⓪

- Maps (survey) (Dec.4).
- Term Grades Posted.
- Solutions to last year's Exam Posted.
- Final: Dec. 12 at 3:30 in CHBE 101.
- Course Evals; do them.
- regular office hours today 2-3:30.

Exam Office Hours. MATH ANNEX.

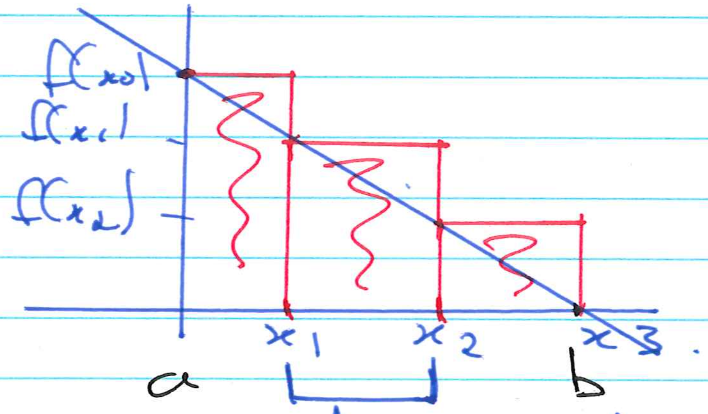
8th Thurs: 1-3pm in MATX 1101
9th Fri: 1-2:30 in LSK 300C.
10th Sat: 12-2 in LSK 300C
↑ near MLC.

Riemann Sums: What do I have to know?

Given a simple function, approximate the area under the curve using Riemann Sums (rectangles)

- using either right / left endpoints
- given number of bars.

n = 3.
left endpoints



〃
x_0

$$\Delta x = \frac{b-a}{n}$$

$$\sum_{i=0}^{2} f(x_i)\,\Delta x = f(x_0)\,\Delta x + f(x_1)\,\Delta x + f(x_2)\,\Delta x$$

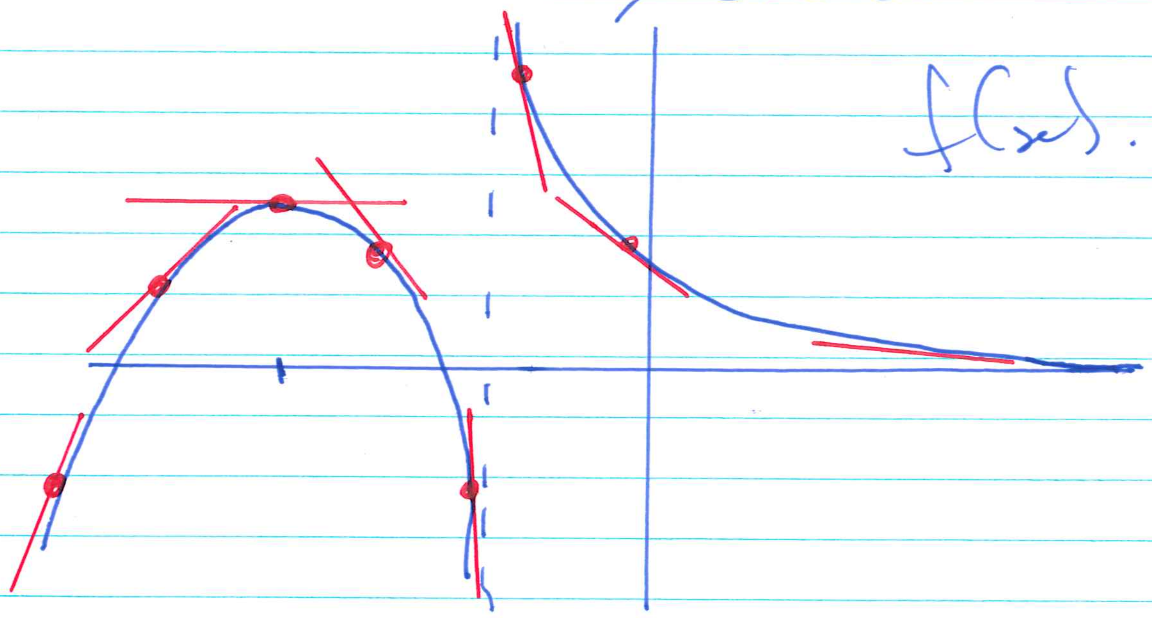
3 more problems.

