

# MATH 2221 A Mathematics Laboratory II

## Lab Assignment 3

Name: \_\_\_\_\_

Student ID.: \_\_\_\_\_

In this assignment, you are asked to run **MATLAB** demos to see **MATLAB** at work. The color version of this assignment can be found in your own **H:**\ drive.

### Instructions

1. Start **MATLAB**, until you see a window with the **MATLAB** prompt `>>`. This window is called the **Command Window**.
2. After you started have **MATLAB**, you will automatically be in the directory **H:**\. Please enter `diary on` after the **MATLAB** prompt `>>` only once to record all your work in **H:**\diary. No marks will be given if no diary is found.
3. Enter `demo` after the prompt `>>`. You will see a new window with many things to play with. This is the **Demo Window**.
4. In the **Demo Window**, try to locate figures or problems similar to those in the exercises below. Then locate the commands that generate these figures or problems. Try them in the **Command Window**. Just enter (or cut and paste) the commands after `>>` to see what happens.
5. You should write your results on the lab sheet provided, and save the figures in the **H:** drive, in your personal drive.
6. Please read and sign the following declaration before handing in your assignment. Otherwise, no marks will be given.

I declare that the assignment here submitted is original except for source material explicitly acknowledged. I also acknowledge that I am aware of University policy and regulations on honesty in academic work, and of the disciplinary guidelines and procedures applicable to breaches of such policy and regulations, as contained on the website <http://www.cuhk.edu.hk/policy/academichonesty/>

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

1 (10 marks)		4 (20 marks)	
2 (30 marks)		5 (20 marks)	
3 (20 marks)			
		Total	/100 pts

Please read the following carefully:

**General Guidelines for Lab Assignment Submission.**

- Please sign and date the statement of Academic Honesty.
- Please go to the class and lab indicated by your registered course code via the CUSIS system. If you go to a different lab than the one you are registered for, you will not receive credit for the assignment even if you completed it.
- Write your COMPLETE name and student ID number legibly on the cover sheet (otherwise we will not take any responsibility for your lab). Please write your answers using a black or blue pen, NOT any other color or a pencil.
- Write your solutions on a double-sided printout of this pdf file. Try to fit your answers inside the available space.
- The use of computers/cellular phones/graphing calculators/iPads will NOT be permitted during tests and lab assignments. Please do not use our lab computer to recharge your cell phone battery.
- In order to make it fair for all students, during the labs and tests, if you touch/press any icons on your cellular phone, our TA will check your phone to determine whether or not you are exchanging messages with another student. If you are found cheating (in the tests or in the lab or on homework assignments), you will automatically get an F grade in this course and your act will be reported to the Department for necessary disciplinary actions.

## Exercises

1. (10 marks) Use **polar** to plot the following heart curve

$$r = 2 - 2 \sin \theta + \sin \theta \frac{\sqrt{|\cos \theta|}}{1.4 + \sin \theta},$$

where  $\theta \in [0, 2\pi]$  with increment  $\frac{\pi}{50}$ .

Save your graph by using the command `print('q1.eps', '-depsc')`. Write down all the MATLAB commands.

```
clear all
theta = 0 : pi/50 : 2*pi;
rho = 2 - 2*sin(theta) + ...
sin(theta).*sqrt(abs(cos(theta)))./(1.4 + sin(theta));
polar(theta, rho);
print('q1.eps', '-depsc');
```

2. (30 marks) Plot  $\sin(x)$  for  $x \in [-\pi, \pi]$  with different increment and line type in the **SAME** graph:

- (a) Increment is  $\frac{\pi}{100}$  with blue solid line and width of the line as 1 pt;
- (b) Increment is  $\frac{\pi}{10}$  with red dash-dot line and width of the line as 2 pt;
- (c) Increment is  $\frac{\pi}{2}$  with cyan dashed line and width of the line as 3 pt.

Use **legend** to add the legend for the 3 curves as “Curve 1”, “Curve 2” and “Curve 3” respectively at the bottom-right corner of the graph and display the grid line. Also use **text** to add the name “Sine function” at the point  $(-3, 0.6)$  on the graph.

