Contents

Copyright

```
close all; format compact; clc;
fprintf("Engineer: Rodrigo Becerril Ferreyra\n");
fprintf("Company: California State University, Long Beach\n");
fprintf("Project Name: Lab 2\n");
fprintf("Date: 22 September 2020\n");
```

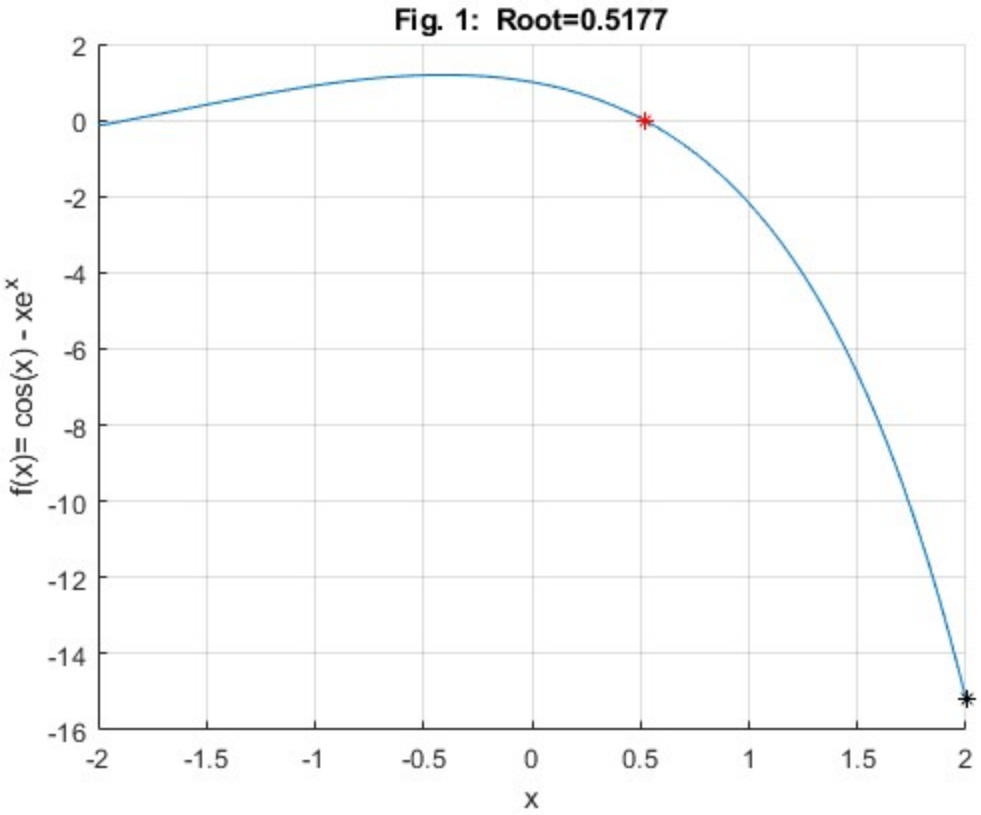
```
Engineer: Rodrigo Becerril Ferreyra
Company: California State University, Long Beach
Project Name: Lab 2
Date: 22 September 2020
```

