



Prince of Songkla University
Faculty of Engineering

Final Test
2 October 2003
215-613 Mathematical Methods in Engineering

Semester 1/2546
13:00 – 16:00
Room ME 222

Name _____

Direction:

1. All types of calculators, document and books are permitted.
2. There are totally 4 problems. Solve all of them, will you?

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Instructor

215-613
Mathematical Methods in Engineering

Midterm Test
Semester 1/2546
Total 60 points

1. 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 $c^2 = k / (\rho c_p)$. The boundary and initial conditions are

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

$$\left. \frac{\partial T}{\partial x} \right|_{x=1\text{m}} = 0$$

$$T(x, t = 0) = x$$

The physical properties of the iron rod are

$$k = 80.2 \text{ W/m.K}$$

$$\rho = 7870 \text{ kg/m}^3$$

$$c_p = 447 \text{ J/kg.K}$$

Determine the temperature profile in the rod. (20 points)

2. Solve the following system by Gaussian Elimination. (15 points)

$$2w - 2x + 4y = 0$$

$$w + 3x - 6y + 2z = 2$$

$$w - x + y + 2z = 3$$

$$4w + 4x - y - z = 1$$

3. In Fluid Mechanics, the flow is considered irrotational when $\nabla \times \mathbf{V} = \mathbf{0}$. For a velocity flow field described by

$$\mathbf{V} = x^2 y \mathbf{i} + (z - y) \mathbf{j} + zx \mathbf{k}$$

determine if the flow is irrotational. (10 points)

4. Evaluate the integral $\oint_C f(z) dz$ around C counterclockwise.

$$f(z) = \frac{z - 3}{z^4 - z^3}$$

where C is described by $|z| = \frac{3}{2}$ (CCW). (15 points)