```
% Topic 1. MATLAB basics
% 1.1 help name, see slide 15
% 1.2 semicolon, suppress output

% 1.3 variables
a=4; b=[1 2 3];
S0=50; r=0.01; % S0 = initial stock price; % r = interest rate
% 1.4 preserved constants: ans, eps, inf, NaN, pi
% answer, precision value, infinity, not a number, pi=3.14...

% 1.5 Basic Operations
% +, -, *, /,^, .,', \
% Example 1, see slide 10 and 12
A=[1 2; 3 4];
A^2; % A*A
A.^2; % this is not matrix multiplication, it is square element by element
A=[1 2; 3 5];
B=[-5 2; 3 -1];
A*B;
A.*B;

% Example 2, see slide 11 and 25
A=[1 2 3; 4 5 6];
size(A);
[m n]= size(A);
length(A);
A'; % transpose
A=[1+i, 2+2i, 3+3i];
A'; % transpose and conjugate of complex numbers
A.'; % transpose

% Example 3, see slide 9
A=[1 2 3; 4 5 6];
test = A*A; % error, dimensions must agree
test = A*A';

% Example 4, see slide 13
A=[1 15 4;2 15 20; 3 30 9];
b=[1;22;9];
x=A\b; % Ax=b; to solve the x, take the inverse matrix A, x=A^-1*b;
x=inv(A)*b;

% 1.6 clearing, see slide 18 and 19
close all; clear; clear all; clc;
clearvars -except b c; clear X; clear X*; % clear variables

% 1.7 format long,format short,format short e, see slide 21
1/3;
format long;
1/3;
format short;
format short e;

% 1.8 comments (ctrl R) and uncomments (ctrl shift R)
```

```
% Topic 2. Vectors and Arrays
% create vectors/array (function: linspace, eye, zeros, ones, logical, random
(uniform dist), random (normal dist), diag)

% 2.1 Euler's method/truncation
%  Example 1: known step length (step 0.1)
a= 0:0.1:1;
%  Example 2: known pieces (10 pieces)
b= linspace(0,1,10);

% 2.2 eye
eye(5);

% 2.3 zeros, see slide 24
% 2.4 ones, see slide 24
% purpose: placeholder, calculate more efficient
m1=zeros(1,3);
m2=ones(3);

% 2.5 concatenate vectors
% Example 1
a=[1 2 3];
b=[4 5 6];
c=[1 2 3; 4 5 6];
d=[a;b];

% Example 2
m=[1 2 3; 7 8 9];
n=[4 5 6; 5 6 7];
p=[m;n];
q=[m n];

% 2.6 Indexing (numeric, slicing, logical (T/F))
% Example 1
a=[1 2 3 4 5;6 7 8 9 10; 11 12 13 14 15];
a(3,5);
a(7); % extract 7th element

% Example 2
a=[1 2 3 4 5;6 7 8 9 10; 11 12 13 14 15];
a(:,2:3);
a(2:3,:);
a(:,[1 3 5]);

% Example 3, see slide 24
m1=zeros(1,3);
m2=ones(3);
m3(1:2,:)=[m2(3,:);[1:1:3]];
m3(2:3,:)=[m1(1,:);[1:1:3]];
clear all; clc;
m1=zeros(1,3);
m2=ones(3);
m3(2:3,:)=[m2(3,:);[1:1:3]];

% Example 4, see slide 28
A=1:9;
tf=(A>2)&(A<6);
```

```
% 2.7 random (uniform distribution and normal distribution)
% Important for MATH4090/MATH7049
% Monte Carlo Simulation, use rand, create all random pricing
% used to model the probability of different outcomes in a process that cannot
easily be predicted due to the intervention of random variables.
% It is a technique used to understand the impact of risk and uncertainty in
prediction and forecasting models.
rand (); % create different values every time
randn(); % create different values every time
rand(5,1); % create different vectors every time
rng(1); % to fix the first set of the values

% 2.8 diagonal
a=magic(5);
sum(magic(5));
diag(a);
diag(a,-1);
diag(a,0);
diag(a,3);

% Topic 3. Programming basics
% For Loops, While Loops, IF else statements
% 3.1 Scripts, see slide 30 and 31

% 3.2 Functions, see slide 32-34
% cannot run the function file
% function[delt, price] = tree_fast(S0, K, T, r, sigma, opttype, Nsteps)

% 3.3 For Loops, see slide 26
x=[3 6 4 1 5];
length(x);
for i=1:length(x)
    y(i)=x(i)^2;
end

% 3.4 While Loops, see slide 26
x=5;
while x>1
    x=x-1;
end

% IF statements, see slide 27
x=80;
if x>=85
    GPA=7;
elseif x<85 && x>=75
    GPA=6;
elseif x<75 && x>=65
    GPA=5;
end
GPA;
```

```
% Topic 4. Graphics and Plots
% 4.1   2-D plots
% Example 1, see slide 39,40
x = [1:1:10];
y_lin = x;
y_quad = x.^2;
subplot(2,1,1), plot(x,y_lin,'bo:');
title('Linear Function');
xlabel('X axis');
ylabel('Y axis');
subplot(2,1,2), plot(x,y_quad,'r+-');
print -deps fig1.eps;

% Example 2, see slide 41,42
clear all;
clc;
close all;
x=linspace(1,10,10);
y_lin = x;
y_log = logspace(0,1,10); % 10^[ equally spaced 0..1 ]
plot(x,y_lin,'*-.');
hold on;
plot(x,y_log,'x--');
axis([0 15 0 11]);
legend('linear', 'exponential');
```