Problem 1

```
clear variables;
disp('Problem 1');
f=@(x) cos(x) - x.*exp(x);
g=@(x) cos(x)./exp(x);

tolerance=1e-4; maxits=100; %Initialize loop constraints
xinit = 2; %Initial guess
k=0; x0=xinit; %Initialize counter and point x0
x1=g(x0); %Get first iterate

while(k<maxits && abs(x0-x1)> tolerance)
    k=k+1;
    x0 = x1; xpts(k)=x0; %Save the old x values
    x1 = g(x0); ypts(k)=x1; %Save new x values (the y values)
end
root=x1; %Save answer as the root

%Display some fixed point iterationresults
disp('  Sequence of iterations:');
disp([xpts;ypts]);
disp(['  root=x1=',num2str(root),' after ',num2str(k),' iterations']);
disp(['  Check: y(x)=',num2str(root),' = ',num2str(f(root)),'(should be ~0)']);

% Plot results
x=linspace(-xinit,xinit,100); %Careful: not good if xinit=0!
```

```
figure(); hold on;
plot(x,f(x));
plot(root,f(root),'r*');
plot(xinit,f(xinit),'k*');
grid on;
str=sprintf('Fig. %d:  Root=%6.4f',1,root);
title(str); xlabel('x'); ylabel('f(x)= cos(x) - xe^x');
hold off;
```

```
Problem 1
  Sequence of iterations:
  Columns 1 through 7
   -0.0563    1.0563    0.1711    0.8304    0.2940    0.7133    0.3706
    1.0563    0.1711    0.8304    0.2940    0.7133    0.3706    0.6435
  Columns 8 through 14
    0.6435    0.4204    0.5996    0.4533    0.5714    0.4750    0.5530
    0.4204    0.5996    0.4533    0.5714    0.4750    0.5530    0.4895
  Columns 15 through 21
    0.4895    0.5410    0.4991    0.5331    0.5054    0.5279    0.5096
    0.5410    0.4991    0.5331    0.5054    0.5279    0.5096    0.5244
  Columns 22 through 28
    0.5244    0.5124    0.5222    0.5142    0.5207    0.5154    0.5197
    0.5124    0.5222    0.5142    0.5207    0.5154    0.5197    0.5162
  Columns 29 through 35
    0.5162    0.5190    0.5167    0.5186    0.5171    0.5183    0.5173
    0.5190    0.5167    0.5186    0.5171    0.5183    0.5173    0.5181
  Columns 36 through 42
    0.5181    0.5175    0.5180    0.5176    0.5179    0.5176    0.5179
    0.5175    0.5180    0.5176    0.5179    0.5176    0.5179    0.5177
  Columns 43 through 46
    0.5177    0.5178    0.5177    0.5178
    0.5178    0.5177    0.5178    0.5177
  root=x1=0.51772 after 46 iterations
  Check: y(x)=0.51772 = 0.00011324(should be ~0)
```

