Math 206 Project 3 **Due 8/19/2012 at 11:59pm**

What to Submit:

For this project you will need to create and submit a collection of six m-files. The first five are function m-files while the last is a script m-file.

`mypw.m`: A simple piecewise function.

`mytaylor.m`: A function approximator using the Taylor Expansion with a `for` loop.

`myleftright.m`: An integral approximator with a `for` loop.

`mynewton.m`: A root (x-intercept) approximator with a `while` loop.

`myimproper.m`: An improper integral approximator with a `while` loop.

`project3.m`: A script m-file marked up for publishing.

Grading Method:

For grading we will publish the `project3.m` m-file.

If there are any unexpected errors then the project will automatically earn a grade of 0 so make sure you try publishing your script m-file and check the output before submitting! Be very careful about making sure that any necessary symbolic variables are defined in your code. The assumption should be that we will publish your m-file from a clear matlab process. Assuming your script m-file publishes without error we will grade each question as correct or incorrect based upon its output.

The Function M-Files:

1. `mypw(a,b)` which takes two inputs:

   `a`: A real number.

   `b`: A real number.

   Returns: If $a > b$ then return a^2. If $a < b$ then return $b - a$. if $a = b$ then return b^2.

2. `mytaylor(f,a,b)` which takes 3 inputs:

   `f`: A function handle.

   `a`: A real number.

   `b`: A real number assumed to be close to `a`.

   Approximates $f(b)$ using the n^{th} Taylor Polynomial about $x = a$. You should use a `for` loop to calculate your answer explicitly, do not use any sneaky Matlab functions. Remember

   $$f(b) \approx f(a) + f'(a)(b-a) + \frac{f''(a)}{2!}(b-a)^2 + \frac{f'''(a)}{3!}(b-a)^3 + ... + \frac{f^{(n)}(a)}{n!}(b-a)^n$$

   Returns: The answer.

3. `myleftright(f,a,b,n)` which takes 4 inputs:

   `f`: A function handle.

   `a`: A real number.

   `b`: A real number assumed to be greater than `a`.

   `n`: A positive integer.

   Does: Approximates $\int_a^b f(x)\ dx$ using both the left sum and right sum with n subintervals and then averaging these two results together. Note that this is not the same as the midpoint sum.
   Returns: This approximation.

4. `mynewton(f,a,tol)` which takes 3 inputs:

   `f`: A function handle.

   `a`: A real number.

   `tol`: A real number assumed to be positive and very close to 0.

   Does: Approximates a root of $f(x)$ using the Newton-Raphson method with initial guess $x = a$ and proceeding until $|f(x)| < tol$.
   Returns: The final value of x.

5. `myimproper(f,a,tol)` which takes 3 inputs:

   `f`: A function handle.

   `a`: A real number.

   `tol`: A real number assumed to be positive and very close to 0.

   Does: Approximates $\int_a^\infty f(x)\ dx$ by finding $\int_a^b f(x)\ dx$ for $b = a, a+1, a+2, ...$ until successive values differ by less than tol.
   Returns: The final integral value.

The Script M-File:

The script m-file is called `project3.m` and should execute the following commands in order. This script m-file should be marked up for publishing in the following way:

Each command should be within its own section (use `%%`) and be preceded by a brief description (use `%`) describing what that particular command does in your own words using full sentences. Make sure at least one of your descriptions uses numbered lines in some way and another uses bullets. Use boldface and italics if you wish. Be creative! The commands to execute in order are:

```
mypw(@(x) 5,7)

mypw(@(x) 10,2)

mypw(@(x) 6,6)

mytaylor(@(x) sqrt(x),9,10)

myleftright(@(x) sqrt(x^3+1),0,4,8)

mynewton(@(x) x^3-10,7,0.0001)

myimproper(@(x) 1/x^2,3,0.0001)
```