Exercise 7 (Optional)

Solve the advection equation

$$\frac{\partial u}{\partial t} + c\frac{\partial u}{\partial x} = 0$$

with the following conditions:

$$0 \leq x \leq 10, \quad t \geq 0, \quad c = 1, \quad u(x, t = 0) = \exp(-10(x-1)^2)$$

using different explicit methods (central differences, upwind, downwind) and study the stability as a function of the time step used.