

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.** What is an “initial condition” for a PDE?

- (a) A condition for the solution at some initial time (usually  $t = 0$ )
- (b) A property used to derive a PDE from physical principles
- (c) The first stage of a method to solve the PDE
- (d) A condition on the PDE solution at spatial boundaries
- (e) An equation that can be ignored when solving a PDE

**3.** Which of the following is always true about boundary conditions for the heat equation?

- (a) Boundary conditions are unnecessary to correctly model temperature diffusion
- (b) Boundary conditions always take the form of prescribed temperature at the boundaries
- (c) Boundary conditions play no role in determining the solution to the heat equation
- (d) Boundary conditions provide necessary constraints on the PDE solution at physical boundaries
- (e) Boundary conditions for the heat equation cannot be mathematically modeled