# AP Calculus BC Practice Test (Sample)

## Study Guide

**Everything you need from our exam experts!**

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# Introduction

**Preparing for a certification exam can feel overwhelming, but with the right tools, it becomes an opportunity to build confidence, sharpen your skills, and move one step closer to your goals. At Examzify, we believe that effective exam preparation isn't just about memorization, it's about understanding the material, identifying knowledge gaps, and building the test-taking strategies that lead to success.**

**This guide was designed to help you do exactly that.**

**Whether you're preparing for a licensing exam, professional certification, or entry-level qualification, this book offers structured practice to reinforce key concepts. You'll find a wide range of multiple-choice questions, each followed by clear explanations to help you understand not just the right answer, but why it's correct.**

**The content in this guide is based on real-world exam objectives and aligned with the types of questions and topics commonly found on official tests. It's ideal for learners who want to:**

- **Practice answering questions under realistic conditions,**
- **Improve accuracy and speed,**
- **Review explanations to strengthen weak areas, and**
- **Approach the exam with greater confidence.**

**We recommend using this book not as a stand-alone study tool, but alongside other resources like flashcards, textbooks, or hands-on training. For best results, we recommend working through each question, reflecting on the explanation provided, and revisiting the topics that challenge you most.**

**Remember: successful test preparation isn't about getting every question right the first time, it's about learning from your mistakes and improving over time. Stay focused, trust the process, and know that every page you turn brings you closer to success.**

**Let's begin.**

# How to Use This Guide

**This guide is designed to help you study more effectively and approach your exam with confidence. Whether you're reviewing for the first time or doing a final refresh, here's how to get the most out of your Examzify study guide:**

## 1. Start with a Diagnostic Review

**Skim through the questions to get a sense of what you know and what you need to focus on. Your goal is to identify knowledge gaps early.**

## 2. Study in Short, Focused Sessions

**Break your study time into manageable blocks (e.g. 30 – 45 minutes). Review a handful of questions, reflect on the explanations.**

## 3. Learn from the Explanations

**After answering a question, always read the explanation, even if you got it right. It reinforces key points, corrects misunderstandings, and teaches subtle distinctions between similar answers.**

## 4. Track Your Progress

**Use bookmarks or notes (if reading digitally) to mark difficult questions. Revisit these regularly and track improvements over time.**

## 5. Simulate the Real Exam

**Once you're comfortable, try taking a full set of questions without pausing. Set a timer and simulate test-day conditions to build confidence and time management skills.**

## 6. Repeat and Review

**Don't just study once, repetition builds retention. Re-attempt questions after a few days and revisit explanations to reinforce learning. Pair this guide with other Examzify tools like flashcards, and digital practice tests to strengthen your preparation across formats.**

**There's no single right way to study, but consistent, thoughtful effort always wins. Use this guide flexibly, adapt the tips above to fit your pace and learning style. You've got this!**

# Questions

1. **Where are critical values located for a function with a differentiable domain?**

   A. $f''(c) = 0$

   B. $f'(c) = 0$ or $f'(x)$ is undefined

   C. $f(c) = 0$

   D. $f'(c) > 0$

2. **The second derivative of a parametric curve is given by which formula?**

   A. $d^2y/dx^2 = (d/dt)(dy/dx) / (dx/dt)$

   B. $d^2y/dx^2 = (dx/dt) / (dy/dt)$

   C. $d^2y/dx^2 = (d/dt)(dx/dy) / (dy/dt)$

   D. $d^2y/dx^2 = (d^2y/dt^2) / (dx/dt)^2$

3. **Which value equals $\sin(\pi/4)$?**

   A. $\sqrt{2}/2$

   B. $1/2$

   C. 0

   D. $\sqrt{3}/2$

4. **The derivative of velocity with respect to time is which function?**

   A. Position

   B. Acceleration

   C. Velocity

   D. Jerk

5. **Which condition identifies a location of a relative maximum for a differentiable function?**