1. Explain why $$\int_a^b f(x)dx = \underbrace{\lim_{n\to\infty}\sum_{i=1}^{n} f(x_i)\Delta x}_{\text{definition of the integral.}}$$

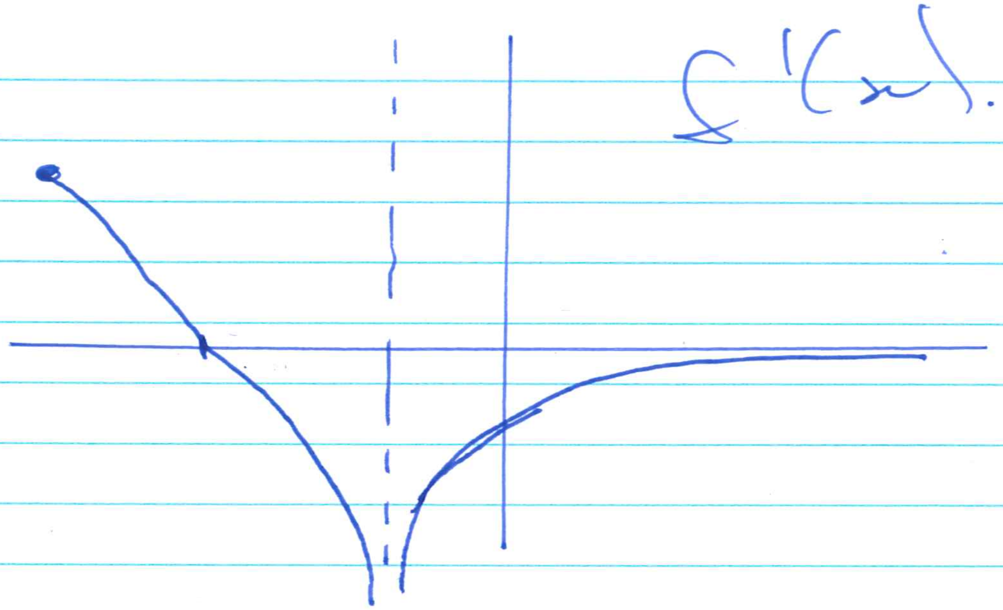
Use words and pictures.
What are x_i, Δx, n?

2. Explain why $$f'(x) = \underbrace{\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}}_{\text{definition of derivative.}}$$

3. Given $f(x)$, sketch $f'(x)$.



③

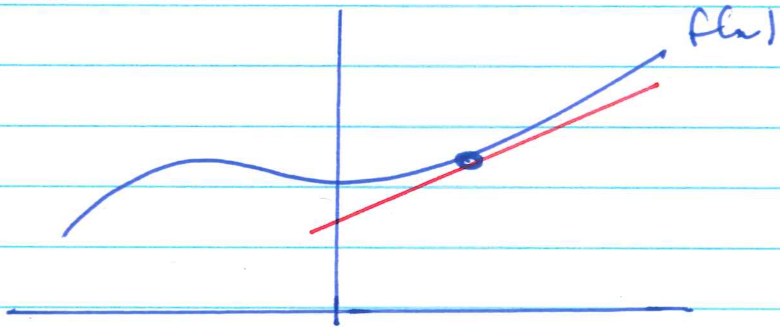


Where does Math go?

What do I do all day?

Differential Calculus:

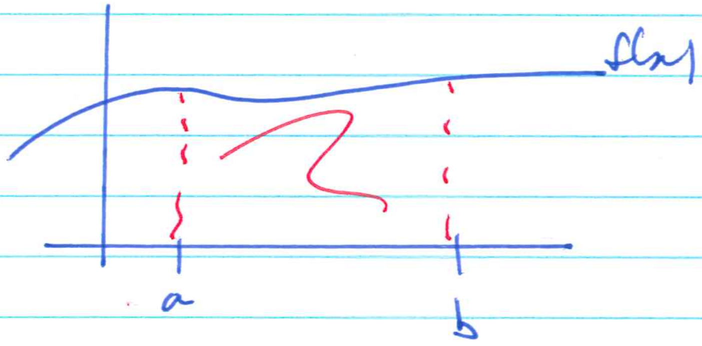
Find Tangent Line? Need Derivatives.



