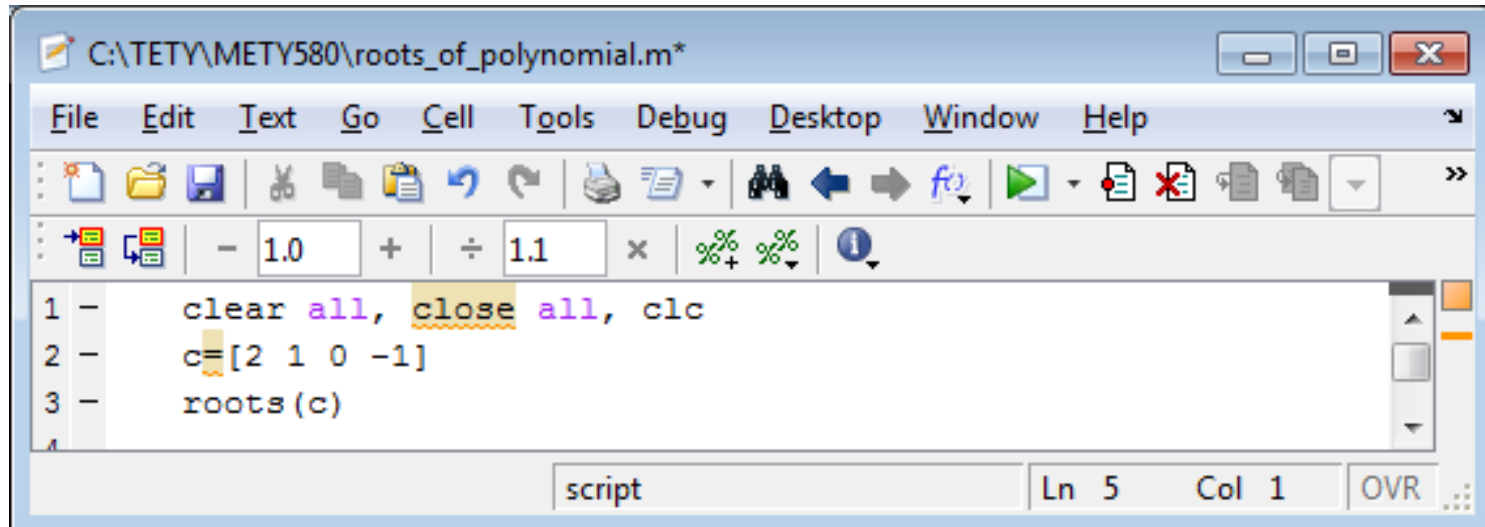


Matlab

Εισαγωγικές έννοιες

C. C. Katsidis

m-file editor

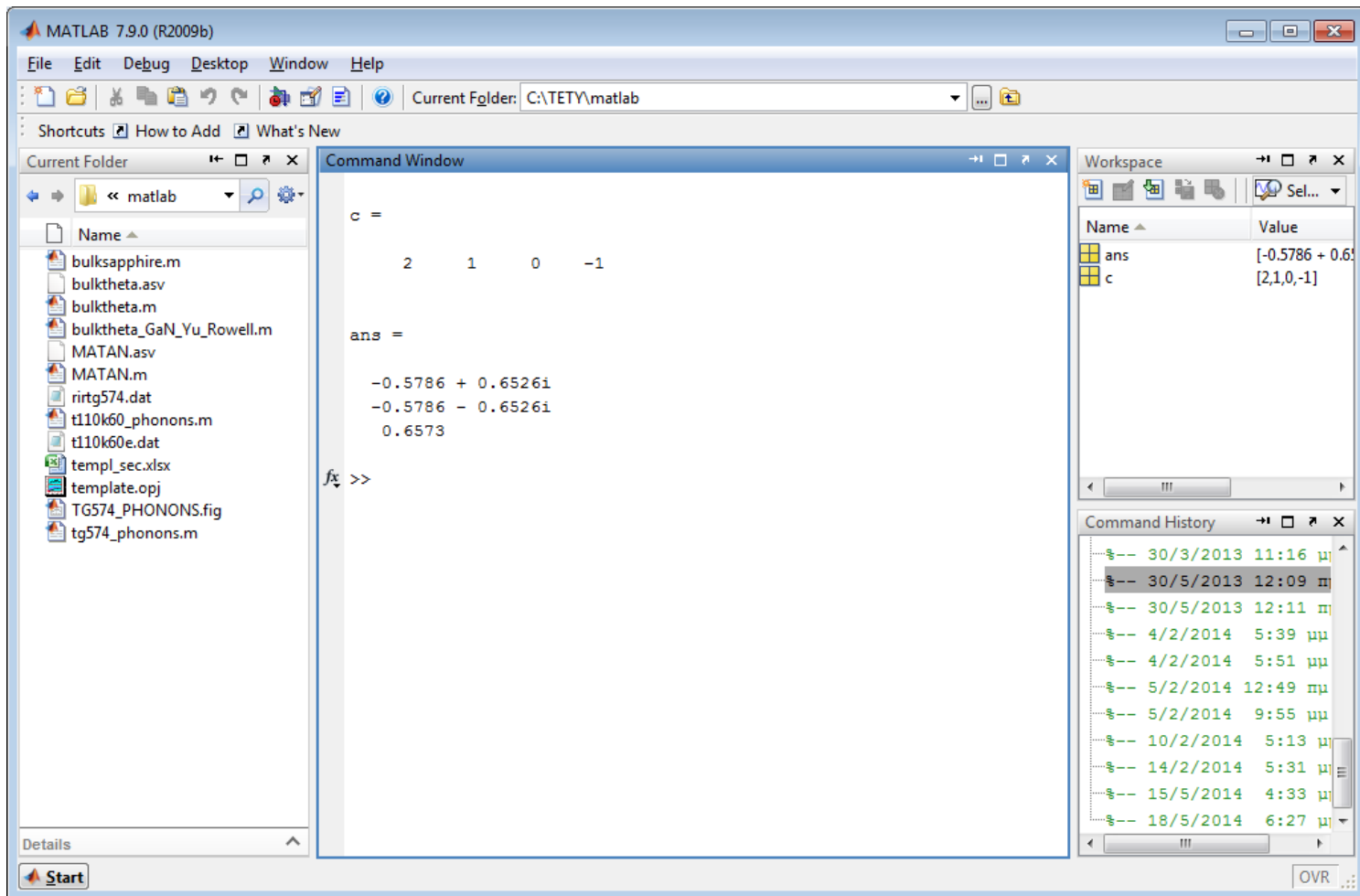


The screenshot shows the MATLAB m-file editor window for a file named 'C:\TETY\METY580\roots_of_polynomial.m*'. The window has a menu bar with 'File', 'Edit', 'Text', 'Go', 'Cell', 'Tools', 'Debug', 'Desktop', 'Window', and 'Help'. Below the menu bar is a toolbar with various icons for file operations and editing. A numeric keypad is visible below the toolbar, showing values like 1.0, 1.1, and mathematical symbols like '+', '-', 'x', and '%+'. The main editing area contains the following code:

