

The derivative of polynomials eq.

ex  $s^4 + 3s^3 - 10s^2 + 15$

المشتقة =  $4s^3 + 9s^2 - 20s$

in Matlab

$\Rightarrow a = [1 \ 3 \ -10 \ 0 \ 15]$

$a =$   
1 3 -10 0 15

$\Rightarrow \text{polyder}(a)$

$\begin{matrix} (4) & (9) & (-20) & 0 \\ \downarrow & \downarrow & \downarrow & \\ 4s^3 & + 9s^2 & - 20s & \end{matrix}$

The integral of Polynomials eq.

ex  $\int x^3 + 5x^2 + 3x + 2 \ dx$

$= 0.25x^4 + 1.6667x^3 + 1.5x^2 + 2x + 0$

in Matlab

$\frac{x^{3+1}}{3+1} = 0.25x^4$

$\frac{5x^2}{\frac{3}{2}} = 1.5x^2$

→ polyint ([1 5 3 2])

ans

0.25      1.6667      1.5      2.0      0

Note

The constant of integral is equal to zero and if we want change it to another no. we write as follows

→ polyint ([1 5 3 2], 4)

ans

0.25      1.6667      1.5      2.0      4.0

$$\frac{x^3}{3} - 2x$$

0.33

-0

-2

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# « Programming in Matlab »

## Programming in Matlab

① البرنامج  
Script program

② Function program

① Script program

~~Script program is a sequence of Matlab commands. It is saved as a .m file.~~

- A script file is a sequence of Matlab command.
- Script file can be typed in any text editor and then pasted into the Matlab editor.
- Script files are also called M-files because the extension (.m) is used when they are saved.

~~Script file is saved as .m file.~~

- Script program start or program directly but function program start ~~with~~ at function word.
- The variable that calculated from function program could not be saved in workspace, otherwise the variable were saved in workspace when script program was used.

المتغير الذي يحسب من البرنامج الوظيفي لا يمكن حفظه في مساحة العمل، بل يتم حفظه في مساحة العمل عند استخدام البرنامج النصي.

## Script program:-

### Creating script file & saving it?

#### From Matlab window

- ① file
- ② New
- ③ M-file \_\_\_\_\_ ④ file in editor
- ⑤ save as from editor file
- ⑥ detect the path to save

مكانه واضع  
في المجلد

Note: The name of script file must be start by a letter. ~~and~~ with no spaces, and Matlab commands or functions should not be used as names of script files.

### Run script file :-

Run icon or F5 or copy paste

### Methods of input var. in a script file:-

#### Input of script files:-

- (a) → variable is defined in script file.   
 and assigned value
- (b) → The var. is defined and assigned value in Command window.
- (c) → The var. is defined in the script file; but a specific value is entered in Command window.

ex1 for (a) type :-

① file is saved as (a1.m)

② mex script file

```
a = 2 ;
b = 4 ;
average = (a+b)/2
```

③ Command window

```
>> a1 ↵
average =
    3
```

script saved

ex2 for (b) type :-

① file is saved as a1.m

② script file

```
average = (a+b) / 2
```

③ Command window

```
>> a = 2 ;
>> b = 4 ;
>> a1 ↵
average =
    3
```

ex3 for (c) type :-

① file is saved as a1.m

② script file

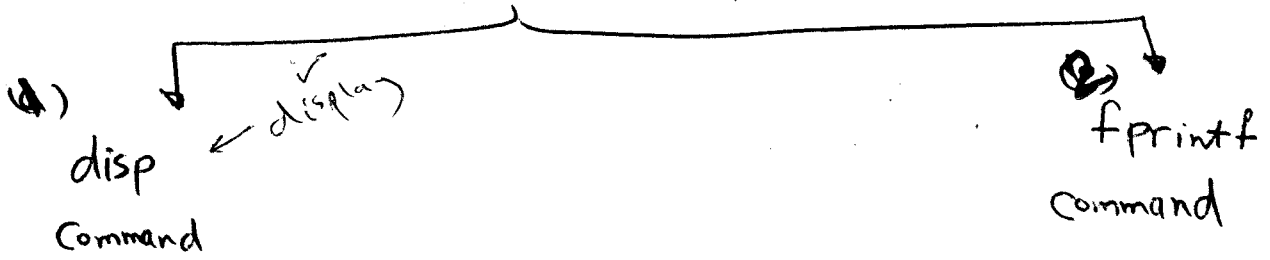
```
a = 2 ;
b = input('The second value is ');
average = (a+b)/2
```

