352 Quiz 13

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For a wave equation

$$\frac{\partial^2 u}{\partial t^2} = \gamma^2 \frac{\partial^2 u}{\partial x^2}$$

the **CFL number** c is defined as

$$c = \frac{|\gamma|\Delta t}{\Delta x}$$

where Δt and Δx are the discretization step.

Multiple choice: 3

Based on how we discretize the first-order PDE

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

we know that the numerical domain of dependence is of a triangular shape. When $c = 1$, the characteristic line lies right on the border of the region. However, when $c > 1$, the characteristic line falls out of the numerical domain of dependence. In this case, if the initial condition is changed, the modification cannot be captured by the numerical domain of dependence. Therefore, the numerical scheme cannot be stable. On the other hand, if the characteristic line is included in the domain, everything is fine.