

ex write a program to calculate the result of series below,

$$y = 1 - \frac{x}{2} + \frac{x^2}{4} - \frac{x^3}{8} + \dots - \frac{x^n}{n}$$

sol.

y = 1;

x = input('x = ');

n = input('n = ');

for i = 1 : n

y = y + (-x/2)^i;

end

fprintf('y = %f', y)

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## Matlab # 4

Q1:

Write a program in a script file that creates a  $n \times m$  matrix with elements that have the following values. The value of the elements in the first row is the number of the column. The value of the element in the first column is the number of the row. The rest of the elements are equal to the sum of the element above them and the element to the left. When executed, the program asks the user to enter values for  $n$  and  $m$ .

Solution

The program, shown below, has two loops (one nested), and a nested if-elseif-else-end statement. The elements in the matrix are assigned values row by row. The loop index variable of the first loop,  $k$ , is the address of the row, and the loop index variable of the second loop,  $h$ , is the address of the column.

The program:

```
n=input('Enter the number of rows ');
m=input('Enter the number of columns ');
A=[];
for k=1:n
    for h=1:m
        if k==1
            A(k,h)=h;
        elseif h==1
            A(k,h)=k;
        else
            A(k,h)=A(k,h-1)+A(k-1,h) ;
        end
    end
end
A
```

row 2  
col 3

1 2 3  
2 4 7

row 3  
col 4

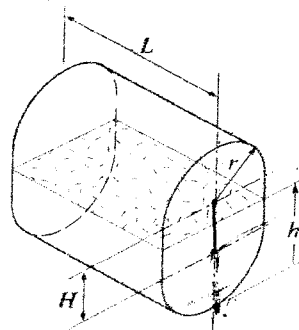
1 2 3 4  
2 4 7 11  
3 7 14 25

Q2:

A fuel tank is made of a rectangular prism center and half circular cylinders at the top and bottom as shown, where  $r = 20$  cm,  $H = 15$  cm, and  $L = 60$  cm.

Write a user-defined function for the function name and arguments use  $V = \text{Volfuel}(h)$  that gives the volume of the fuel in the tank (in liters) as a function of the height  $h$  (measured from the bottom). Use the function to calculate the volume of the fuel in the tank for  $0 < h < 55$  cm.

to print the results for  $0 < h < 55$  cm



$r < h < 55$

Q3:

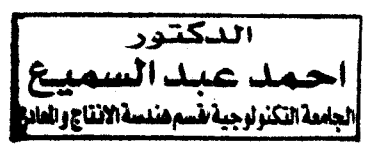
A vector is given by:  $x = [15 \ -6 \ 0 \ 8 \ -2 \ 5 \ 4 \ -10 \ 0.5 \ 3]$ . Using conditional statements and loops, write a program that determines and displays the sum of the positive elements of the vector, and the sum of the negative elements of the vector.

## Q2:

```
h=[0 20 27.5 35 55];
H=[0 0 7.5 15 15];L=60;
for i=1:5
    Vt(i)=((h(i)-H(i))/2)^2*pi*L+(H(i)*L*(h(i)-H(i))/2);
    fprintf('Vt(i)=%f',Vt(i))
end
Vt
plot(h,vt)
xlabel('h')
ylabel('Vt')
```

## Q3:

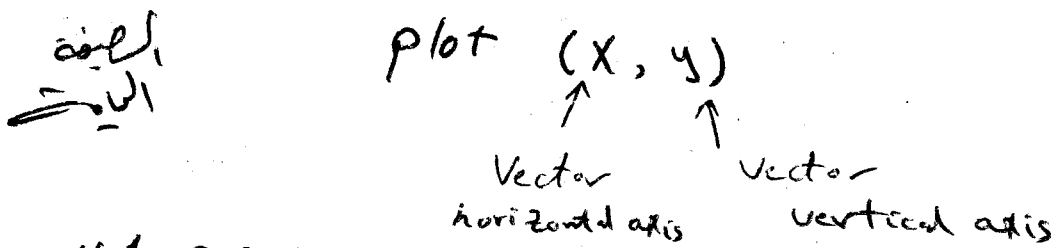
```
x=[15 -6 0 8 -2 5 4 -10 0.5 3];
p=0;n=0;
for i =1:10
    if x(i)>=0
        p=p+ x(i);
    else
        x(i)<0
        n=n+x(i);
    end
end
fprintf('p=%f',p)
fprintf('n=%f',n)
```



