Step 1 of 3

When using numerical approximation techniques, it is useful to have programs written to aid in numerical calculations to avoid calculations by hand. Using Matlab, create an

M-file named "fixp.m" which will contain Matlab code that implements the fixed point method.

Inside this file, write the code to implement the method. One example of a correctly executable routine based on the algorithm in the text is as follows:

function rtn = fixp (f,x0,Tol)

%fixed point reaches a certain tolerance to approximate root of fx

%inputs are function f, initial point x0, and tolerance

i=1; %initialize iteration count

n=0; %loop control

while (n == 0)%checks if Tolerance is reached

x1 = x0; x0 = f(x0);

X = [i, x1]; % vector containing iteration count apx.root

i=i+1; %increment iteration count by one

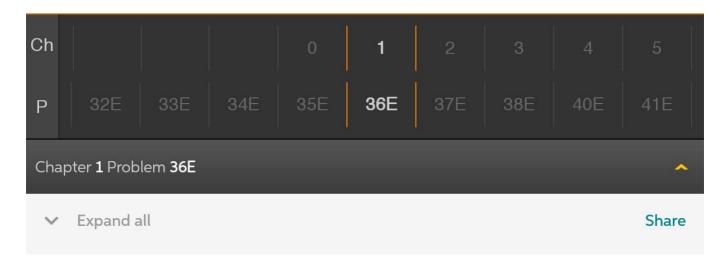
if (abs(x0 - x1)< Tol) %tolerance based on norm convergence

n = 1:

disp (X) %display vector X

end

end % of while loop



Step 2

a) To approximate a root of $f(x) = e^x - 2x^2$ using the fixed point method, find an arrangement of f(x) = 0 such that x = g(x) (it is a trial and error approach to find an appropriate function that converges to a desired root).

The text suggests to first try $x = \sqrt{(e^x/2)}$ using the point $x_0 = 1.5$ to initialize the method to approximate the root.

For this problem, let the tolerance be .00001. The root approximation will be in the second column of the row output.

INPUT:

>> format longG

 \Rightarrow f=@(x)sqrt(exp(x)/2)

OUTPUT:

f =

Step 3

 \bigcirc 0

0

@(x)sqrt(exp(x)/2)

Step 4



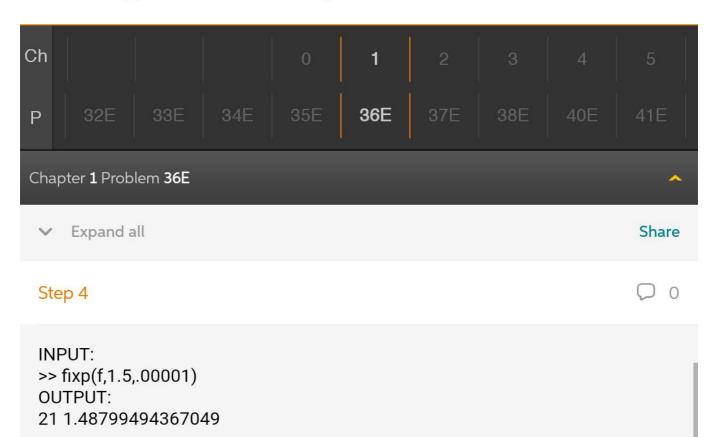
INPUT:

>> fixp(f,1.5,.00001)

OUT DUT







Step 5

 \bigcirc 0

Looking at the Matlab outputs, it appears that x = 1.48799494367049 is the root near 1.5.

Note: Answers may vary due to choice of tolerance, convergence criteria, and root finding algorithm.

Step 6



Next, the text suggests trying $x = -\sqrt{(e^x/2)}$ using the point $x_0 = -0.5$ to initialize the method to approximate the root.

For this problem, let the tolerance be .00001. The root approximation will be in the second column of the row output.

INPUT:

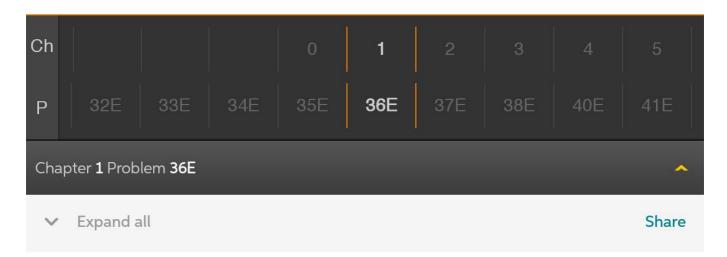
 \Rightarrow f=@(x)sqrt(exp(x)/2)

OUTPUT:

f =







Next, the text suggests trying $x = -\sqrt{(e^x/2)}$ using the point $x_0 = -0.5$ to initialize the method to approximate the root.

For this problem, let the tolerance be .00001. The root approximation will be in the second column of the row output.

INPUT:

 \Rightarrow f=@(x)sqrt(exp(x)/2)

OUTPUT:

f =

Step 7 \bigcirc 0

@(x)-sqrt(exp(x)/2)