③ Command window

```
>> a1 ↵
The second value is 2 ↵
average =
    3
```

variable name = input('describe the variable')

output of script file



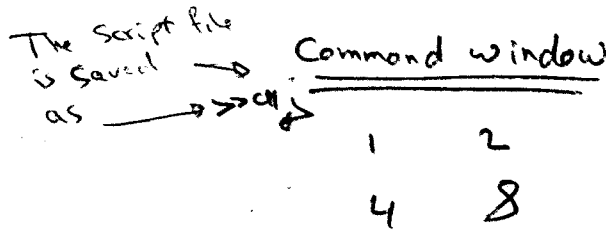
1) disp command :-

- سؤال
- 1) disp (name of variable)
  - 2) disp ('text as string')

ex 1

```

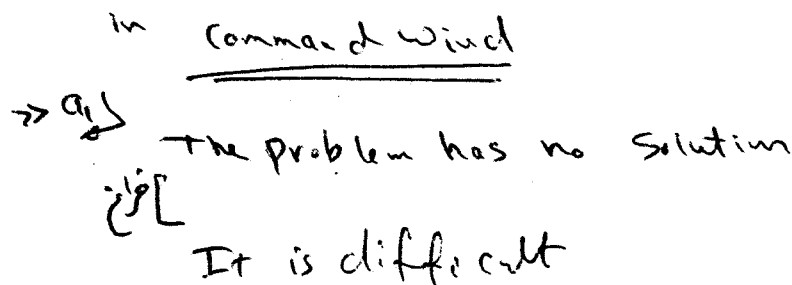
a = [1 2 3 4 5 6 7 8];
a = [1 2 ; 4 8];
disp(a)
    
```



ex 2

```

m-file
>> disp('The problem has no solution')
>> disp(' ')
>> disp('It is difficult')
    
```



(b) fprintf Command :-

The fprintf command can be used to display output (text & data) on the screen.

تستخدم fprintf لإظهار مخرجات (نص وبيانات) على الشاشة.

الكتابة

```
fprintf ('text as string %f additional text',  

    variable name)
```

fixed point notation

- ~~%d~~
- %E expo-
- %i integer

% This marks mean  
 The number is  
 inserted within  
 the text -

ex

1) file is saved as a1.m

2) m-file

```
a=2;  

b=4;  

average = (a+b)/2  

disp(' ');  

fprintf('The average is %f,  

    average')
```

3) Command window

```
>> a1  

    average =  

         3  

    [ The average is 3.0000
```

! إذا كان في المخرج ارقام كثيرة ستجدها قريبة من الصفر

```
fprintf('The average is %f ••••• The value a %f ••••• The  

    value b %f', average, a, b)
```

② function program - [is a Matlab program that created by the user saved as a function file, and then can be used like a built-in function]

⚡ function files are created and edited like script files.

file  
↓  
new  
↓  
m-file

السينة

function [output variables] = functionname (input variables)

↑ space

↑ without space

ex write a function file (name is result) for the function

$$f(x) = \frac{x^4 \sqrt{3x+5}}{(x^2+1)^2}$$

The input to the function is x

x and the output is  $f(x) = y$

for a)  $f(x)$  for  $x=6$

b)  $f(x)$  for  $x = 1, 3, 5, 7, 9$ , and 11

Note (where x can be a vector)