## Two-Dimensional Plots :-

### ① The Plot Command :-

The (plot) command is used to create Two-dimensional plots.

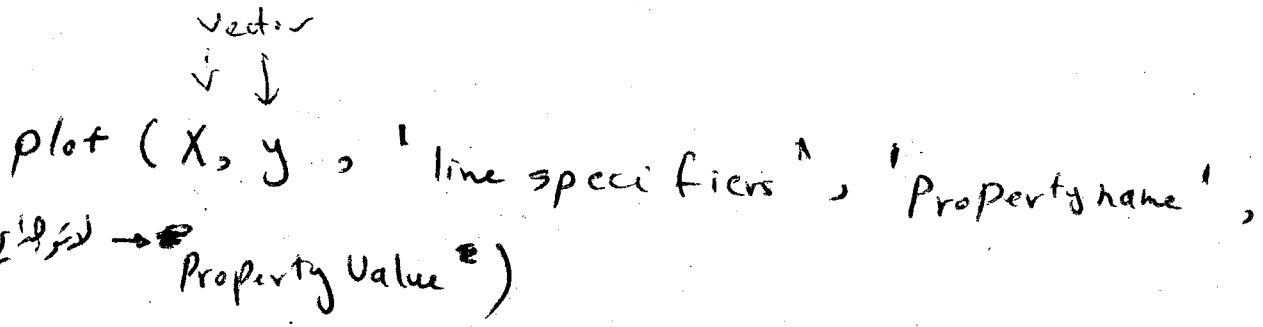


Note: ① Both vectors X & y must have the same number of elements.

② The first vector represent the hor. axis, and the second vector = = ver. =

③ The default color of the line is blue, and if we want to change the color or some properties of the line we must use

The form below :-



## Line specifiers :-

It is used To define the style and color of the line and the type of markers.

(1) - The line style specifiers are;

<u>Line style</u>	<u>specifiers</u>
Solid	-
dashed	--
dotted	...
dash-dot	-.

(2) - The line color specifiers are :-

<u>Line Color</u>	<u>specifiers</u>
red	r
green	g
yellow	y
black	k
etc-	

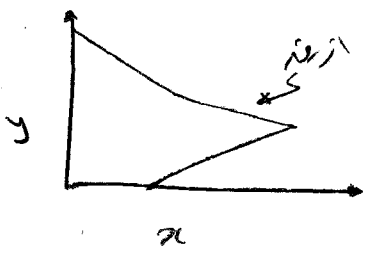
(3) - The Marker Type specifiers are :-

<u>Marker Type</u>	<u>specifiers</u>
plus sign	+
circle	O ← The letter o
cross	X ← the letter X
square	S
etc-	v

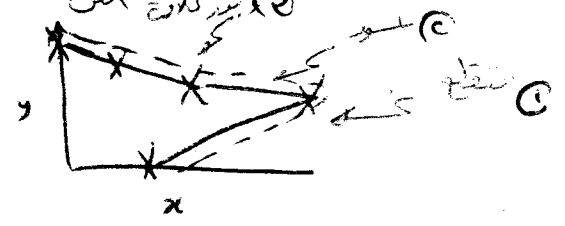
ex

$\Rightarrow x = [7 \ 9 \ 6 \ 5 \ 4] ; y = [5 \ 6 \ 7 \ 8 \ 9] ;$

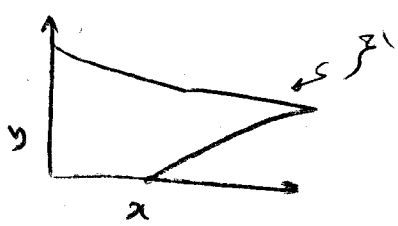
Plot (x,y)



