Quiz 4 **Name:** ______________________________

MATH 3150, Section 004 February 11, 2019

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 true about the method of separation of variables?

(a) Only the heat equation can be solved using separation of variables

(b) The initial and boundary conditions are discarded and ignored

(c) The PDE cannot be time-dependent

(d) After finding eigenfunctions, superposition is used to construct a general solution

(e) The solution to the PDE problem is always the constant function

**2.** Consider the eigenvalue problem

$$\begin{aligned}\phi''(x) + \lambda\phi(x) = 0, \quad 0 < x < 1 \\ \phi(0) = 0, \quad \phi(1) = 0\end{aligned}$$

Which of the following is true about an eigenvalue $\lambda$ for this problem?

(a) $\lambda = 0$ is an eigenvalue with eigenfunction $\phi(x) = 0$

(b) $\lambda = \pi^2$ is an eigenvalue with eigenfunction $\phi(x) = \sin(\pi x)$

(c) $\lambda = -e^2$ is an eigenvalue with no eigenfunction

(d) There are no eigenvalues for this problem

**3.** What is the solution $u(x,t)$ to the following PDE problem?

$$\begin{aligned}u_t = u_{xx}, \quad 0 < x < L \\ u(0,t) = u(L,t) = 0 \\ u(x,0) = \sin\left(\frac{3\pi x}{L}\right)\end{aligned}$$

(a) $u(x,t) = 0$

(b) $u(x,t) = \sin\left(\frac{3\pi x}{L}\right)\exp\left(-\left(\frac{3\pi}{L}\right)^2 t\right)$

(c) $u(x,t) = \frac{1}{L}\int_0^L \sin\left(\frac{3\pi s}{L}\right)\mathrm{d}s$

(d) $u(x,t) = \sum_{n=1}^{\infty}\sin\left(\frac{n\pi x}{L}\right)\exp(-t)$