

Calculus Foundations and Concepts

Calculus · Answer Key · 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