16.930 PS5

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1 Verification of primal DG

Since I was not able to get the DG code working at the time of the first project, I found it helpful to verify that this new implementation works as expected.

As a reminder, the three problems are given by

$$-u_{xx} = x^2 \tag{1}$$

$$-10^{-4}u_{xx} + u = 0 \tag{2}$$

$$-10^{-2}u_{xx} + u_x = 0, \tag{3}$$

where the boundary conditions for all three are $u(0) = 0$ and $u(1) = 1$. Analytical solutions to the three problems are given by

$$u(x) = \frac{x}{12}\left(13 - x^3\right) \tag{4}$$

$$u(x) = \frac{\exp(100x) - \exp(-100x)}{\exp(100) - \exp(-100)} \tag{5}$$

$$u(x) = \frac{1 - \exp(100x)}{1 - \exp(100)} \tag{6}$$

$$\tag{7}$$

respectively.

2