Suppose $f$ integrable
(Note $f$ continuous implies $f$ integrable).
Suppose $a = x_0 < x_1 < x_2 < ....x_{n-1} < x_n = b$, $\Delta x = x_i - x_{i-1}$

$$\int_a^b f(x)dx = lim_{n\to\infty}\Sigma_{i=1}^n f(x_i^*)\Delta x$$

If $n$ equal subdivisions: $\Delta x = \frac{b-a}{n}$ and if we use right-hand endpoints: $x_i^* = x_i$

$$\int_a^b f(x)dx = lim_{n\to\infty}\Sigma_{i=1}^n f(x_i)\frac{b-a}{n}$$

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The Fundamental Theorem of Calculus: Suppose $f$ continuous on $[a, b]$.

1.) If $g(x) = \int_a^x f(t)dt$, then $g'(x) = f(x)$.

2.) $\int_a^b f(t)dt = F(b) - F(a)$ where $F$ is any antiderivative of $f$, that is $F' = f$.

The Fundamental Theorem of Calculus: Suppose $f$ continuous on $[a, b]$.

1.) If $\frac{d}{dx}[\int_a^x f(t)dt] = f(x)$.

2.) $\int_a^b F'(t)dt = F(b) - F(a)$.

Examples:

1.) If $g(x) = \int_0^x t^2 dt$, then $g'(x) =$ ________________.

2.) If $g(x) = \int_5^x t^2 dt$, then $g'(x) =$ ________________.

3.) If $g(x) = \int_{\_} 2^x sin(t^2) dt$, then $g'(x) =$ ________________.

4.) If $g(x) = \int_4^x tan(\frac{t^3}{t+1}) dt$, then $g'(x) =$ ________________.

5.) If $g(x) = \int_1^x \sqrt{3t-5} dt$, then $g'(x) =$ ________________.

Examples:

1.) If $g(x) = \int_0^{x^3} t^2 dt$, then $g'(x) =$ ________________.

2.) If $g(x) = \int_5^{x^3} t^2 dt$, then $g'(x) =$ ________________.

3.) If $g(x) = \int_2^{ln(x)} \frac{t}{t+1} dt$, then $g'(x) =$ ________________.

4.) If $g(x) = \int_3^{\frac{1}{x}} sec(t) dt$, then $g'(x) =$ ________________.

Evaluate the limit by recognizing the sum as a Riemann sum for a function defined on [0, 1]

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

2.) $lim_{n\to\infty} \Sigma_{i=1}^{n} \frac{i^5}{n^6}$