ASE 211 Homework 2

Due: 12:00 noon, Friday, September 15. Put assignments in the drawer on the third floor of WRW marked 'ASE 211.'

1. Consider problem A2.2 in the book. Here you want to find the angle θ that satisfies

$$f(\theta) = 1.732\sin(\theta) - \cos(\theta) + .25 = 0$$

Starting with an initial interval of [0,60]. Apply 5 iterations (by hand) of the bisection method for determining θ.

a	b	x	f(a)	f(b)	f(x)
0	60	30	-.75	1.25	.25
0	30	15	-.75	.25	-.2677
15	30	22.5	.2677	.25	-.0111
22.5	30	26.25	-.0111	.25	.1192
22.5	26.25	24.375	-.0111	.1192	.0539

2. Take 5 iterations of Newton's method (by hand) for problem 1, starting with an initial guess of $\theta = 30$ degrees. It's best to work this problem in radians, for then $sin'(\theta) = cos(\theta)$. Otherwise you must account for a factor of $\pi/180$ in the derivative, since to convert from radians to degrees

$$\sin(\theta(deg)) = \sin(\theta * \pi/180(rad))$$

and therefore

$$\sin'(\theta(deg)) = \cos(\theta\pi/180(rad)) * \pi/180$$

by the chain rule.

x	f(x)
30	.25
22.8386	.00065
22.8198	0 (to six digits)

3. Write a Matlab m-file which will implement Newton's method. The outline of the m-file is as follows:

```
function newton(x0,xtol,maxiter)
%
%  Matlab function which uses Newton's method to find the
%  roots of a given function funcf.
%
%  m-files funcf.m and funcfp.m which specify the function and its derivative
%  must be provided.
%
%  xtol is the tolerance used for stopping
%  x0 is the starting guess for the method
%  maxiter is the maximum number of iterations allowed
%
%
k=0;
x1=x0-funcf(x0)/funcfp(x0);
%
%  do until convergence
%
while (abs(x1-x0)>xtol & k <= maxiter)
.....
.....
.....
end
k
x1
funcf(x1)
```

Use your m-file to solve problem 1 with the initial guess given in problem 2. Set $xtol = .0001$ and $maxiter = 50$. Since matlab assumes angles are given in radians, you will need to input your initial guess in radians. 1 degree $= \pi/180$ radians.

Keep a diary of your matlab session. Hand in all m-files and your diary.

```
function newton(x0,xtol,maxiter)
%
%  function which uses Newton's method to find the
%  roots of a given function funcf
%  xtol is the tolerance used for stopping
```

```
%  x0 is the starting guess for the method
%  maxiter is the maximum number of iterations allowed
%
%
k=0;
x1=x0-funcf(x0)/funcfp(x0);
%
%  do until convergence
%
while (abs(x1-x0)>xtol & k <= maxiter)
  x0=x1;
  x1=x0-funcf(x0)/funcfp(x0);
  k=k+1;
end
k
disp('the answer is ')
x1*180/pi

function y=funcf(x)
y=1.732*sin(x)-cos(x)+.25;

function y=funcfp(x)
y=1.732*cos(x)+sin(x);
```

Matlab Diary:

```
>> x0=30*pi/180

x0 =

    0.5236

>> xtol=.0001;
>> maxiter=50;
```

```
>> newton(x0,xtol,maxiter)


k =

     2

the answer is

ans =

   22.8198

>> diary
```