The Hashemite University | Department of Mathematics | April 25, 2012
Ordinary Differential Equations (1) | Seconed Exam | Time: 60 Minutes

Name (in Arabic): ____________________ Student Number: ____________________

Section number or lecture time: ____________________ Instructor name: ____________________

Question one: Choose the correct answer and fill it in the following table (2 points each)

1	2	3	4	5	6
a	a	a	a	a	a
b	b	b	b	b	b
c	c	c	c	c	c
d	d	d	d	d	d

1. Given that $y_1(x) = x$ is a solution to the differential equation $xy'' + y' + q(x)y = 0, \quad x > 0$. If the reduction of order method is used to obtain a second linearly independent solution (y_2), then

   a. $y_2(x) = \ln(x)$ b. $y_2(x) = x\ln(x)$
   c. $y_2(x) = \frac{1}{x^2}$ d. $y_2(x) = \frac{1}{x}$

2. The Wronskian of three solutions for the differential equation $x^4y''' - x^3y'' + y = 0, \quad x > 0$ is

   a. Cx b. $\frac{C}{x}$ c. $Ce^{\frac{-x^4}{4}}$ d. $Ce^{\frac{x^4}{4}}$

3. One of the following sets can be fundamental solution set for third order linear deferential equation

   a. $\{e^x,\ e^{-x},\ \cosh(x)\}$ b. $\{-3,\ 5\cos^2(x),\ \sin^2(x)\}$
   c. $\{\cos(2x),\ 1,\ \cos^2(x)\}$ d. $\{1,\ x,\ x^2\}$

4. Given that y_1 is a solution to $L[y](x) = 3g(x)$ and y_2 is a solution to $L[y](x) = g(x), \quad g(x) \neq 0$, then a solution of $L[y](x) = 0$ is

   a. $2y_1 - y_2$ b. $y_1 - 3y_2$ c. $3y_1 - y_2$ d. $y_1 - 2y_2$

5. Suppose that $r^2(r-3)^2(r^2+9)^3 = 0$ is the auxiliary equation of some differential equation with constant coefficients. Then the order of this equation is

   a. 8 b. 9 c. 10 d. 11

6. The general solution for $y^{(4)} - 8y'' - 9y = 0$ is given by

   a. $c_1\cos(3x) + c_2\sin(3x) + c_3e^x + c_4xe^x$ b. $c_1\cos(x) + c_2\sin(x) + c_3e^{3x} + c_4e^{-3x}$
   c. $c_1\cos(x) + c_2\sin(x) + c_3e^{3x} + c_4xe^{3x}$ d. $c_1\cos(3x) + c_2\sin(3x) + c_3e^x + c_4e^{-x}$

Question two : (3 points) Find the particular solution to

$$L[y](x) := y'' - y' - 6y = 7^x.$$

Question three : (3 points) Determine the **form** (Do not evaluate the constants) of a particular solution to

$$y'' + 2y' + 5y = e^{-x}(\cos 2x + x)$$

Question four : (2 points) Find a general solution to the linear homogeneous differential equation with constant coefficients whose auxiliary equation is given by

$$(r-1)^2(r+5)(r^2+4)^2 = 0$$

Question five : (5 points) Use variation of parameters method to find a general solution to the following equation

$$x^2y'' - 4xy' + 6y = x, \qquad x > 0$$