

MATLAB Assignment # 1
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ECE 2010
Section B03



Due 10/27 9PM

MATLAB PROBLEM SET #1 ECE2010 B19

Working in MATLAB Command Window

Due Submission Online– Sunday Oct. 27th by 9 PM

Preamble

What is MATLAB?

Perhaps the most popular general-purpose engineering software package around the World.

What can I do in MATLAB?

Basic functions include data plotting and data processing. Many advanced functions and toolboxes cover all of college engineering and math, as well as multiple research tasks.

How to open MATLAB using Remote Desktop?

To access MATLAB (or any other programs) on a WPI server from a Microsoft Windows PC:

1. Open “Remote Desktop Connection” from the Start menu (usually under Accessories).
2. Type in the name of a WPI server. You will typically use one of the following:
 - **matlab01.wpi.edu**
 - **matlab02.wpi.edu**
 - **windows.wpi.edu**
3. Log into the remote server with your username and password.
4. Open MATLAB R2019a from the desktop or start menu.
5. The servers can convert files into .pdfs via a program’s Print command. This will be useful if you would like to convert your work into a .pdf in order to submit it.

How to install MATLAB on a Personally-Owned Machine?

To install a stand-alone version of MATLAB on your own machine please follow instructions from <https://its.wpi.edu/software/482/matlab>

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Pdf format

Working in MATLAB Command Window

What is MATLAB Command Window?

MATLAB can operate directly from the Command Window, **very similar to an advanced calculator**. No MATLAB scripts or programs are necessary in this case. The Command Window is shown in Fig. 1. For example, open MATLAB and type 2+2 (or 2 + 2 since spaces do not matter) in the Command Window, then hit ENTER.

