NAME : _____

Exam 2, Math 254, Summer 2013

23 July 2013

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INSTRUCTIONS:

- This is a closed book, closed notes exam.
- You are not to give or receive help from any outside source during the exam.
- You have **1 hour**.

2. (20) Find a solution of the differential equation.

$$\frac{d^2y}{dx^2} - 9y = 5x^2$$

$y = -\frac{5}{9}x^2 - \frac{10}{81}$

3. (20) What is the correct guess to apply the method of undetermined coefficients and find a solution to each of the following differential equations? **NOTE: You do not need to solve these differential equations.**

A. $y'' - 6y' + 9y = te^{3t}$,

aux. eqn: $r^2 - 6r + 9 = 0$

$(r-3)^2 = 0$

double root.

So the guess is

$y = t^2(At+B)e^{3t}$.

B. $y'' - 4y = t + \sin(2t)$

aux. eqn. $r^2 - 4 = 0$

$r = \pm 2$

So the guess is $y = At + B + C\cos 2t + D\sin 2t$

4. (20) Solve the initial value problem

$$y'' + 4y = \cos t\,, \qquad y(0) = 0, \qquad y'(0) = 3\,.$$

homogeneous: $y_h = c_1 \cos 2t + c_2 \sin 2t$

particular: $y_p = \frac{1}{3}\cos t$

full soln. w/ Initial Values: $y = \frac{1}{3}\cos t + \frac{3}{2}\sin 2t - \frac{1}{3}\cos(2t)$

5. (20) Consider the *third order, constant coefficient* differential equation $y''' - 2y'' + y' = 0$.

A. Find and solve the auxiliary equation for this differential equation.

$y = e^{rt}$ $r^3 - 2r^2 + r = 0$ $r(r-1)(r-1) = 0$

$r = 0,\ r = 1,\ r = 1$ (double root)

B. What is the general solution to this differential equation? (Your answer should contain three arbitrary constants.)

$y = C_1 + C_2 e^t + C_3 t e^t$.