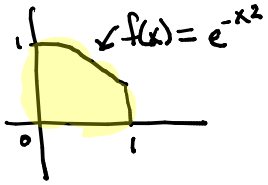
PHYS 171
winter 2019

lecture 3: numerical integration

learning goals
- understand foundations of numerical integration
- code and apply basic integration schemes

how to approach integration when not analytically tractable?

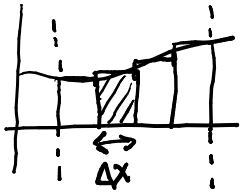
consider: $\int_0^1 dx\, e^{-x^2}$, answer uses "error function"



* how to estimate area?

need some way to sum up areas under (arbitrary-shaped) curve

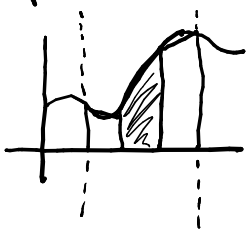
Riemann sum



divide x-axis into bins of width Δx

$A = \sum_i \Delta x f(x_i)$, w/ x_i in the middle of each bin

Trapezoidal rule



same as Riemann sum, but now we use trapezoids to fill area instead of rectangles

$A = \sum_i \Delta x \frac{f(x_i) + f(x_{i+1})}{2}$, w/ x_i at bin edges

* notebook example (use range, lists/arrays, functions)

students suggest enumeration methods, cover loop and range()

referencing package functions

formatting output

if time, vectorized operations, reduce # computations