Outline

1. Calculating Riemann sums with a calculator.
2. Definite integrals.
3. Functions defined by integrals.

1. Evaluating Areas with a Calculator

- Steps to approximate the area under $y = f(x)$ between $x = a$ and $x = b$ using N rectangles.

① Enter formula for $f(x)$ into Y1 screen of calculator.

② STO▶ the values of a, b, N in memories A, B, N.

③ STO▶ $(B - A)/N$ in W. (width of each rectangle.)

④ Left hand Riemann sum:

sum(seq(Y1(A+K*W)*W, K, 0, N-1))

⑤ Right hand Riemann sum:

sum(seq(Y1(A+K*W)*W, K, 1, N))

For intravenous curve:

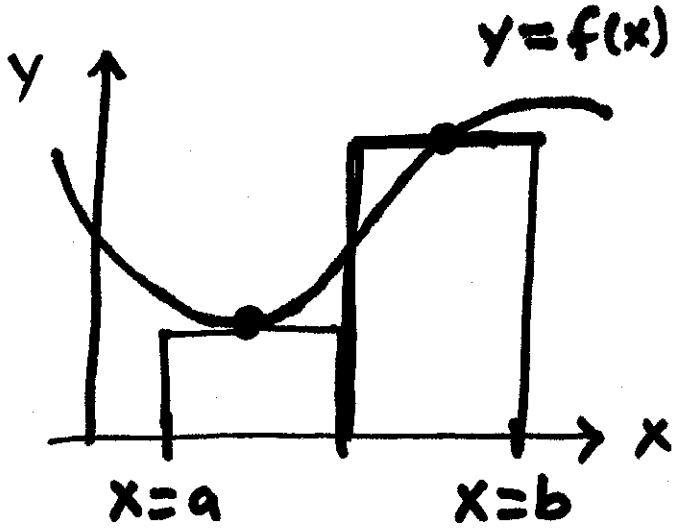
Left hand = 4884.823281

Right hand = 4488.823281

"Best estimate" = $\frac{4884.8232 + 4488.8232}{2}$

= 4686.8232

- Midpoint Rule: The height of the function in the middle of each rectangle gives the height of the rectangle.



- To figure out a midpoint sum on your calculator, do everything you would for a left hand sum, and execute the final command:

$$\text{sum}(\text{seq}(Y1(A+K*W+\underbrace{0.5*W}_{\text{the only difference}})*W, K, 0, N-1))$$

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$$\text{Biovailability} = \frac{2020.11}{4686.82} \times \frac{100}{1} = 43.10\%$$

(more accurate- use "best estimate" on top as well)

$$= \frac{1994.63}{4686.82} \times \frac{100}{1} = 42.56\%$$

2. Definite Integral

- Way to improve the accuracy of a Riemann sum is to increase the number of rectangles, N.

- When we take the Limit as $N \to \infty$:

$$\lim_{N\to\infty} \sum_{k=0}^{N-1} f(a+k\cdot\Delta x)\cdot\Delta x = \int_a^b f(x)\cdot dx$$

a: x-value where area starts

b: x-value where area ends

$f(x)$: height

dx: width

- The definite integral $\int_a^b f(x)\cdot dx$ gives the <u>exact</u> amount of area under the curve.