Save your graph by using the command `print('q2.eps', '-depsc')`. The figure you draw should be like Figure 1.

Write down all the MATLAB commands and briefly explain why the curves from same function aren't the same.

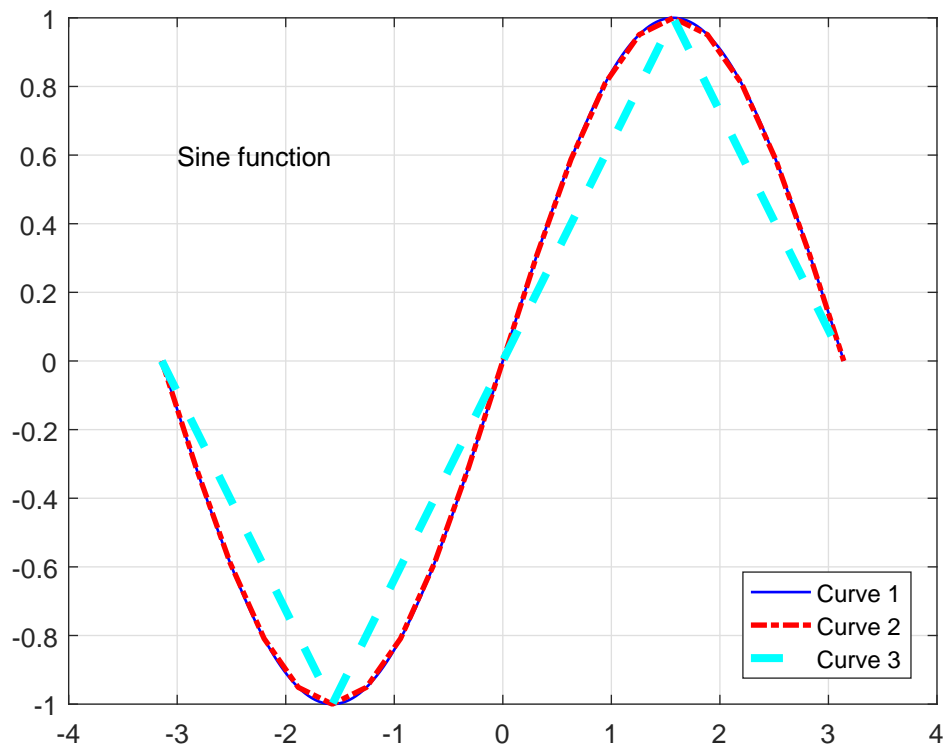


Figure 1: q2.eps

```
clear all
x1 = -pi : pi/100 : pi;
x2 = -pi : pi/10 : pi;
x3 = -pi : pi/2 : pi;
plot(x1, sin(x1), 'b-', 'lineWidth', 1);
hold on
plot(x2, sin(x2), 'r-.', 'lineWidth', 2);
plot(x3, sin(x3), 'c--', 'lineWidth', 3);
grid on
text(-3, 0.6, 'Sine function');
legend('Curve 1', 'Curve 2', 'Curve 3', 'Location', 'southeast')
print('q2.eps', '-depsc');
hold off

% The grid for each curve is not the same, that means
% the discrete form of sin function is different. Therefore,
% please pay attention on the grid when plot or create
% a function.
```

3. (20 marks) Use **subplot** to plot two Legendre polynomials for  $x \in [-1, 1]$  with increment 0.05 into an 1-by-2 grid of graphs.

(a)  $P_2(x) = \frac{1}{2}(3x^2 - 1)$ ;

(b)  $P_2(x) = \frac{1}{2}(5x^2 - 3x)$ .

Add a subtitle  $P_1(x)$  and  $P_2(x)$  to each graph. The two curves should be marked with plus sign (o) and circle (x) respectively.

