

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

1. An equilibrium solution u_e for the heat equation (with appropriate initial and boundary conditions) satisfies which of the following properties in general?

- (a) u_e does *not* respect the boundary conditions.
- (b) $u_e = 0$.
- (c) u_e does *not* depend on time t .
- (d) u_e is unrelated to the solution u of the heat equation.
- (e) u_e cannot be computed.

2. Which of the following properties is used to derive the principle of superposition?

- (a) Conservation of energy
- (b) Linearity of a PDE operator
- (c) The wave equation
- (d) The Divergence Theorem
- (e) Initial and boundary conditions

3. With u_1 and u_2 arbitrary functions, c_1 and c_2 arbitrary constants, and L an operator, which of the following is the definition of linearity of L ?

- (a) $L[c_1c_2u_1u_2] = c_1u_2 + c_2u_1$
- (b) $L[c_1u_1 + c_2u_2] = c_1L[u_1] + c_2L[u_2]$
- (c) $c_1L[u_1] = c_2L[u_2]$
- (d) $c_1L[u_1] + c_2L[u_2] = 0$
- (e) $c_1 + c_2 = L[u_1] + L[u_2]$