Contents


```
% HW 3 Problem 2(a)&(b)
% Find all the roots (real & complex) of a polynomial
% Change the order (o) and coefficients (a) accordingly
% This script will work up to 5th order

clear
clc
close all
```

Define the funtion 2(a)

```
o = 5; % Order of the poly
i = o;
a(:,1) = [1;-15;85;-225;274;-120]; % Coefficients of the poly

% %% Define the funtion 2(b)
% o = 3; % Order of the poly
% i = o;
% a(:,1) = [1;-3;4;-2]; % Coefficients
```

Newton's Method

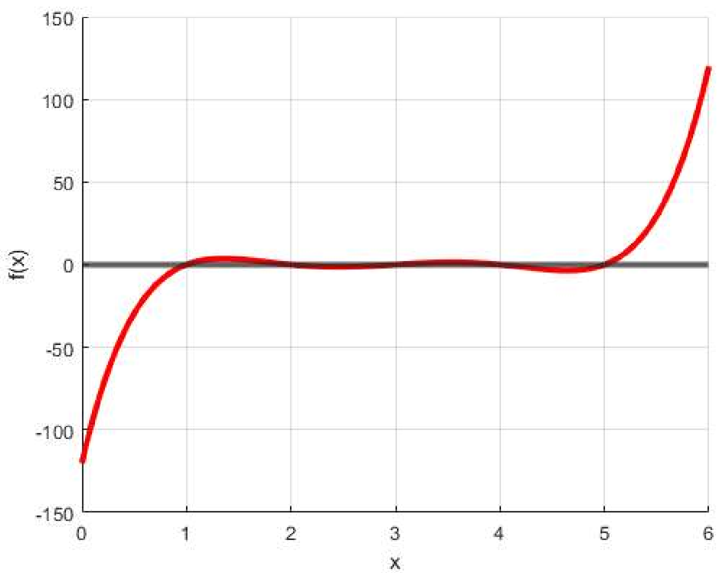
```
maxit = 1000000;
tol = 1e-10;
x0 = 0.5;    % Initial guess for root

for j = 1 : o

    if i == 5
        F = @(x) a(1,j)*x^(o+1-j) + a(2,j)*x^(o-j) + a(3,j)*x^(o-1-j) + a(4,j)*x^(o-2-j) + a(5,j)*x^(o-3-j)+ a(6,j)*x^(o-4-j);
        Fprime = @(x) (o+1-j)*a(1,j)*x^(o-j) + (o-j)*a(2,j)*x^(o-1-j) + (o-1-j)*a(3,j)*x^(o-2-j) + (o-2-j)*a(4,j)*x^(o-3-j) + (o-3-j)*a(5,j)*x^(o-4-j);
    elseif i == 4
        F = @(x) a(1,j)*x^(o+1-j) + a(2,j)*x^(o-j) + a(3,j)*x^(o-1-j) + a(4,j)*x^(o-2-j) + a(5,j)*x^(o-3-j);
        Fprime = @(x) (o+1-j)*a(1,j)*x^(o-j) + (o-j)*a(2,j)*x^(o-1-j) + (o-1-j)*a(3,j)*x^(o-2-j) + (o-2-j)*a(4,j)*x^(o-3-j);
    elseif i == 3
        F = @(x) a(1,j)*x^(o+1-j) + a(2,j)*x^(o-j) + a(3,j)*x^(o-1-j) + a(4,j)*x^(o-2-j);
        Fprime = @(x) (o+1-j)*a(1,j)*x^(o-j) + (o-j)*a(2,j)*x^(o-1-j) + (o-1-j)*a(3,j)*x^(o-2-j);
    elseif i == 2
        F = @(x) a(1,j)*x^(o+1-j) + a(2,j)*x^(o-j) + a(3,j)*x^(o-1-j);
        Fprime = @(x) (o+1-j)*a(1,j)*x^(o-j) + (o-j)*a(2,j)*x^(o-1-j);
    elseif i == 1
        F = @(x) a(1,j)*x^(o+1-j) + a(2,j)*x^(o-j);
        Fprime = @(x) (o+1-j)*a(1,j)*x^(o-j);
    end % if

    [root(j,1),it(j,1),success(j,1)] = newton_exact(F,Fprime,x0,maxit,tol);

    % Obtain next coefficients
    for k = 1 : o+1-j
        if k == 1
            a(k,j+1) = a(k,j);
        else
            a(k,j+1) = a(k,j) + root(j,1)*a(k-1,j+1);
        end % if
    end % for

    i = i - 1;  % Update the order for the next poly

end % for

table(root,it,success)
```

```
ans =

  5×3 table

    root    it    success
    ____    __    _______

     1      6      true
     2      8      true
```

```
     3       8       true
     4       7       true
     5       1       true
```

Plot the polynomial

```
figure
grid on
j = 1;
x = 0:0.01:6;
yline(0,'LineWidth',3)
hold on
if o == 5
    plot(x,a(1,j)*x.^(o+1-j) + a(2,j)*x.^(o-j) + a(3,j)*x.^(o-1-j) + a(4,j)*x.^(o-2-j) + a(5,j)*x.^(o-3-j) + a(6,j)*x.^(o-4-j),'r','LineWidth',3);
elseif o ==4
    plot(x,a(1,j)*x.^(o+1-j) + a(2,j)*x.^(o-j) + a(3,j)*x.^(o-1-j) + a(4,j)*x.^(o-2-j) + a(5,j)*x.^(o-3-j),'r','LineWidth',3);
elseif o == 3
    plot(x,a(1,j)*x.^(o+1-j) + a(2,j)*x.^(o-j) + a(3,j)*x.^(o-1-j) + a(4,j)*x.^(o-2-j),'r','LineWidth',3);
elseif o == 2
    plot(x,a(1,j)*x.^(o+1-j) + a(2,j)*x.^(o-j) + a(3,j)*x.^(o-1-j),'r','LineWidth',3);
elseif o == 1
    plot(x,a(1,j)*x.^(o+1-j) + a(2,j)*x.^(o-j),'r','LineWidth',3);
end % if
xlabel('x');
ylabel('f(x)');
```



Published with MATLAB® R2020b