اسم الطالب	
الرقم الأكاديمي	
اسم المقرر	تحليل عددى
المستوى	الأول
عنوان البحث المرجعي	مسائل متنوعة عن طرق الحل باستخدام التحليل العددى

رقم السؤال	الدرجة	التوقيع
السؤال الأول		
السؤال الثاني		
السؤال الثالث		
السؤال الرابع		
السؤال الخامس		
المجموع		
النتيجة		

توقيع لجنة الامتحان

ا.د. احمد احمد السنباطي
asonbaty63@yahoo.com

Question 1: (20 Mark)

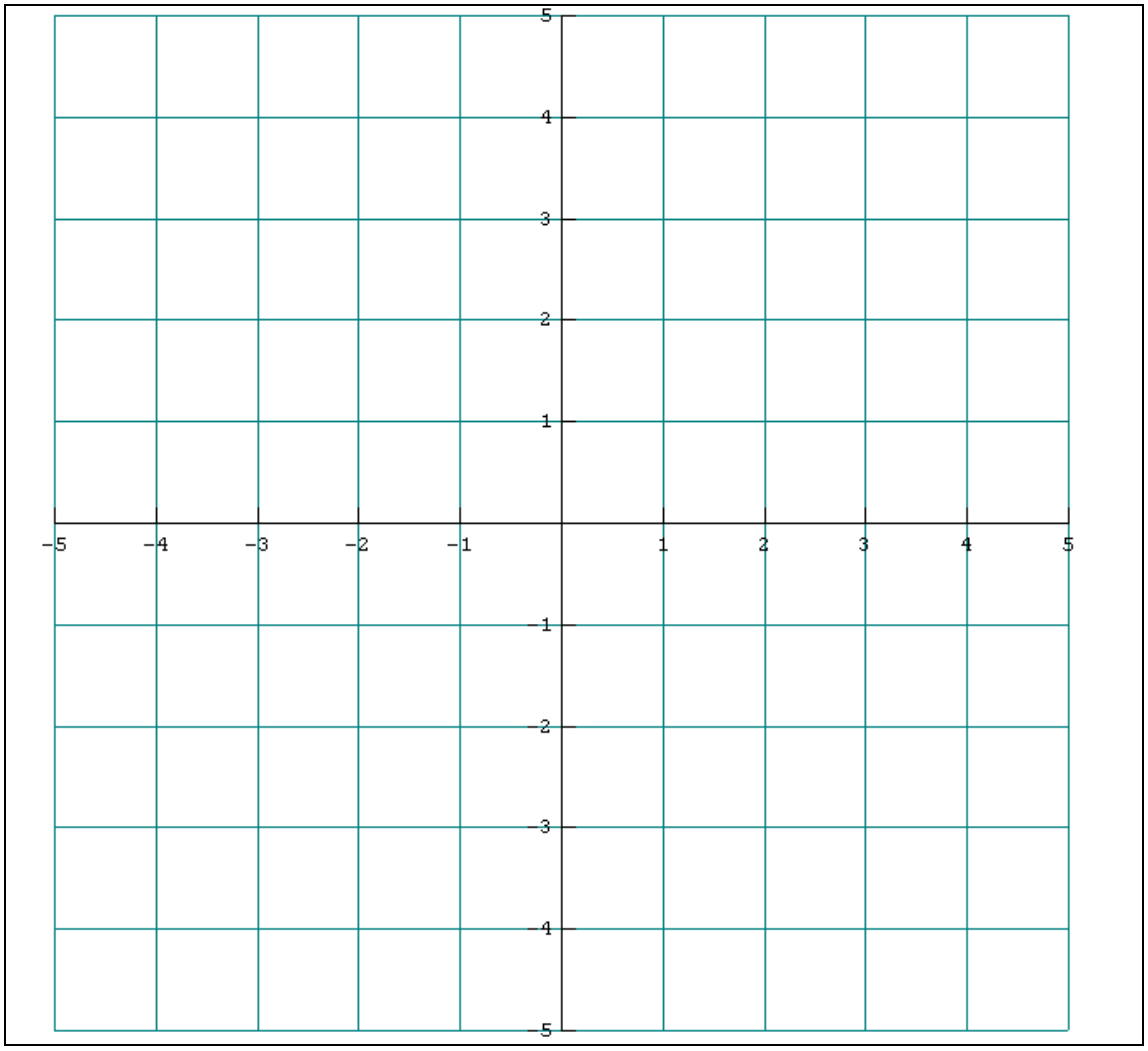
1. **Determine the real root of**

   $f(x) = e^{-x^2} - x = 0$. **(*use an error tolerance of* $\varepsilon = .005$)**

