

MAE/MSE 502, Fall 2021 HW3 Solution

Problem 1

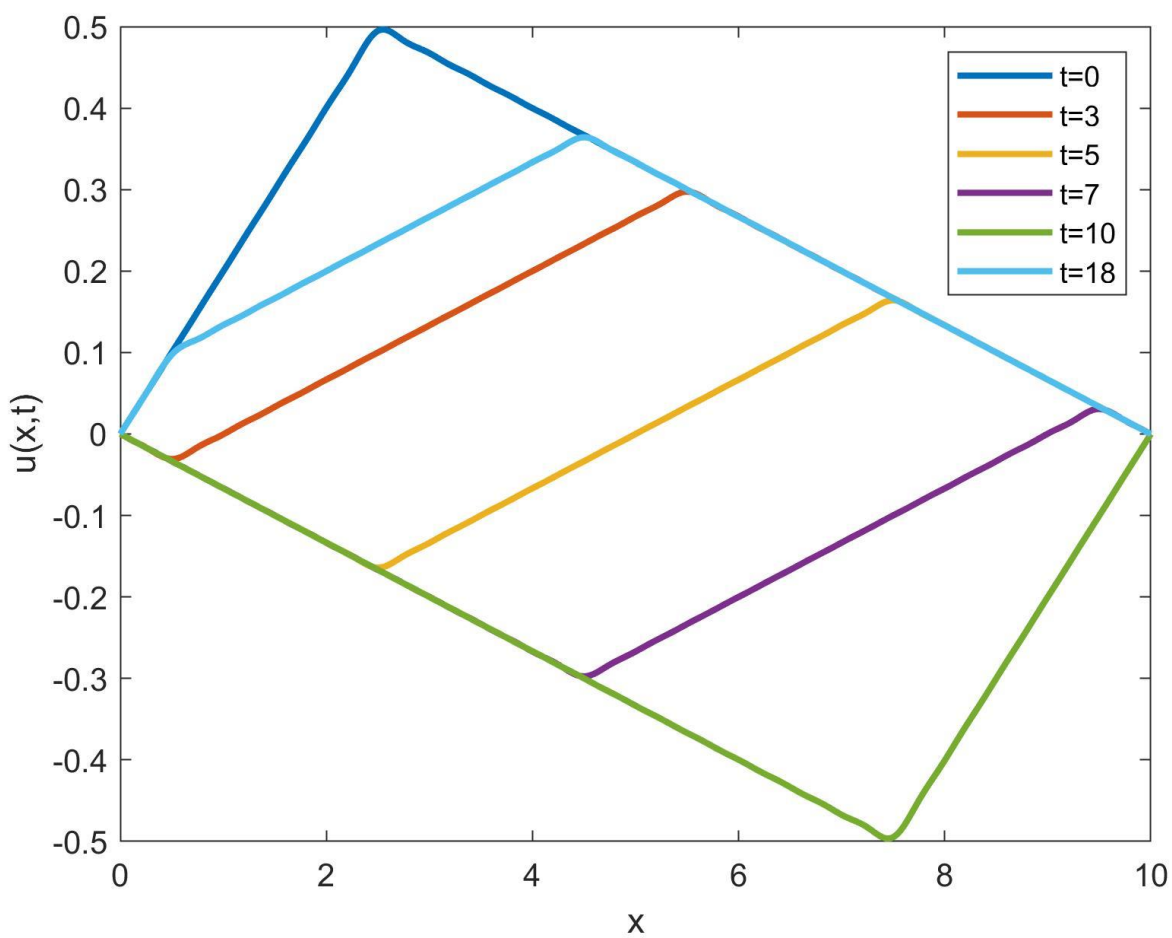
$$u(x, t) = \sum_{n=1}^{\infty} a_n \sin\left(\frac{n\pi x}{10}\right) \cos\left(\frac{n\pi t}{10}\right)$$

where

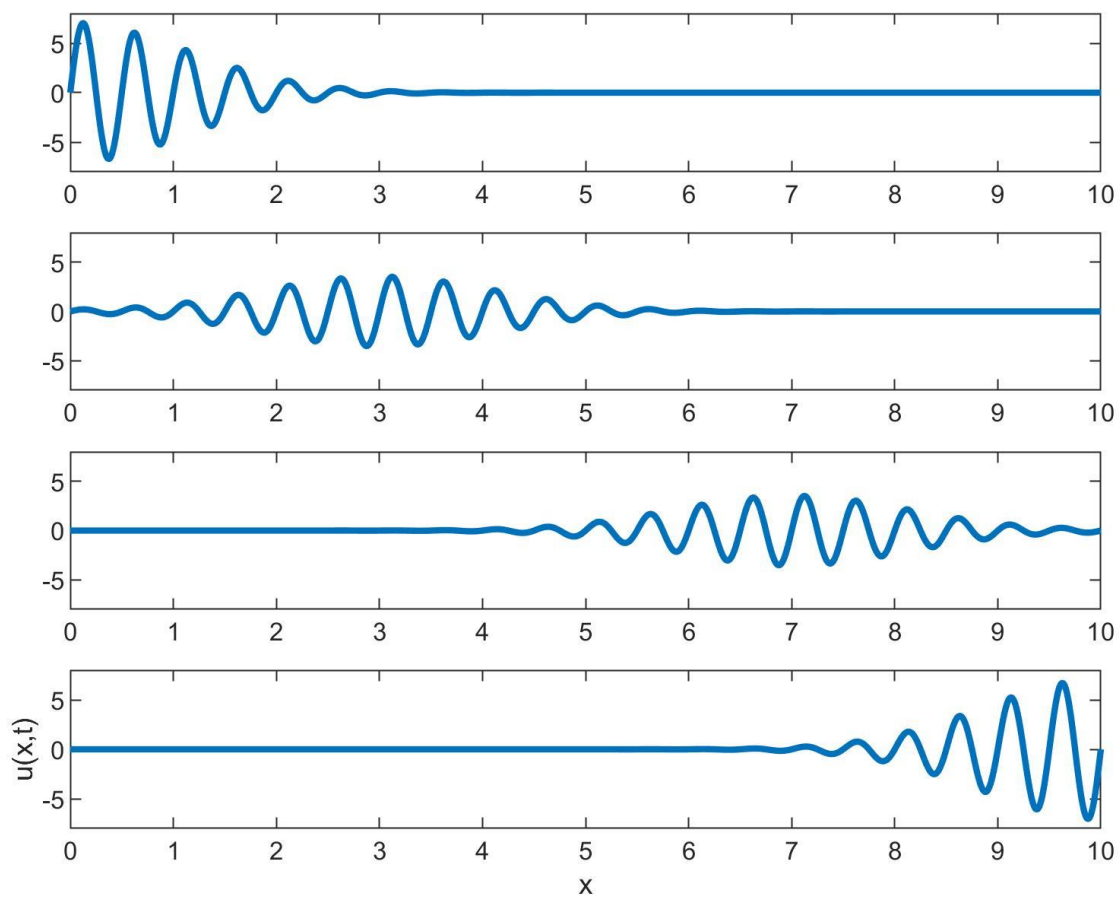
$$a_n = \frac{1}{5} \int_0^{10} P(x) \sin\left(\frac{n\pi x}{10}\right) dx$$

