Phys234, 2018, Problem set #4: In-lab questions, Thursday lab

Question 1:

Find all the roots of the following functions $f(x)$ in the given interval:

a) $f(x) = \cos(5x) - x$ in the interval $-2\pi \leq x \leq 2\pi$
b) $f(x) = \sin(1/x)$ in the interval $\pi/50 \leq x \leq \pi/3$
c) $f(x) = \tan(x)$ in the interval $-2\pi \leq x \leq 2\pi$

Use the bisection method with the `bisect.m` function that we saw in class, with a tolerance of `1.e-15` for both the tolerance on f and and on x. *Do not alter the function* `bisect.m`. Submit your answers for each case in separate functions `ps4q1a`, `ps4q1b` and `ps4q1c` that follow the format given below. (You can download this template on eclass (problem set section) it is called **ps4q1_template.m**) You will need to create separate function m-files `f1a`, `f1b` to store $f(x)$ for cases (a) and (b) (and use the built-in function `tan` for (c)).

```
function ps4q1a
% ID:XXXXXXX, your name
% Solution to question 1a, problem set 4

% define tolerance on x and f
tolx=1.e-15;
tolf=1.e-15;

% get first root
xb = [a1,b1];  % bracket containing root
               %(a1 and b1 will have to be replaced by your choices)
x_root1 = bisect('your_function_name',xb,tolx,tolf);
        % 'your_function_name' is the name of the m-file containing f(x)
        % or the name the inline function (which you would need to define
        % earlier in this file)

% get second root
xb = ...
x_root2 = ...

 ...  % repeat for additional roots

% print out of my answer
fprintf('The 1st root is %15.8e \n', x_root1)
fprintf('The 2nd root is %15.8e \n', x_root2)
 ...  % repeat for additional roots

end
```

Question 2:

Find all the roots of the following functions in the given interval by using Newton's method with the `newton.m` function that we saw in class:

a) $\sin(x^2) + x^2 - 2x = 0.09$ in the interval $-1 \leq x \leq 3$
b) $(1-x)\sqrt{3+x} = 3.06\, x\, \sqrt{1+x}$ in the interval $0.1 \leq x \leq 10$

Use a tolerance of `1.e-15` on both f and x. *Do not alter the function* `newton.m`. You will need to create separate function m-files `f2a` and `f2b`, calculating the function and the derivative for each of these two cases (these are the function names that need to be supplied to the function `newton.m`). Submit your answer in a function `ps4q2` that follows the format of your answer files for Question 1.