Sol:-

⚡ open m-file and saved as

a2

result of function calling

② function file

```
function y = result(x)
y = (x^4 * sqrt(3*x+5)) ./ (x^2+1)^2
```

$$\rightarrow (x^2+1)^2$$



ex

function  $y =$  ~~result~~  
value of  $(x)$  ;

$$y = \text{~~ex~~} x^2 ;$$

printf ( ' The y value is %f ' , y )

3 Command window

```
>> a2(6)
ans =
    4.5401
or
>> c = a2(6)
c = 4.5401
```

٦ خروج

Command Wind

```
>> x = [1:2:4];
>> a2(x)
```

ans =  
0.7071 3.0307 4.1347 4.8971 5.5127 6.0638

### { Comparison between script files & function files }

- ① Both script & function files are saved with extension .m
- ② Script file start on program directly but function files start at function word.
- ③ The variable that calculated from function program could not be saved in workspace, other wise the variable could be saved in workspace when script program be used.

↓  
with



## Conditional statements :



a conditional statement is a command that allows Matlab to make a decision to execute a group of <sup>other</sup> commands that follow the conditional statement.

### form

if condition expression consisting of relational and logical operators.

<>

ex

if a < b

if c >= 5

if (d < b) & (x > 7)

relational  
comparison

logical

### Notes

The if statement is commonly used in three structures,

(a) if - end

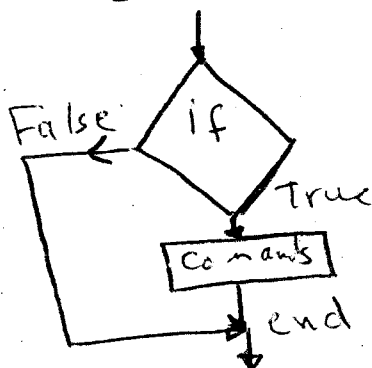
(b) if - else - end

(c) if - elseif - else - end

### a if - end structure :-



#### Flow chart



#### Matlab

if conditional expression  
[ ] a group of matlab  
command  
end  
[ ] matlab program

Prob :-

A worker is paid <sup>to him</sup> according to his hourly wage <sup>جورالساة</sup> up to 40 hours, <sup>and for up to 40 hours work</sup> and 50% more <sup>المرة</sup> for overtime. Write a program in a script file

- ① that calculates the pay to a worker. The program asks the user to <sup>②</sup> enter the number of hours and <sup>②</sup> hourly wage. The
- ④ Program then displays the pay.

Sol :-

The script file will be saved as (a worker name)

```
t = input('please enter the number of hours worked');
h = input('please enter the hourly wage in $ ');
Pay = t * h ;
if t > 40
    Pay = Pay + (t - 40) * 0.5 * h ;
end
fprintf('The worker's pay is $ %f', Pay)
```

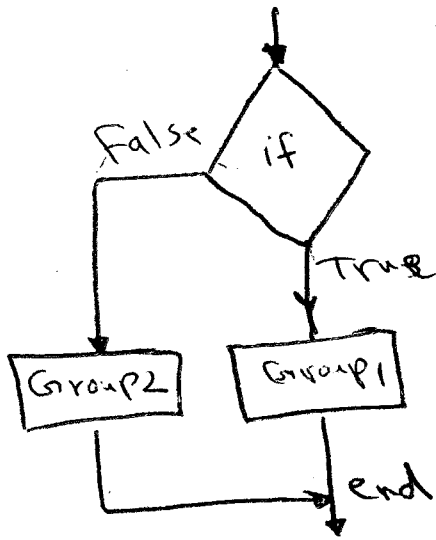
in command window

```

>> worker
Please enter the number of hours worked 35
" " = hourly wage in $ 8
The worker's pay is $ 280.00
    
```

b if - else - end structure -

Flow chart



Matlab

```
if conditional expression
== ] Group 1 of
    matlab prog.
else
== ] Group 2 of
    matlab prog.
end
== ] matlab program.
```