[Note the factor of 1/5 (instead of 2) in front of the integral for a_n .]

Plot for (a)



Plot for (b)



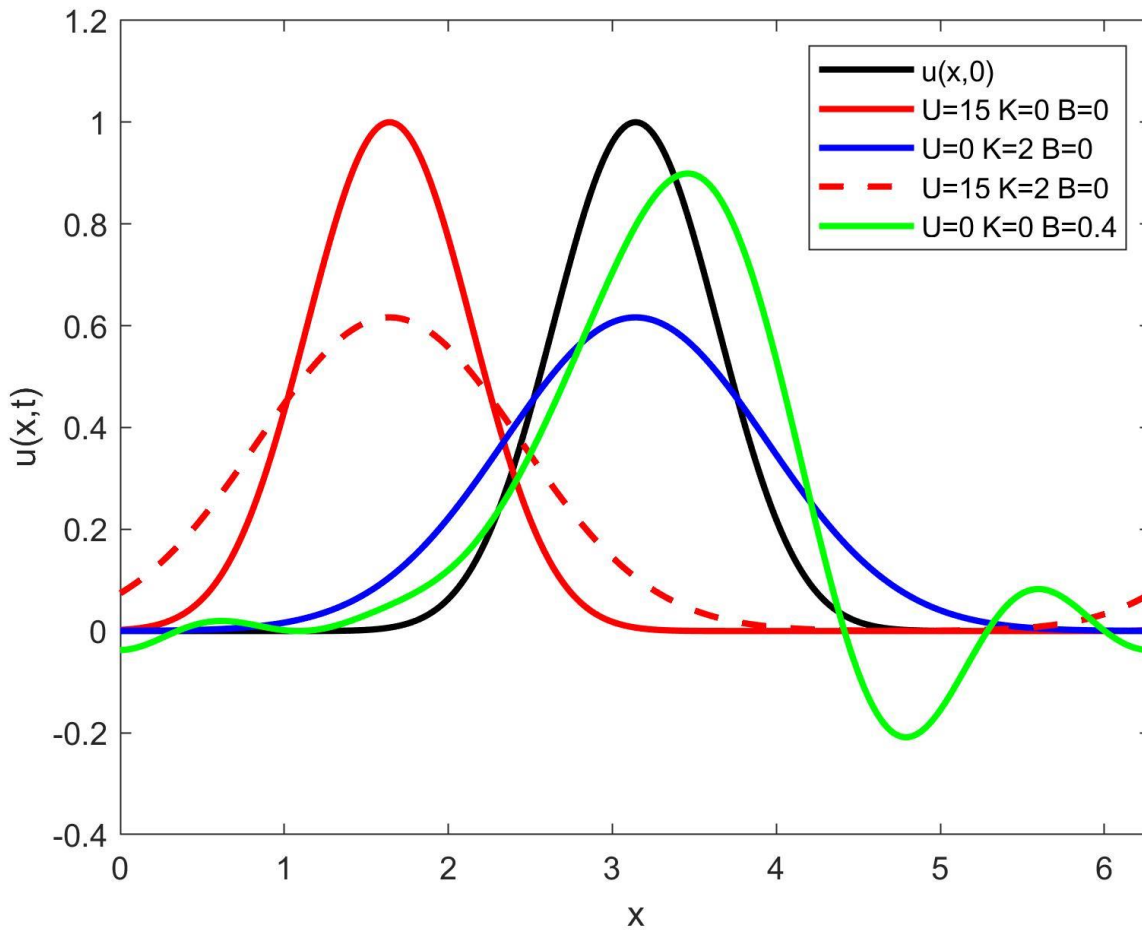
Problem 2

$$u(x, t) = \sum_{n=-\infty}^{\infty} C_n(0) e^{(inU - n^2K - in^3B)t + inx}$$

where

$$C_n(0) = \frac{1}{2\pi} \int_0^{2\pi} u(x, 0) e^{-inx} dx$$

Plot:



Problem 3

$$u(x, t) = e^{2t^2} + e^{1.5t^2} \sin(x) + \cos(2x + 24t)$$

Problem 4

$$u(x, t) = \frac{1}{5} e^t - \frac{1}{5} e^{-4t} + \cos(2x)$$