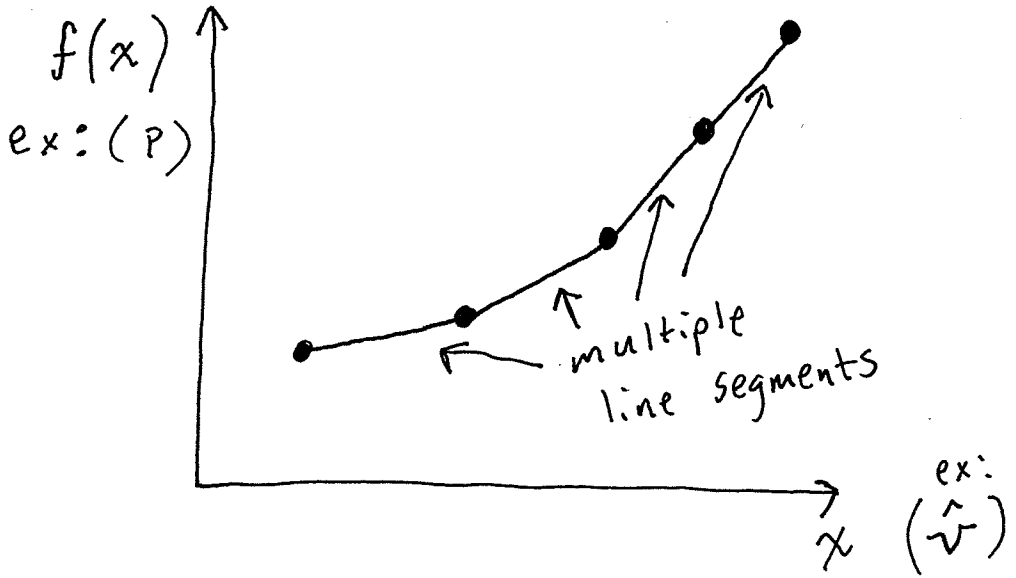
Numerical Integration

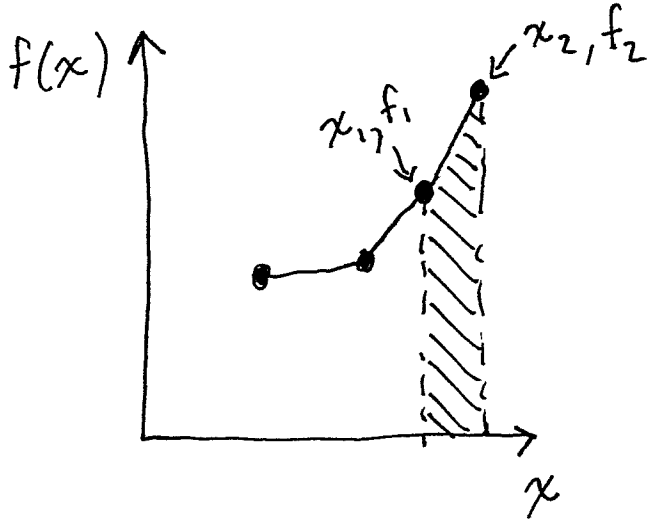
- Sometimes we don't have an analytical equation/function for the relationship between variables/properties (e.g., P, $\hat{v}$, T)
- Instead must make use of tabulated/discrete data.
  → ex: steam tables
- Integrating between discrete points:



Approximation:
- data between tabulated points can be interpolated using a linear function

- To calculate integral
  - use interpolation between discrete points

- Trapezoid rule:



$$\int_{x_1}^{x_2} f(x)\,dx \approx (x_2 - x_1)\left(\frac{f_1 + f_2}{2}\right)$$

This formula can be used to numerically calculate integrals

→ Excel

→ MATLAB (trapz function)

ex: $G = \int_1^2 x^2\,dx$