AP Calculus BC Practice Test (Sample)

Study Guide

BY EXAMZIFY

Everything you need from our exam experts!

Table of Contents

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. **If velocity components are x'(t) = t and y'(t) = t^2, the speed is sqrt(t^2 + t^4).**

   A. sqrt(t^2 + t^4)

   B. t + t^2

   C. t^2 + t^4

   D. sqrt(t^4 - t^2)

2. **Which condition indicates that the particle is speeding up?**

   A. v(t) and a(t) have the same sign

   B. v(t) and a(t) have opposite signs

   C. v(t) = 0

   D. |v(t)| increasing

3. **The acceleration vector of a particle with position r(t) = (x(t), y(t)) is which of the following?**

   A. (x''(t), y''(t))

   B. (dx/dt, dy/dt)

   C. (d^3x/dt^3, d^3y/dt^3)

   D. (x(t), y(t))

4. **If f''(x) > 0 on (a,b), the function is concave up on that interval. Which choice best expresses this?**

   A. concave down

   B. concave up

   C. linear

   D. has a maximum everywhere

5. **In the logistic model, the population grows fastest when P equals which value?**

   A. L/2

   B. L

   C. 0

   D. L/4

6. **If a function has cross-sectional area A(x) perpendicular to the x-axis, its volume over [a,b] is:**
   - **A. ∫_a^b A(x) dx**
   - **B. ∫_a^b x A(x) dx**
   - **C. ∫_a^b A(x) dx^2**
   - **D. ∫_a^b dA(x) dx**

7. **If y = cos(u), where u is a differentiable function of x, what is dy/dx?**
   - **A. -u' sin(u)**
   - **B. u' cos(u)**
   - **C. u' sec^2(u)**
   - **D. -u' csc^2(u)**

8. **If F(x) = ∫_{a}^{x} f(t) dt, what is F'(x)?**
   - **A. f(x)**
   - **B. f'(x)**
   - **C. ∫ f(t) dt**
   - **D. 0**

9. **Which growth order correctly ranks exponential, polynomial, and logarithmic functions as x grows large?**
   - **A. Exponential, Polynomials, Logs**
   - **B. Logs, Exponential, Polynomials**
   - **C. Exponential, Logs, Polynomials**
   - **D. Polynomials, Exponential, Logs**

10. **If y = sin(3x), dy/dx = ?**
   - **A. cos(3x)**
   - **B. -3 sin(3x)**
   - **C. 3 cos(3x)**
   - **D. 3 sin(3x)**

Answers

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

Explanations

1. If velocity components are x'(t) = t and y'(t) = t^2, the speed is sqrt(t^2 + t^4).

A. sqrt(t^2 + t^4)

B. t + t^2

C. t^2 + t^4

D. sqrt(t^4 - t^2)

Speed is the magnitude of the velocity vector. In the plane, if x′(t) and y′(t) are the velocity components, the speed is sqrt[(x′(t))^2 + (y′(t))^2]. Here x′(t) = t and y′(t) = t^2, so the speed is sqrt(t^2 + (t^2)^2) = sqrt(t^2 + t^4). This can be written as |t| sqrt(1 + t^2), which is nonnegative as speed must be. The other forms don't represent the magnitude: t + t^2 is just a sum; t^2 + t^4 is the square of the speed; sqrt(t^4 - t^2) uses a difference under the root and isn't correct.

2. Which condition indicates that the particle is speeding up?

A. v(t) and a(t) have the same sign

B. v(t) and a(t) have opposite signs

C. v(t) = 0

D. |v(t)| increasing

Speeding up means the speed of the particle is increasing, which happens when velocity and acceleration point in the same direction. In one dimension, that means v and a have the same sign: if you're moving to the right (positive v) and speeding up, a is also positive; if you're moving to the left (negative v) and speeding up, a is negative. When they have opposite signs, the acceleration acts to slow you down, so the speed decreases. The moment when v is zero is a special edge case where you can't determine speeding up just from the signs at that exact instant, but outside that instant the same-sign condition cleanly signals speeding up. That's why this condition is the best indicator.

3. The acceleration vector of a particle with position r(t) = (x(t), y(t)) is which of the following?

A. (x''(t), y''(t))

B. (dx/dt, dy/dt)

C. (d^3x/dt^3, d^3y/dt^3)

D. (x(t), y(t))

Acceleration is the rate of change of velocity, so for a particle with position r(t) = (x(t), y(t)), its velocity is v(t) = r'(t) = (x'(t), y'(t)). The acceleration is the derivative of velocity, a(t) = v'(t) = r''(t) = (x''(t), y''(t)). Thus the acceleration vector has components given by the second-time derivatives of the coordinates. The first derivatives (x'(t), y'(t)) are velocity, the original position (x(t), y(t)) is position, and the third derivatives (x'''(t), y'''(t)) relate to jerk.

