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% DATE: Mar 21, 2022
%
% PROGRAM: Problem27a.m
% PURPOSE: Use bisection to find the zeros with ten decimal places accuracy.
%           What are they?
% CREDIT: Adapted from an example written by Dr. Lucas

% JMU PLEDGE
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

clc

f=@(x) 273000*x.^4-277490*x.^3-228731*x.^2+256181*x-31234; % defining
function;
% answer of (a)
x=-2:0.01:2; % discretized value of x in [0.4,2];
y=f(x); % computing function values.
plot(x,y,'LineWidth',1.25);
set(gca,'XAxisLocation','origin');
set(gca,'YAxisLocation','origin');
grid minor;

disp('There are 4 total roots:')
disp('[-1,-0.75],[0,0.25],[0.75,1],[1,1.25]')

f=@(x) 273000*x.^4-277490*x.^3-228731*x.^2+256181*x-31234; % defining
function;
I1=[-1 -0.75];
I2=[0 0.25];
I3=[0.75 1];
I4=[1 1.25];
tolerance=1e-10;
bisection(f, I1, tolerance);
bisection(f, I2, tolerance);
bisection(f, I3, tolerance);
bisection(f, I4, tolerance);

function bisection(f, Interval, tolerance)
% f=function;
% Interval=initial interval;
% tolerance=error tolerance;
xl=Interval(1); % lower value of the interval;
xu=Interval(2); % upper value of the interval;
xr=(xl+xu)/2; %% mid-point of the initial interval;

error=1e5;
iter=0;

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while error>tolerance
    iter=iter+1; % updating iteration number;

    if f(xl)*f(xr)<0 % updating interval
        xu=xr;
    elseif f(xr)*f(xu)<0
        xl=xr;
    end
    xr=(xl+xu)/2;
    error=abs(f(xr));
end
fprintf('\nRoot in the interval [%g , %g] is: %.12f \n',Interval,xr);
fprintf('\nNumber of iterations: %d \n\n',iter);
end
```

There are 4 total roots:

[-1,-0.75],[0,0.25],[0.75,1],[1,1.25]

Root in the interval [-1 , -0.75] is: -0.970000000000

Number of iterations: 49

Root in the interval [0 , 0.25] is: 0.142857142857

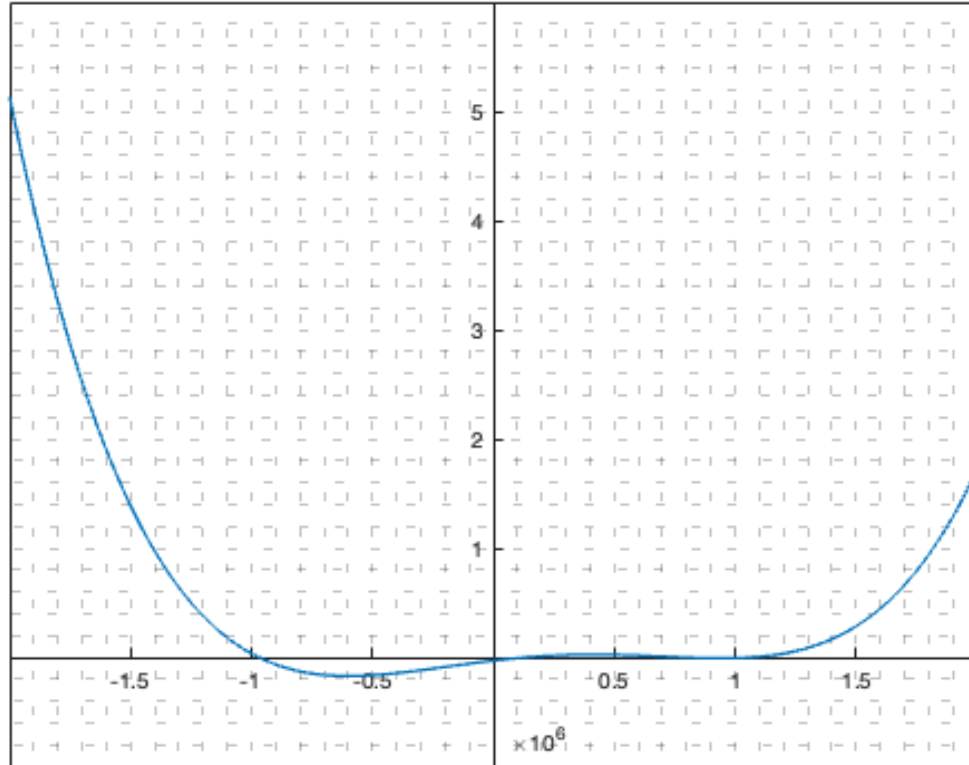
Number of iterations: 45

Root in the interval [0.75 , 1] is: 0.766666666667

Number of iterations: 46

Root in the interval [1 , 1.25] is: 1.076923076923

Number of iterations: 45



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