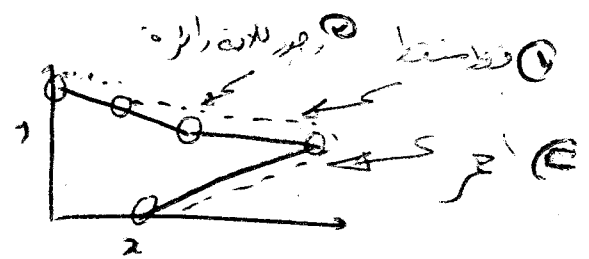
Plot (x,y, 'r', 'k')



Plot (x,y, 'r')



Plot (x,y, 'ro')



- Property name & Property value :-



It is used to specify the thickness of the line, the size of the marker, The color of the marker (edge and fill).

as follow :-

Property name & Property Value



- LineWidth (or linewidth)
- MarkerSize (or markersize)
- MarkerEdgeColor (or markeredgecolor)
- MarkerFaceColor (or markerfacecolor)

السؤال:

plot (x, y, '-ro', 'LineWidth', 2, 'markersize', 12,  
'MarkerEdgeColor', 'b', 'markerfacecolor', 'y')

ex

Draw find The relation of the Two Variable ~~between~~  
in table below using (plot) function. Note: The line color is  
~~black~~<sup>red</sup>, The linewidth is 2 & the marker size is 12.

Year	1988	1989	1990	1991
Sales	8	12	20	22

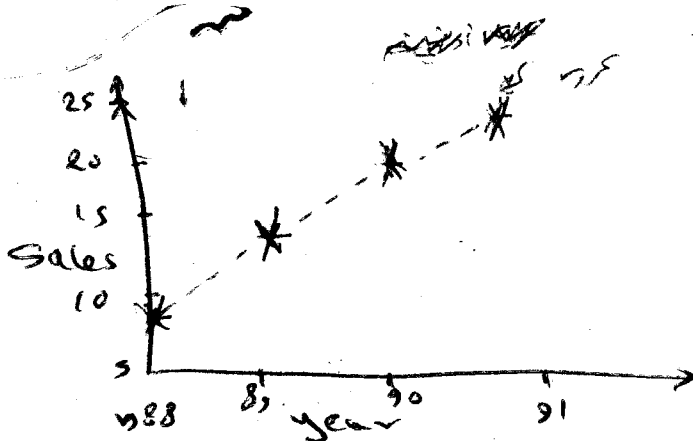
ans 2.

→ year = [1988 : 1 : 1991];

→ sales = [8 12 20 22];

→ plot (year, sales, '--rx', 'linewidth', 2,

'marker size', 12)







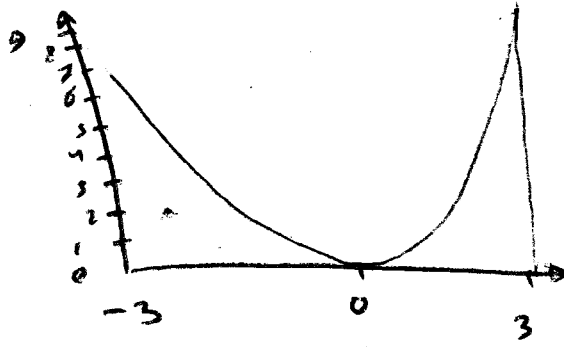


Fig (1)