   A. $f'(c) = 0$ OR $f'(x)$ is undefined AND $f'(c)$ switches from positive to negative

   B. $f'(c) = 0$

   C. $f''(c) < 0$

   D. $f'(c) \neq 0$

**6. Which statement about absolute extrema is true?**

- **A. They can only occur at endpoints.**
- **B. They must occur where f' = 0.**
- **C. They can occur at endpoints or at critical points where f' is zero or undefined.**
- **D. They cannot occur if the function is increasing.**

**7. If y = a^x, where a > 0 and a ≠ 1, what is dy/dx?**

- **A. a^x**
- **B. a^x ln(a)**
- **C. ln(a) / a^x**
- **D. x ln(a)**

**8. If f is differentiable on (a,b) then f is ______ on [a,b].**

- **A. Continuous**
- **B. Differentiable**
- **C. Bounded**
- **D. Integrable**

**9. The distance traveled by a particle along a parametric path r(t) from t = a to t = b is given by which integral?**

- **A. ∫_a^b sqrt((dx/dt)^2 + (dy/dt)^2) dt**
- **B. ∫_a^b (dx/dt + dy/dt) dt**
- **C. ∫_a^b (dx/dt)^2 + (dy/dt)^2 dt**
- **D. ∫_a^b sqrt((dx/dt)^2 - (dy/dt)^2) dt**

**10. Which approach helps organize potential extrema by listing end points and critical points and comparing their y-values?**

- **A. Create a table of end points and critical points and compare values.**
- **B. Only evaluate endpoints.**
- **C. Only differentiate and solve.**
- **D. Only evaluate interior points.**

# Answers

1. **B**
2. **A**
3. **A**
4. **B**
5. **A**
6. **C**
7. **B**
8. **A**
9. **A**
10. **D**

# Explanations

## 1. Where are critical values located for a function with a differentiable domain?

**A. f''(c) = 0**

**B. f'(c) = 0 or f'(x) is undefined**

**C. f(c) = 0**

**D. f'(c) > 0**

**Critical values occur where the slope of the function is zero or the slope fails to exist. If a point in the interior of the domain is a local maximum or minimum, and the derivative exists there, Fermat's idea tells us the derivative must be zero at that point. If the derivative doesn't exist at a point—such as at a sharp corner, a cusp, or a vertical tangent—that can also be a critical value because the function can have an extremum there or behave differently than the surrounding points. So the place to look for critical values is where f′(x) = 0 or where f′(x) is undefined. The other possibilities don't capture that idea: a zero of f itself is a root, not a critical point, and a positive derivative means the function is increasing, not a point where the slope vanishes or breaks. The second derivative being zero is related to concavity, not to where the slope vanishes or ceases to exist.**

## 2. The second derivative of a parametric curve is given by which formula?

**A. d^2y/dx^2 = (d/dt)(dy/dx) / (dx/dt)**

**B. d^2y/dx^2 = (dx/dt) / (dy/dt)**

**C. d^2y/dx^2 = (d/dt)(dx/dy) / (dy/dt)**

**D. d^2y/dx^2 = (d^2y/dt^2) / (dx/dt)^2**

**When x and y depend on a parameter t, the slope is dy/dx = (dy/dt)/(dx/dt). The second derivative with respect to x measures how this slope changes as x changes, so you differentiate dy/dx with respect to t and then divide by dx/dt (chain rule: d/dx = (1/(dx/dt)) d/dt). This gives d^2y/dx^2 = [d/dt (dy/dx)] / (dx/dt). If you expand that, you'd get an explicit form: d^2y/dx^2 = [ (d^2y/dt^2)(dx/dt) − (dy/dt)(d^2x/dt^2) ] / (dx/dt)^3, which confirms the compact form. The other expressions don't match the derivative with respect to x for a parametric curve.**