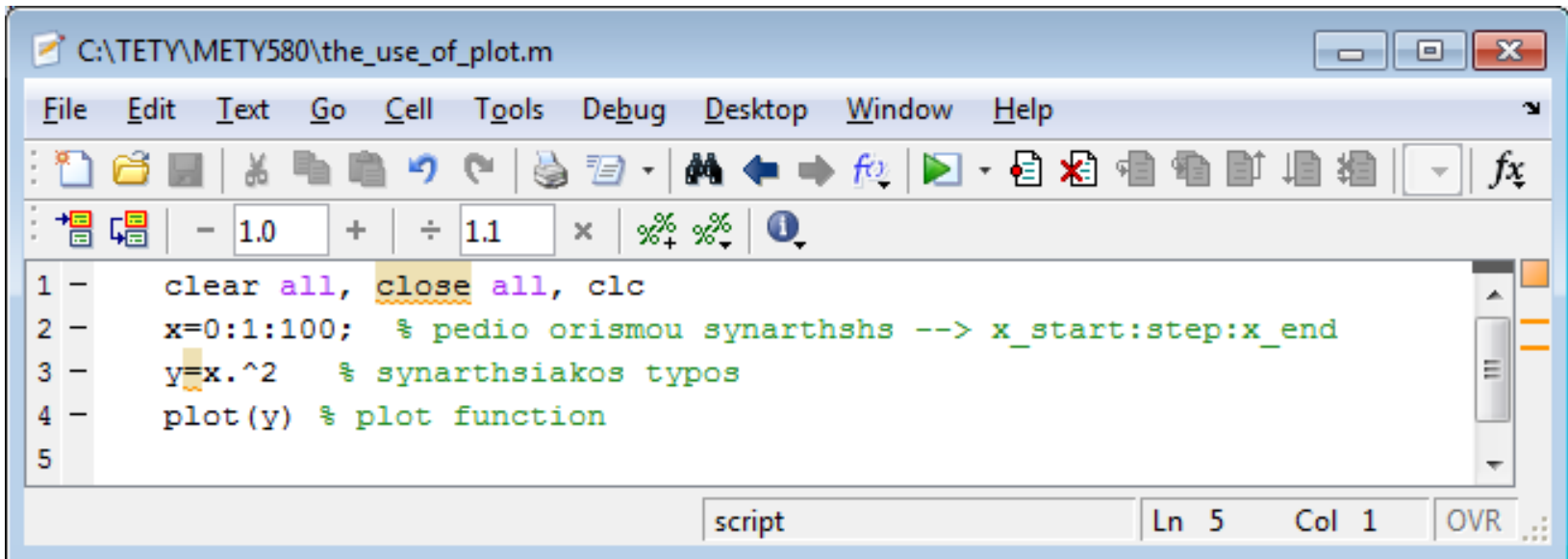
```
1 - clear all, close all, clc
2 - c=[2 1 0 -1]
3 - roots(c)
4
```

At the bottom of the window, there is a status bar showing 'script', 'Ln 5', 'Col 1', and 'OVR'.

Command Window



Ορισμός και γραφικές παραστάσεις συναρτήσεων στο matlab (συνάρτηση $y=x^2$)

