

Calculus Foundations and Concepts

Calculus · Practice Test · 12 Questions

1. What is the formal definition of the derivative of a function $f(x)$ at a point x ?

- A) The limit of $[f(x+h) - f(x)] / h$ as h approaches 0
- B) The limit of $[f(x+h) + f(x)] / h$ as h approaches 0
- C) The average rate of change over the interval $[0, x]$
- D) The product of $f(x)$ and x

2. Which mathematician is historically credited with independently co-inventing calculus alongside Isaac Newton?

- A) Leonhard Euler
- B) Gottfried Wilhelm Leibniz
- C) Carl Friedrich Gauss
- D) Bernhard Riemann

3. What does the Fundamental Theorem of Calculus establish the relationship between?

- A) Addition and multiplication
- B) Differentiation and integration
- C) Limits and infinity
- D) Geometry and algebra

4. In calculus, what does the 'integral' of a continuous function on a closed interval represent graphically?

- A) The slope of the tangent line
- B) The average value of the function
- C) The area under the curve
- D) The point of inflection

5. What is the derivative of the constant function $f(x) = c$?

- A) c
- B) 1
- C) x
- D) 0

6. Which rule is used to differentiate a function that is the product of two other functions?

- A) The Power Rule
- B) The Product Rule
- C) The Quotient Rule
- D) The Chain Rule

7. What is the limit of $(\sin x) / x$ as x approaches 0?

- A) 0
- B) 1
- C) Infinity
- D) Undefined

8. If a function is differentiable at a point, what must be true about the function at that point?

- A) It must be continuous
- B) It must be increasing
- C) It must be a polynomial
- D) It must be zero

9. What type of function is the result of the power rule derivative $d/dx(x^n) = nx^{(n-1)}$?

- A) A logarithmic function
- B) A power function
- C) A trigonometric function
- D) A constant function

10. The second derivative of a position function with respect to time represents which physical quantity?

- A) Velocity
- B) Speed
- C) Acceleration
- D) Displacement

11. What is the slope of the tangent line to the curve $y = x^2$ at the point (3, 9)?

- A) 3
- B) 6
- C) 9
- D) 18

12. Which theorem states that if a function is continuous on $[a, b]$ and differentiable on (a, b) , there exists a point c in (a, b) where the instantaneous rate of change equals the average rate of change?

- A) Mean Value Theorem
- B) Intermediate Value Theorem
- C) Extreme Value Theorem
- D) Taylor's Theorem