



Prince of Songkla University
Faculty of Engineering

Final Test
26 February 2014
215-274 Numerical Methods for Mechanical Engineering

Semester 2/2013
09:00-12:00
Room: S201 S817

Name _____ ID _____

Direction:

1. All types of calculator and dictionary are permitted.
2. There are totally 4 problems.
3. One sheet of hand-written A4 paper is allowed. No photocopy!!

Perapong Tekasakul
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Instructors

Problem No.	Full score	Your mark
1	10	
2	20	
3	15	
4	15	
Total	60	

1.

$$\frac{dy}{dx} = -2y + 4e^{-x}, \quad y(0) = 2$$
$$\frac{dz}{dx} = -\frac{yz^2}{3}, \quad z(0) = 4$$

Solve from $x = 0$ to 1 with a step size of 0.2 using

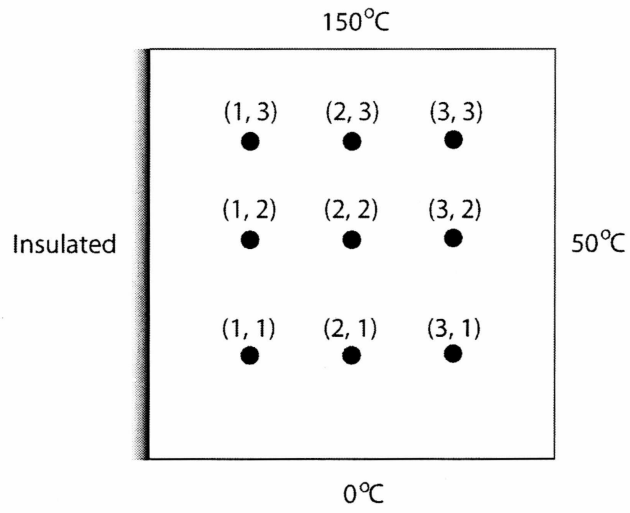
- (a) Euler's Method (5 points)
- (b) The fourth-order RK method (5 points)

2. Use the shooting method to solve

$$7 \frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} - y + x = 0, \quad y(0) = 5, \quad y(10) = 10$$

Employ the Heun's method with a step size of 2. The two guesses for initial condition of z are -1 and -0.5. (20 points)

3. Use Liebmann's method to solve for the temperature of the plate shown in the figure below. Use a relaxation factor of 1.2. Do only 1 iteration. (15 points)



4. Use the explicit method to solve for the temperature distribution of a long thin rod with a length of 10 cm and the following values: $k = 0.835 \text{ cm}^2/\text{s}$, $\lambda = 0.020875$, $\Delta x = 2 \text{ cm}$, and $\Delta t = 0.1 \text{ s}$. Determine the temperature distribution until $t = 0.5 \text{ s}$. At $t = 0$, the temperature of the rod is zero and the boundary conditions are fixed for all times at $T(0) = 50^\circ \text{C}$ and $T(10) = 100^\circ \text{C}$. (15 points)