Recall: Definite Integral

If f is defined on $[a,b]$ then $\lim\limits_{n\to\infty}\sum\limits_{i=1}^{n} f(x_i)\Delta x$ where $\Delta x = \dfrac{b-a}{n}$ and $x_i = a + \Delta x \cdot i$.

$$= \boxed{\int_a^b f(x)\, dx}$$

First, practice evaluating some indefinite integrals:

Do: $\displaystyle\int \frac{\sqrt[5]{x^3}}{11}\, dx$

Do: $\displaystyle\int \frac{2}{x}\, dx$

Do: $\displaystyle\int \sec x \tan x\, dx$

Evaluating Indefinite Integral with an Initial Condition

ex. $\int 8 \, dx$ where $F(1) = 4$.

ex. $\int \left(3x^2 - 4x + 7 \right) dx$ where $F(0) = 8$.

ex. $\int \left(\sin x - e^x \right) dx$ where $F(0) = 9$.

A few more indefinite integrals that require manipulation:

ex. $\int (3x-2)(2x+7)\ dx$

ex. $\int \sqrt{x}\,(x+3)\ dx$

ex. $\int \dfrac{4x^3 - 7x^2}{x}\ dx$

Evaluating a Definite Integral

> ## FTC Part 2:

ex. $\int_1^3 5x \, dx$

ex. $\int_1^e \frac{3}{x} \, dx$

ex. $\int_0^1 \left(e^x + x^2 - 9 \right) dx$

ex. $\int_1^4 7\sqrt{x} \, dx$

Now, on to examples of FTC Part 1:

Recall:

FTC Part 1: $\int_a^x f(t)\ dt = g(x)$ where f is continuous on $[a,b]$

FTC Part 1: (rewritten)

ex. Find the derivative of $\int_0^x \sqrt{1+t^2}\ dt$

ex. Determine $\dfrac{d}{dx}\int_0^x 7t^3\ dt$

ex. Use Chain Rule to determine $\dfrac{d}{dx}\int_1^{x^4} \ln t\ dt$