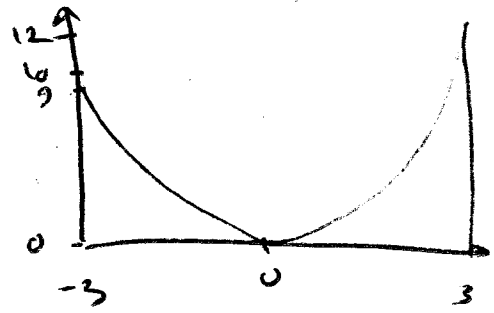


Fig (2)

### ③ Plotting Multiple graphs in the same plot :-

There are three methods to plot multiple graphs in one figure.

a Using plot command

~~with~~ plot (x, y, u, v, t, h)

or plot (x, y, '-b', u, v, '--r', t, h,

'y')

Solid  
blue

dashed  
red

dotted  
yellow

ex

Plot the function  $y = 3x^3 - 26x + 10$ , and its first and second derivatives for  $-2 \leq x \leq 4$ , all in the same plot.  
and step is 0.5

Sol:

The first derivative at the function  
= second = " = " = "

$$y' = 9x^2 - 26$$

$$y'' = 18x$$

$$\Rightarrow x = [-2, 0, 4];$$

$$y = 3 * x.^3 - 26 * x + 10;$$

$$y_d = 9 * x.^2 - 26;$$

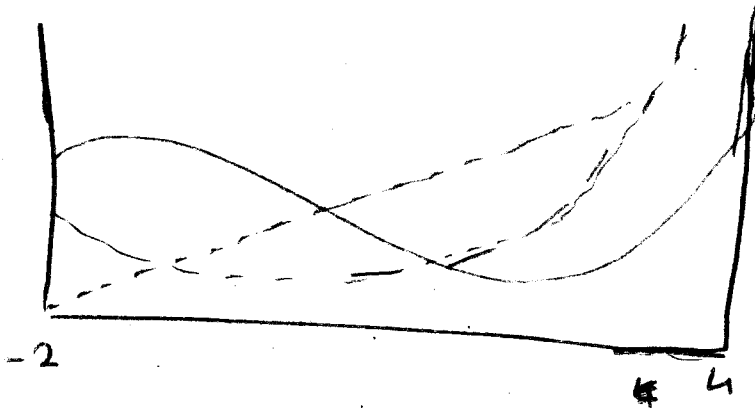
$$y_{dd} = 18 * x;$$

plot (x, y, '-b', x, y\_d, '--r', x, y\_{dd}, ':k')

Solid blue                      dashed red                      dotted black

$$x = -2 \quad -1.5 \quad -1 \quad -0.5 \quad 0 \quad 0.5 \quad 1$$

- - - - 4



b using the hold on, hold off commands.

To plot several graphs using hold on, hold off commands, one graph is plotted first with the plot command. Then hold on command is typed, and additional graphs can be added with plot commands that are typed next. Finally, hold off command stops this process.

ex

The same example as 3-

$$x = [-2 : 0.5 : 4];$$

$$y = 3 * x.^3 - 26 * x + 10;$$

$$y_d = 9 * x.^2 - 26;$$

$$y_{dd} = 18 * x;$$

plot (x, y, '-b')

← The first graph is created

hold on

plot (x, y\_d, '--r')

plot (x, y\_dd, ':k')

← Two graphs are added to the same fig.

hold off

5 Using line Command:-

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line (X, y, 'PropertyName', PropertyValue)

ex The same example:-

$$X = [-2 : 0.5 : 4];$$

$$y = 3 * X.^3 - 26 * X + 6;$$

$$y_d = 9 * X.^2 - 26;$$

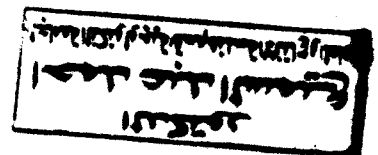
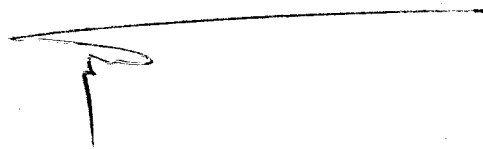
$$y_{dd} = 18 * X.$$

plot (X, y, ~~line~~ 'linestyle', '-', 'color', 'b')

line (X, y\_d, 'linestyle', '--', 'color', 'r')

line (X, y\_{dd}, 'linestyle', ':', 'color', 'k')

