

Name

student identifican no.

Math 441

Exam No. 2

March 29, 2019

A rule to trick th' arithmetic.

*To the True Romance* by R. Kipling

SHOW ALL WORK. INDICATE ALL REASONING.

ALL ANSWERS SHOULD BE EXPRESSED IN TERMS OF REAL VALUED FUNCTIONS.

1. Find the general solution of

$$y'' - y' - 2y = 3e^{2t}.$$

2. Write down the general form of a particular solution to

$$y''' - 2y'' + y' - 2y = 3t \cos(t) + 5 + t^3 e^{2t}.$$

(You do not have to solve the differential equation.)

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3. Consider the differential equation

$$y'' + x^3y' + x^2y = 0. \quad (1)$$

- a. Determine if  $x = 0$  is an ordinary point or a singular point.
- b. Without solving the differential equation, determine the radius of convergence of two linearly independent power series solutions of (1) about  $x = 0$ .
- c. Find two linearly independent solutions about  $x = 0$  of (1).

Continue (if necessary) your solution on the following page.

4. Consider the differential equation

$$x^2(x-1)y'' - xy' + 2y = 0. \quad (2)$$

- a. Determine all singular points of (2) and determine if they are regular or irregular.
- b. Consider  $x_0 = 0$ . Find the indicial equation and its roots.
- c. Let

$$y = \sum_{n=0}^{\infty} a_n x^{n+r}. \quad (3)$$

Use one of our basic theorems to determine a minimal radius of convergence for any solution of the form (3).

- d. Using (3) in (2) calculate the indicial polynomial once again and find a recurrence relation for  $a_n, n \geq 1$ . (You do not need to calculate any coefficients.)