

## Quiz #4 (EngMath I) [Thursday, November 1, 2018]

Name: \_\_\_\_\_ Dept: \_\_\_\_\_ ID No: \_\_\_\_\_

1. (10 points) Solve the following initial value problem by the power series method. Find the recurrence formula and find the first four nonzero terms in the series.

$$3y'' - y' + (x + 1)y = 1, \quad y(0) = 0, \quad y'(0) = 0.$$

2. (10 points) Compute the Fourier series of the following function:

$$f(x+6) = f(x) = \begin{cases} 0, & \text{if } -3 < x < -1, \\ 1, & \text{if } -1 < x < 1, \\ 0, & \text{if } 1 < x < 3. \end{cases}$$

3. (15 points)

(a) (5 points) Represent  $f(x) = e^{-x}$ ,  $x > 0$ , by a Fourier cosine integral.

(b) (5 points) Represent  $f(x) = e^{-x}$ ,  $x > 0$ , by a Fourier sine integral.

(c) (5 points) Solve the following integral equation for the function  $f(x)$

$$\int_0^{\infty} f(x) \cos \omega x \, dx = e^{-\omega}, \quad \omega > 0.$$

4. (15 points) Table 1 shows the result of applying the Runge-Kutta method to the following initial value problem

$$y' = 1 - x + 4y, \quad y(0) = 1,$$

from  $x = 0$  to  $x = 1$  with  $h = 0.2$ . Fill in the blank and show your work for partial credit.

$x_i$	$y_i$
0.0	1.0000
0.2	2.5016
0.4	
0.6	12.9972
0.8	28.9808
1.0	64.4416

Table 1: Runge-Kutta Method