(a) Graphically (plot $f_1(x) = e^{-x^2}$, $f_2(x) = x$ and $f(x) = e^{-x^2} - x$

(b) Apply Secant method ($x_{n+1} = x_n - f(x_n)\dfrac{x_n - x_{n-1}}{f(x_n) - f(x_{n-1})}$)

Solution:



x	$f_1(x) = e^{-x^2}$	$f_2(x) = x$	$f(x) = e^{-x^2} - x$
-4			
-3			
-2			
-1			
0			
1			
2			
3			
4			

n (No. of iteration)	x_n	$f(x_n)$	$x_n - x_{n-1}$
0			
1			
2			
3			
4			
5			
6			
7			

2. Write the Algorithm, which is used to find the roots of function $f(x) = 0$ in one variable using Newton –Raphson method.

   Newton-Raphson Algorithm.
   To find a solution of $f(x) = 0.$ given an initial approximation x_o:

(*iteration formula has the form* $x_{n+1} = x_n - \frac{f(x)}{f'(x)}$)

INPUT:……

OUTPUT:……..

Step 1:

Step 2:

.
.
.
.
.
.
.
.

End

Question 2: (20 Mark)

1. In the following table, list of population of one country from 1970 to 2000 are given.

Year	1970	1980	1990	2000
Population (in thousands)	123	131	150	179

Find polynomial of degree 3 (using Newton divided-difference method) for fitting this data, and use this polynomial to estimate the population in the year 1985 and 2005?

Solution

i	x_1	$f(x_i)$	$f[x_i, x_{i+1}]$	$f[x_i, x_{i+1}.x_{i+2}]$	.....

2. Calculate the **Lagrange polynomial** $P_2(x)$ for 5 significant digits of the error function.)

$$f(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-w^2}\, dw$$

Namely $f(0.25) = 0.27632$, $f(0.5) = 0.525$, $f(1) = 0.8270$ and from $P_2(x)$ *an approximation of* $f(0.75)$. *answer* $= 0.71116$

Question 3: (20 Mark)

1. Evaluate $f(x) = x^3 - 6x^2 + 3x - 0.149$ at $x = 4.71$ using 3-Significant digits. ()

2.

$$
\begin{aligned}
4x_1 \;-\; x_2 \;-\; x_3 &= 5 \\
-x_1 + 4x_2 \;-\; x_4 &= -3 \\
-x_1 + 4x_3 \;-\; x_4 &= -7 \\
-x_2 \;-\; x_3 + 4x_4 &= 9
\end{aligned}
$$

()

Solve the above system using ***Gauss-Seidel iteration*** starting from $x_1 = 0, x_2 = 0, x_3 = 0, x_4 = 0$. ()

k	$x_1^{(k)}$	$x_2^{(k)}$	$x_3^{(k)}$	$x_4^{(k)}$	Error	
0	**0**	**0**	**0**	**0**		
1						
2						
3						
4						

Question 4: (20 Mark)

1. Calculate the error, and relative error and number of significant of the following approximation $x_A = x_T$.

   i) $x_T = 28.254, x_A = 28.271$ ii) $x_T = 0.028254, x_A = 0.028271$

   iii) $x_T = e, x_A = \frac{19}{7}$

()

2. Find the roots of the equation $x^2 - 40x + 2 = 0$, using 5 significant digits in the computation. Study the loss of significant digits and suggest another formula to avoid the loss of significant digits. ()

Another Method

Question 5: (20 Mark)

1.a- The following polynomial, classify the type of roots *(real (positive -r negative-zero), imagina5y)*, then using **Newton's method** to find the root.*(* $\varepsilon = .001$ *)*

()

$f(x) = x^6 - x - 1 = 0.$

Starting from $p_0 = 1.5$ **,**

Iteration formula has the form:

$p_{n+1} =$ .....

n (No. of iteration)	p_n	$f(p)$			$p_n - p_{n-1}$
0					
1					
2					
3					
4					

1.b- If the previous equation is solved by using *bisection method*. Find an interval $[a,b]$ on which changes sign and the number of iteration needed to obtain an approximate root that is accurate within an error tolerance *(* $\varepsilon = .01$).

n (No. of iteration)	a	b	p	Error (p-b)	$f(p)$
1					
2					
3					
4					
5					
6					
7					

2- Write the Algorithm or draw flow chart , which is used to find the roots of function $f(x) = 0$ in one variable using Newton -Raphson method. *()*