Matlab

Matrices

shortcuts:-
clc: cleans the screen
who: shows variables
clear: deletes all variables

a = [1 2 3 4]

- matrix with one line (row)

a = [1 2 3 4]' = a'

- matrix with one column

- To know a matrix length use:
  length (matrix name)

- To multiply element by element
  a.*b
- To squane a matrix:
  a.^2 ← can be 3, 4, ---
- Transpose of a matrix
  a'
- To cut specific rows or columns

old matrix →

B = A([1 2] , [3 4])

B ← new matrix

[1 2] ← الصف الأول والصف الثاني

[3 4] ← العمود الثالث والعمود الرابع

- interchanging

  C = A ([3 2 1], :)

  هناحط الصف الـ 3 أولاً ثم الـ 2 معلو بحل الصف الـ 1 بصير آخر اشي

- To delete a certain row

  A(2, :) = [ ]

- To delete a certain column

  A(:, 2) = [ ]

- To get all columns sequenced

  C(:)

- To change a matrix to diagonal matrix

  D = diag(d)

  d = [1 2 3] ⇒ D = $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

- To solve equations (linear) using matrices

  $2x + 2y - z = 10$

  $-x + 3y + 2z = 5$

  $x - y - z = -1$

  $a = \begin{bmatrix} 2 & 2 & -1 \\ -1 & 3 & 2 \\ 1 & -1 & -1 \end{bmatrix}$ $b = \begin{bmatrix} 10 \\ 5 \\ -1 \end{bmatrix}$

  so x, y, z :-

  X = a\b

- solving an equation using matlab

  solve ('eq', 'var')

  هون المعادلة ← ، المتغير الي بحل بالنسبة اله

- To round

  vpa (ans, 3)

  ← الجواب الي مطلوب تقريبه ، منازل التقريب

• To define a function

f= inline (' eq ' , ' x ')

بعدها بقدر اعوض أي رقم بدي ياه
مثلاً f(205)

Syms → تستعمل لتعريف

• To differentiate

diff ('eq' , ' y ')

1, 2, 3 ← درجة الاشتقاق

• To find extreme values of a function

Steps to Solve:

1- find f' : diff (function)
2- Solve for zero : solve (function)
3- Take answers (and put in second derivative (diff (fun, 2))
   If Ans > 0 → Min
   If Ans < 0 → Max
4- put in f to find y points

• To integrate :- syms x لازم أعمل بس

→ with limits

int (, , 0 , 1)

function ( ) مشتقة التكامل

حدود التكامل 0 و 1 من 0 لـ 1

→ without limits

int ( )

الاقتران

• To solve equations :-

$x^2 + x + y^2 = 2$

$2x - y = 2$

[x y] = solve (' ' , ' ' , ' ' , ' ')

eq1 eq2 1st var 2nd var

• Double integration

syms x y

int (int (function , y , ,) , x , ,)

order أول حد أول حد ثاني order ثاني حد أول حد ثاني

• limits:

limit (Function , x ,)

المتغير تقترب من

• Solving differential eqs

dsolve ('Dy-1' , 'x')

equation

y' - 1

يعني الجواب يكون y = x + c2

→ with initial ~~equation~~ condition

dsolve ('eq' , 'IC' , 'x')

ex dsolve ('Dy - 1' , 'y(1) = 5' , 'x')

- 2nd order derivative eqs

dsolve ('D2y - 3*Dy + 2*y', 'x')

→ Initial condition

dsolve ('...', 'IC1', 'IC2', 'x')

Plotting :-

to plot $y = x^2$

- put a range of x : x = 0:0.01:1 (Increment, Domain)
- y = x.^2 (for x as a matrix)
- plot (x, y)
- to put a title
  title (' ')
- to put a title for axis
  xlabel (' ')
- to make range x = range y
  axis ('square')
- to draw more than one function using same range

plot (x, y, x, y1, x, y2 ----)

(y → 1st fun, y1 → 2nd fun, y2 → 3rd fun)

- Subplot

subplot (2, 2, 1) ← رسم رقم 1

رسم (under the first 2)

2x2 window

plot (x, y₁) ← هي تكون اول رسمة

- Different shapes of drawing

y	yellow	.	point
m	magenta	o	circle
c	cyan	x	x-mark
r	red	+	plus
g	green	-	solid
b	blue	*	star
w	white	:	dotted
K	Black	-.	dash dot
		--	dashed