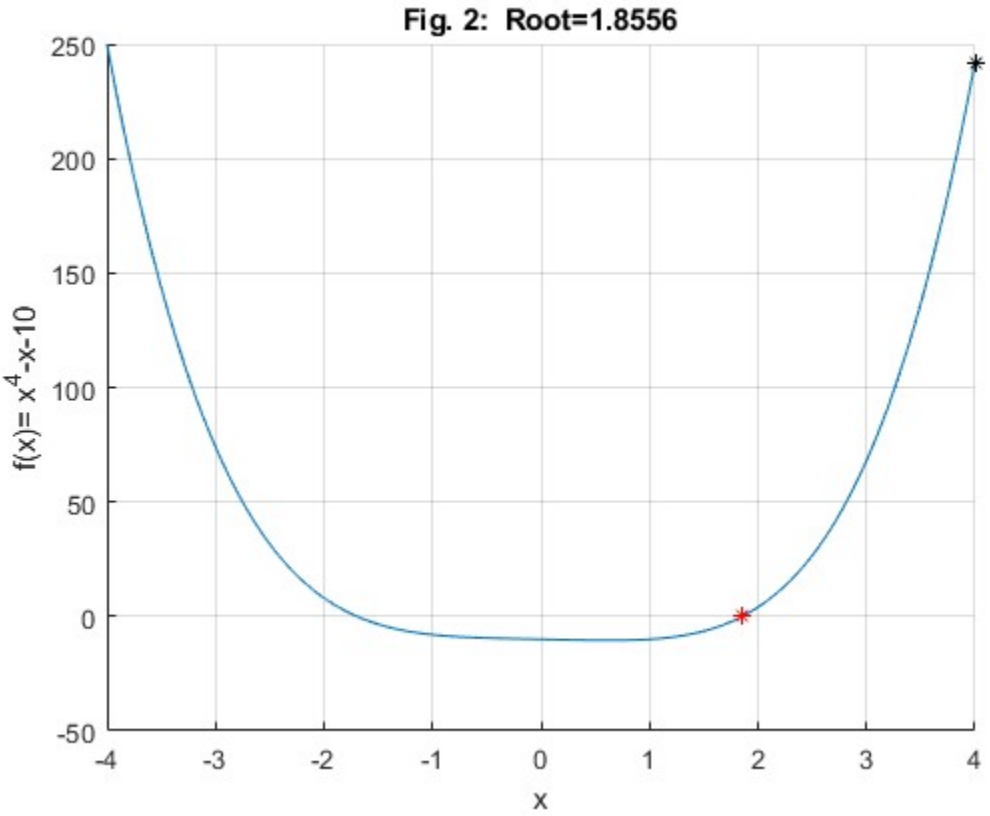


Problem 2

```
clear variables;
disp('Problem 2');
f=@(x) x.^4 - x - 10;
g=@(x) (x + 10).^0.25;

tolerance=1e-4; maxits=100; %Initialize loop constraints
xinit = 4; %Initial guess
k=0; x0=xinit; %Initialize counter and point x0
x1=g(x0); %Get first iterate

while(k<maxits && abs(x0-x1)> tolerance)
    k=k+1;
    x0 = x1; xpts(k)=x0; %Save the old x values
    x1 = g(x0); ypts(k)=x1; %Save new x values (the y values)
end
root=x1; %Save answer as the root

%Display some fixed point iterationresults
disp('  Sequence of iterations:');
disp([xpts;ypts]);
disp(['  root=x1=',num2str(root),' after ',num2str(k),' iterations']);
disp(['  Check: y(x)=',num2str(root),' = ',num2str(f(root)),'(should be ~0)']);

% Plot results
x=linspace(-xinit,xinit,100); %Careful: not good if xinit=0!
figure(); hold on;
plot(x,f(x));
```

```
plot(root,f(root),'r*');
plot(xinit,f(xinit),'k*');
grid on;
str=sprintf('Fig. %d:  Root=%6.4f',2,root);
title(str); xlabel('x'); ylabel('f(x)= x^4-x-10');
hold off;
```

```
Problem 2
  Sequence of iterations:
    1.9343    1.8587    1.8557    1.8556
    1.8587    1.8557    1.8556    1.8556
  root=x1=1.8556 after 4 iterations
  Check: y(x)=1.8556 = 4.5216e-06(should be ~0)
```

