

MATLAB.1

Texts:

[B-D] Boyce & DiPrima, Elementary Diff. Eq. & B.V. Problems, 7th Ed
 [P-A] Polking & Arnold, ODEs using MATLAB, 2nd 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 a M-file.

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

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```

Go to the command window and type:

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*****
```

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

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*****
```

Note $x=[-1,-.9,\dots,3.9,4]$ and $g(x)=[g(-1),g(-.9),\dots,g(3.9),g(4)]$.

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:

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```
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 :

$$\text{A. a) Let } A = \begin{bmatrix} 1 & 7 \\ 0 & -3 \end{bmatrix} \quad B = \begin{bmatrix} -3 & 2 \\ 3 & -2 \end{bmatrix} \quad C = \begin{bmatrix} 3 & 4 & 1 \\ -2 & -1 & 4 \\ 0 & -4 & 3 \end{bmatrix}$$

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

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.

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

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

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

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

b) Show that $A = \begin{bmatrix} 1 & -2 \\ 0 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & -3 \\ 0 & 1 \end{bmatrix}$ commute.

c) Consider the initial value problem

$$\begin{aligned} z''(x) + 4z(x) &= 0 \\ z(0) &= 1 \\ z'(0) &= -2. \end{aligned}$$

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

$$z = a_0 + a_1x + a_2x^2 + \dots$$

where $a_0 = z(0) = 1$ and $a_1 = z'(0) = -2$.

From Math 262 you can solve the i.v.p. exactly

$$z = \cos(2x) - \sin(2x) \quad (\text{for a review of this see Chapter 3 in [B-D]}).$$

First find a_2 and a_3 . Then make M.files for the three functions

$$z_2(x) = a_0 + a_1x + a_2x.^2, \quad z_3(x) = a_0 + a_1x + a_2x.^2 + a_3x.^3,$$

and $z(x) = \cos(2x) - \sin(2x)$ 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 $[0, 2]$.

- Use the plot command with subintervals of length $h = .2$.
- Use fplot.

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