King Saud University
Department of Mathematics
Second Semester 1436-1437 H

MATH 352 (Numerical Analysis)
First Midterm Exam
Duration: $1\frac{1}{2}$ Hours

Student's Name	Student's ID	Group No.

Question No.	I	II	III	IV	Total
Mark					

[I] Determine whether the following is **True** or **False**. **Justify** your answer. [4 *Points*]

1. If p^* approximates π to 3 significant digits, then $p^* \in [0.995\pi, 1.005\pi]$. (   )

2. If $x = \frac{6}{7}$ and $y = \frac{2}{3}$ then the 4-digit rounding value of $x \ominus y$ is 0.1905. (   )

3. If the growth of error for an algorithm is linear, then this algorithm is stable. (   )

4. $g(x) = x^3 - 4x^2$ has two fixed-points in $[-1, 5]$. (   )

OVER

[II] Let $\alpha_n = \frac{n+4}{(2n+1)^3}$ and $F(h) = \frac{1-e^h}{h}$. [4 *Points*]

(a) **Determine** the rate of convergence for α_n.

(b) **Determine** the rate of convergence for $F(h)$.

OVER

[III] Let $f(x) = x^5 - 2x - 1$. [5 *Points*]

(a) **Show** that f has a root in $[1, 1.5]$.

(b) Use the Bisection method to **find the root** of f on $[1, 1.5]$ accurate to within 10^{-2}.

(c) **Estimate** the relative error in (b).

OVER

[IV] [7 *Points*]

A. Let $f(x) = x^3 - x^2 - 3$.

(i) If $f(p) = 0$, **show** that each of the functions $g_1(x) = \sqrt[3]{3 + x^2}$ and $g_2(x) = \frac{3}{x^2} + 1$ has a fixed point at p.

(ii) **Which** of the functions g_1 and g_2 in (i) is better for the fixed-point iterations on $[1, 2]$? **Justify** your answer.

B. Use an appropriate fixed-point iteration to **find the root** of $\pi + \frac{1}{2}\sin(\frac{x}{2}) - x$ on $[0, 2\pi]$ with accuracy 10^{-3}.

Good Luck