

MAE/MSE 502 Spring 2018 Homework #3 solution

Task 1

$$u(x, t) = \sum_{n=-\infty}^{\infty} C_n(t) e^{inx} ,$$

where

$$(I) \quad C_n(t) = C_n(0) e^{int}$$

$$(II) \quad C_n(t) = C_n(0) e^{-n^2 t}$$

$$(III) \quad C_n(t) = C_n(0) e^{-in^3 t}$$

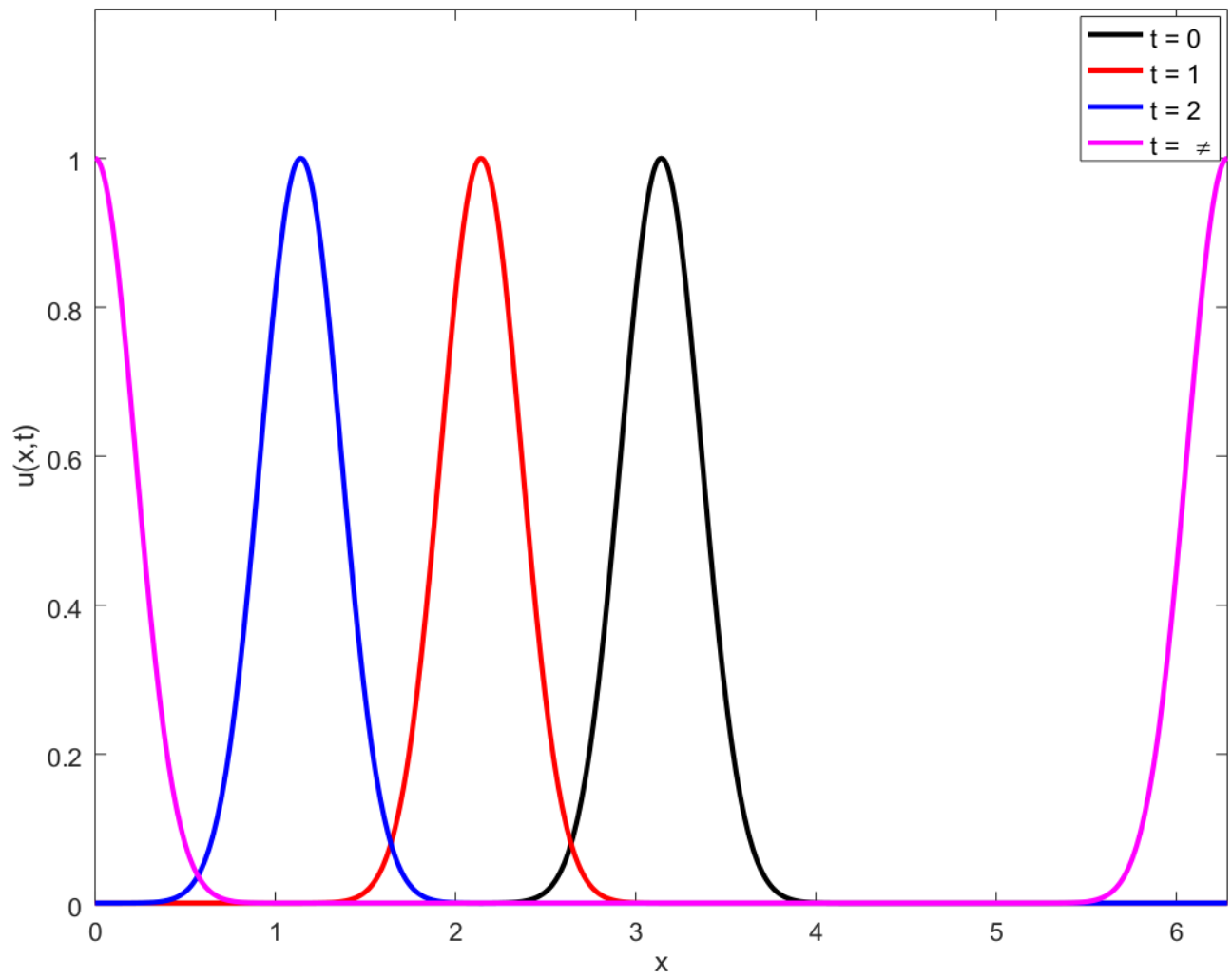
$$(IV) \quad C_n(t) = C_n(0) \cos(nt) ,$$

