

MATLAB TUTORIAL

1. Simple Commands

In this section, we review the commands discussed during the discussion section held on 01/25. The following are the five basic operations of numbers: addition, subtraction, multiplication, division, and exponentiation. The results of the code is given next to the code as a comment `%=`.

```
3+5 %=8
10-3 %=7
7*2 %=14
15/3 %=5
2^4 %=16
```

If one ends the line with a semicolon `;`, one can hide the output of the computation. Next, we have introduce predefined functions and constant.

```
sin(x) %sine function
cos(x) %cosine function
exp(x) %exponential function
```

```
pi
```

The exponential function is defined as $\exp(x) = e^x$. Sine function, cosine function, and the constant $\pi (= \pi)$ should be self-explanatory.

To define a function, one must first symbolize $f(x)$ using `syms`. Then you can define $f(x)$ as a function in terms of x . Differentiation is shortened to `diff` and integration is shortened to `int`.

```
syms f(x)
f(x) = 3x^2
diff(f(x),x) %=6x
int(f(x),x) %=x^3
int(f(x),x,1,3) %=26
```

The variable x for the second input is the variable you are differentiating (resp. integrating). This becomes important when you take multivariable calculus. For definite integral, the third and fourth input gives you the bound. When $f(x)$ is complicated so that the computer cannot found a formula for the integral of $f(x)$, the output of `int(f(x), x, 1, 3)` may be simply `int(f(x), x, 1, 3)`. To get a numerical answer, one must apply `vpa`, i.e. `vpa(int(f(x), x, 1, 3))` or use `vpaintegral(f(x), x, 1, 3)`.

Finally, the first `%% ...` will be the title of your pdf. Remember to have a space between the double percentage and your title, e.g. `%% Title`. After that `%% Section Title` will be your section titles. You then have the option to run the script by section. Use this format to separate the problems. For sub-problems, use `% Problem x.x`.

2. Practice Problems

Write a MATLAB script for the following problems.

Problem 1. Let

$$f(x) = \frac{e^{\sin(x) - \cos(5x)}}{\sin^4\left(\frac{x}{2}\right)}.$$

(a) Find the derivative $f'(x)$.

(b) Find

$$\int_{\pi/2}^{\pi} f(x) dx.$$

Problem 2. Let

$$v = [5 \ 7] \quad \text{and} \quad A = \begin{bmatrix} 2 & 3 \\ 5 & 6 \end{bmatrix}.$$

Compute A^5 , vA and $v \cdot v$ (dot product).

3. Code for Practice Problems

```
%% Sample Practice Problem Answers
%% Problem 1

syms f(x)
f(x) = exp(sin(x)-cos(5*x))/(sin(x/2))^4;

% Problem 1.a

diff(f(x),x)

% Problem 1.b

int(f(x), x, pi/2, pi)
vpa(int(f(x), x, pi/2, pi)) %To get numerical answer

%% Problem 2
v=[5 7];
A=[2 3; 5 6];

A^5
v*A
dot(v,v)
```