4. If $f''(x) > 0$ on (a,b), the function is concave up on that interval. Which choice best expresses this?

A. concave down

B. concave up

C. linear

D. has a maximum everywhere

Concavity is determined by the second derivative: when $f''(x) > 0$, the graph is concave up on that interval. This means the slope of the tangent line is increasing as x increases, so the curve bends upward like a cup. An example you can picture is $f(x) = x^2$, where $f''(x) = 2 > 0$ everywhere, giving a clear concave-up shape. So the best description here is concave up because the positive second derivative indicates the graph bends upward and the tangent slopes are getting steeper as x grows. A concave-down graph would have $f''(x) < 0$, a linear function would have $f''(x) = 0$, and a function with a maximum everywhere cannot have $f'' > 0$ on the interval.

5. In the logistic model, the population grows fastest when P equals which value?

A. $L/2$

B. L

C. 0

D. $L/4$

In the logistic model the growth rate is $dP/dt = rP(1 - P/L)$, which is a downward-opening quadratic in P. The maximum occurs at the vertex, found by setting the derivative with respect to P to zero: $1 - 2P/L = 0$, so $P = L/2$. This is the point where resources are still available but crowding starts to limit growth, giving the fastest increase. For example, at $P = L/2$ you get $dP/dt = r(L/2)(1/2) = rL/4$, which is larger than the rate at $P = L/4$ or $P = L$ (the latter being zero).

6. If a function has cross-sectional area $A(x)$ perpendicular to the x-axis, its volume over $[a,b]$ is:

A. $\int_a^b A(x)\,dx$

B. $\int_a^b x\,A(x)\,dx$

C. $\int_a^b A(x)\,dx^2$

D. $\int_a^b dA(x)\,dx$

Think of building the solid by stacking thin slices perpendicular to the x-axis. Each slice has cross-sectional area $A(x)$ and thickness dx, so its volume is $A(x)\,dx$. Adding up all these slices over the interval from a to b gives the total volume, which is $V = \int_a^b A(x)\,dx$. This uses the fundamental idea of slicing: area times thickness summed continuously along x yields volume. The other expressions don’t match this idea. Multiplying by x would weight each slice by its position, giving a different quantity. Using dx^2 isn’t a standard infinitesimal for volume in this context. Using the derivative $dA(x)/dx$ times dx would collapse to dA, which represents a change in area, not the actual volume formed by the slices.

7. If y = cos(u), where u is a differentiable function of x, what is dy/dx?

A. -u' sin(u)

B. u' cos(u)

C. u' sec^2(u)

D. -u' csc^2(u)

The chain rule is at work: when a function y depends on x through an inner function u(x), its derivative is dy/dx = (dy/du)·(du/dx). Here y = cos(u), so dy/du = -sin(u). Multiplying by du/dx, which is u', gives dy/dx = -sin(u)·u' = -u' sin(u). This is the derivative with respect to x. If the outer function were different, you'd get different forms: for example, with sin(u) you'd have u' cos(u); with tan(u) you'd have u' sec^2(u); with cot(u) you'd have -u' csc^2(u).

8. If F(x) = ∫_{a}^{x} f(t) dt, what is F'(x)?

A. f(x)

B. f'(x)

C. ∫ f(t) dt

D. 0

The rate at which the accumulated area changes when the upper limit moves is given by the integrand at that upper limit. This is a direct consequence of the Fundamental Theorem of Calculus: for F(x) = ∫ from a to x of f(t) dt, the derivative F'(x) equals f(x), as long as f is continuous on [a, x]. Intuitively, increasing x by a tiny amount adds a thin strip of height f(x) and width dx, so the change in F is about f(x)·dx. So F'(x) = f(x). The other forms don't match the situation: differentiating the integrand would give f'(x), not the rate of change of the accumulated area; an indefinite integral ∫ f(t) dt is an antiderivative with respect to t, not a function of x in this context; and 0 would imply no change, which isn't true since the upper limit x is changing.

9. Which growth order correctly ranks exponential, polynomial, and logarithmic functions as x grows large?

A. Exponential, Polynomials, Logs

B. Logs, Exponential, Polynomials

C. Exponential, Logs, Polynomials

D. Polynomials, Exponential, Logs

When x gets really large, compare how fast each function goes to infinity. Exponential growth dominates every polynomial: for any base a > 1 and any positive n, the ratio a^x / x^n tends to infinity as x → ∞. So exponentials outrun polynomials. Next, polynomials outrun logarithms: for any n > 0, x^n / log x → ∞ as x → ∞. Therefore, the fastest to slowest among these is exponential, then polynomial, then logarithmic growth. The standard ranking from fastest to slowest is exponential, polynomial, logarithmic.

10. If y = sin(3x), dy/dx = ?

A. cos(3x)

B. -3 sin(3x)

C. 3 cos(3x)

D. 3 sin(3x)

Using the chain rule: when differentiating sin(u) with respect to x, you get cos(u) · du/dx. Here u = 3x, so du/dx = 3. Multiply: dy/dx = 3 cos(3x). The other forms would come from differentiating related functions (for example, the derivative of cos(3x) is -3 sin(3x), and differentiating sin(3x) without the inner-derivative factor would give cos(3x) instead of 3 cos(3x)). So the correct derivative is 3 cos(3x).

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!