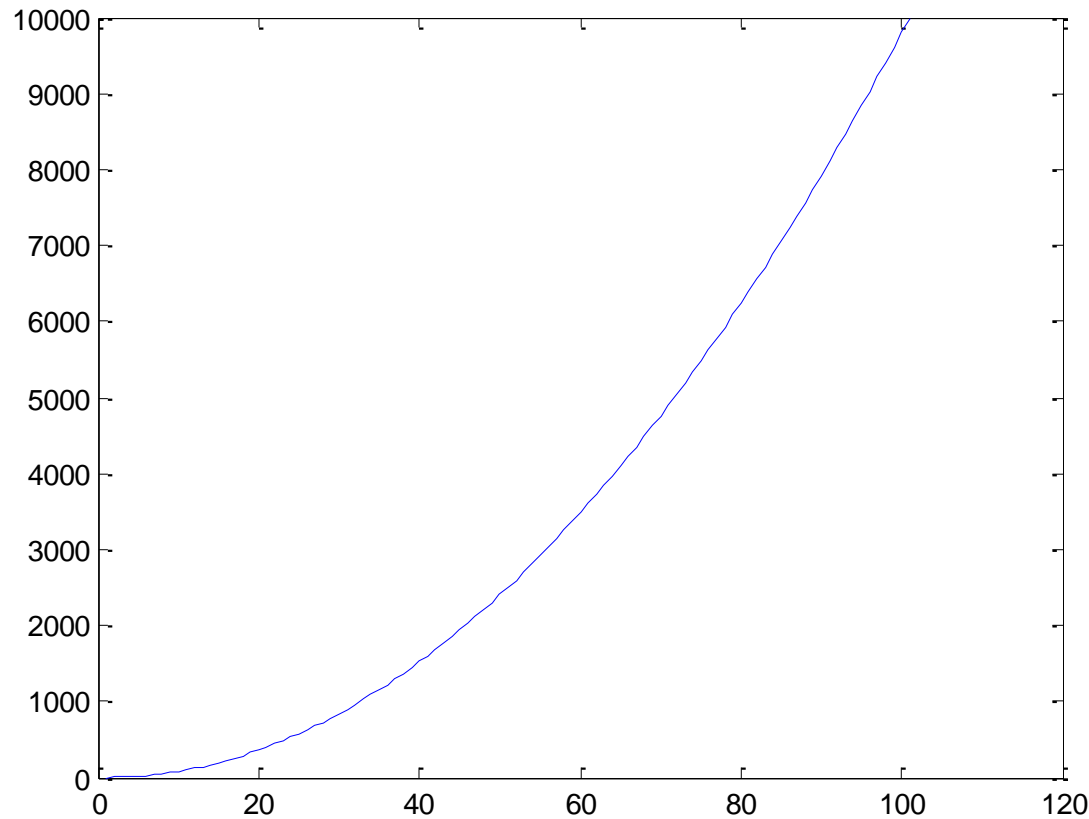


The screenshot shows a MATLAB script editor window titled "C:\TETY\METY580\the_use_of_plot.m". The window contains a script with the following code:

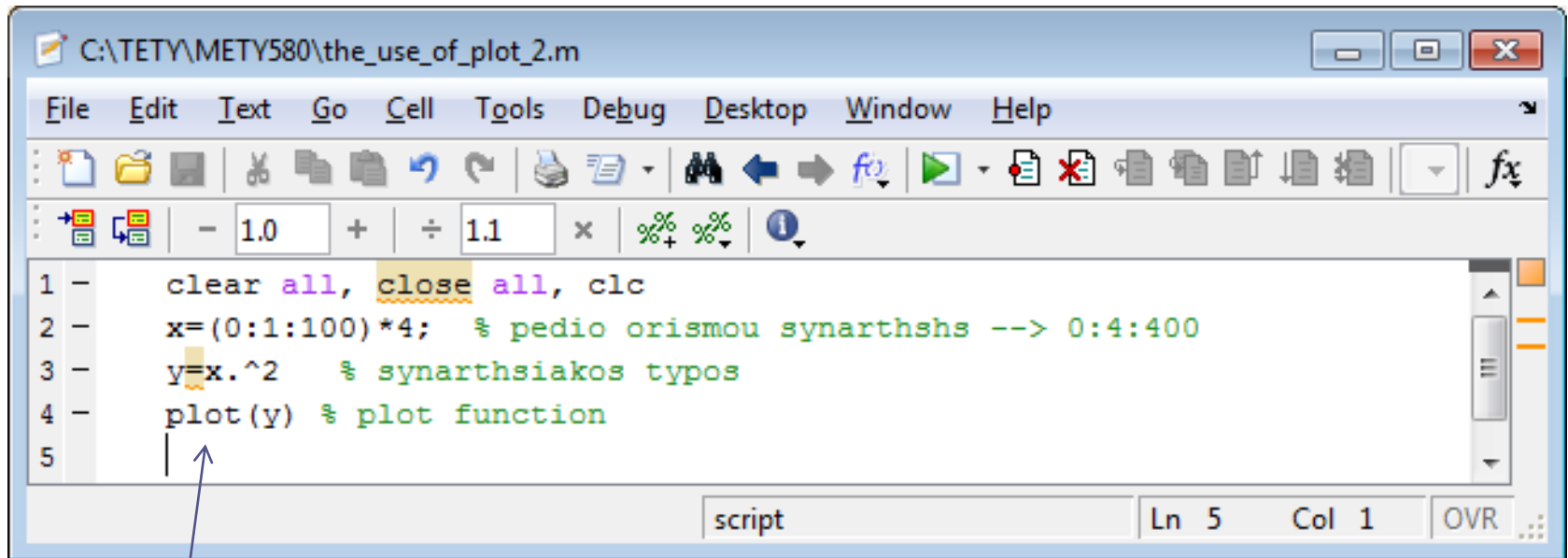
```
1 - clear all, close all, clc
2 - x=0:1:100; % pedio orismou synarthshs --> x_start:step:x_end
3 - y=x.^2 % synarthsiakos typos
4 - plot(y) % plot function
5
```

The status bar at the bottom indicates "script", "Ln 5", "Col 1", and "OVR".