and

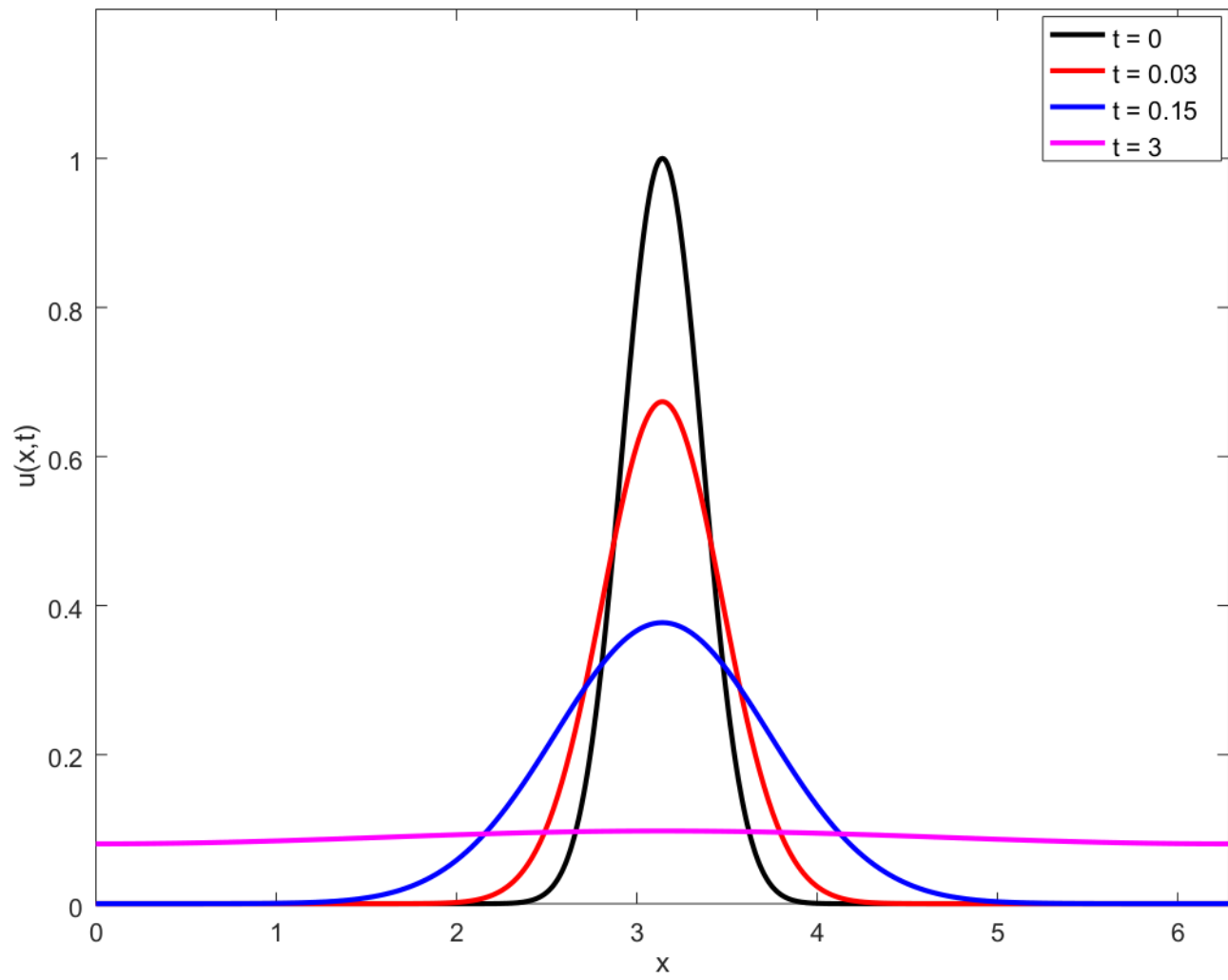
$$C_n(0) = \int_0^{2\pi} \left[ \frac{1 - \cos(x)}{2} \right]^{40} e^{-inx} dx .$$

Plots in next 4 pages.