The structure provides <sup>means</sup> ~~means~~ for <sup>one</sup> choosing of one group of elements for ~~execution~~ <sup>running</sup>.

ex <sup>1</sup> write a program to calculate the value of T from the two eqs. below? <sup>2</sup> The program ask the user to enter the number of a & b; The program then display the value of T.

$$T = A^2 - 2B - 5 \quad \text{if } A > B \quad \text{final}$$

$$T = A^3 - 3B + 10 \quad \text{otherwise}$$

Sol: Script file saved as (T name)

```
a = input('The value of a is ');
b = input('The value of b is ');
if a > b
    t = a^2 - 2*b - 5;
else
    t = a^3 - 3*b + 10;
end
fprintf('The value of t is %f', t)
```

in Command Window  
→ t

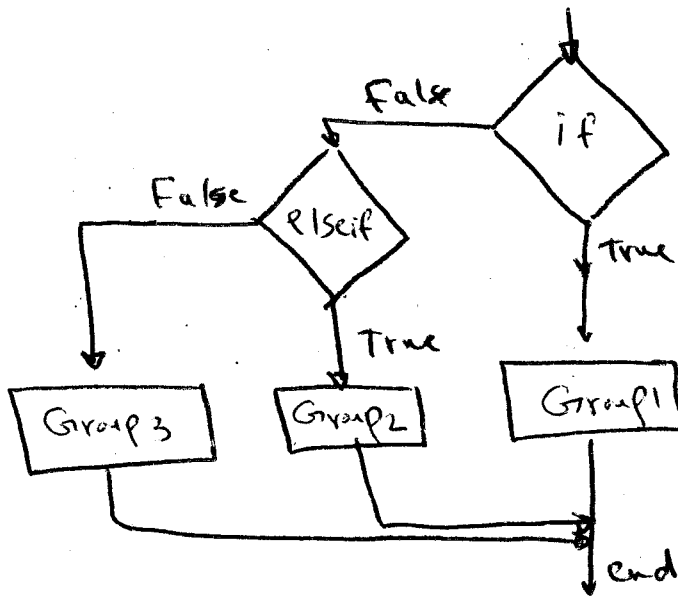
The value of a is 2

The value of b is 3

The value of t is 9.0000 →

٣٩  
① if-elseif-else-end structure

Flowchart



Matlab

if condition expression  
== ] Group 1 of  
matlab command

elseif  
== ] Group 2 of  
Matlab Command

else  
== ] Group 3 of  
matlab

end  
== matlab program

ex 1.

write a program to calculate y from the eqn below?

$y = x^2$  ; if  $x = 1$  or 5

$y = x^3$  ; if  $x = 2$  or 4

$y = x + 3$  ; if  $x = 3$

$y = x$  ; if  $x$  any no. except above no.

Q. 37.3 = 28.2 , 22.1 , 18.000 , 15.1

How write a program to calculate  $f(x)$  from the eqn below using function program? and run the program?

$$f(x) = \begin{cases} \sin(x)/x & x \neq 0 \\ 1 & x = 0 \end{cases}$$

Sol function  $y = f(x)$

if  $x == 0$ ;

$y = 1$ ;

else

$y = \sin(x)/x$ ;

end

run

$\Rightarrow y = f(2)$

$y = 0.4546$

$\Rightarrow y = f(0)$

$y = 1$



Sol.

```
x = input ('The value of x is ');
if x == 1 | x == 5
    y = x^2;
elseif x == 2 | x == 4
    y = x^3;
elseif x == 3
    y = x + 3;
else
    y = x;
end
fprintf ('The value of y is %f', y)
```

clear

In Command windows (saved as: y)

>> y ↓

The value of x is 3

The value of y is 6.0000 >>



ex Find The largest no. between three No.?

The program asks the user to enter the ~~the~~ <sup>three</sup> no. of (a, b & c); The Program then display the max. no.

```
a > b & a > c
    max = a
b > a & b > c
    max = b
else
    max = c
```

a = 1  
b = 3  
c = 2

5