Self-Assessment Quiz
Integration: Riemann Sums and Fundamental Theorems

Instructions: This is a self-assessment quiz. There is no grading. Choose the most appropriate option for each question. Answers are provided at the end.

Multiple Choice Questions

Q1. A Riemann sum is used to:

  (A) Find the exact value of a derivative

  (B) Approximate the area under a curve

  (C) Solve differential equations

  (D) Find the roots of a function

Q2. In a Riemann sum, Δx represents:

  (A) The height of each rectangle

  (B) The width of each subinterval

  (C) The midpoint of an interval

  (D) The slope of the curve

Q3. Which of the following corresponds to a **right-endpoint** Riemann sum?

  (A) $f(x_{i-1})$

  (B) $f\left(\frac{x_{i-1}+x_i}{2}\right)$

  (C) $f(x_i)$

  (D) $f(a)$

Q4. The definite integral $\int_a^b f(x)\,dx$ represents:

  (A) The slope of $f(x)$

  (B) The limit of Riemann sums

  (C) The derivative of $f(x)$

  (D) The maximum value of $f(x)$

Q5. If $f(x) \geq 0$ on $[a, b]$, then $\int_a^b f(x)\,dx$ gives:

(A) The net area below the x-axis

(B) The average value of $f(x)$

(C) The area under the curve from a to b

(D) The arc length of the curve

Q6. The Fundamental Theorem of Calculus (Part I) connects:

(A) Limits and continuity

(B) Integrals and derivatives

(C) Series and sequences

(D) Differentiation and geometry

Q7. If $F'(x) = f(x)$, then according to the Fundamental Theorem of Calculus:

(A) $\int_a^b f(x)\,dx = f(b) - f(a)$

(B) $\int_a^b f(x)\,dx = F(b) - F(a)$

(C) $\int_a^b f(x)\,dx = F'(b) - F'(a)$

(D) $\int_a^b f(x)\,dx = 0$

Q8. Which of the following is an antiderivative of $f(x) = 2x$?

(A) x^2

(B) $2x^2$

(C) $x^2 + C$

(D) $2x + C$

Q9. The midpoint Riemann sum generally gives a better approximation because:

(A) It uses smaller rectangles

(B) It balances overestimation and underestimation

(C) It always underestimates area

(D) It ignores curvature

Q10. If the number of subintervals n increases in a Riemann sum, the approximation:

(A) Becomes less accurate

(B) Approaches the exact integral value

(C) Becomes undefined

(D) Depends only on endpoints

Q11. The Fundamental Theorem of Calculus (Part II) is mainly used to:

    (A) Approximate areas

    (B) Evaluate definite integrals easily

    (C) Prove continuity

    (D) Find limits

Q12. If $f(x)$ is continuous on $[a, b]$, then:

    (A) $\int_a^b f(x)\, dx$ does not exist

    (B) Riemann sums do not converge

    (C) The definite integral exists

    (D) $f(x)$ must be linear

Q13. Which expression represents a left Riemann sum?

    (A) $\sum_{i=1}^{n} f(x_i)\Delta x$

    (B) $\sum_{i=1}^{n} f(x_{i-1})\Delta x$

    (C) $\sum_{i=1}^{n} f(\Delta x)$

    (D) $\sum_{i=1}^{n} \Delta x$

Q14. The definite integral measures:

    (A) Total change of a quantity

    (B) Instantaneous rate of change

    (C) Slope at a point

    (D) Curvature of a function

Q15. The geometric interpretation of integration is:

    (A) Slope of a tangent

    (B) Area under a curve

    (C) Maximum value of a function

    (D) Equation of a line

Answer Key

Q1. B

Q2. B

Q3. C

Q4. B

Q5. C

Q6. B

Q7. B

Q8. C

Q9. B

Q10. B

Q11. B

Q12. C

Q13. B

Q14. A

Q15. B