MATLAB.1

Texts:
[B-D] Boyce & Diprima, Elementary Diff. Eq. & B.V. Problems, 8th Ed
[P-A] Polking & Arnold, ODEs using MATLAB, 3nd Ed

A. Getting Started with MATLAB

Read Chapters 1 and 3 in Polking. Do this before trying to go on.

B. More on Functions

Once a function y=g(x) is defined with a M-file you now know how to graph it on an interval [a,b] using the plot command. First you partition [a,b]. Next you evaluate g at these values. The plot command then plots these vertices connecting them by lines to give a piecewise linear approximation to the graph of g.

Example: Plot sin(x^2) on [-1,4]. First we make an M-file.

```
************************************************************
function y=g(x)
y=sin(x.^2);
************************************************************
```

Go to the command window and type:

```
************************************************************
x=-1:.1:4;
plot(x,g(x))
title('y=sin(x^2)')
************************************************************
```

Note x=[-1, -.9,..,3.9,4] and g(x)=[g(-1),g(-.9),..,g(3.9),g(4)].
The graph is pretty crude because g oscillates more as x increases.
A second way to graph is with the command fplot.

Example: (continued)
Go to the command window and type:

```
************************************************************
fplot('g(x)',[-1,4])
************************************************************
```

One of the conveniences of fplot is, given g.m, it determines how fine the partition of [a,b] needs to be (what the vector x should

be) so that the piecewise linear approximation gives an accurate picture. A second feature of fplot is that it does not require g.m to be written with array smart notation as is required when using plot.

CAUTION!! Don't name a function y(x) (that is, use the file y.m); fplot will not plot it. Also fplot only recognizes "x" as the independent variable. So type "fplot('g(x)',[-1,4])", not "fplot('g(t)',[-1,4])" even if you used "t" as the independent variable in g.m.

ASSIGNMENT 1:

A. a) Let A= 1 7 B= -3 2 C= 3 4 1
0 -3 3 -2 -2 -1 4
0 -4 3

v=[3 5]' w=[2 -9]' x=[-4 3] y=[0 6 -3].

Note []' is the transpose of [].

Try to find the following combinations in MATLAB. Which are defined and which are not? Where a combination is not defined explain why.

A*A A*B A*C A.*A A+B A+C A./C A.\B

A*x x*A v*A x.*A A.*x y*C C*x C*y

A*v y.^2 y^2 A^2 x+y v*w x*w x.*w

b) Show that A= 1 -2 and B= -2 -3 commute.
0 3 0 1

c) Consider the initial value problem

z''(x) + 4*z(x)=0
z(0)=1
z'(0)=-2.

From Section 5.2 in [B-D] we have a power series representation for z(x):

z=a0 + a1*x + a2*x^2 + ...

where a0=z(0)=1 and a1=z'(0)=-2.
From Math 262 you can solve the i.v.p. exactly: z=cos(2*x) -sin(2*x)
(for a review of this see Chapter 3 in [B-D]).
First find a2 and a3. Then make M.files for the three functions

z2(x) = a0 + a1*x + a2*x.^2,
z3(x) = a0 + a1*x + a2*x.^2 +a3*x.^3, and
z(x) = cos(2*x) -sin(2*x) for x in [0,pi/2].

Plot the three curves on the same figure. Use different line styles
for each curve, and label the figure appropriately.

B. Graph f(x)=cos(x.^4) on [0,2].
  a) Use the plot command with subintervals of length h=.2.
  b) Use fplot.

FOR ALL OF YOUR MATLAB GRAPHING HOMEWORK FOR THIS COURSE TITLE YOUR GRAPHS.