

AP Calculus AB · Analyzing Functions with Derivatives · Quiz

Common Core AP Calculus AB Unit 5 · mathovore.fr

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

This ap calculus analyzing functions quiz asks 10 multiple-choice questions on analyzing functions with derivatives, and each answer comes with a short explanation.

Ten multiple-choice questions check the core ideas of AP Calculus AB Unit 5: critical numbers, graphs of derivatives, the Second Derivative Test, inflection points, the Mean Value Theorem, absolute extrema and implicit differentiation. Pick the single best answer for each question.

AP Calculus ABCommon Core: AP Calculus AB Unit 5

Questions

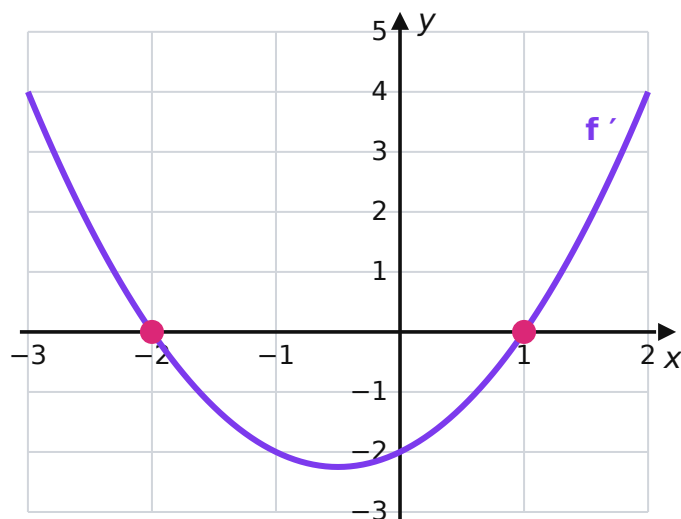
Question 1

Find all critical numbers of $f(x) = x^3 + 3x^2 - 9x$.

- A. $x = -1$ and $x = 3$
- B. $x = -3$ only
- C. $x = -3$ and $x = 1$
- D. $x = -9$ and $x = 1$

Question 2

The graph of f' is shown. On which interval is f decreasing?



- A. $(-\infty, -2)$ and $(1, \infty)$
- B. $(-2, 1)$
- C. $(-\infty, 1)$
- D. $(-2, \infty)$

Question 3

Suppose $f'(3) = 0$ and $f''(3) = -4$. What does the Second Derivative Test conclude about f at $x = 3$?

- A. A local minimum
- B. A point of inflection
- C. A local maximum
- D. The test is inconclusive

Question 4

Where does $f(x) = x^3 - 6x^2 + 2x$ have a point of inflection?

- A. $x = 2$
- B. $x = 0$
- C. $x = 4$
- D. $x = 6$

Question 5

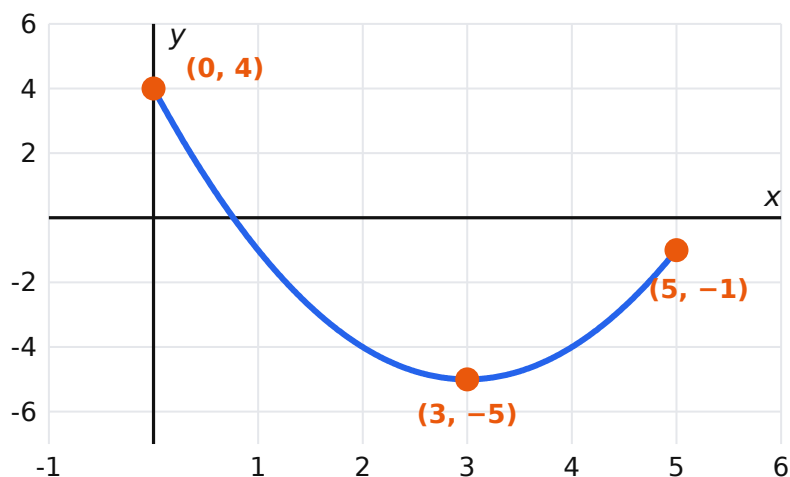
The Mean Value Theorem is applied to $f(x) = x^3$ on $[0, 2]$. What is c ?

- A. 1

- B. $\frac{4}{3}$
- C. $\frac{4}{3}$
- D. $\frac{2\sqrt{3}}{3}$

Question 6

The graph of $f(x) = x^2 - 6x + 4$ on $[0, 5]$ is shown. What is the absolute maximum value of f on this interval?



