

Name \_\_\_\_\_



Prince of Songkla University  
Faculty of Engineering

Midterm Test

Semester 1/2008

2 August 2007

9:00-12:00

215-613 Mathematical Methods in Engineering

Room R300

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Direction:

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

Midterm Test  
Semester 1/2008  
**Total 60 points**

Problem #	Full Score	Your mark
1	10	
2	20	
3	10	
4	20	
<b>Total</b>	<b>60</b>	

Perapong Tekasakul  
Instructor

Name \_\_\_\_\_

215-613  
Mathematical Methods in Engineering

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Midterm Test  
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1. Describe if the following differential equations are *ordinary* or *partial*, *linear* or *non-linear*, *homogeneous* or *nonhomogeneous*, and give the *order* of the differential equations as well. (10 points)

(a)  $2x^2 \frac{dy}{dx} + 2y = x$

(b)  $\frac{\partial^2 T}{\partial t^2} = \frac{1}{3} \left( \frac{\partial^2 T}{\partial x^2} + \frac{\partial^2 T}{\partial y^2} \right)$

(c)  $\frac{d^3 u}{dx^3} - \frac{dy}{dx} \left( \frac{d^2 y}{dx^2} \right) = y$

(d)  $x^2 \frac{d^4 y}{dx^4} - 3 \frac{d^2 y}{dx^2} - y^2 = 0$

(e)  $\frac{d^2 y}{dx^2} + \frac{dy}{dx} - 5 = 0$

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2. Solve (20 points)

$$2x^2y'' + 3xy' - y = x$$

$$y(1) = 1$$

$$y'(1) = 1$$

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3. Show that the following differential equation is reducible to Bessel's equation and solve it (10 points)

$$x^2 y'' + xy' + (\lambda^2 x^2 - \nu^2) y = 0$$

Hint:  $\lambda x = z$

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4. The motion of the mass-spring-damper system is described by

$$y'' - 2y' - 3y = 3\delta(t-1)$$

The initial conditions for the system are

$$y(0) = 0 \quad \text{and} \quad y'(0) = 0$$

Determine the response  $y(t)$ . (20 points)