CHE 581
Assignment 4
Due: 18 February 2019

21.13
21.28

Additional Problem

For the following function f(x),

```
f=@(xx) sin(50.*xx).*xx.^2
```

Develop an "m" to compute its derivative on the interval x in (0,1). Assign the interval, the spacing h, and the function values using a command like:

```
x=linspace(0,1,n);
h = 1/n;
y = f(x);
```

Then, assign a "new" varible, xx, by

```
xx=x(2:n-1);
```

Assess the numerical derivatives only at the points "xx"; the advantage of using the interval defined by "xx" is that the necessary values of the function f will always be defined, regardless of which kind of derivative you need to compute. In other words, there is always an f(1) and f(n) defined because of the way that "xx" is defined.

Using this as a starting point, please do the following.

(a) Compute the derivative of the function f for the points "xx" using n = 100. Compute the lowest-order forward, backward, and centered difference approximations to the function, and plot them on a single plot.

(b) For the three kinds of derivatives computed in (a), compute the true percent relative error, and plot it for each value of "xx". Note that the derivative of f(x) is:
```
g=@(xx) 50*cos(50.*xx).*xx.^2 + 2*sin(50.*xx).*xx
```

(c) Compute the derivative of the function f using the forward difference scheme only, but with n=10, 20, 40, and 100. Plot these using **points**, along with the exact derivative given by "g" above (as a **line**).

(d) Compute the true percent relative error for each value of "xx" associated with these values of n, and plot all four cases on one plot (plot as points).

(e) Using the centered difference, develop a code to compute the $O(h^4)$ accurate derivative. Feel free to restrict the domain like you did for "xx" to make this computation more tractable. Plot the results for the two derivatives on a single plot using n = 50. Compute the true relative percent error for the $O(h^2)$ and $O(h^4)$ centered difference schemes, and plot them.