MATH 101

Farid Aliniaeifard

University of British Columbia

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Learning Goals 1

(1) Approximate the area between a curve and x-axis by using **left, right, or midpoint** sums. Interpret a definite integral in terms of the area between a curve and x-axis. Compute definite integral by using the **Riemann Sum**, the definition of definite integral. Examples,

▶ Estimate the area under the graph $y = \sqrt{x}$ from $x = 0$ to $x = 4$ using N approximating rectangles and right endpoints. Sketch the graph and rectangles. Is your estimate an underestimate or overestimate?

▶ Write an integral that is defined by the expression

$$\lim_{n \to \infty} \sum_{i=1}^{n} \frac{\pi}{n} \sin(\frac{i}{4n}).$$

▶ Use the definition of a definite integral to show that

$$\int_a^b x^2 dx = \frac{b^3 - a^3}{3}.$$

Learning Goals 2

Compute definite integrals by using the **fundamental theorem of calculus**. Be able to recognize functions that are given as definite integrals with variable upper and lower limits and find their derivatives, relate antiderivatives to definite and indefinite integrals, and the **net change** as the definite integral of a rate of change. Examples:

1. Evaluate $\int_0^4 (\frac{x^2}{4} + \sqrt{x} + e^x)dx$.
2. Differentiate $\int_{\ln x}^{e^x} \frac{1}{\sqrt{1+t^4}} dt$.