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# Plotting Multiple Plots on the same Page

المادة مباشرة

انقاص

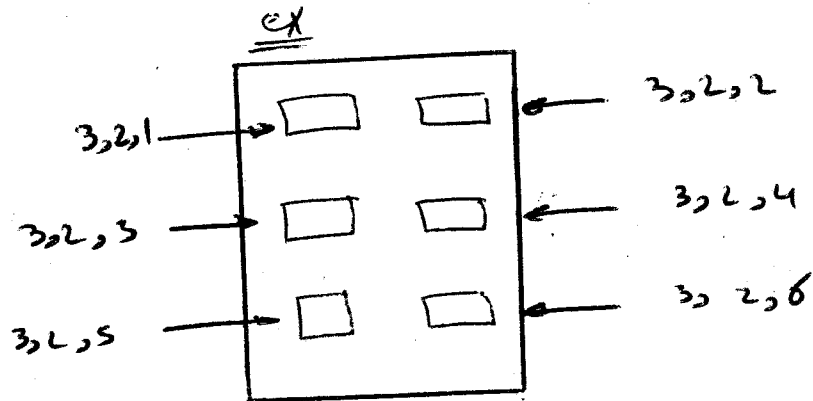
Form

subplot (m, n, P)

where:-

m & n : no. of plots on the same page in matrix form

P : The sequence of plotting on the same page from left to right & from up to down.



ex

$$X = [-2 : 0.5 : 4];$$

$$y = 3 * X.^3 - 26 * X + 6;$$

$$yd = 9 * X.^2 - 26;$$

$$ydd = 18 * X;$$

subplot (3,2,1)

plot (X,y)

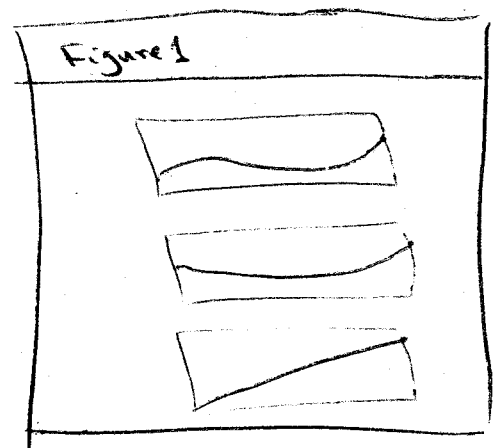
subplot (3,2,2)

plot (X,yd)

subplot (3,2,3)

plot (X,ydd)

enter



## Multiple ~~Vijay~~ windows:-

ex

$$x = [-2 : 0.5 : 4];$$

$$y = 3 \dots$$

$$ydd =$$

$$ydd = \dots$$

- |                         |    |                       |
|-------------------------|----|-----------------------|
| ① figure<br>plot(x,y)   | or | plot(x,y)             |
| ② figure<br>plot(x,yd)  |    | figure<br>plot(x,yd)  |
| ③ figure<br>plot(x,ydd) |    | figure<br>plot(x,ydd) |

## Polar Plots:-

It is used to plot ~~function~~ in Polar coordinates.

