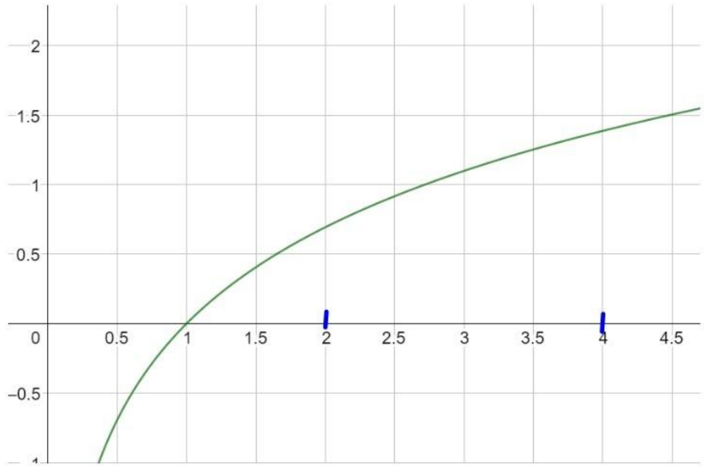
Good afternoon: for the warm up, finish the task from DS

Approximate $\int_2^4 \ln x \, dx$ using 4 midpoint rectangles



$\Delta x = \frac{4-2}{4} = 0.5$

Subintervals midpts

2 to 2.5: 2.25

2.5 to 3: 2.75

3 to 3.5: 3.25

3.5 to 4: 3.75

(fire drill? second level, speed bump)

$0.5\left(f(2.25) + f(2.75) + f(3.25) + f(3.75)\right)$

$= \boxed{}$

CIM

$$\int_2^4 \ln x \, dx$$

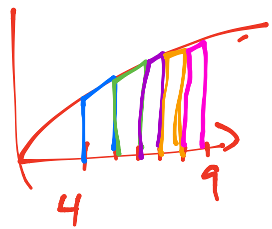
these numbers are x-values

Approximate $\int_4^9 \sqrt{x}\,dx$ using 5 trapezoids of equal width.

$\Delta x = \frac{9-4}{5} = 1$

$\frac{\Delta x}{2}\left[f(x_0)+2[f(x_1)+\cdots]+f(x_n)\right]$

$\frac{1}{2}\left[\sqrt{4}+2[\sqrt{5}+\sqrt{6}+\sqrt{7}+\sqrt{8}]+\sqrt{9}\right]$



≈ 12.660

$\Delta x \left[f(x_0)+2[f(x_1)+\ldots+f(x_{n-1})]+f(x_n)\right]$

Suppose f is a continuous function with the selected values below. Approximate the integral using 4 rectangles, LRAM and RRAM.

$$\int_0^8 f(x)\,dx$$

1 2 3 2 ← varying Δx's

x	0	1	3	6	8
$f(x)$	5	4	5	4	5

LRAM

$\approx 5\cdot 1 + 4\cdot 2 + 5\cdot 3 + 4\cdot 2$

$5 + 8 + 15 + 8$

36

$f(x)\Delta x$

RRAM: $4\cdot 1 + 5\cdot 2 + 4\cdot 3 + 5\cdot 2$

$4 + 10 + 12 + 10$

$= 36$

Why do it from a table?
We don't always have all the values, or a specific function that models behavior--just data.

Especially useful for position-velocity-acceleration

Riemann Definition of Definite Integral

$$\Delta x = \frac{\overbrace{b-a}^{\text{interval width}}}{n}$$

width of 1 rect.

# of rectangles

$$\lim_{n\to\infty} \underbrace{\sum_{i=1}^{n}}_{\text{Area of } n \text{ rectangles}} \overbrace{\underbrace{f(x_i)}_{\text{height of } i^{th} \text{ rectangle}} \underbrace{\Delta x}_{\text{width}}}^{\text{area of } i^{th} \text{ rectangle}} = \overbrace{\underbrace{\int_a^b f(x)\,dx}_{\text{exact area under } f(x) \text{ between } a \text{ ; } b}}^{\text{"definite Integral"}}$$

∞ many rect., very thin width.

Be fluent algebraically:

Write a definite integral whose value equals

$$\lim_{n\to\infty} \sum_{i=0}^{n} \left[\left(\underbrace{3+\frac{5}{n}i}\right)^3 + \left(3+\frac{5}{n}i\right)^2 - 4\right]\frac{5}{n}$$

Δx

so, $b-a=5$

$b=a+5$

varies as i increases to n; starts @ 3. this is x

3 is a starting value

$$\int_3^8 x^3 + x^2 - 4 \, dx$$

Write a definite integral whose value equals

$$\lim_{n\to\infty} \sum_{i=1}^{n} \sin\Big(\underbrace{6}_{a}+\overbrace{\boxed{\tfrac{2i}{n}}}^{x}\Big)\underbrace{\frac{2}{n}}_{\Delta x}$$

b-a

if $b-a=2$
then $b=a+2$

$\rightarrow a=6$
so $b=8$

$$\int_6^8 \sin(x)\,dx$$

Write an infinite Riemann sum whose value equals

$$\int_5^8 \sqrt{x+3}\,dx$$

$b-a$
$=3$

a

$$\lim_{n\to\infty} \sum_{i=0}^{n} \sqrt{\underbrace{\left(5+\frac{3}{n}i\right)}_{x}+3}\;\frac{3}{n}$$

$a + \Delta x \cdot i$

https://www.desmos.com/calculator/wlo7qlygfi

Write an infinite Riemann sum whose value equals

$$\int_2^7 e^{3x}\,dx$$

$$\lim_{n \to \infty} \sum_{i=0}^{n} e^{3\left(2+\frac{5i}{n}\right)} \frac{5}{n}$$