## 3. Which value equals sin(π/4)?

**A. sqrt(2)/2**

**B. 1/2**

**C. 0**

**D. sqrt(3)/2**

**Sine corresponds to the y-coordinate on the unit circle. For an angle of π/4 (45 degrees) the point on the unit circle is (√2/2, √2/2), so the sine is the y-coordinate, giving sin(π/4) = √2/2. This also matches the 45-45-90 triangle intuition: with a unit hypotenuse, the equal legs are √2/2 each. Values like 1/2 or √3/2 correspond to other standard angles (π/6 or π/3), and 0 corresponds to angles like 0 or π, so sin(π/4) is the √2/2 result.**

## 4. The derivative of velocity with respect to time is which function?

A. Position

B. Acceleration

C. Velocity

D. Jerk

**Acceleration. The rate at which velocity changes with time is what acceleration measures. If velocity is v(t), then acceleration is a(t) = dv/dt. Since velocity is itself the rate of change of position (v = dx/dt), acceleration is the second derivative of position (a = d^2x/dt^2). This captures changes in speed and/or direction. If velocity is constant, dv/dt = 0, so acceleration is zero. Jerk would be the derivative of acceleration, not of velocity.**

## 5. Which condition identifies a location of a relative maximum for a differentiable function?

A. f'(c) = 0 OR f'(x) is undefined AND f'(c) switches from positive to negative

B. f'(c) = 0

C. f''(c) < 0

D. f'(c) ≠ 0

**The main idea is the first derivative test for a local maximum: a point where the function goes up as you approach from the left and goes down as you leave to the right. For a differentiable function, that shows up as the derivative being positive just before the point and negative just after it, so the tangent slope is zero at the peak. But a local maximum can also occur if the derivative does not exist at the point, provided the left-hand slope is positive and the right-hand slope is negative, meaning the function increases then decreases around that point. That's why the most complete condition is that at the candidate location the derivative is zero, or the derivative is undefined with a sign change from positive to negative across the point. If you only had the derivative equal to zero, that isn't enough by itself, since a horizontal tangent can occur at an inflection point or a non-maximum. Relying on the second derivative test, f''(c) < 0 is a sufficient condition when f'(c)=0 and the function is twice differentiable, but not necessary and doesn't cover cases where the second derivative doesn't exist or f'(c) = 0 but the sign change isn't clear. If the derivative is nonzero at the point, the function is still increasing or decreasing there, so it cannot be a local maximum.**

## 6. Which statement about absolute extrema is true?

**A. They can only occur at endpoints.**

**B. They must occur where f' = 0.**

**C. They can occur at endpoints or at critical points where f' is zero or undefined.**

**D. They cannot occur if the function is increasing.**

**Absolute extrema on a closed interval occur either at the endpoints or at interior points where the derivative is zero or undefined. If an interior point is an absolute maximum or minimum and the derivative exists there, Fermat's principle says the slope must be zero. If the derivative isn't defined at a point (such as a cusp or corner), that point can also be an extremum. The endpoints must be checked separately because the derivative test applies only to interior points. For example, the absolute maximum of f(x)=x^2 on [-1,2] occurs at x=2 (an endpoint), while the absolute minimum occurs at x=0 (an interior point where f' = 0). In another case like f(x)=|x| on [-1,1], the minimum occurs at the interior point x=0 where the derivative is undefined, while the maximum occurs at the endpoints. So the correct statement is that absolute extrema can occur at endpoints or at interior critical points where f' is zero or undefined. The other ideas are too restrictive or incomplete: extremes need not be only at endpoints, they can occur where the derivative is undefined, and an increasing function can still have an endpoint as an extremum.**