form

$$\text{Polar} \left( \underbrace{\text{theta}}_{\text{vector}}, \underbrace{\text{radius}}_{\text{vector}}, \text{'linespecifiers'} \right)$$

ex:-

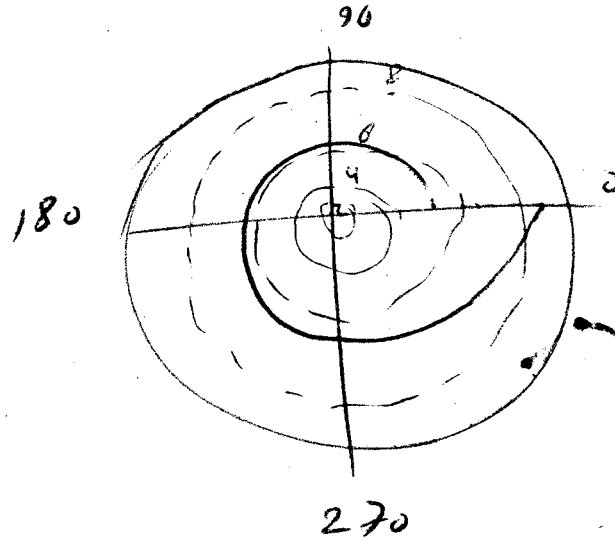
Plot a function  $r = 3 \cos^2(0.5 \theta) + \theta$   
 for  $0 \leq \theta \leq 2\pi$  ?

Sol :-

$$t = \text{linspace}(0, 2 * \pi, 200)$$

$$r = 3 * \cos(0.5 * t) .^2 + t; \quad \text{or} \quad 3 * \cos(0.5 * t) .^2 + (t * \frac{180}{\pi})$$

polar(t, r)



Formatting a plot using Commands :-

① To Add a title to each axis:-

Form  $x\text{label}(' \overset{\text{strain}}{\text{stress}}')$   
 $y\text{label}(' \text{stress}')$

② To Add a title To the plot :-

Form  $\text{title}(' \text{The relation between stress \& strain}')$

③ The legend command:-

The legend shows a sample of line type of each graph

was  
 that is plotted, and ~~places a label~~ sp

forms:

البيانات  
 'string1'

البيانات  
 'string2'

legend ('Theory', 'Experiment',

X = [ ]

y =

yd =

ydd =

plot

hold on

plot (x, yd) ('-r')

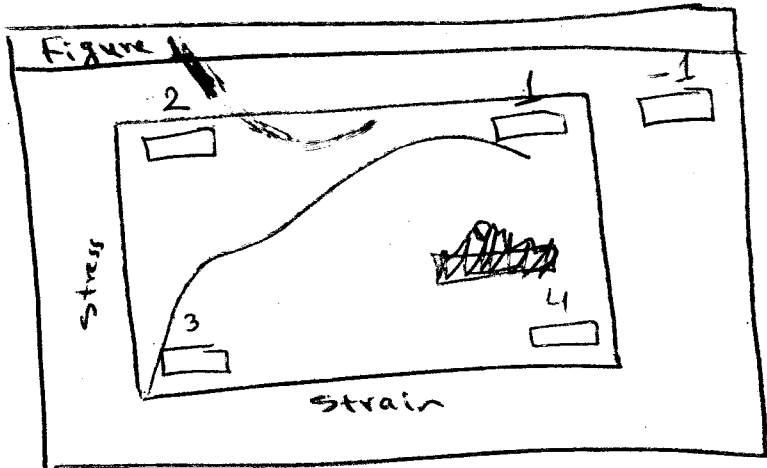
plot (ydd) ('--g')

title

leg and  
 hold off

option number

that specifies where in the fig.  
 the legend is placed.



(u) text & gtext commands.

Text label can be placed in the plot with  
 text or gtext commands.

text (x, y, 'string text')

↑ نقطة  
 النقطتين  
 التي  
 نكتب  
 عليهما

gtext('string text')

النقطتين  
 التي  
 نكتب  
 عليهما



⑤

grid on

:

grid off

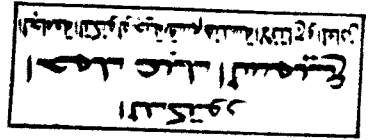
Add grid lines  
to the plot

Remove grid lines  
from the plot

increment value =  $\frac{a-b}{c-1}$

(a, b, c)

~~التمرين الثاني~~  
~~أي فرق بين الأوامر الثلاثة~~



Loop Command :-

~~The execution of~~ Command ~~is~~ <sup>that used to</sup> repeated several times consecutively. There are three types of loop commands

- ① For-end loops
- ② While-end loops
- ③ Nested loops

① For-end loops :-

Form  $\text{for } k = f : s : t$   
 $\text{---}]$  a group of  
 matlab command  
 end

where  $k$ : index variable.  
 $f$ : first value of var.  $k$ .  
 $s$ : increment step.  
 $t$ : final value of var.  $k$ .