- markersiz

بستخدم لتكبير الخط في الرسمة

- Drawing in 3D

- 3D line plots

syntax: plot3 (x, y, z)

x, y, z : vectors or matrices

→ helix 

```
t = linspace (0, 10*pi)
plot3 (sint, cost, t)
text (0,0,0, 'origin')
```

linspace: بقسم الفترة لـ 100 قسم

grid on ← تحط grid بالخلفية عشان تكون اوضح

هون 3D view

▸ view command

view(0, 90) ← اشوفها الرسمة من فوق → x,y plane

view(0, 60) ← مسحّب

view(0, 0) ← x,z plane

view(90, 0) ← y,z plane

Sine graph

X = linspace (0, 3* pi)
z_1 = sin (x)
z_2 = sin(2 * x)
z_3 = sin (3 * x)
y_1 = zeros (size(x)) → spread on y axis
y_3 = ones (size (x)) → by giving each
y_2 = y_3/2 curve a value of y

Representing a matrix as a surface

• Mesh and surface plots

→ mesh(X) ← matrix
لو كانت 3x3 هتطلع شكل 3x3

gives a colored, wire frame view of the surface and displays it in a 3-D view

→ surf (y)
بترسم سطح مش خطوط
في كمان surfc : بترسم الخطوط في surfl

→ meshgrid
تحول Range لـ x و y لـ matrices عشان نستخدم في الـ Plots

مثال:
X = 0:pi/3:pi;
y = 0:0.1:1;
[X Y] = meshgrid (x,y); هيحولوا لـ matrix
(X, Y capital; x, y small)

Z = exp(-Y) .* sin(X) (capital)
خطوط الكنتور ← Contour (Z) , or surf (Z) or mesh (Z)

Peaks function

- function of two variables
- Peaks(X, Y)
  should be same size

Ex:

```
[X, Y] = meshgrid (-3:0.125:3);
Z = peaks (X, Y);
meshc (X, Y, Z);
axis ([-3  3  -3  3  -10  5])
```

(Additional) Scale of axis

- peaks (n)
  أي رقم بلا
  matrix nxn يعطي

mesh3 : adds a curtain or a reference plane under graph
(surface should be defined on a rectangular grid)

~~Waterfall graph~~

→ same previous code but mesh3 instead of mesh to make a rectangular base.

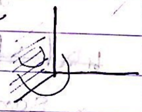
sphere

used to generate a 3D sphere

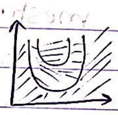
Syntax:
- sphere : default 20-by-20 faces sphere
- sphere (n) : nxn faces sphere
- [X, Y, Z] = sphere (n)
  surf (X, Y, Z) أو
  or mesh (X, Y, Z)

Contour : بتعطيك شكل حدود الشكل 2D

contour3 : 3D ~



contourf : 2D ~ بس ملونة



Interpolation :

let X = [0 ← one row
1
2
3
4
5]

y = [15 ← one row
10
9
6
2
0]

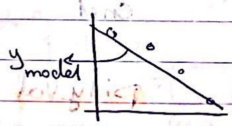
To find y of X = 3.5

let new x = 3.5 ;

new y = interp1(X, y, new – x)

Regression :

• **linear Regression** : 1st order $y = ax + b$



x = [ ]

y = [ ]

n = 1

P = PolyFit (x, y, 1)

ستخدم بالتقريب

a = P(1)

b = P(2)

ymodel = a * x + b ← تتحل ثابتة

plot (X, y, 'O', X, ymodel)

Polynomial Regression

$y(x) = a_0 x^n + a_1 x^{n-1} + \dots + a_{n-1} x + a$

We will use a loop:

```
x = [        ];
y = [        ];

          2,3,4,5
for n = 2:5;
  p = polyfit (x,y,n)
  ymodel = polyval (P,x)
  subplot (2,2,n-1)
  plot (x,y,'o',x,ymodel)
end
```

polyval : معناها برجع قيمة
ال Polynomial عند قيمة معينة لـ x
P

Simulation

- Solving 2nd order differential equation

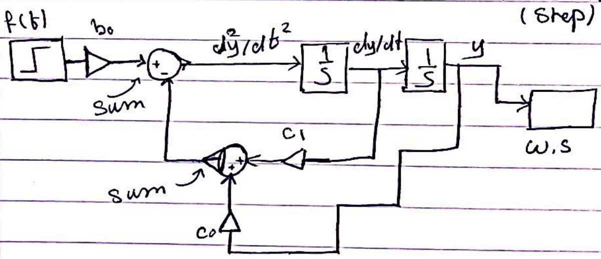
▷ : معامل لا شي

[step block] : بجي معطى من السؤال

Workspace : تحفظ الجواب

$d^2y/dt^2 + C_1\, dy/dt + C_0 y = b_0 f(t)$

function (step)



- Systems in Simulations.

$$d^2x/dt^2 = \frac{F}{m}$$

Using Sine Wave and 100 = m