## 7. If y = a^x, where a > 0 and a ≠ 1, what is dy/dx?

**A. a^x**

**B. a^x ln(a)**

**C. ln(a) / a^x**

**D. x ln(a)**

**When differentiating an exponential with a constant base, use logarithms. Start with y = a^x and take natural logs: ln y = x ln a. Differentiate implicitly: (1/y) dy/dx = ln a. Multiply both sides by y to get dy/dx = y ln a, and substitute y = a^x to obtain dy/dx = a^x ln a. Since a > 0 and a ≠ 1, ln a is defined (and positive if a > 1, negative if 0 < a < 1), so the slope at any x is scaled by a^x. The expression a^x ln a is the correct rate of change. The other forms don't come from this differentiation rule: they either miss the factor ln a, place it in the denominator, or replace the derivative with x times ln a, which would correspond to a different function.**

## 8. If f is differentiable on (a,b) then f is ______ on [a,b].

**A. Continuous**

**B. Differentiable**

**C. Bounded**

**D. Integrable**

**Differentiability implies continuity. If f has a derivative at every point inside (a,b), then for each such point c, the limit of [f(x) − f(c)]/(x − c) as x approaches c exists and equals f′(c). That forces lim x→c f(x) = f(c), so f is continuous at every interior point. Since the function is defined on the closed interval [a,b], the usual way we describe its behavior on that interval is that it is continuous there as well, with the understanding that endpoints involve one-sided behavior. The differentiability on the open interval guarantees no jumps or breaks inside, which is the essential takeaway.**

**9. The distance traveled by a particle along a parametric path $r(t)$ from $t = a$ to $t = b$ is given by which integral?**

- **A. $\int_a^b \sqrt{(dx/dt)^2 + (dy/dt)^2}\, dt$**
- **B. $\int_a^b (dx/dt + dy/dt)\, dt$**
- **C. $\int_a^b (dx/dt)^2 + (dy/dt)^2\, dt$**
- **D. $\int_a^b \sqrt{(dx/dt)^2 - (dy/dt)^2}\, dt$**

**Distance traveled along a parametric path comes from integrating the speed over time. If the path is $r(t) = \langle x(t), y(t)\rangle$, then the velocity is $r'(t) = \langle dx/dt, dy/dt\rangle$ and the speed is its magnitude $|r'(t)| = \sqrt{(dx/dt)^2 + (dy/dt)^2}$. So the distance from $t = a$ to $t = b$ is $\int_a^b |r'(t)|\, dt = \int_a^b \sqrt{(dx/dt)^2 + (dy/dt)^2}\, dt$. The other expressions don’t measure length: summing the rates, $dx/dt + dy/dt$, would give $\Delta x + \Delta y$, not the distance traveled. Integrating the sum of squares isn’t a length either, and the form with a minus sign under the square root isn’t generally valid for a path’s length.**

**10. Which approach helps organize potential extrema by listing end points and critical points and comparing their y-values?**

- **A. Create a table of end points and critical points and compare values.**
- **B. Only evaluate endpoints.**
- **C. Only differentiate and solve.**
- **D. Only evaluate interior points.**

**To locate extrema, you need to consider all potential candidates for where extrema could occur: interior points where the derivative is zero or undefined (critical points) and the endpoints of the domain. Evaluating the function at each of these x-values and comparing the resulting y-values tells you where the largest and smallest values occur. If you only look at interior points, you can miss an extreme that happens at an endpoint. If you only check endpoints, you might miss interior extrema indicated by where the derivative vanishes or fails to exist. By listing both endpoints together with all critical points and then comparing the corresponding y-values, you capture every possible extremum and identify the actual maximum and minimum.**

# Next Steps

**Congratulations on reaching the final section of this guide. You've taken a meaningful step toward passing your certification exam and advancing your career.**

**As you continue preparing, remember that consistent practice, review, and self-reflection are key to success. Make time to revisit difficult topics, simulate exam conditions, and track your progress along the way.**

**If you need help, have suggestions, or want to share feedback, we'd love to hear from you. Reach out to our team at hello@examzify.com.**

**Or visit your dedicated course page for more study tools and resources:**

**https://apcalcbc.examzify.com**

**We wish you the very best on your exam journey. You've got this!**