

## Math 229 Calculus Computer Lab Fall 10 Sample Midterm 1

- You may use only MATLAB during this exam. No calculators.

### Problem 1 (12 pts.):

Write a short MATLAB command to generate each of the following sequences.

- MATLAB command for 10, 15, 20, 25, ..., 300
- MATLAB command for 750 *evenly spaced* numbers from 24 to 263
- Write the MATLAB commands to assign  $x$  to be the first 50 square numbers,  $x = [1, 4, 9, 16, \dots, 2500]$ .

### Problem 2 (6 pts.):

Write MATLAB commands to plot the horizontal line  $y = 25$  for  $15 \leq x \leq 40$ .

(Make sure it's a solid line, not dots!)

### Problem 3 (12 pts.):

Convert the following MATLAB expressions to standard mathematical expressions. Use parentheses to clearly indicate the order of operations:

- $x - y ./ x + z$
- $\sin(x)^2 / 5 * \text{sqrt}(x)$
- $(x - y * (z + x)) ./ (y - x)$

### Problem 4 (12 pts.):

Convert each of the following expressions to its MATLAB equivalent:

- $x^{y^z}$

b.  $\frac{x}{\frac{y}{z}}$

c.  $\frac{\arctan^2 x}{8} + \frac{5e^{\sqrt{x}}}{3}$

**Problem 5** (10 pts.):

Suppose  $a$ ,  $b$ ,  $c$  are vectors with 100 elements. Each given MATLAB expression has unnecessary dots and/or parentheses. Choose the correct MATLAB expression with the fewest dots and parentheses.

Circle the correct MATLAB expression with the fewest dots and parentheses.

a.  $(a.+b).-(b+c)$   $\left\{ \begin{array}{l} 1.) (a+b)-(b+c) \\ 2.) a+b-(b+c) \\ 3.) a+b-b+c \\ 4.) (a+b)-b+c \\ 5.) a+(b-b+c) \end{array} \right.$

b.  $6.*(b^5)$   $\left\{ \begin{array}{l} 1.) 6*(b.^5) \\ 2.) 6*b.^5 \\ 3.) 6.*b.^5 \\ 4.) 6.*(b.^5) \\ 5.) 6.*b^5 \end{array} \right.$

c.  $a/(b/c)$   $\left\{ \begin{array}{l} 1.) a/b/c \\ 2.) (a/b)./c \\ 3.) a./b./c \\ 4.) a./(b./c) \\ 5.) (a./b)./c \end{array} \right.$

**Problem 6** (10 pts.):

Let  $f(x) = 2x^4 - 13x^2 - 30$ .

- a. Write the commands to compute the roots of  $f(x)$  using the `roots` function in MATLAB.

- b. How many roots are listed as the output of the `roots` function? \_\_\_\_\_
- c. What are the real root(s) (accurate to 4 decimal places)?

**Problem 7** (15 pts.):

Plot the following functions on the interval  $(\pi, 6)$ .

$$f(x) = \frac{\sin(11x)}{e^x} \qquad g(x) = \frac{\cos(11x)}{e^x}$$

- a. What command generates the  $x$ -values?
- b. What commands generate the  $y$ -values?
- c. What command plots the functions together on one graph?
- d. What is the number of local minima for each function? (Exclude end-points)

Number of local minima for  $f(x)$  is \_\_\_\_\_.

Number of local minima for  $g(x)$  is \_\_\_\_\_.

- e. What is the number of local maxima for each function? (Exclude end-points)

Number of local maxima for  $f(x)$  is \_\_\_\_\_.

Number of local maxima for  $g(x)$  is \_\_\_\_\_.

**Problem 8** (15 pts.):

Find the minimum (to two decimal places) of  $f(x) = \left( \cos(x) + \frac{1}{(x - \pi)^2} \right)$  on  $(0, \pi)$ .

Write the MATLAB commands you used to get your answer.

**Problem 9** (15 pts.):

Use MATLAB to find where the following functions are equal (to two decimal places). Write the MATLAB commands, and/or explain how you got your answer.

$$f(x) = 5 \cos(3x) \quad \text{and} \quad g(x) = -7x + 50$$