

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

Common Core AP Calculus AB Unit 4 · mathovore.fr

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

This ap calculus contextual applications quiz asks 10 multiple-choice questions on derivatives in context: motion and related rates, and each answer comes with a short explanation.

Ten multiple-choice questions on motion, interpreting derivatives, linearization, related rates and L'Hôpital's Rule. Pick one answer for each, then read the explanation to see the common mistake.

AP Calculus ABCommon Core: AP Calculus AB Unit 4

Questions

Question 1

A particle has position $s(t) = t^2 - 4t$. What is its velocity at $t = 3$?

- A. -3
- B. 6
- C. 0
- D. 2

Question 2

A particle has position $s(t) = 2t^3 - 9t$. What is its acceleration at $t = 2$?

- A. 24
- B. 15
- C. 12
- D. 48

Question 3

Which pair of values means the particle's speed is increasing?

- A. $v = -3, a = 2$
- B. $v = 3, a = -2$
- C. $v = -3, a = -2$
- D. $v = 2, a = 0$

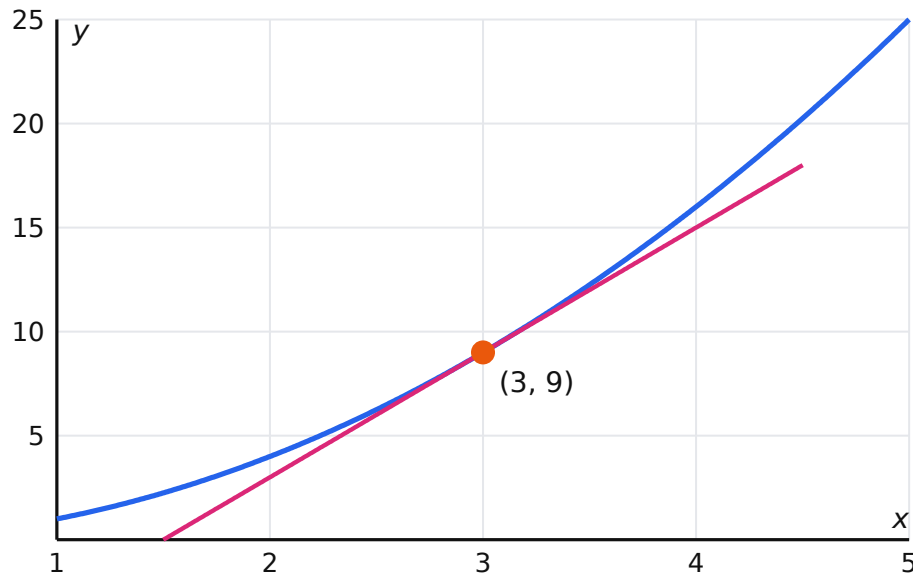
Question 4

The temperature of a pond is $T(t)$ °F at hour t . If $T'(2) = -4$, which statement is correct?

- A. At hour 2, the temperature is 4 °F lower than at hour 0.
- B. At hour 2, the temperature is -4 °F.
- C. Over the first 2 hours, the temperature fell 4 °F.
- D. At hour 2, the temperature is falling at about 4 °F per hour.

Question 5

Use the tangent line to $f(x) = x^2$ at $x = 3$ to approximate $f(3.1)$.



Tangent line to $f(x) = x^2$ at $x = 3$.

- A. 9.61
- B. 9.6
- C. 9.1
- D. 6.1

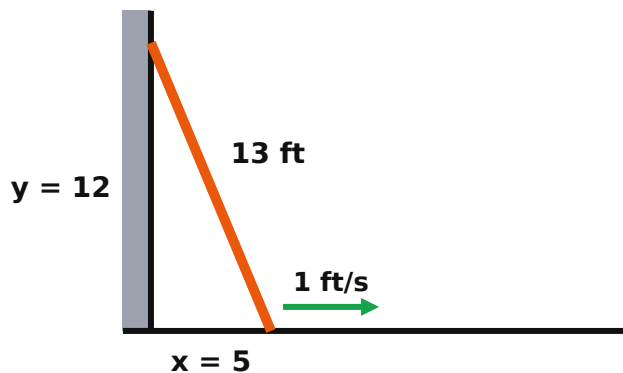
Question 6

Evaluate $\lim_{x \rightarrow 0} \frac{\ln(1+5x)}{x}$.