Ορισμός και γραφικές παραστάσεις συναρτήσεων στο matlab (συνάρτηση $y=x^2$)



Ορισμός και γραφικές παραστάσεις συναρτήσεων στο matlab (συνάρτηση $y=x^2$)



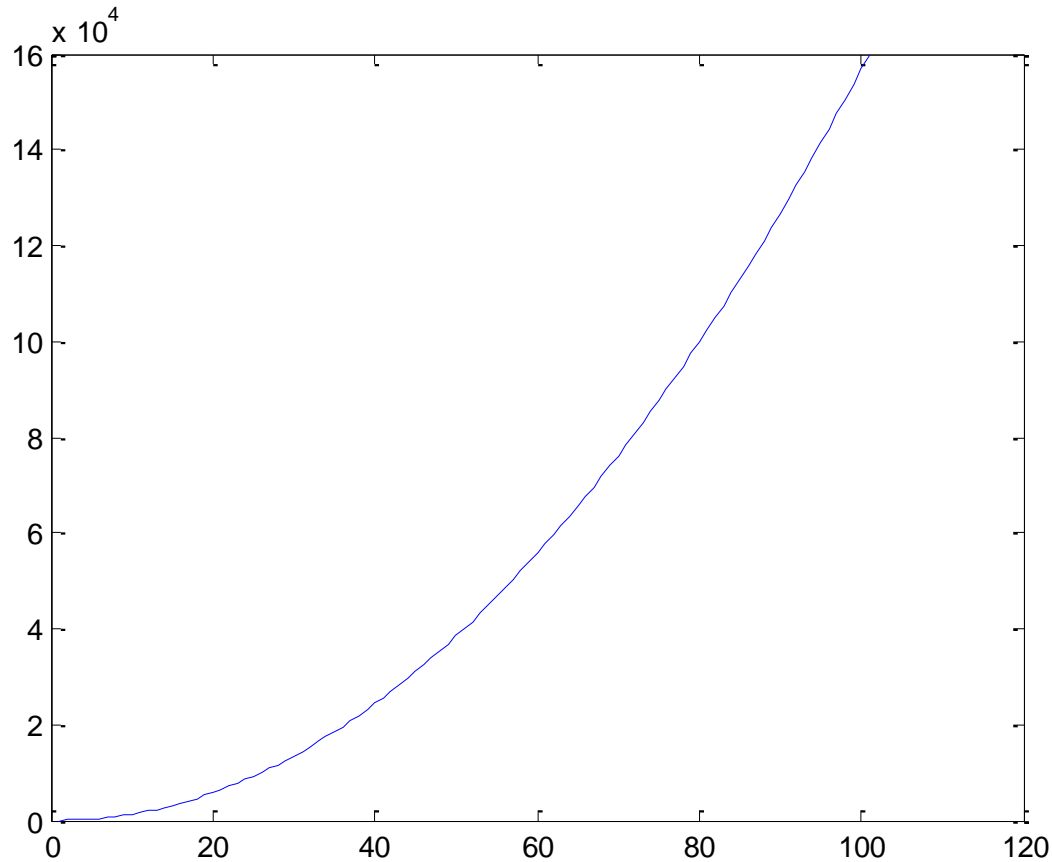
The screenshot shows the MATLAB script editor window titled "C:\TETY\METY580\the_use_of_plot_2.m". The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, Desktop, Window, and Help. The toolbar contains various icons for file operations, editing, and execution. Below the toolbar is a numeric keypad with values 1.0, 1.1, and mathematical symbols like +, -, *, /, and %. The script content is as follows:

```
1 - clear all, close all, clc
2 - x=(0:1:100)*4; % pedio orismou synarthshs --> 0:4:400
3 - y=x.^2 % synarthsiakos typos
4 - plot(y) % plot function
5 -
```