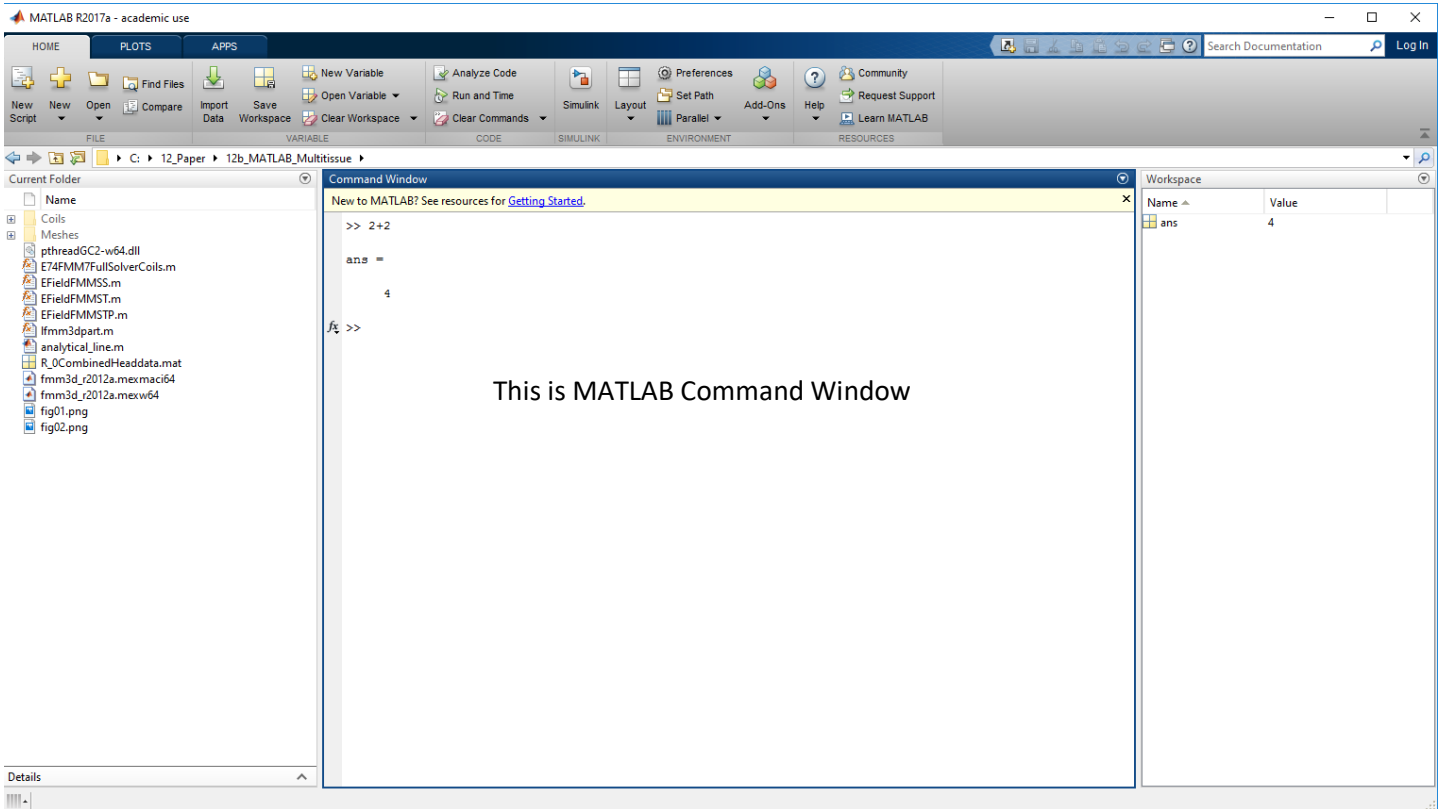


Fig. 1 MATLAB Command Window as it appears after opening MATLAB. This layout may change from version to version; you could customize it as well.

The following sets of short problems review some basic operations in MATLAB (basic syntax, arrays). **You will be working in MATLAB command window only**. You could use this Word document as a template and type or paste your answers. Finally, please convert it to PDF format.

Problem 1 Basic syntax (originally from Mechanical Engineering, MIT)

Evaluate the following mathematical expressions in MATLAB (you may want to use the [Help Menu](#) from the top toolbar (type `MATLAB Operators`) in order to see the prototypes of the following functions: `^`, `pi`, `nthroot`, `exp`, `ln`, `log10`, `tan`, **imaginary unit *i* or *j***, etc.). Display your evaluations by omitting semicolons at the end of your lines.

- a. $2 + 2$
- b. $2018 - 2010 + 95.4$
- c. 3.5^3
- d. $\frac{14}{13} - \pi/2$
- e. $\sqrt{3^3 - \frac{50}{7}}$
- f. $\ln(10)$
- g. $\log_{10}(5)$
- h. $\sin\left(\frac{\pi}{6}\right) + \cos\left(\frac{\pi}{6}\right) - \tan\left(\frac{\pi}{6}\right)$
- i. $\frac{1+i}{1-i}$ or $\frac{1+j}{1-j}$

Your report should include:

- 1. A line of the MATLAB code that does the job.
- 2. Numerical answer (preferably in red or blue).

a.	4
b.	103.4000
c.	42.8750
d.	-.4939
e.	9.9286
f.	2.3026
g.	0.6990
h.	0.7887
i	0.0000 + 1.0000i

Problem 2 Basic array operations (originally from Bucknell)

A. Given a linear array $x = [1 \ 3 \ 5 \ 7 \ 2 \ 4 \ 6]$ (a row vector; type this vector **directly** in the MATLAB Command Window), explain what the following commands "mean" by summarizing the net result of the command.

```
a. x(3)
b. x(end)
c. x(2:4)
d. x(end:-1:1)
e. length(x)
f. size(x)
g. sort(x)
h. mean(x)
i. x'
j. x-0.5
```

Your report should include the result (copy and paste from the MATLAB Command Window) and its brief explanation in one sentence.

