



Prince of Songkla University
Faculty of Engineering

Final Test
5 October 2011
215-613 Mathematical Methods in Engineering

Semester 1/2554
9:00-12:00
Room: The Robot Head

Name _____ ID _____

Direction:

1. Open book exam. Everything is allowed.
2. There are total of 4 problems.

Problem	Full score	Your score
1	10	
2	20	
3	10	
4	20	
Total	60	

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Instructor

215-613
Mathematical Methods in Engineering

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Total 60 points

1. Plot the graphs and determine if the following functions are odd, even, or neither odd nor even? (10 points)
- (a) $x = |y|$
 - (b) $y = |x| + 1$
 - (c) $y = e^{-3|x|}$
 - (d) $x = -y$
 - (e) $y = (x^2 + 2)^3$

2. The 1-D heat conduction in a 1-m long iron rod can be described by

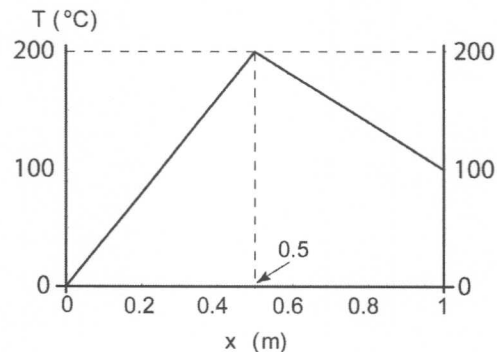
$$\frac{\partial T}{\partial t} = c^2 \frac{\partial^2 T}{\partial x^2}$$

where $c^2 = 1 \text{ m}^2/\text{sec}$. The boundary conditions are

$$T(x = 0, t) = 0 \text{ }^\circ\text{C}$$

$$T(x = 1, t) = 100 \text{ }^\circ\text{C}$$

The initial temperature profile is shown in the following figure



Write the initial condition in mathematical representation and determine the temperature profile in the rod. (20 points)

3. One end of a semi infinite string is fixed to the wall at $x = 0$. The boundary condition and initial conditions are

$$\text{BC: } u(0, t) = 0$$

$$\text{ICs: } u(x, 0) = f(x)$$

$$\left. \frac{\partial u}{\partial t} \right|_{t=0} = 0$$

Convert the partial differential equation to an ordinary differential equation, and obtain general solution. Do not attempt to solve for constants. (10 points)

4. Use the forward difference method to solve Prob. 2 by setting $h = 0.1$ m and $k = 0.001$ sec. Obtain the temperature profile at $t = 0.002$ sec. Is the solution stable? Why? What happens if h is set to 0.01 m. (20 points)