

**M353 8.2 wave** (S. Zhang) .

1. (8.2:a1) Solve the wave equation by the finite difference method with  $h = 1/3$  and  $k = 0.1$ .

$$u_{tt} = 4u_{xx}; \quad t \in (0, 0.2), \quad x \in (0, 1)$$

with initial and boundary values

$$u(x, 0) = 1, \quad u_t(x, 0) = 2x,$$

$$u(0, t) = 0, \quad u(1, t) = 0.$$

2. (8.2:a2) Solving the wave equation by the finite difference method.

$$u_{tt} = 4u_{xx}, \quad t \in (0, .4), \quad x \in (0, 1)$$

with initial and boundary values

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

$$u_t(x, 0) = x,$$

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

$$u(1, t) = 0.$$

(a) Let  $h = \Delta x = \frac{1}{3}$ ,  $k = \Delta t = 0.1$ . Find  $u(x_i, 0.4)$ .

(b) Let  $h = \Delta x = \frac{1}{4}$ ,  $k = \Delta t = 0.1$ . Find  $u(x_i, 0.2)$ .