- A. 4
- B. -5
- C. -1
- D. 5

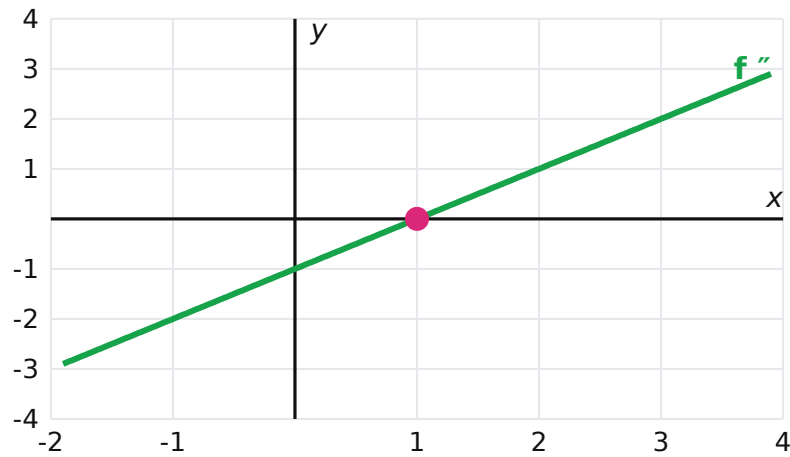
Question 7

A rectangle has perimeter 40 inches. What is its greatest possible area?

- A. 80 in^2
- B. 100 in^2
- C. 200 in^2
- D. 400 in^2

Question 8

The graph of f'' is shown. For which values of x is the graph of f concave up?



- A. $x < 1$
- B. $x > 1$
- C. $x > 0$
- D. $x < -1$

Question 9

For the circle $x^2 + y^2 = 25$, what is $\frac{dy}{dx}$ at the point $(3, 4)$?

- A. $\frac{3}{4}$
- B. $-\frac{4}{3}$
- C. $\frac{4}{3}$
- D. $-\frac{3}{4}$

Question 10

On which function and interval does the Mean Value Theorem apply?

- A. $f(x) = |x - 2|$ on $[0, 4]$
- B. $f(x) = \frac{1}{x-2}$ on $[0, 4]$
- C. $f(x) = \sqrt{x}$ on $[0, 4]$
- D. $f(x) = \frac{x}{x-4}$ on $[0, 4]$

Answer key

1. **C** - $f'(x) = 3x^2 + 6x - 9 = 3(x+3)(x-1) = 0$ gives $x = -3$ and $x = 1$. A common slip is flipping the signs of the factors.
2. **B** - f decreases where $f' < 0$, which is where the graph is below the x -axis, between -2 and 1 . The outer intervals are where f increases.
3. **C** - A negative second derivative means concave down, so the critical point is a local maximum. The test is inconclusive only when $f''(3) = 0$.
4. **A** - $f''(x) = 6x - 12$ is zero at $x = 2$ and changes sign there. Setting f' equal to zero instead would find critical numbers, not inflection points.
5. **D** - The average rate of change is $\frac{8-0}{2} = 4$, and $3c^2 = 4$ gives $c = \frac{2\sqrt{3}}{3} \approx 1.155$. The midpoint $c = 1$ is not generally the answer.
6. **A** - Candidates: $f(0) = 4$, $f(3) = -5$, $f(5) = -1$. The largest is 4 , at an endpoint. The value -5 is the absolute minimum.
7. **B** - With width w , $A = w(20 - w)$, and $A' = 20 - 2w = 0$ gives $w = 10$, a square, so $A = 100$. Using the whole perimeter, 40 , as a side length gives the wrong setup.
8. **B** - Concave up means $f'' > 0$, which is where the line is above the x -axis: $x > 1$. The point $x = 1$ is an inflection point.
9. **D** - Implicit differentiation gives $\frac{dy}{dx} = -\frac{x}{y} = -\frac{3}{4}$. Swapping the coordinates gives $-\frac{4}{3}$, a common slip.
10. **C** - $\sqrt{x}$ is continuous on $[0, 4]$ and differentiable on $(0, 4)$. The absolute value has a corner at 2 , and the other two functions are undefined at a point of the interval.

How does this quiz work?

Read each question, choose one answer among A, B, C and D, then check it: a short explanation appears after every answer. Your score out of 10 is shown at the end, and you can restart the quiz as often as you like.

What should you review before the quiz?

Reread the key facts of the lesson and the worked example. If a question is hard, go back to the matching part of the lesson, then try the quiz again. Write your work on scrap paper: most mistakes come from skipping a step, not from the idea itself.

Remember:

- AP Calculus AB Unit 5: use f' and f'' to describe increasing, decreasing, concavity, extrema and inflection points.
- Candidates Test: on $[a, b]$, compare f at critical numbers and at both endpoints.
- Mean Value Theorem: continuous on $[a, b]$ and differentiable on (a, b) guarantees

$$f'(c) = \frac{f(b) - f(a)}{b - a} \text{ for some } c.$$

- Second Derivative Test: if $f'(c) = 0$, then $f''(c) < 0$ means a local maximum and $f''(c) > 0$ means a local minimum.

How to use this ap calculus analyzing functions quiz

Retake this ap calculus analyzing functions quiz until every answer is right, then move on to the worksheet and the test.