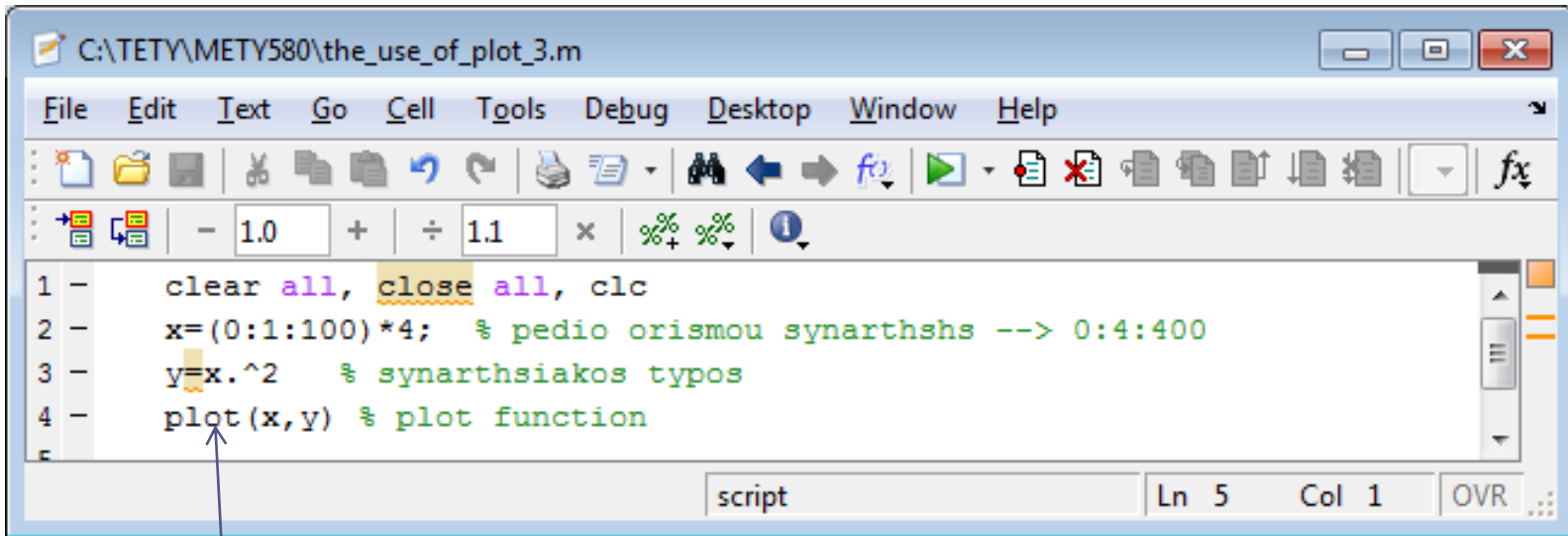
The status bar at the bottom indicates "script", "Ln 5", "Col 1", and "OVR".

plot(y)

Ορισμός και γραφικές παραστάσεις συναρτήσεων στο matlab (συνάρτηση $y=x^2$)



Ορισμός και γραφικές παραστάσεις συναρτήσεων στο matlab (συνάρτηση $y=x^2$)



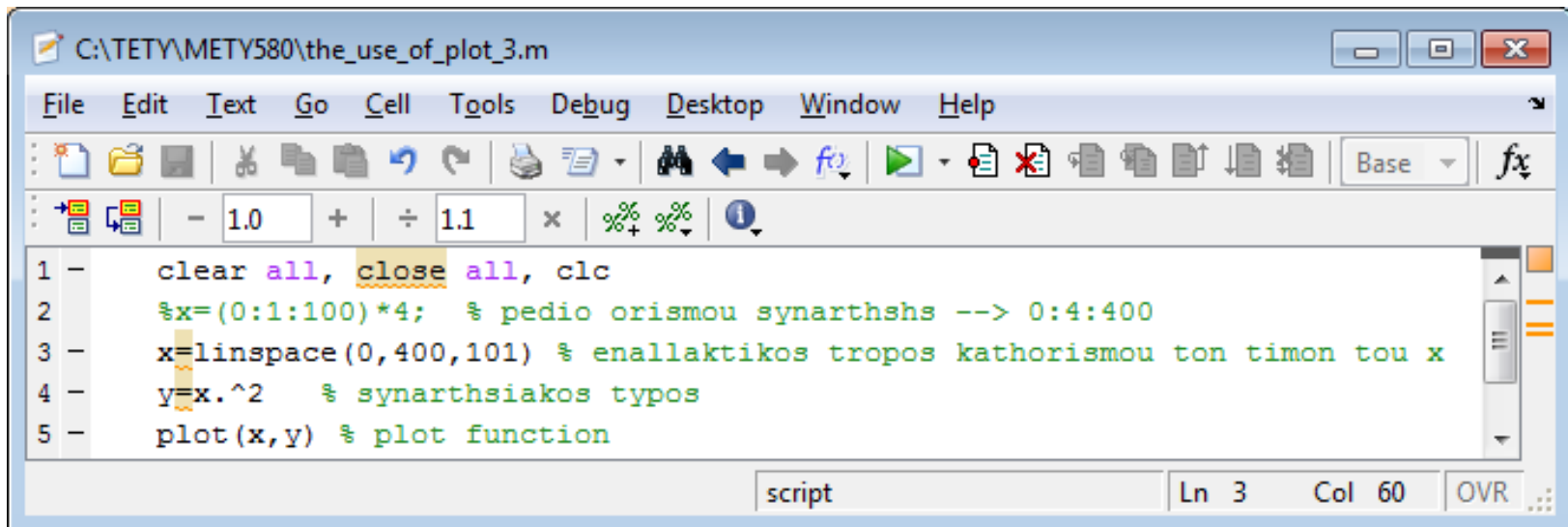
The screenshot shows a MATLAB script editor window titled 'C:\TETY\METY580\the_use_of_plot_3.m'. The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, Desktop, Window, and Help. The toolbar contains various icons for file operations and execution. Below the toolbar is a numeric keypad with values 1.0, 1.1, and symbols for addition, subtraction, multiplication, and division. The main editor area contains the following code:

```
1 - clear all, close all, clc
2 - x=(0:1:100)*4; % pedio orismou synarthshs --> 0:4:400
3 - y=x.^2 % synarthsiakos typos
4 - plot(x,y) % plot function
```

