

Math 251 section 007 Quiz 5

Write your name and PSU ID here:

Write your answers here:

1. A 2. B 3. D

1. Extend the function $f(x) = 1$, $0 < x < 1$ to an EVEN periodic function of period 2, find a_1 in its Fourier series

$$f(x) = \frac{a_0}{2} + \sum_{m=1}^{\infty} \left(a_m \cos \frac{m\pi x}{L} + b_m \sin \frac{m\pi x}{L} \right)$$

(a) $a_1 = 0$ (b) $a_1 = 1$ (c) $a_1 = -1$ (d) $a_1 = 4/\pi$

2. Find the solution of the heat conduction problem

$$u_{xx} = u_t, \quad 0 < x < 2\pi, \quad t > 0;$$

$$u(0, t) = 0, \quad u(2\pi, t) = 0, \quad t > 0;$$

$$u(x, 0) = 2 \sin x, \quad 0 \leq x \leq 2\pi$$

(a) $u(x, t) = e^{-t} \sin 2x$ (b) $u(x, t) = 2e^{-t} \sin x$
(c) $u(x, t) = 2e^{-\pi^2 t} \sin x$ (d) $u(x, t) = 2e^{-t/4} \sin x$

3. Find the steady-state solution of the heat conduction equation $\alpha^2 u_{xx} = u_t$ that satisfies the boundary conditions $3u_x(0, t) + u(0, t) = 0$, $u(5, t) = 80$

(a) $v(x) = 40$ (b) $v(x) = 10x + 30$
(c) $v(x) = 15x + 5$ (d) $v(x) = 40x - 120$