

For all the following multiple-choice questions, circle your answers clearly. No partial credit will be awarded; any scratch work will be ignored.

1. Which of the following is a physical principle used in class to derive the heat equation?

- (a) Conservation of momentum
- (b) Principle of least action
- (c) Conservation of (heat) energy
- (d) Second law of thermodynamics
- (e) Maxwell's equations

2. For some $k > 0$, which of the following PDEs is the heat equation for $u(x, t)$?

- (a) $u = ku_x$
- (b) $u_t = ku$
- (c) $u_t = ku_x$
- (d) $u_{tt} = ku_{xx}$
- (e) $u_t = ku_{xx}$

3. Which of the following is ***not*** part of a complete heat equation problem description for $u(x, t)$, in the domain $x \in [0, L]$ and $t \geq 0$?

- (a) The differential equation prescribing behavior of u in the domain interior.
- (b) The initial conditions $u(x, 0)$ specifying the starting state of the system.
- (c) The boundary conditions specifying behavior at the endpoints $x = 0$ and $x = L$.
- (d) The interplay between space x on time t and how they influence each other.
- (e) The values of parameters in the PDE, such as the diffusion coefficient k .