$$\frac{df}{dx}$$

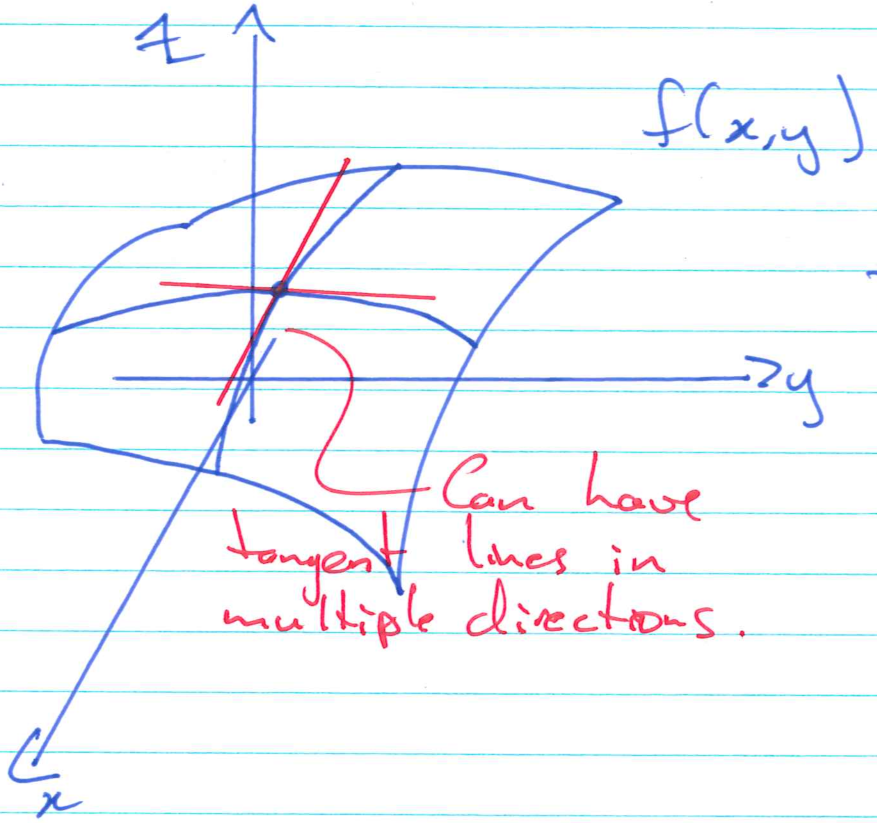
Integral Calculus:

Find Area?. Need Integrals.



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

Multi-Variable Calculus:



Can have tangent lines in multiple directions.

Need **Partial Derivatives**

$$\frac{\partial f}{\partial x}, \frac{\partial f}{\partial y}.$$

Differential Equations:

"Solve" for an unknown function given information about its derivatives.

Eg:

- $f'(x) = f(x)$
  $\longrightarrow f(x) = e^{x}$.
- $f''(x) = -f(x)$
  $\longrightarrow f(x) = \pm\cos x$ or $\pm\sin x$
- $f''(x) - 5f'(x) + 6f(x) = 0$
  $\longrightarrow f(x) = e^{3x}$ or e^{2x},

Partial Differential Equations

I study the Nonlinear Shrödinger Equation.

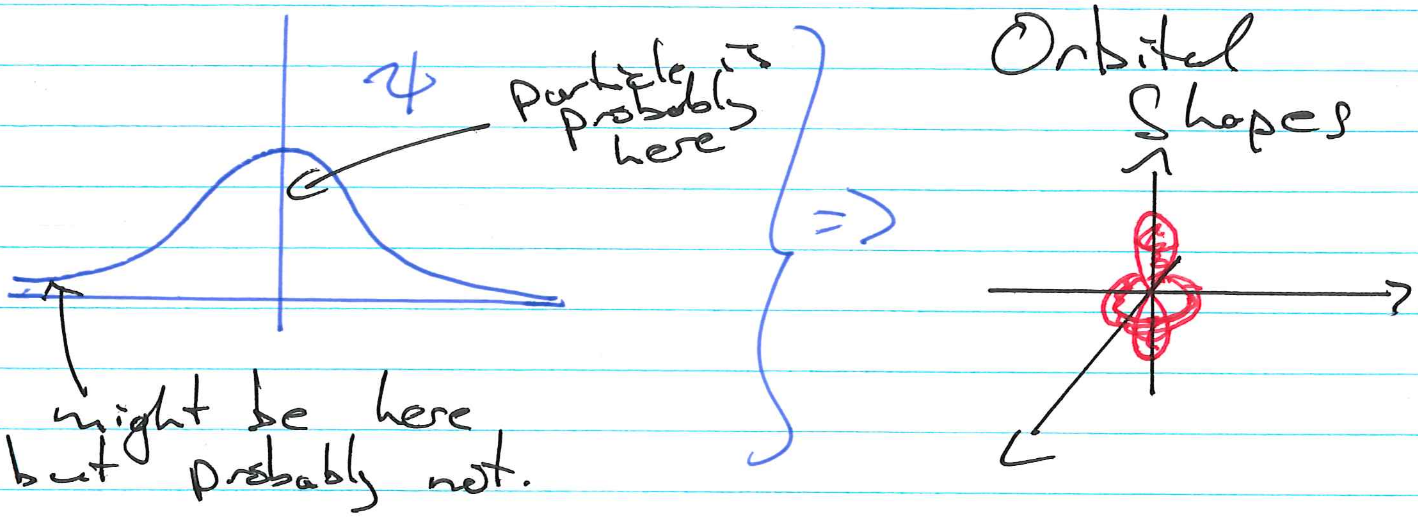
Linear:

$$i\frac{\partial \psi}{\partial t} = -\frac{\partial^2 \psi}{\partial x^2} + V\psi$$

ψ - wave function

$i = \sqrt{-1}$

V - external potential.



Nonlinear!

$$i\frac{\partial \psi}{\partial t} = -\frac{\partial^2 \psi}{\partial x^2} \pm |\psi|^2\psi.$$

Models Many cold particles

+ particles don't like each other

− particles do like each other.