KING SAUD UNIVERSITY
DEPARTMENT OF MATHEMATICS

FULL MARKS: 25

TIME: 1.30 HOURS

25/04/2018

Alternative Exam Mid (2). Math 204

Question 1.[5,4] a) Find the largest constant a for which the initial value problem

$$\begin{cases} (x-2)(x+1)y''-\dfrac{x}{x-3}y'+y = 0 \\ y(0) = 0, \quad y'(0) = 2. \end{cases}$$

has a unique solution in the interval $(-a, a)$.

b) Find the general solution of the differential equation

$$(x-4)y''-y'+\dfrac{1}{x-4}y = 1, \quad x > 4$$

Question 2[4,4]. a) What would be the general form of the particular solution $y_p(x)$ of the differential equation

$$y'''-y''+y'-y = 2\sin x + 5x\cos x + 2^{x+2} + 8(1+x)e^x$$

b) If $y_1 = e^{-3x}$ is a given solution of the differential equation

$$y'' + 6y' + 9y = 0,$$

then use the reduction of order method to find the general solution of the equation

$$y'' + 6y' + 9y = x^{-3}e^{-3x}$$

Question 3 [4]. Find the general solution of

$$x\,y''-3y'+\dfrac{3}{x}y = x\,\cos x \qquad x > 0$$

Question 4. [4] Find the general solution of the differential equation

$$y'' - 2y' + y = \dfrac{e^x}{x}$$