The status bar at the bottom indicates 'script', 'Ln 5', 'Col 1', and 'OVR'.

plot (x,y)

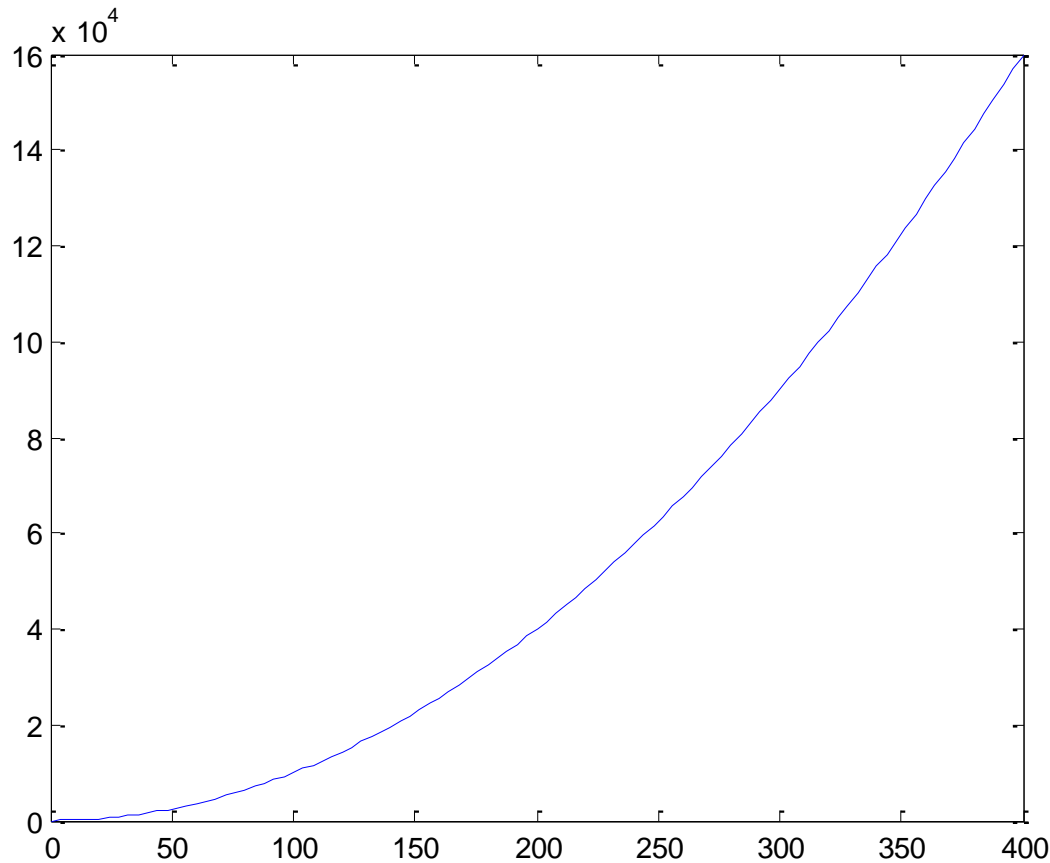
Ορισμός και γραφικές παραστάσεις συναρτήσεων στο matlab (συνάρτηση $y=x^2$)



```
C:\TETY\METY580\the_use_of_plot_3.m
File Edit Text Go Cell Tools Debug Desktop Window Help
- 1.0 + ÷ 1.1 x %>% %>% ⓘ
1 - clear all, close all, clc
2 - %x=(0:1:100)*4; % pedio orismou synarthshs --> 0:4:400
3 - x=linspace(0,400,101) % enallaktikos tropos kathorismou ton timon tou x
4 - y=x.^2 % synarthsiakos typos
5 - plot(x,y) % plot function
script Ln 3 Col 60 OVR
```

