.

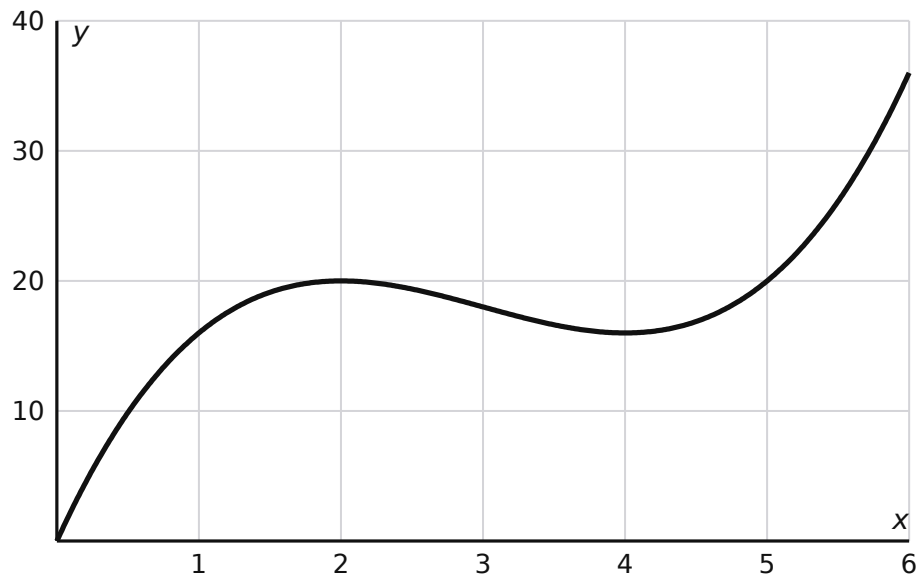
Test information

- **Grade:** AP Calculus AB
- **Chapter:** Derivatives in Context: Motion and Related Rates
- **Common Core:** AP Calculus AB Unit 4
- **Time:** 45 minutes
- **Total:** 20 points (Question 1: 3 pts; Question 2: 2 pts; Question 3: 3 pts; Question 4: 2 pts; Question 5: 3 pts; Question 6: 3 pts; Question 7: 2 pts; Question 8: 2 pts)

AP Calculus Contextual Applications Test: questions 1-5

Question 1: Particle motion (3 points)

A particle moves along a line with position $s(t) = t^3 - 9t^2 + 24t$ feet, for $0 \leq t \leq 6$ seconds.



$s(t)$ in feet for $0 \leq t \leq 6$ seconds.

- Find $v(t)$ and $a(t)$. (1 point)
- Find the times when the particle is at rest. (1 point)
- Is the speed increasing or decreasing at $t=5$? (1 point)

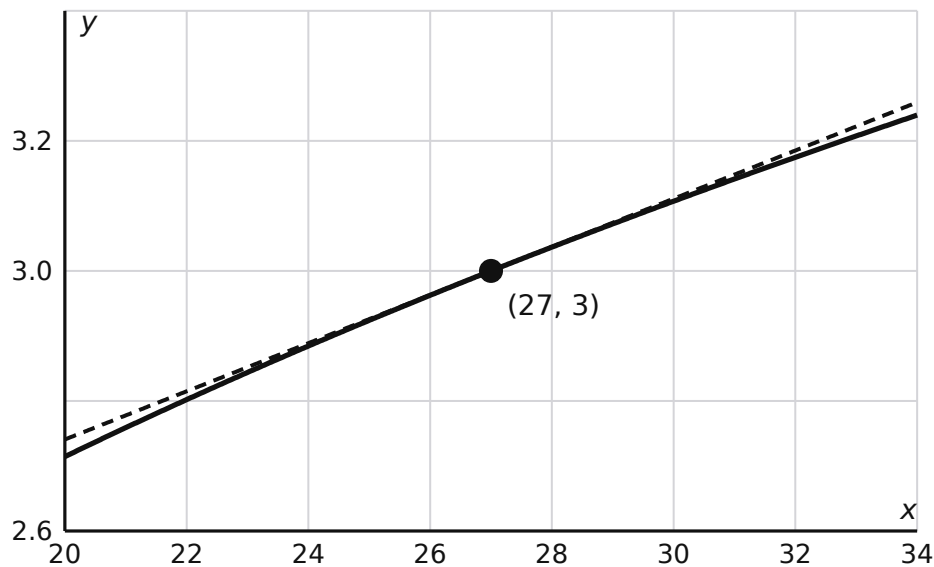
Question 2: Interpreting a derivative (2 points)

The temperature of a bowl of soup is $H(t)$ °F, t minutes after serving. $H(10)=140$ and $H'(10)=-1.8$.

- Interpret $H'(10)$ with units. (1 point)
- Use the tangent line at $t=10$ to estimate $H(12)$. (1 point)

Question 3: Local linearization (3 points)

Let $f(x)=\sqrt[3]{x}$. The graph and its tangent line at $x=27$ are shown.



Cube root of x and its tangent line at $x = 27$.

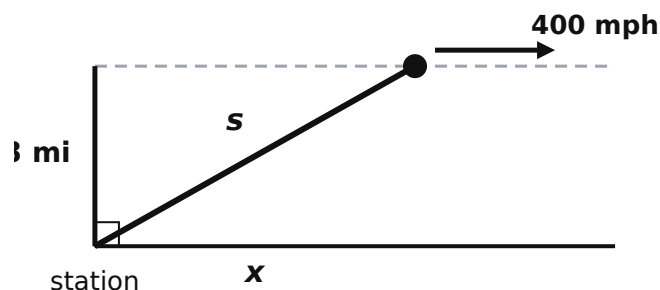
- Write the tangent line equation at $x = 27$. (1 point)
- Approximate $\sqrt[3]{28}$. (1 point)
- Is the approximation an overestimate or an underestimate? Justify. (1 point)

Question 4: Melting ice cube (2 points)

A cube of ice melts so that its edge length decreases at 0.2 inch per minute. Find the rate of change of its volume when the edge length is 5 inches. The volume of a cube is $V = s^3$.

Question 5: Plane and radar station (3 points)

An airplane flies horizontally at a constant altitude of 3 miles, directly away from a radar station, at 400 mph. Let x be the horizontal distance from the point on the ground below the plane to the station, and s the straight-line distance.



The plane flies at constant altitude 3 mi.

- Write an equation relating s and x . (1 point)
- Find $\frac{ds}{dt}$ when $x = 4$ miles. (2 points)

AP Calculus Contextual Applications Test: questions 6-8

Question 6: Limits with L'Hôpital (3 points)

- a. Evaluate $\lim_{x \rightarrow 0} \frac{1 - \cos(4x)}{x^2}$. (2 points)
- b. Evaluate $\lim_{x \rightarrow \infty} \frac{\ln x}{\sqrt{x}}$. (1 point)

Question 7: Marginal revenue (2 points)

The revenue in dollars from selling x scarves is $R(x) = 50x - 0.1x^2$.

- a. Find $R'(100)$. (1 point)
- b. Interpret the value in context. (1 point)

Question 8: Speeding up and slowing down (2 points)

A particle moves on a line with velocity $v(t) = t^2 - 6t + 8$ ft/s for $t \geq 0$. Find all intervals on which the speed is increasing.

How to use this ap calculus contextual applications test

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