- A. 5
- B. 0
- C. 1
- D. $\frac{1}{5}$

Question 7

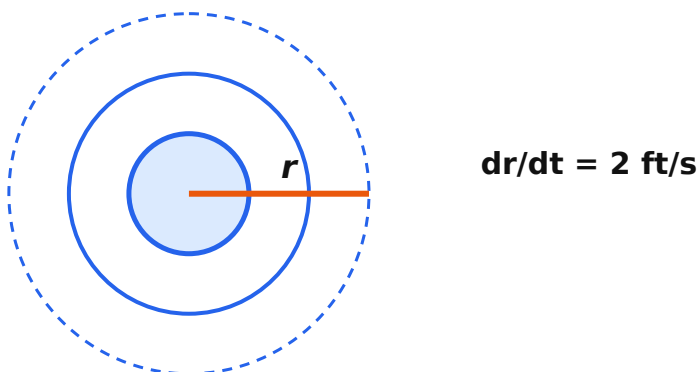
A 13-foot ladder leans on a wall. The base is 5 ft from the wall and slides away at 1 ft/s. How fast is the top sliding, in ft/s?



- A. $\frac{5}{12}$
- B. $-\frac{12}{5}$
- C. $-\frac{5}{12}$
- D. -1

Question 8

The radius of a circular ripple grows at 2 ft/s. How fast is the area increasing when the radius is 3 ft?



The ripple radius r increases at 2 ft/s.

- A. $6\pi \text{ ft}^2/\text{s}$
- B. $12\pi \text{ ft}^2/\text{s}$
- C. $9\pi \text{ ft}^2/\text{s}$
- D. $18\pi \text{ ft}^2/\text{s}$

Question 9

Which limit has the form $\frac{0}{0}$ so that L'Hôpital's Rule applies?

- A. $\lim_{x \rightarrow 0} \frac{x+3}{x+1}$
- B. $\lim_{x \rightarrow 0} \frac{e^x - 1}{x}$
- C. $\lim_{x \rightarrow 1} \frac{x^2 + 2}{x - 1}$
- D. $\lim_{x \rightarrow 0} \frac{\cos x}{x}$

Question 10

The cost in dollars of x items is $C(x) = 0.5x^2 + 10x$. What is the marginal cost at $x = 20$?

- A. \$400 per item
- B. \$20 per item
- C. \$30 per item
- D. \$10 per item

Answer key

1. **D** - $v(t) = 2t - 4$, so $v(3) = 2$. The value -3 is the position, not the velocity.
2. **A** - $a(t) = s''(t) = 12t$, so $a(2) = 24$. The value 15 is the velocity $v(2)$.
3. **C** - Speed increases when velocity and acceleration have the same sign. Both are negative in the correct choice.
4. **D** - The derivative is an instantaneous rate with units of °F per hour, not a temperature or a total change.
5. **B** - $L(x) = 9 + 6(x - 3)$, so $L(3.1) = 9.6$. The value 9.61 is the exact $f(3.1)$, not the approximation.
6. **A** - The form is $\frac{0}{0}$. L'Hôpital gives $\frac{5/(1+5x)}{1} \rightarrow 5$.
7. **C** - $\frac{dy}{dx} = -\frac{x}{y} \frac{dx}{dx} = -\frac{5}{12}$. The top moves down, so the sign is negative.
8. **B** - $\frac{dA}{dt} = 2\pi r \frac{dr}{dt} = 2\pi(3)(2) = 12\pi$. Forgetting $\frac{dr}{dt}$ gives 6π .
9. **B** - At $x = 0$ the numerator and denominator of the correct limit are both 0. The others are not indeterminate.
10. **C** - $C'(x) = x + 10$, so $C'(20) = 30$. The number 400 is the total cost $C(20)$.

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:

- $v(t) = s'(t)$ and $a(t) = v'(t)$; the particle is at rest when $v = 0$.
- Speed increases when velocity and acceleration have the same sign.
- Related rates: differentiate the linking equation with respect to t , then substitute values.
- Local linearization: $L(x) = f(a) + f'(a)(x - a)$; concave down means an overestimate.
- L'Hôpital's Rule applies only to $0/0$ or ∞/∞ forms.

How to use this ap calculus contextual applications quiz

Retake this ap calculus contextual applications quiz until every answer is right, then move on

to the worksheet and the test.