a.	5 Gives the 3 rd number in the array
b.	6 End number in array
c.	3 5 7 2 nd and 4 th number in the array
d.	6 4 2 7 5 3 1 Reads the array in reverse
e.	7 The count of the number
f.	1 7 The length reads the first and last digit of the array
g.	1 2 3 4 5 6 7 Sorts them in numerical order
h.	4 Mean of the array
i.	1 3 5 7 2 4 6 Puts the digits them in a vertical format
j.	0.5000 2.5000 4.5000 6.5000 1.5000 3.5000 5.5000 Subtract .5 from all values from the array

B. Given an array $A = \begin{bmatrix} 1 & 3 & 5 \\ 2 & 1 & 7 \\ 0 & 1 & 0 \end{bmatrix}$ (a square matrix), provide the commands needed to:

- assign the first row of A to a row vector called x1
- assign the second column of A to an array called y1
- compute determinant of A ((hint: use function `det`)
- compute the sum of every column of A (the result is a row vector)
- compute the sum of every row of A (the result is a column vector)
- solve a system of linear equations $Ax=b$ where $b = [0 \ 1 \ 1]'$ (hint: use function `linsolve` or left matrix divide; type `help linsolve` for more info)

Your report should include:

- A line of the MATLAB code that does the job.
- Numerical answer.

a.	<pre>x1 = [1 3 5]</pre> <pre>x1 =</pre> <pre>1 3 5</pre>
b.	<pre>y1 = [1 2 0]'</pre> <pre>y1 =</pre> <pre>1</pre> <pre>2</pre> <pre>0</pre>
c.	<pre>det(A)</pre> <pre>3.0000</pre>
d.	<pre>S = sum(A)</pre> <pre>S =</pre> <pre>3 5 12</pre>
e.	<pre>S = sum(A,2)</pre> <pre>S =</pre> <pre>9</pre> <pre>10</pre> <pre>1</pre>
f.	<pre>A = magic(3);</pre> <pre>B = [0; 1; 1];</pre> <pre>x = A\B</pre> <pre>x =</pre> <pre>-0.0806</pre> <pre>0.1278</pre> <pre>0.0861</pre>

C. Given three arrays/matrices $x = [1 \ 2 \ 1]$, $y = [8 \ 2 \ 1]$, $M = [1 \ 2 \ 0; 2 \ 2 \ 1]$, determine which of the following statements will correctly execute and provide the result. If the command will not correctly execute, state why it will not. Using the command `whos` may be helpful here.

- a. `3*x - 2*y`
- b. `x.*y`
- c. `x./y`
- d. `cos(x).*cos(y)`
- e. `M.*M/3`
- f. `M*M`
- g. `M + x`
- h. `M + repmat(x, 2, 1)`
- i. `x.*y - times(x, y)`
- j. `x./y - rdivide(x, y)`

Your report should include the operation result or an explanation why the operation did not work.

a.	<p>Error: Invalid text character. Check for unsupported symbol, invisible character, or pasting of non-ASCII characters.</p> <p>It needs to multiple the 2 matrices out separately first and not do them together parenthesis needed</p>
b.	<p><code>x.*y</code></p> <p>ans =</p> <p>8 4 1</p>
c.	<p><code>x./y</code></p> <p>ans =</p> <p>0.1250 1.0000 1.0000</p>
d.	<p><code>cos(x).*cos(y)</code></p> <p>ans =</p> <p>-0.0786 0.1732 0.2919</p>
e.	<p><code>M.*M/3</code></p> <p>ans =</p> <p>0.3333 1.3333 0 1.3333 1.3333 0.3333</p>
f.	<p>Error using <code>*</code></p> <p>Incorrect dimensions for matrix multiplication. Check that the number of columns in the first matrix matches the number of rows in the second matrix. To perform elementwise multiplication, use <code>.*</code>.</p> <p>Matrices can't be multiplied if they have a dimension that doesn't supported by multiplying. The number of columns in the 1st one equals the number of rows in the 2nd one.</p>