Notes (1)  $s$  can be negative ex ( $k = 25 : -5 : 10$ )  
 $k = 25, 20, 15, 10$

- ② if  $s$  is omitted ; The default value of  $s$  is equal to (1)
- ③ each for command must have an end command.

function  $y = T \sin(x, n)$

$$x_v = x \times \pi / 180$$

$$y = 0$$

for  $k = 0 = n - 1$

$$y = y + (-1)^k \times x_v^{(2k+1)} /$$

factorial  $(2k+1)$

end

run

$$T \sin(150, 3)$$

$$\text{ans} = 0.6523$$

H.w write a user-defined function file that calculates  $\sin(x)$  by using the series below:

$$\sin x = \sum_{k=0}^{\infty} \frac{(-1)^k x^{2k+1}}{(2k+1)!} \leftarrow \text{Factorial}$$

For the function name use  $y = \text{tsin}(x, n)$

The input are the angle ( $x$ ) in degree, and ( $n$ )

which is no. of term in series? finally use

The function to calculate  $\sin(150)$  using 3 & 7 term.

3 & 7 term.

Note: use the  $(k!)$  as Factorial

②

While-end Loops as it is used in situations when looping is needed but the no. of passes is not known

Form

while conditional expression

≡ ] a group of  
matlab command

end

Note: ① if/condit. expr. True matlab will execute the group of command between while & end; ② if/condit. expr. false

Ex write a program to find the sum of 1 to n

The eqn below:

$$T = 1 + 2 + 3 + 4 + \dots + n$$

where  $n \leq 1000$

$$n = 1 \rightarrow T = 0$$

while  $n \leq 1000$

matlab will skip to the end statement and continues with program.

Command, Then matlab jumps back to the while command and check the condit. expr. This looping process continues until the condit. expr. is false ③

ex run the program below?

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```
n = 1;
while n <= 10
    n = n * 2
end
fprintf('n = %.f', n)
```

n = 16

where .  
1 <= 10 T  
n = 1 \* 2 = 2  
2 <= 10 T  
n = 2 \* 2 = 4  
4 <= 10 T  
n = 4 \* 2 = 8  
8 <= 10 T  
n = 8 \* 2 = 16  
16 <= 10 F → out  
n = 16

ex write a program to find the summation of the series below:

$$T = 5 + 6 + 8 + 11 + 15 + 20 + 26 = 91$$

where n <= 26 then run the program?

Sol:

```
t = 0, n = 5, i = 1
while n <= 26
    t = t + n;
    n = n + i;
    i = i + 1;
end
```

n = 26  
for i = 1  
n <= 26  
T  
F

