

Dr. Z.'s Calc5 Homework assignment 14

- 1.** A rod of length 10 coincides with the interval $[0, 10]$ on the x -axis. Set up the boundary value problem for the temperature $u(x, t)$.
 - a.** The right end is insulated, the left-end is held at temperature 1000, the initial temperature is 100 degrees throughout.
 - b.** The left end is held at temperature 130, the right end is insulated and the initial temperature at distance x from the left is x^2 degrees.
 - c.** The left and right ends are insulated and the initial temperature at distance x from the left is $\sin x$ degrees.

- 2** A string of length 100 coincides with the interval $[0, 100]$ on the x -axis. Set up the boundary-value problem for the displacement $u(x, t)$.
 - a.** The ends are secured to the x -axis. The initial displacement is 0 (i.e. it lies on top of the x -axis), and the initial velocity at distance x from the left is $\sin 20x$.
 - b.** The initial displacement at distance x from the left end is x^3 , the initial velocity at distance x from the left end is $\cos 5x$, the left end is moving in a transversal motion like $\sin 5t$, and the right end is moving in a transversal motion like $\cos 3t$.

- 3.** Set up the boundary value problem for the steady-state temperature $u(x, y)$, where a thin rectangular plate coincides with the region in the xy -plane defined by $0 \leq x \leq 10, 0 \leq y \leq 20$. With the following
 - a.** The left end and the bottom of the plate are held at temperature 150, the top of the plate is held at temperature 50, and the right end of the plate is held at temperature $g(y)$.
 - b.** The bottom, left and right sides are insulated, while the top side is held at temperature $f(x)$.
 - c.** The top and bottom are held at temperature 50, the left side is held at temperature $\sin 2y$, and the right side is insulated.

- 4.** Read and understand the physics in deriving the heat and wave equations.