IS5306: NUMERICAL METHODS

TAKE HOME ASSIGNMENT 1

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1. Calculations

Using newton Raphson method find the solution of x^3-6x^2+8x+1=0? In this equation use interval as [-1,0]?

• **MATLAB Code**

```
% Define the function and its derivative
f = @(x) x^3 - 6*x^2 + 8*x + 1;
df = @(x) 3*x^2 - 12*x + 8;
% Set the interval
interval = [-1, 0];
% Check if the interval contains a root
if f(interval(1)) * f(interval(2)) > 0
error('No root in the specified interval.');
end
% Set tolerance for convergence
tolerance = 1e-6;
% Set maximum number of iterations
maxIterations = 100;
% Initialize variables
x0 = (interval(1) + interval(2)) / 2; % Start with the
midpoint of the interval
iterations = 0;
% Perform Newton-Raphson iterations
while iterations < maxIterations
x1 = x0 - f(x0) / df(x0);
% Display iteration and current approximation
fprintf('Iteration %d: x = %.8f\n', iterations, x1);
% Check for convergence
if abs(x1 - x0) < tolerance
fprintf('Root found: %f\n', x1);
break;
end
x0 = x1;
iterations = iterations + 1;
end
% Display a message if the method does not converge
if iterations == maxIterations
fprintf('Newton-Raphson method did not converge within %d
iterations\n', maxIterations);
end
```

- **Answer**

Iteration 0: x = -0.18644068

Iteration 1: x = -0.11811769

Iteration 2: x = -0.11491446

Iteration 3: x = -0.11490754

Iteration 4: x = -0.11490754

Root found: -0.114908

- **Analytical Method**

$$PUT\ X_0 = 0, \qquad f(0) = 1 > 0\ \&$$

$$X = -1, \qquad f(-1) = -15 < 0$$

So, we shall take, $X_0 = m_1 = 0 + (-1)^2 = 0.5$

Now,

$$f(x) = x^3 - 6x^2 + 8x + 1$$

$$f^{/}(x) = 3x^2 - 12x + 8$$

$$X_{n+1} = X_n - \frac{f(X_n)}{f^{|}(X_n)} = X_n - \frac{\text{x3} - \text{6x2} + \text{8x} + 1}{\text{3x2} - \text{12x} + 8}$$

n	x_n	$f(x_n)$	$f^{/}(x_n)$	x_{n+1}
0	-0.5	-4.6250	14.7500	-0.1864
1	-0.1864	10.3410	4.34	-0.1181
2	-0.1181	-0.0301	9.4590	-0.1149
3	-0.1149	0.0001	9.4184	-0.1149
4	-0.1149	0.0001	9.4184	-0.1149

$$\therefore The\ root = -0.1149$$

2. Conclusion

Whether using analytical techniques or MATLAB code, the core result is always the same. These methods generate a root that is near to the correct answer, but they do not produce the exact solution.