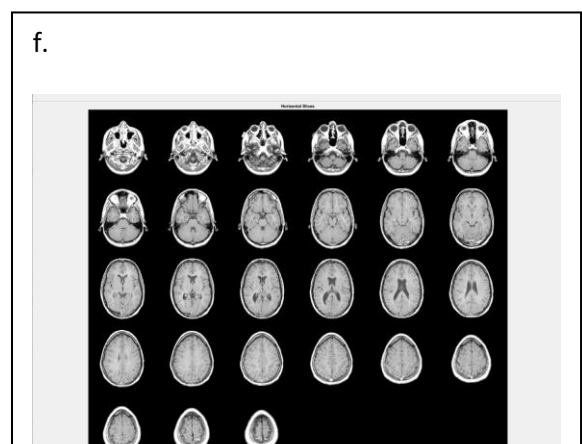
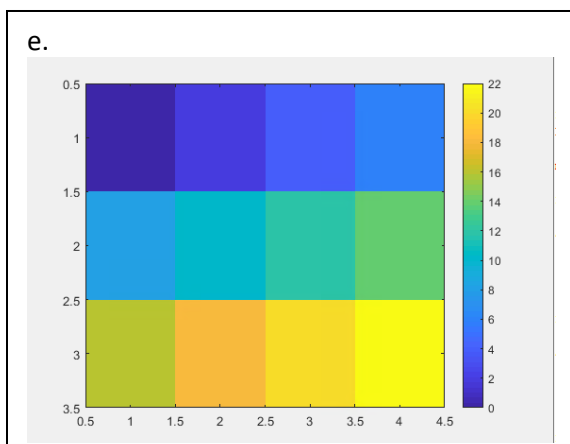
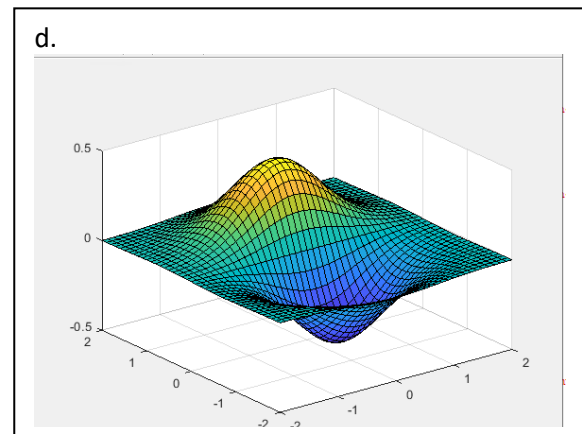
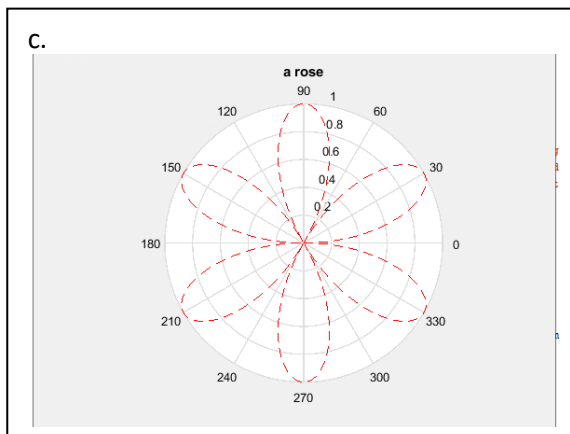
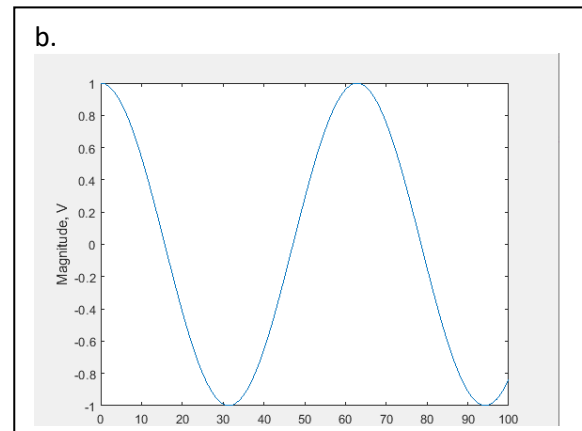
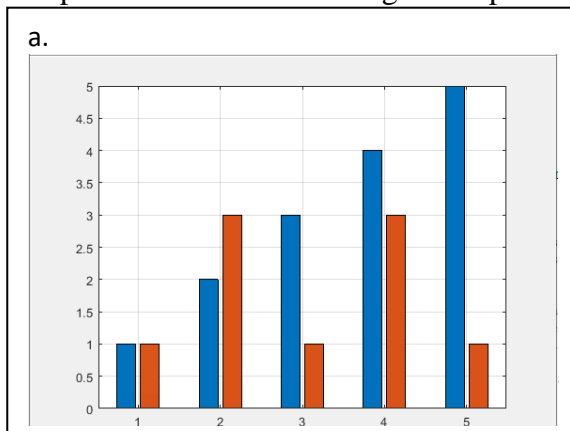
g.	<pre> M + x ans = 2 4 1 3 4 2 </pre>
h.	<pre> M + repmat(x, 2, 1) ans = 2 4 1 3 4 2 </pre>
i.	<pre> x.*y - times(x, y) ans = 0 0 0 </pre>
j.	<pre> x./y - rdivide(x, y) ans = 0 0 0 </pre>

