Department of Mathematics

Homework II

Differential Equations (Math 331)   **August 2, 2018**

Instructor: Dr. Ala Talahmeh   **Summer 2018**

Name: _____ Number: _____ Section: _____

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Question One. Determine a lower bound for the radius of convergence of the series solutions about $x_0 = 3$ for the differential equation

$$2x(x-5)^2 y'' + xy' + (x-5)y = 0.$$

Question Two. Consider the following IVP:

$$(2 - x^2)y'' + 2(x-1)y' + 4y = 0, \quad y(0) = 6; \quad y'(0) = 2.$$

Find the first four nonzero terms of the series solution about the ordinary point $x_0 = 0$.

Question Three. Determine the singular points of the differential equation

$$(x^2 - 4)y'' + \frac{x}{x+2}y' + \frac{3}{x-2}y = 0,$$

and classify them as regular or irregular.

Question Four. Find two linearly independent power series solutions of the ODE

$$(x-2)y'' + (x-1)y' + y = 0.$$

Give the first three nonzero terms for each series solution.

Question Five.
(a) Find the Laplace transform of

$$f(t) = te^{-t}\sin^2(3t).$$

(b) Find the inverse Laplace transform of

$$F(s) = \frac{s^2 + s - 1}{2s^2 + 2s + 1}$$

Question Six. Use the Laplace transform to solve the following BVP

$$y'' + 9y = \cos 2t, \quad y(0) = 1, \quad y\left(\frac{\pi}{2}\right) = -1.$$

Good Luck