11/06

Monday, November 6, 2017 8:22 AM

Ex:

$$\int \frac{3}{x[\ln(2x)]^4}\,dx$$

$u = \ln(2x)$

$du = \frac{1}{\cancel{2}x}\cancel{2}\,dx$

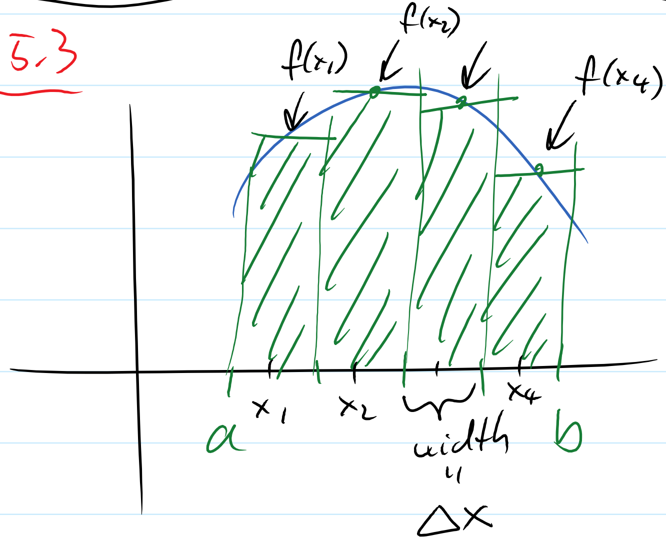
$du = \frac{1}{x}\,dx$

$$= 3\int \frac{1}{u^4}\,du = 3\int u^{-4}\,du$$

$$= \cancel{3}\,\frac{-1}{\cancel{3}}u^{-3} + C = -u^{-3} + C$$

$$= \boxed{\frac{-1}{[\ln(2x)]^3} + C}$$

Section 5.3



Area under the curve is about

$$\Delta x\left(f(x_1) + f(x_2) + \dots + f(x_4)\right)$$

The exact are is

$$\lim_{\Delta x \to 0} \Delta x\left[f(x_1) + f(x_2) + \dots + f(x_n)\right]$$

$$= \lim \sum_{i}^{n} f(x_i)\cdot \Delta x = \dots$$

$$= \lim_{\Delta x \to 0} \sum_{i=1}^{n} f(x_i) \cdot \Delta x = \ldots$$

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

Def If $f(x)$ is continuous on $[a,b]$ and $f(x) \geq 0$ on the interval $[a,b]$, then the region R under the curve $y = f(x)$ over the interval $[a,b]$ has area given by the definite integral

$$\int_a^b f(x)\, dx$$

Def: (Fundam. thm. of Calculus)
If the function $f(x)$ is continuous on $[a,b]$, then

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

"definite integral from a to b of $f(x)$"

where $F(x)$ is <u>any</u> antiderivative of $f(x)$ on $[a,b]$.

Find the area under the curve $y = 2x+1$ over the interval $1 \leq x \leq 3$.

$$\int_1^3 2x+1\, dx = F(3) - F(1)$$

$$\int_1^1 2x+1\,dx = F(3) - F(1)$$

$$\int 2x+1\,dx = x^2+x+C$$

$$F(x) = x^2+x$$

$$= (3^2+3) - (1^2+1) = 12 - 2 = \boxed{10}$$

$$\int_1^3 2x+1\,dx = x^2+x\Big|_1^3 = (3^2+3) - (1^2+1) = \boxed{10}$$

Evaluate:

$$\int_1^4 \left(\frac{1}{x} - x^2\right) dx = \ln|x| - \frac{1}{3}x^3\Big|_1^4$$

$$= \left(\ln 4 - \frac{1}{3}\cdot 4^3\right) - \left(\ln 1 - \frac{1}{3}\right)$$

$$= \ln 4 - \frac{64}{3} - 0 + \frac{1}{3}$$

$$= \ln 4 - \frac{63}{3} = \boxed{-21 + \ln 4}$$

$$= \boxed{\ln(4) - 21}$$