Save your graph by using the command `print('q3.eps', '-depsc')`. The figure you draw should be like Figure 2. Write down all the MATLAB commands.

```
clear all
x = -1:0.05:1;
figure;
subplot(1, 2, 1)
plot(x, (3*x.^2-1)/2, 'o');
title('P_1(x)')
subplot(1, 2, 2)
plot(x, (5*x.^3 - 3*x)/2, 'x');
title('P_2(x)');
print('q3.eps', '-depsc')
```

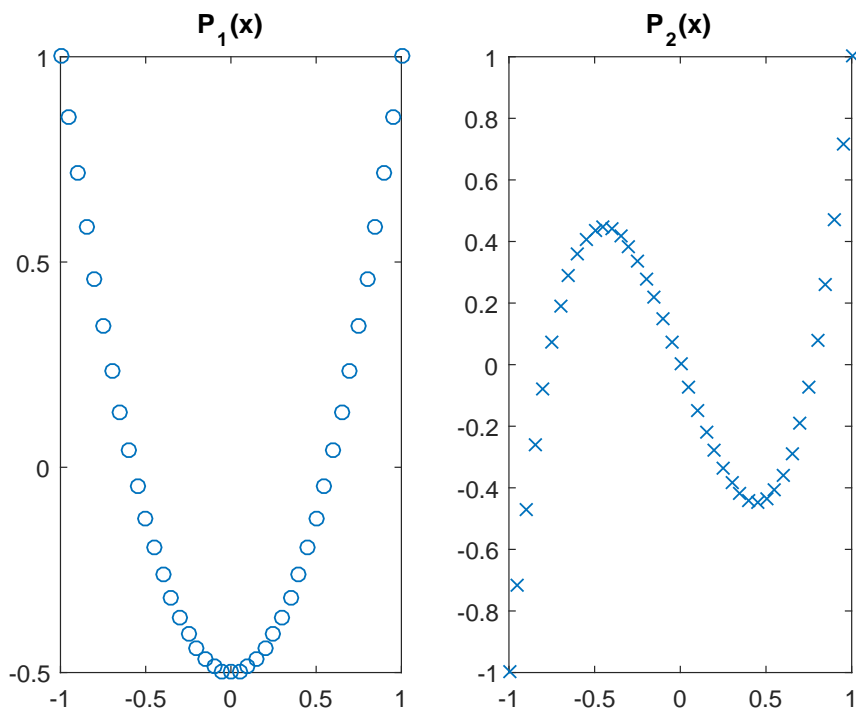


Figure 2: q3.eps.

4. (20 marks) Use **subplot** to plot the natural logarithm  $\ln x$  for  $x \in [0, 1]$  with increment 0.01 by different Graphic commands.
- (a) Creates a plot using a linear scale both for  $x$ -axis and  $y$ -axis;
  - (b) Creates a plot using a logarithmic scale for the  $x$ -axis and a linear scale for the  $y$ -axis;
  - (c) Creates a plot using a linear scale for the  $x$ -axis and a logarithmic scale for the  $y$ -axis;
  - (d) Creates a plot using a logarithmic scale for both the  $x$ -axis and the  $y$ -axis.

Display the grid line for each subfigure.

Save your graph by using the command `print('q4.eps', '-depsc')`. Write down all the MATLAB commands.

```
clear all
x = 0 : 0.01 : 1;
subplot(2, 2, 1);
plot(x,log(x));
grid on
subplot(2, 2, 2);
semilogx(x, log(x));
grid on
subplot(2, 2, 3);
semilogy(x, log(x));
grid on
subplot(2, 2, 4);
loglog(x, log(x));
grid on
print('q4.eps', '-depsc')
```

5. Use **bar** and **pie** to plot two statistic graphs on world population by continents. Data is given in Table 1.

Table 1: World population by continents (in millions).

Asia	Europe	Africa	North America	South America
3332	696	694	437	307

- Plot pie graph and label the slices by the continents' name;
- Plot bar graph and label all bar by continents' name.

Hint: As for labelling in bar graph, `set(gca, 'xticklabel', label)` can be used. `label` is a set of string representing the continents' name.

Save your graphs as the name 'q5\_1.eps' and 'q5\_2.eps' respectively.

Write down all the MATLAB commands.

```
clear all
label = {'Asia', 'Europe', 'Africa', ...
        'N. America', 'S. America'};
x = [3332 696 694 437 307];
figure;
pie(x,label)
print('q5_1.eps', '-depsc')
figure;
bar(x)
set(gca, 'xticklabel', label)
print('q5_2.eps', '-depsc')
```