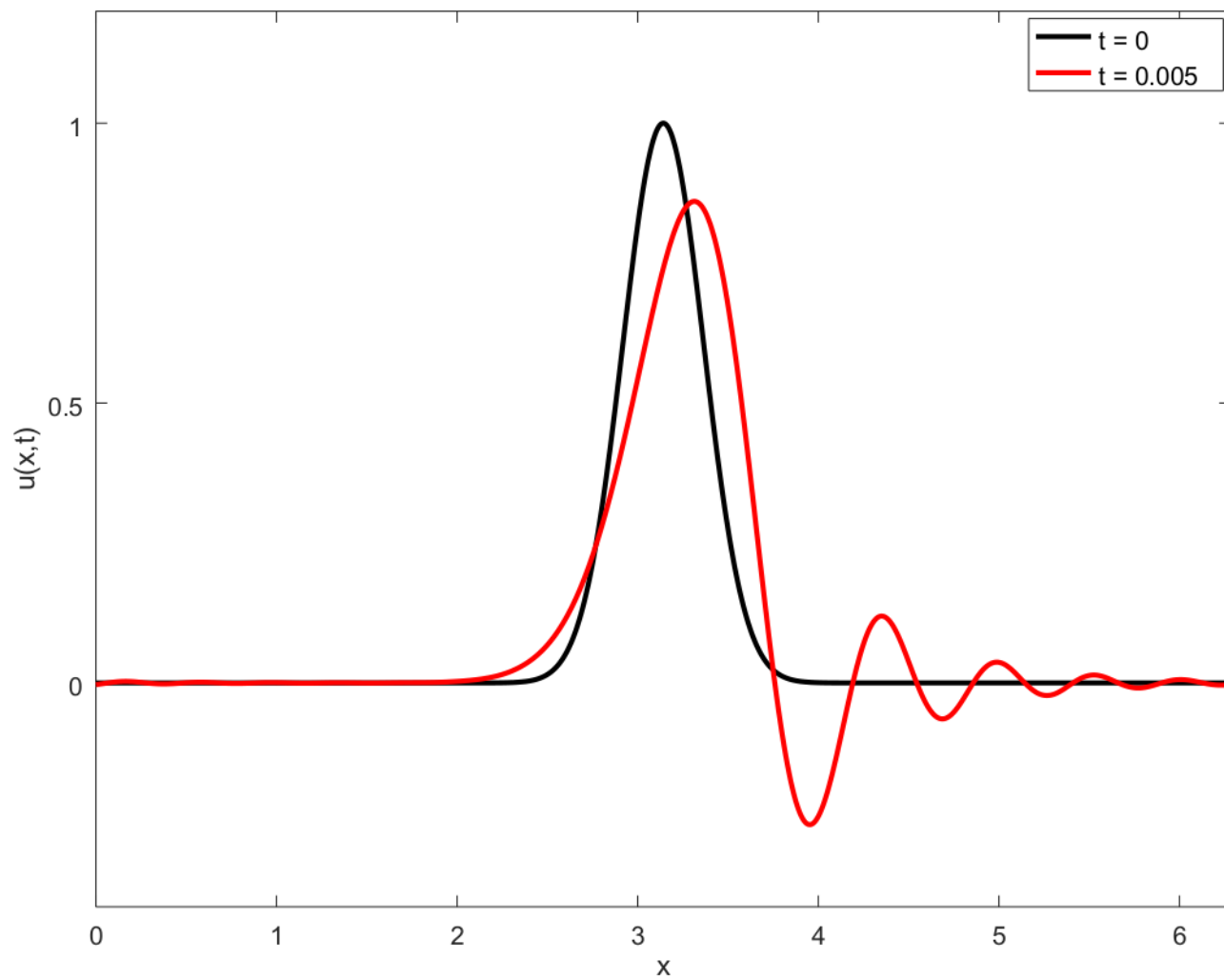
Plot for (I):