```
fprintf('t = %.f n = %.f i = %.f', t, n, i)
```

in Command windows :-

$t = 5$   
 $n = 6$   
 $I = 2$

$t = 11$   
 $n = 8$   
 $I = 3$

$t = 19$   
 $n = 11$   
 $I = 4$

$t = 30$   
 $n = 15$   
 $I = 5$

$t = 45$   
 $n = 20$   
 $I = 6$

$t = 65$   
 $n = 26$   
 $I = 7$

$t = 91$   
 $n = 33$   
 $I = 8$

$\Rightarrow t = 91 \quad n = 33 \quad I = 8$

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Q1) Write a function program to compute the following equation then plot it.

~~y(t)~~

$$f(t) = \frac{\sin 3\pi t + t^3}{5t}$$

when  $t = 0$  to  $1$   
step =  $0.1$

Then executed it in Command wind.

---

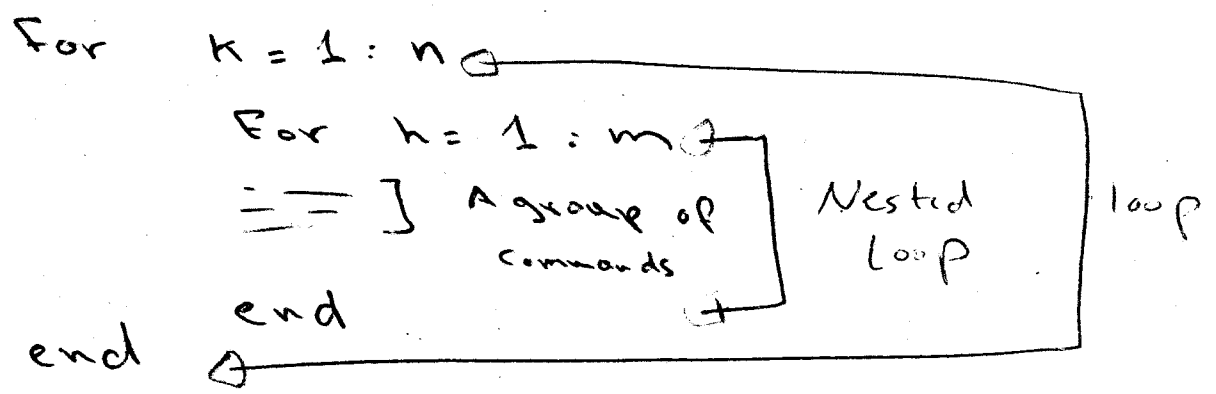
Q2) Write a Script program to compute the summation of the following series.

$$y = \frac{1}{2} + \frac{3}{4} + \frac{5}{6} + \frac{7}{8} \dots$$

③ Nested Loops :-

Loops & Conditional statements can be nested within themselves and/or. and There is no limit to the number of Loops and Conditional statements that can be nested.

Form of nested Loops:-



ex :- ~~Factorial~~

Write a program to calculate the factorial numbers from 1 to 5?

Sol :-

```

For i = 1 : 5
  Fa = 1;
  For k = 1 : i
    Fa = Fa * k;
  end
  fprintf('Fa = %.f', Fa)
end
  
```

$1! = 1 \times 1 = 1$   
 $2! = 1 \times 2 = 2$   
 $3! = 1 \times 2 \times 3 = 6$   
 $4! = 1 \times 2 \times 3 \times 4 = 24$   
 $5! = 1 \times 2 \times 3 \times 4 \times 5 = 120$

Fa=1    Fa=2    Fa=6    Fa=24    Fa=120



Ex: write a program to display the table of multiplication numbers from 1 to 5?

1	1x1, 1x2, 1x3, 1x4, 1x5
2	2x1, 2x2, 2x3, 2x4, 2x5

Sol:

```

For i = 1 : 5
    For j = 1 : 5
        x = i * j
        fprintf('x = %f', x)
    end
end

```

x=1 x=2 x=3 x=4 x=5 x=2 x=4 x=6 x=8  
 x=10 x=3 x=6

Ex: write a program to calculate the eqn. below:-

$$E^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots + \frac{x^n}{n!}$$

Sol:

A=1  
 Fa=1  
 input a  
 input x

```

E = 1;
Fa = 1;
x = input('x = ');
n = input('n = ');
for i = 1:n
    Fa = Fa * x;
    E = E + x^i / Fa;
end
fprintf('E = %f', E)

```

x = 8  
 n = 3  
 i = 1, 2, 3  
 Fa = 1x1 = 1  
 E = 1 + 8^1/1!  
 Fa = 1x2 = 2  
 E = 1 + 8^2/2!  
 Fa = 2x3 = 6  
 E = 1 + 8^3/6