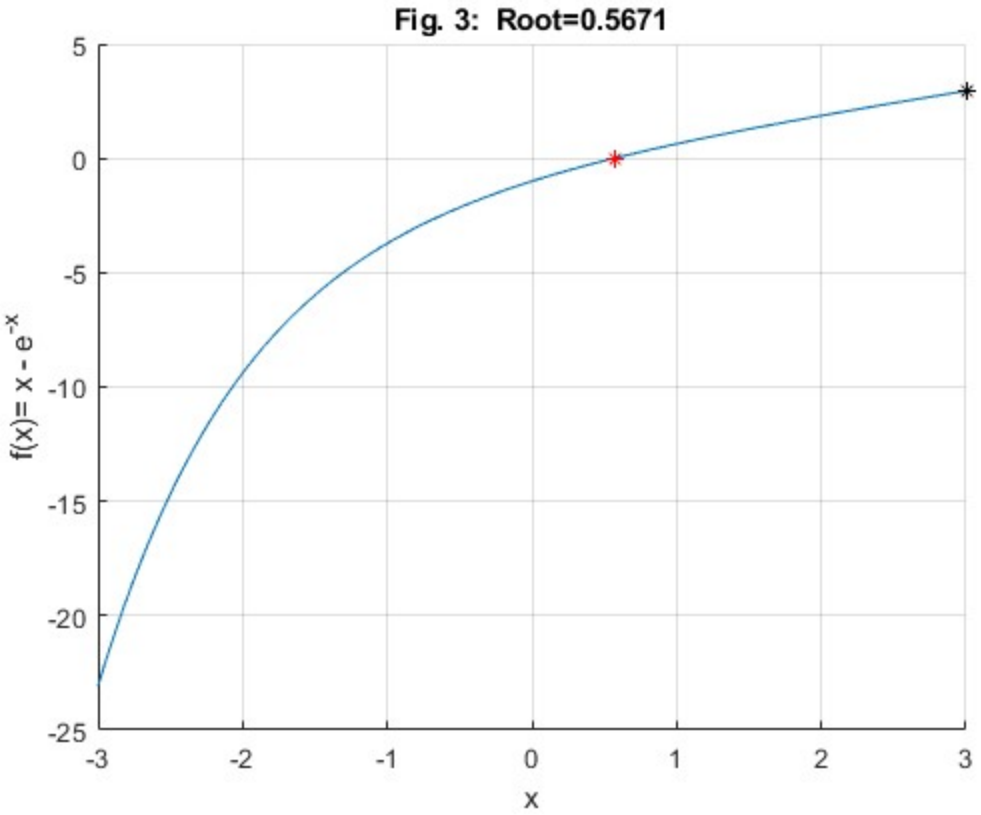


Problem 3

```
clear variables;
disp('Problem 3');
f=@(x) x - exp(-x);
g=@(x) exp(-x);

tolerance=1e-4; maxits=100; %Initialize loop constraints
xinit = 3; %Initial guess
k=0; x0=xinit; %Initialize counter and point x0
x1=g(x0); %Get first iterate

while(k<maxits && abs(x0-x1)> tolerance)
```

```
    k=k+1;
    x0 = x1; xpts(k)=x0; %Save the old x values
    x1 = g(x0); ypts(k)=x1; %Save new x values (the y values)
end
root=x1; %Save answer as the root

%Display some fixed point iterationresults
disp('  Sequence of iterations:');
disp([xpts;ypts]);
disp(['  root=x1=',num2str(root),' after ',num2str(k),' iterations']);
disp(['  Check: y(x)=',num2str(root),' = ',num2str(f(root)),'(should be ~0)']);

% Plot results
x=linspace(-xinit,xinit,100); %Careful: not good if xinit=0!
figure(); hold on;
plot(x,f(x));
plot(root,f(root),'r*');
plot(xinit,f(xinit),'k*');
grid on;
str=sprintf('Fig. %d:  Root=%6.4f',3,root);
title(str); xlabel('x'); ylabel('f(x)= x - e^{-x}');
hold off;
```

```
Problem 3
  Sequence of iterations:
  Columns 1 through 7
    0.0498    0.9514    0.3862    0.6796    0.5068    0.6024    0.5475
    0.9514    0.3862    0.6796    0.5068    0.6024    0.5475    0.5784
  Columns 8 through 14
    0.5784    0.5608    0.5708    0.5651    0.5683    0.5665    0.5675
    0.5608    0.5708    0.5651    0.5683    0.5665    0.5675    0.5669
  Columns 15 through 18
    0.5669    0.5673    0.5671    0.5672
    0.5673    0.5671    0.5672    0.5671
  root=x1=0.56712 after 18 iterations
  Check: y(x)=0.56712 = -3.4332e-05(should be ~0)
```

