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

MATH 352 (Numerical Analysis)
Second 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 k is a positive integer, then the convergence of the sequence $p_n = \frac{1}{n^k}$ to zero is **linear**. ( )

2. $x = 1$ is a **simple** root of $g(x) = x^3e^x - 2x^2e^x + xe^x$. ( )

3. If $f[3, 5, 6] = 7$ and $f[5, 6] = 1$ are given divided differences for a function f, then $f[3, 5] = 22$. ( )

OVER

[II] Let $f(x) = x^5 - x^2 + x + 1$. [4 *Points*]

(a) **Use** two iterations of the Modified Newton Method to **approximate** the root of f on $[-1, 1]$.

(b) **How** accurate is the approximation in (a)? **Justify** your answer.

OVER

[III] If $f(0.25) = 1.648$, $f(0.5) = 2.718$, and $f(0.75) = 4.481$, [5 *Points*]

(i) **use** an appropriate Lagrange polynomial of degree two to **approximate** $f(0.43)$.

(ii) Given that $f(x) = e^{2x}$, **use** the error formula to **find** an upper bound for the error in (i).

(iii) **Compare** the bound in (ii) with the actual relative error.

OVER

[V] Use the data in the following table for all parts of this question. [7 *Points*]

x	0	0.2	0.4	0.6
f(x)	1	1.22	1.49	1.82

(i) **Approximate** $f(0.5)$ by the Newton Forward-Difference formula with 3 points.

(ii) **Approximate** $f''(0.4)$ by a second derivative midpoint formula.

(iii) **Approximate** $f'(0.2)$ by a 3-point formula.

(iv) **Estimate** the error in (iii) if you know that $f(x) = e^x \cos x$.

Good Luck