



İzmir Institute of Technology

Numerical Methods in Engineering

CE301

Assignment #3

Section B

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Mechanical Engineering

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Error in the task is interpreted as absolute error. Initial guesses are the range of integers between -5 and 5, inclusive.

$$\{x \mid x \in \mathbb{Z}, -5 \leq x \leq 5\} \quad (1)$$

Equation given:

$$f(x) = e^{2x} \sin x - 3x \cos 2x \quad (2)$$

Newton method is as follows:

$$x_0 = -x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad (3)$$

```

1 x values for initial guesses between -5 and 5 w/ step size of 1
2
3 ----> error < 0.001 :
4
5 x_err001 =
6
7      -5.4978      -3.927      -2.3567      -2.3567      -0.75171
8          0      0.39076      0.39097      3.1235      3.1235
9      3.1235
10
11 ----> error < 0.0001 :
12
13 x_err0001 =
14
15      -5.4978      -3.927      -2.3566      -2.3566      -0.75171
16          0      0.39076      0.39075      3.1235      3.1235
17      3.1235
18
19 ----> error < 0.00001 :
20
21 x_err00001 =
22
23      -5.4978      -3.927      -2.3566      -2.3566      -0.7517
24          0      0.39075      0.39075      3.1235      3.1235
25      3.1235

```

Appendix

A.1 Computer Code

```
1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% Mert Emrem - 250203015 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%% CE301 - Assignment #2 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
3
4 % NOTE: Error (epsilon) is interpreted as absolute error.
5
6 clc; clear all;
7
8 syms f(x)
9
10 f(x) = exp(2*x)*sin(x) - 3*x*cos(2*x);
11
12 % Following line executed once externally to save computation load
13 % Df = diff(f,x);
14
15 Df(x) = 6*x*sin(2*x) - 3*cos(2*x) + exp(2*x)*cos(x) + 2*exp(2*x)*sin(x)
16 ;
17
18 err001 = 0.001;
19 err0001 = 0.0001;
20 err00001 = 0.00001;
21 x = 0;
22 x_err001 = [];
23 x_err0001 = [];
24 x_err00001 = [];
25 maxit = 100;
26
27 err = 1;
28
29 for i = -5:1:5
30
31     iteration = 0;
32     x = i;
33
34     while err > err001 && iteration <= maxit
35
36         iteration = iteration + 1;
37         x = x - double(f(x))/double(Df(x));
```

```

37
38     err = abs(double(f(x)));
39 end
40
41 x_err001 = [x_err001 x];
42 err = 1;
43
44 end
45
46
47 for i = -5:1:5
48
49     iteration = 0;
50     x = i;
51
52     while err > err0001 && iteration <= maxit
53
54         iteration = iteration + 1;
55         x = x - double(f(x))/double(Df(x));
56
57         err = abs(double(f(x)));
58     end
59
60     x_err0001 = [x_err0001 x];
61     err = 1;
62
63 end
64
65
66 for i = -5:1:5
67
68     iteration = 0;
69     x = i;
70
71     while err > err00001 && iteration <= maxit
72
73         iteration = iteration + 1;
74         x = x - double(f(x))/double(Df(x));
75
76         err = abs(double(f(x)));
77     end
78
79     x_err00001 = [x_err00001 x];
80     err = 1;
81
82 end
83

```

```
84
85 disp("x values for initial guesses between -5 and 5 w/ step size of 1")
86 ;
87
88
89 line_1 = ['----> error < 0.001 : ',,];
90 disp(" ");
91 disp(line_1);
92 x_err001
93 disp(" ");
94 line_1 = ['----> error < 0.0001 : ',,];
95 disp(" ");
96 disp(line_1);
97 x_err0001
98 disp(" ");
99 line_1 = ['----> error < 0.00001 : ',,];
100 disp(" ");
101 disp(line_1);
102 x_err00001
```