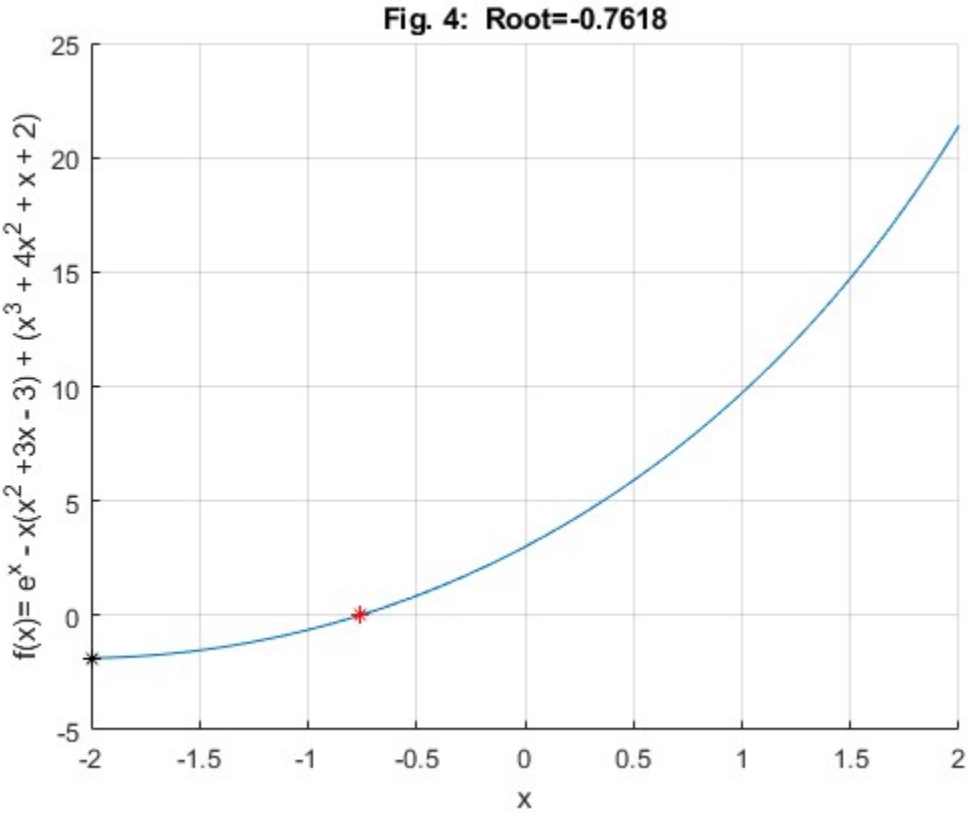


Problem 4

```
clear variables;
disp('Problem 4');
f=@(x) exp(x) - (x .* (x.^2 + 3.*x -3)) + (x.^3 + 4.*x.^2 + x + 2);
g=@(x) (exp(x) + x.^3 + 4.*x.^2 + x + 2)./(x.^2 + 3.*x - 3);

tolerance=1e-4; maxits=100; %Initialize loop constraints
xinit = -2; %Initial guess
k=0; x0=xinit; %Initialize counter and point x0
x1=g(x0); %Get first iterate

while(k<maxits && abs(x0-x1)> tolerance)
    k=k+1;
    x0 = x1; xpts(k)=x0; %Save the old x values
    x1 = g(x0); ypts(k)=x1; %Save new x values (the y values)
end
root=x1; %Save answer as the root

%Display some fixed point iterationresults
disp('  Sequence of iterations:');
disp([xpts;ypts]);
disp(['  root=x1=',num2str(root),' after ',num2str(k),' iterations']);
disp(['  Check: y(x)=',num2str(root),' = ',num2str(f(root)),'(should be ~0)']);

% Plot results
x=linspace(-xinit,xinit,100); %Careful: not good if xinit=0!
figure(); hold on;
plot(x,f(x));
```

```
plot(root,f(root),'r*');
plot(xinit,f(xinit),'k*');
grid on;
str=sprintf('Fig. %d:  Root=%6.4f',4,root);
title(str); xlabel('x'); ylabel('f(x)= e^x - x(x^2 +3x - 3) + (x^3 + 4x^2 + x + 2)');
hold off;
```

```
Problem 4
  Sequence of iterations:
  Columns 1 through 7
   -1.6271   -1.3091   -1.0688   -0.9129   -0.8279   -0.7885   -0.7721
   -1.3091   -1.0688   -0.9129   -0.8279   -0.7885   -0.7721   -0.7657
  Columns 8 through 12
   -0.7657   -0.7633   -0.7623   -0.7620   -0.7619
   -0.7633   -0.7623   -0.7620   -0.7619   -0.7618
  root=x1=-0.76182 after 12 iterations
  Check: y(x)=-0.76182 = -8.5377e-05(should be ~0)
```

