HW 3 5131 Fall 2014 DUE SEPT 22

September 9, 2014

Put your answers neatly on these sheets. Attach any other worksheets and include the MATLAB code and figures - with your name on the pages.

Do the problems by hand and **check** the results whenever possible. However, you may wish to verify your results with MATLAB solutions to the problems when appropriate. You can use symbolic MATLAB to check results if you have access to it.

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Harman Chapters 1, 2, 6, 12 will be helpful.
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Problem 1 25 Points
Differentiate the following functions and show all steps.

1. $\ln \sqrt{\dfrac{x^2 + 1}{x^2 - 1}}$

2. 10^x

Problem 2 25 Points

Integrate the following

(a)

$$\int_{-\pi}^{\pi} x \cos nx \ dx$$

(b)

$$\int \sin(\alpha t) \ e^{j\omega t} dt$$

Problem 3 25 Points

An experiment yields a nonlinear curve

$$f(x) = z = 0.4x^3.$$

Do the following:

1. Linearize the function about the point $(2, 3.2)$ and write the equation for the approximate function $f^*(x)$.

2. What are the errors in the approximation at $x = 2$ and $x = 1$?

3. Plot the functions with MATLAB $f(x)$ and $f^*(x)$ from $x = 1$ to $x = 3$ on the same graph. Comment on the approximation and the errors at different values of x. Turn in the MATLAB code and the figure with labels indicating the meaning of the curves.

Problem 4 25 Points

MATLAB arclength You are to buy cable for a single-span suspension bridge that has a cable hanging in the form of a parabola $y = kx^2$. Write a MATLAB program to compute the **length in feet** of the cable for the bridge with the characteristics:

1. The distance between the supports is 1 mile.

2. The height of the cable (relative to its lowest point) is 1250 feet.