Prince Sultan University
MATH 221
Third Examination
First Semester 2015/2016, Term 151
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Name: _____ ID Number # _____

Q1

A- Consider the following table:

x	1	2	3	4	5
f(x)	3.6	1.8	1.2	0.9	0.72

1) Construct divided difference table for the tabulated function.

2) Compute the Newton interpolating polynomial $p_3(x)$ at x=2.5 and at x=3.5.

B- a) Let $g(x) = xLn(x+2)$. Use the Lagrange formula based on the points $x_0 = 0, x_1 = 1, x_2 = 2,$ and $x_3 = 3$ to approximate g(0.5). Also compute the error bound for your approximation.

b) Estimate the integral $\int_0^1 \frac{dx}{1+x^2}$ using the Simpson' s rule with n=8. Also compute the error bound for your approximation.

C- Let $f(x) = x + Ln(x+2)$. Use the three point with h=0.1. Use the central formula to approximate the second derivative $f''(2)$. Then find the error bound for your approximation.

Q2.

a) Find the approximate solution y(0.2) of the following initial–value problem $y' = (1-x)y^2 - y$, $y(0) = 2$ using the following fourth-order Runge Kutta formula using h=0.2. Then compute the error bound for your approximation.

$$y_{i+1} = y_i + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)h$$

$$k_1 = f(x_i, y_i)$$

$$k_2 = f\left(x_i + \frac{1}{2}h, y_i + \frac{1}{2}k_1 h\right)$$

$$k_3 = f\left(x_i + \frac{1}{2}h, y_i + \frac{1}{2}k_2 h\right)$$

$$k_4 = f(x_i + h, y_i + k_3 h)$$

b) Find the approximate solution y(0.2) of the following initial–value problem $y' = (1-x)y^2 - y$, $y(0) = 2$ using the Euler's formula using h=0.2. Compare the error bound of this approximation with the error bound found in question a).