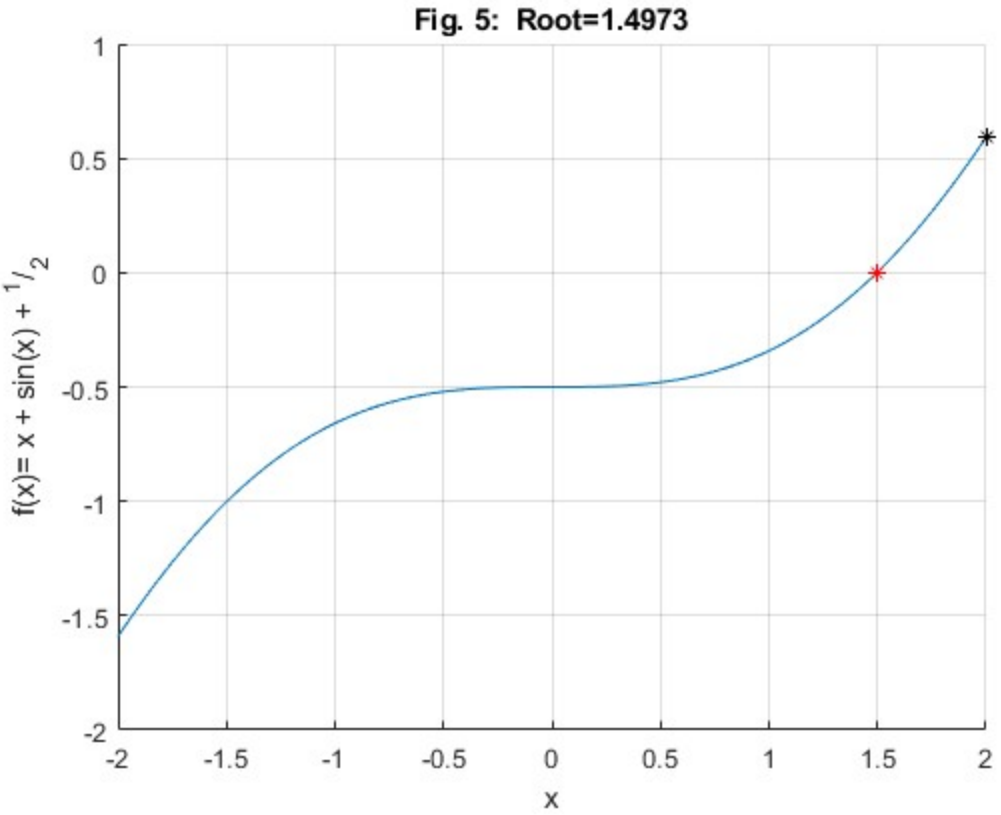


Problem 5

```
clear variables;
disp('Problem 5');
f=@(x) x - sin(x) - 0.5;
g=@(x) sin(x) + 0.5;

tolerance=1e-4; maxits=100; %Initialize loop constraints
xinit = 2; %Initial guess
```

```
k=0; x0=xinit; %Initialize counter and point x0
x1=g(x0); %Get first iterate

while(k<maxits && abs(x0-x1)> tolerance)
    k=k+1;
    x0 = x1; xpts(k)=x0; %Save the old x values
    x1 = g(x0); ypts(k)=x1; %Save new x values (the y values)
end
root=x1; %Save answer as the root

%Display some fixed point iterationresults
disp('  Sequence of iterations:');
disp([xpts;ypts]);
disp(['  root=x1=',num2str(root),' after ',num2str(k),' iterations']);
disp(['  Check: y(x)=',num2str(root),' = ',num2str(f(root)),'(should be ~0)']);

% Plot results
x=linspace(-xinit,xinit,100); %Careful: not good if xinit=0!
figure(); hold on;
plot(x,f(x));
plot(root,f(root),'r*');
plot(xinit,f(xinit),'k*');
grid on;
str=sprintf('Fig. %d:  Root=%6.4f',5,root);
title(str); xlabel('x'); ylabel('f(x)= x + sin(x) + {}^1/{}_2');
hold off;
```

```
Problem 5
  Sequence of iterations:
    1.4093    1.4870    1.4965    1.4972
    1.4870    1.4965    1.4972    1.4973
  root=x1=1.4973 after 4 iterations
  Check: y(x)=1.4973 = -4.0722e-06(should be ~0)
```

