

1. Solve the initial value problem (10%)

$$y' + 2xy = 4x, y(0) = 3$$

2. Solve (15%)

$$x^2 y'' - 2xy' + 2y = 5x^3 \cos x$$

3. Solve the system of ordinary differential equations:

$$y_1'' = y_1 + 3y_2, y_2'' = 4y_1 - 4e^t \quad (25\%)$$

$$y_1(0) = 2, y_1'(0) = 3, y_2(0) = 1, y_2'(0) = 2$$

4. Find a general solution of  $y'' + \omega^2 y = r(t)$ , where

$$r(t) = t^2 / 4 \quad (-\pi < t < \pi),$$

$$r(t+2\pi) = r(t), \quad |\omega| \neq 0, 1, 2, \dots \quad (25\%)$$

5. The faces of a thin square plate (Fig. 1, where  $a=24$ ) are perfectly insulated. The upper side is kept at temperature 20 degree C and the other sides are kept at 0 degree C. Find the steady-state temperature  $u(x,y)$  in the plate. (25%)

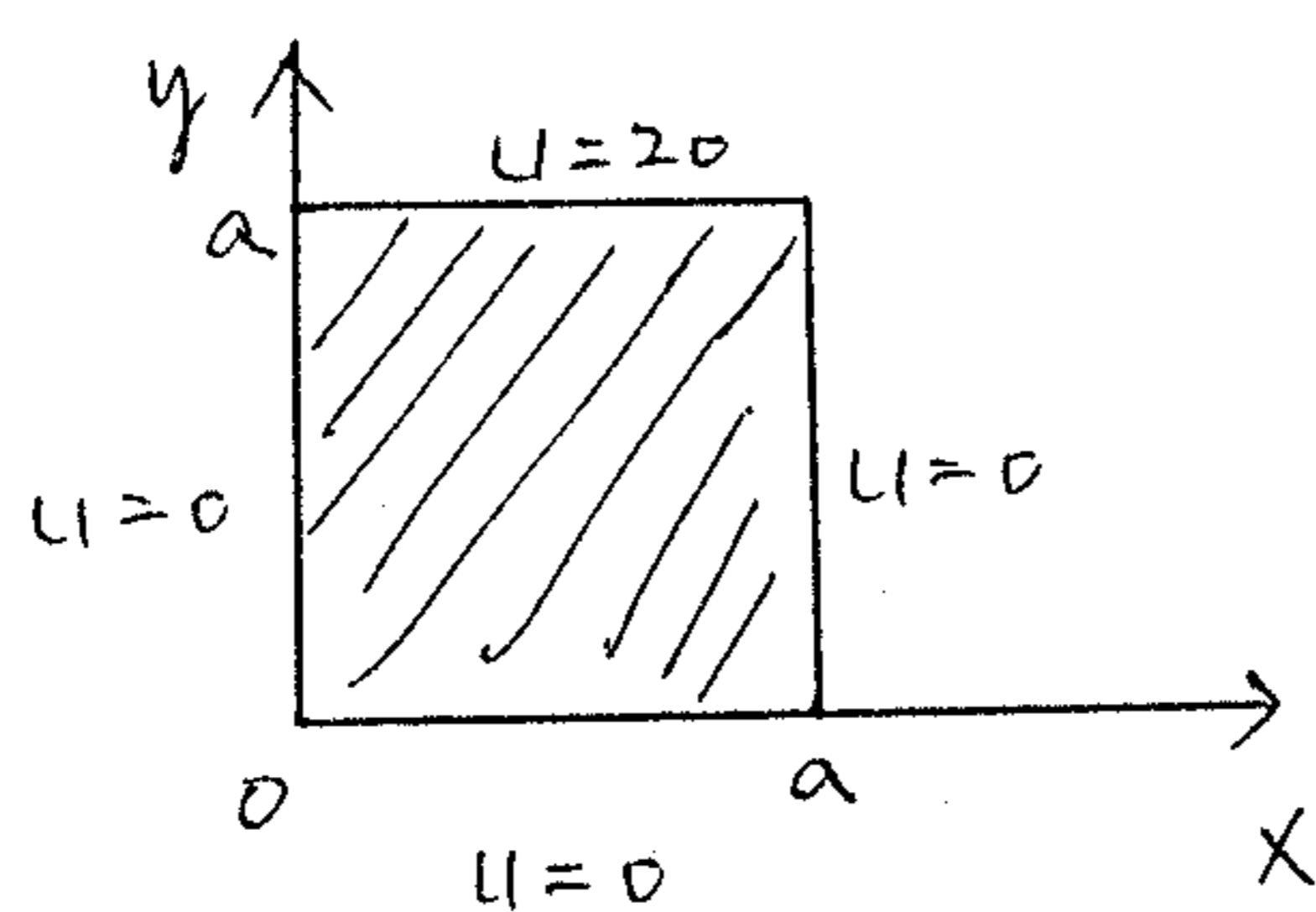


Fig. 1.