Serial No.:_____ Student Name:_____ Student Number: _____

Instructor: M. Z. Abu-Sbeih Math 101- Q3 Date: 22-8-2016

**SHOW ALL YOUR WORK. NO CREDITS FOR ANSWERES WITHOUT JUSTIFICATIONS**

**Problem 1: (7 points)** Find the absolute maximum and absolute minimum of the function $y = x\sqrt{1-x}$ on the interval [-3,1].

**Problem 2: (7 points)** Show that the function $f(x) = x + \ln x$ satisfies the hypotheses of the Mean Value Theorem on the interval [1, $e$]. Find a number $c$ that satisfies the conclusion of the MVT.

**Problem 3: (14 points)** Find the limit if it exists.

a) $\lim_{x\to 0}\left(\frac{1}{x}-\frac{1}{\sin x}\right)$

b) $\lim_{x\to 0}\left(x+e^{x}\right)^{\frac{1}{x}}$

**<u>Problem 4:</u> (12 points)** The first and second derivatives of the function $y = f(x) = \frac{x^2}{x-1}$ are $y' = \frac{x^2-2x}{(x-1)^2}$ and $y'' = \frac{2}{(x-1)^3}$ respectively. Find

(a) the critical numbers, if any exists,

(b) the increasing and decreasing intervals,

(c) the local extrema,

(d) concavity intervals,

(e) inflection points, if any exists.