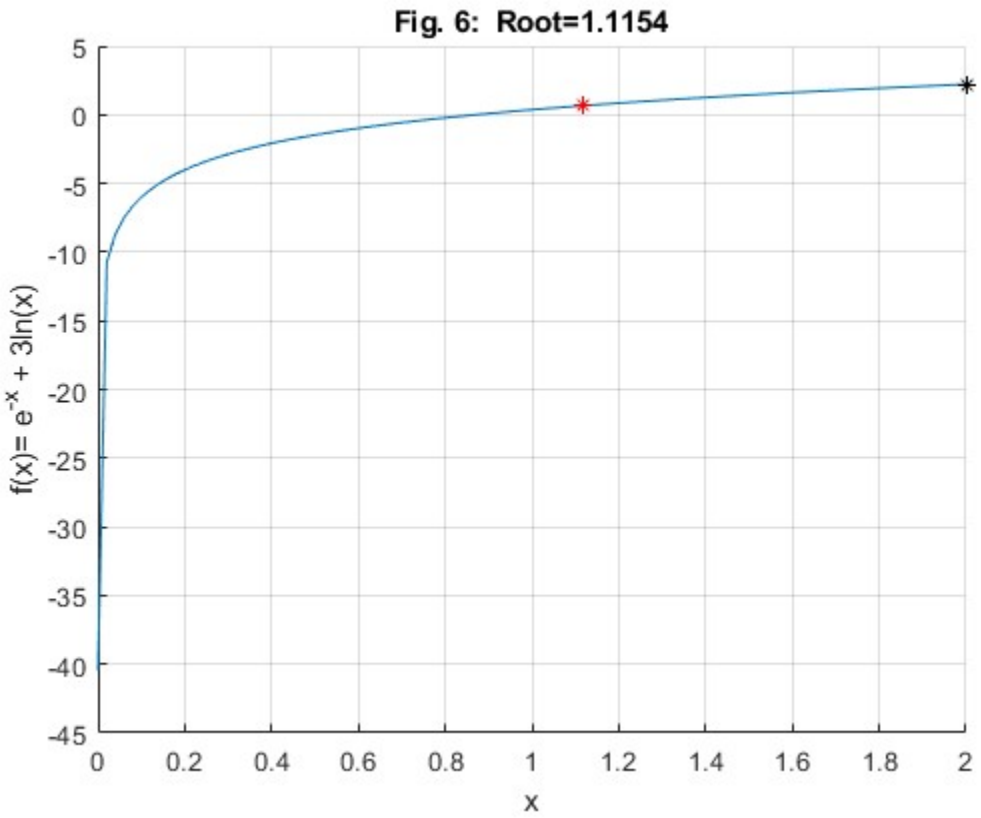


Problem 6

```
clear variables;
disp('Problem 6');
f=@(x) exp(-x) + 3.*log(x);
g=@(x) exp(exp(-x)./3);

tolerance=1e-4; maxits=100; %Initialize loop constraints
xinit = 2; %Initial guess
k=0; x0=xinit; %Initialize counter and point x0
x1=g(x0); %Get first iterate

while(k<maxits && abs(x0-x1)> tolerance)
    k=k+1;
    x0 = x1; xpts(k)=x0; %Save the old x values
    x1 = g(x0); ypts(k)=x1; %Save new x values (the y values)
end
root=x1; %Save answer as the root

%Display some fixed point iterationresults
disp('  Sequence of iterations:');
disp([xpts;ypts]);
disp(['  root=x1=',num2str(root),' after ',num2str(k),' iterations']);
disp(['  Check: y(x)=',num2str(root),' = ',num2str(f(root)),'(should be ~0)']);

% Plot results
x=linspace(1e-6,xinit,100); %The domain of ln is (0, inf)
figure(); hold on;
plot(x,f(x));
```

```
plot(root,f(root),'r*');
plot(xinit,f(xinit),'k*');
grid on;
str=sprintf('Fig. %d:  Root=%6.4f',6,root);
title(str); xlabel('x'); ylabel('f(x)= e^{-x} + 3ln(x)');
hold off;
```

```
Problem 6
  Sequence of iterations:
    1.0461    1.1242    1.1144    1.1156    1.1154
    1.1242    1.1144    1.1156    1.1154    1.1154
  root=x1=1.1154 after 5 iterations
  Check: y(x)=1.1154 = 0.65554(should be ~0)
```



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