Problem 3 Basic plotting operations

Execute the following commands and present MATLAB figures so generated.

- ```
a. x = [1 2 3 4 5; 1 3 1 3 1]'; bar(x, 'grouped'); grid on
b. y = [0:100]; z = cos(0.1*y); plot(y, z); xlabel('Time, ms'); ylabel('Magnitude, V')
c. t = [0:.01:2*pi]; polar(t, abs(sin(3*t)), '--r'); title('a rose')
d. [X Y] = meshgrid([-2:0.1:2], [-2:0.1:2]); surf(X, Y, Y.*exp(-Y.^2-X.^2))
e. C = [0 2 4 6; 8 10 12 14; 16 18 20 22]; image(C, 'CDataMapping', 'scaled'); colorbar;
f. load mri; montage(D, map); title('Horizontal Slices');
```

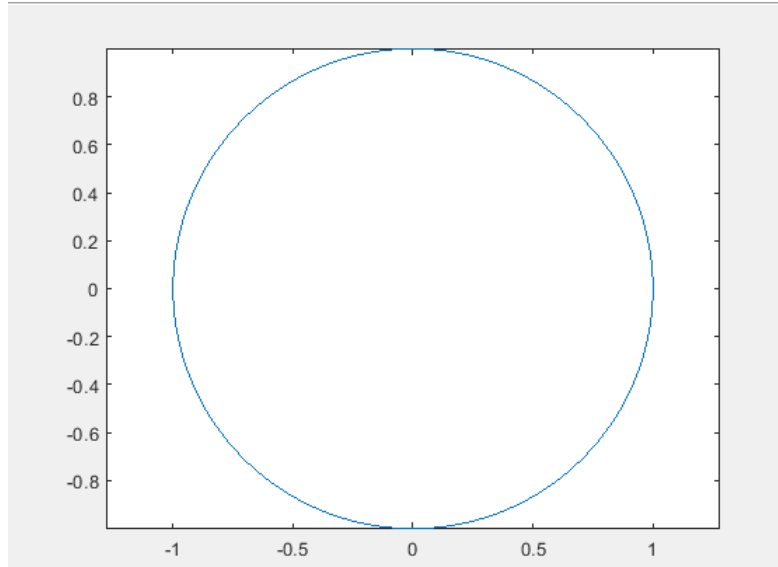
Your report should include the figure snapshots:



#### Problem 4 Basic plotting operations (cont.)

Based on any of the codes from Problem 3, try to plot a circle in MATLAB. Present your code (and your figure) here:

Code:  
`angle = linspace(0, 2*pi, 360);`  
`>> x = cos(angle);`  
`>> y = sin(angle);`  
`>> plot(x, y)`  
Figure:



Your report (a PDF document uploaded to CANVAS by 9 PM on this coming Sunday) should include:

- i. A title page with your name and section number;
- ii. This completed document with all the results.