Objectives.
(1) Introduce a finite volume view of differencing
(2) Represent the average flux as a constant or a linear
(3) Build some intuition around slope limiters

TODO.
(1) run adv1dFV.py and turn limiting on and off

Questions.
(1) Suppose
\[ u_t + (f(u))_x = 0 \]
what does
\[ \frac{d}{dt} \int_{x_1}^{x_2} u(x, t) \, dx = \ldots \]

(2) Give an example of a numerical flux that satisfies the consistency requirement.

(3) What does Gudunov say about monotone schemes?

(4) Consider the REA algorithm: reconstruct-evolve-average. What steps adhere to the conservation law automatically?

(5) Suppose
\[ \bar{u} = \frac{1}{\Delta x} \int_{x_1}^{x_2} u(x) \, dx \]
Let \( g(x) = \bar{u} \) for \( x \in [x_1, x_2] \). Then
\[ \frac{1}{\Delta x} \int_{x_1}^{x_2} g(x) \, dx = \bar{u} \]
What form should \( g_\ell(x) \) have if \( g_\ell \) is linear and satisfies
\[ \frac{1}{\Delta x} \int_{x_1}^{x_2} g_\ell(x) \, dx = \bar{u} \]
(6) Draw a picture of the slope construction used for Beam-Warming vs Lax-Wendroff?

(7) Run the REA algorithm using linear reconstruction on