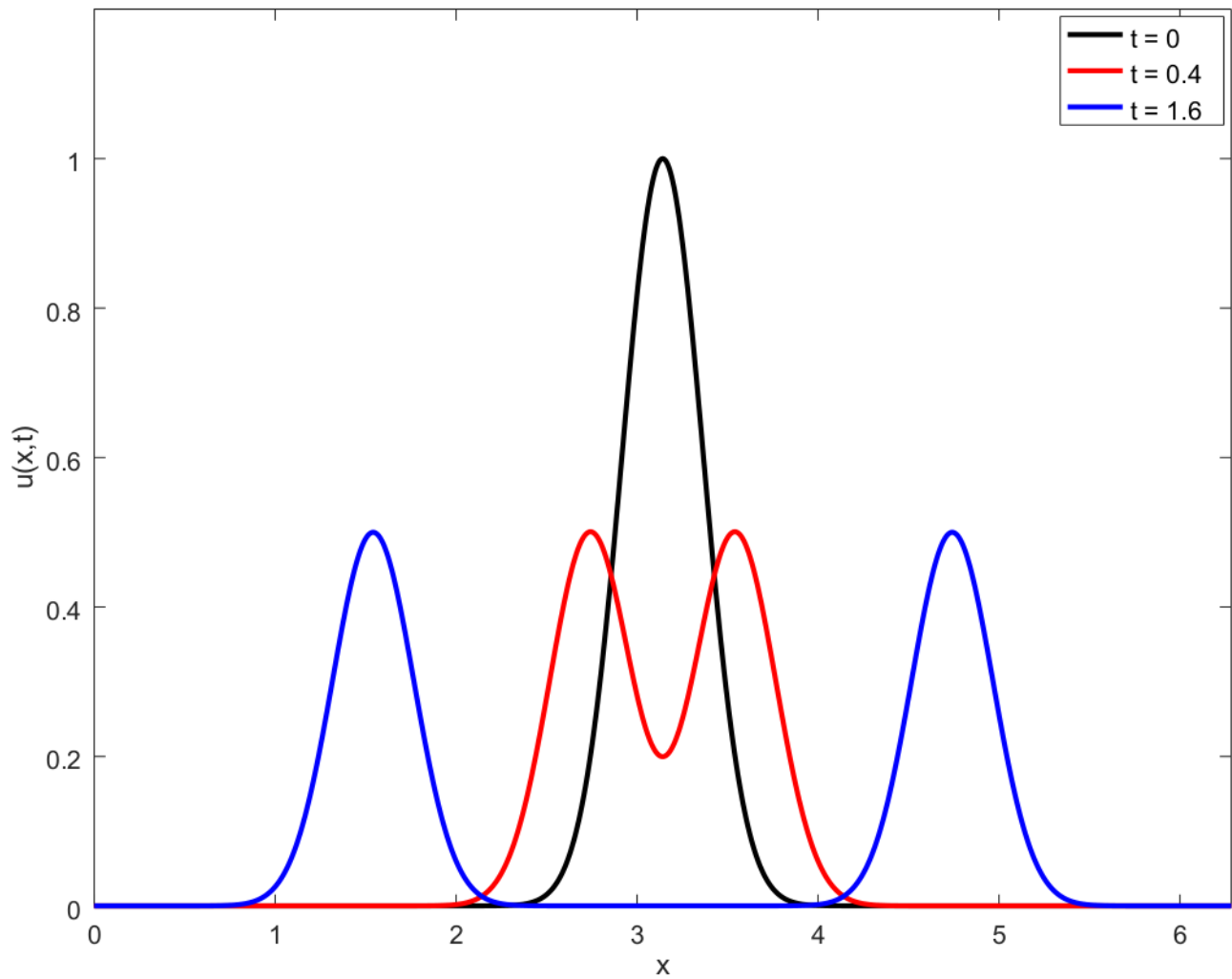
Plot for (II):



Plot for (III):



Plot for (IV):



Task 2

$$u(x, t) = 5e^{-t} + \sin(x-5t) e^{-t} + \cos(2x-64t) e^{-t}$$

Task 3

$$u(x, t) = 2t + \frac{3}{2} t^2 + t \cos(x) + \sin(x)$$

Task 4

- (a)  $A = \frac{33}{7}$  (b) There are multiple solutions