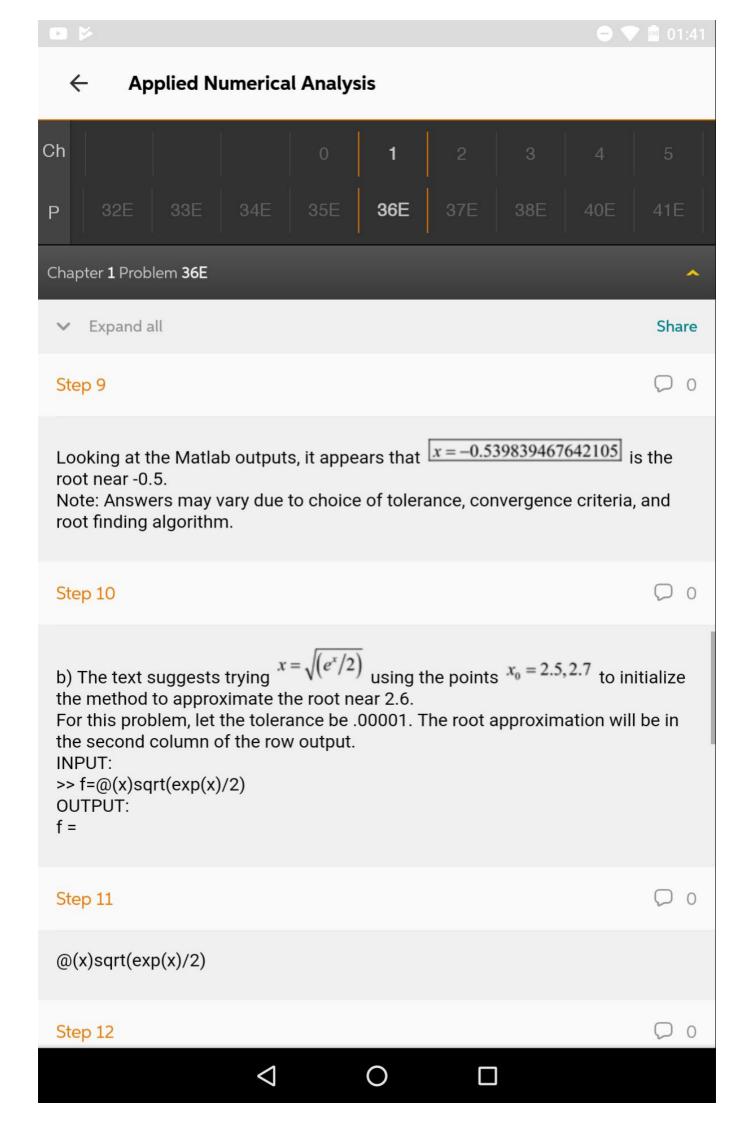
Step 8

INPUT:

 \Rightarrow fixp(f,-0.5,.00001)

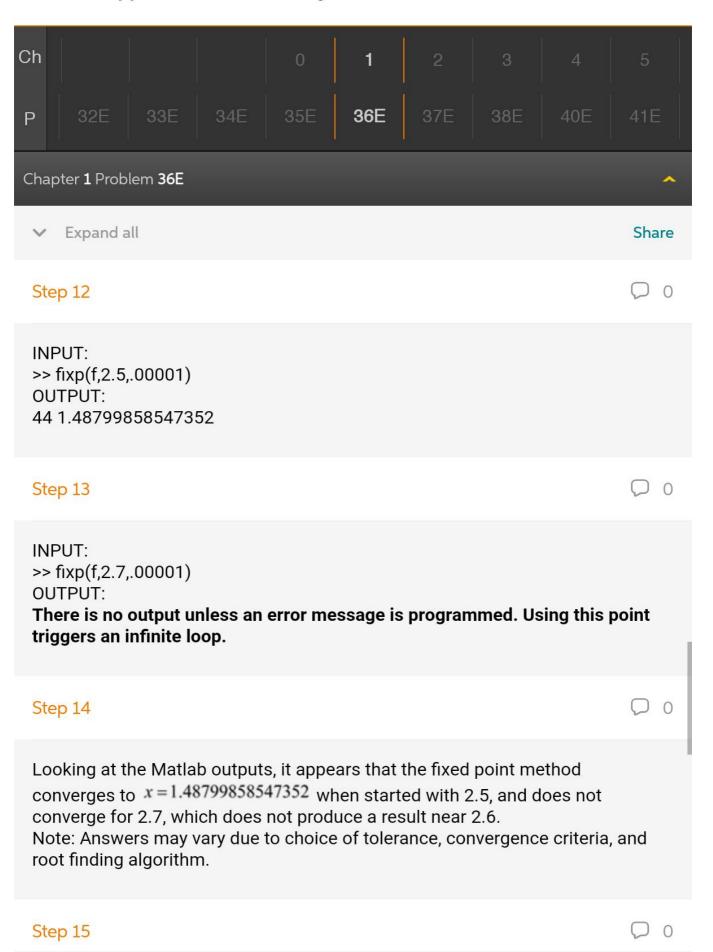
OUTPUT:

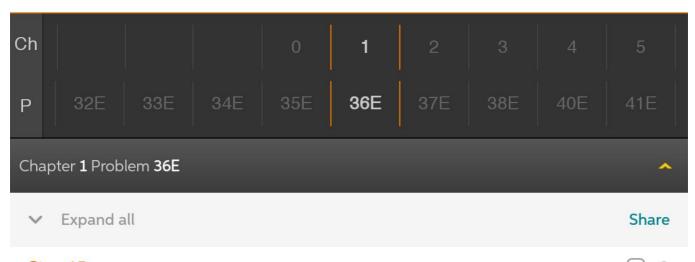
8 -0.539839467642105











Step 15

c) To find an arrangement that converges to the other positive root, try

$$e^{x} - 2x^{2} = 0$$
$$e^{x} = 2x^{2}$$
$$x = \ln(2x^{2})$$

Step 16

> 0

Next, give the following sequence of commands in the Matlab command

window to apply the fixed point method to $x = \ln(2x^2)$, using the point $x_0 = 2.6$ to initialize the method to approximate the root.

For this problem, let the tolerance be .00001. The root approximation will be in the second column of the row output.

INPUT:

OUTPUT:

f =

Step 17

 \bigcirc

@(x)log(2*x^2)