`linspace(x_start,x_end,number of points)`

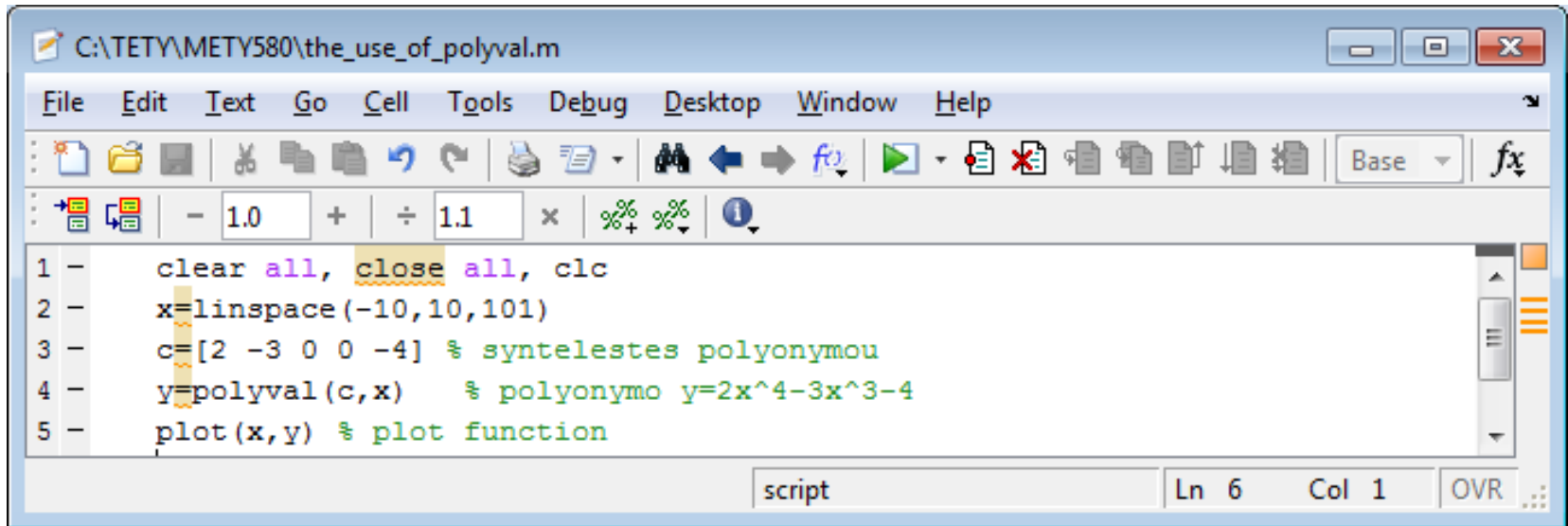
Ορισμός και γραφικές παραστάσεις συναρτήσεων στο matlab (συνάρτηση $y=x^2$)



Τιμές x →

Ορισμός και γραφικές παραστάσεις πολυωνυμικών συναρτησεων στο matlab

Παράδειγμα: $y=2x^4-3x^3-4$



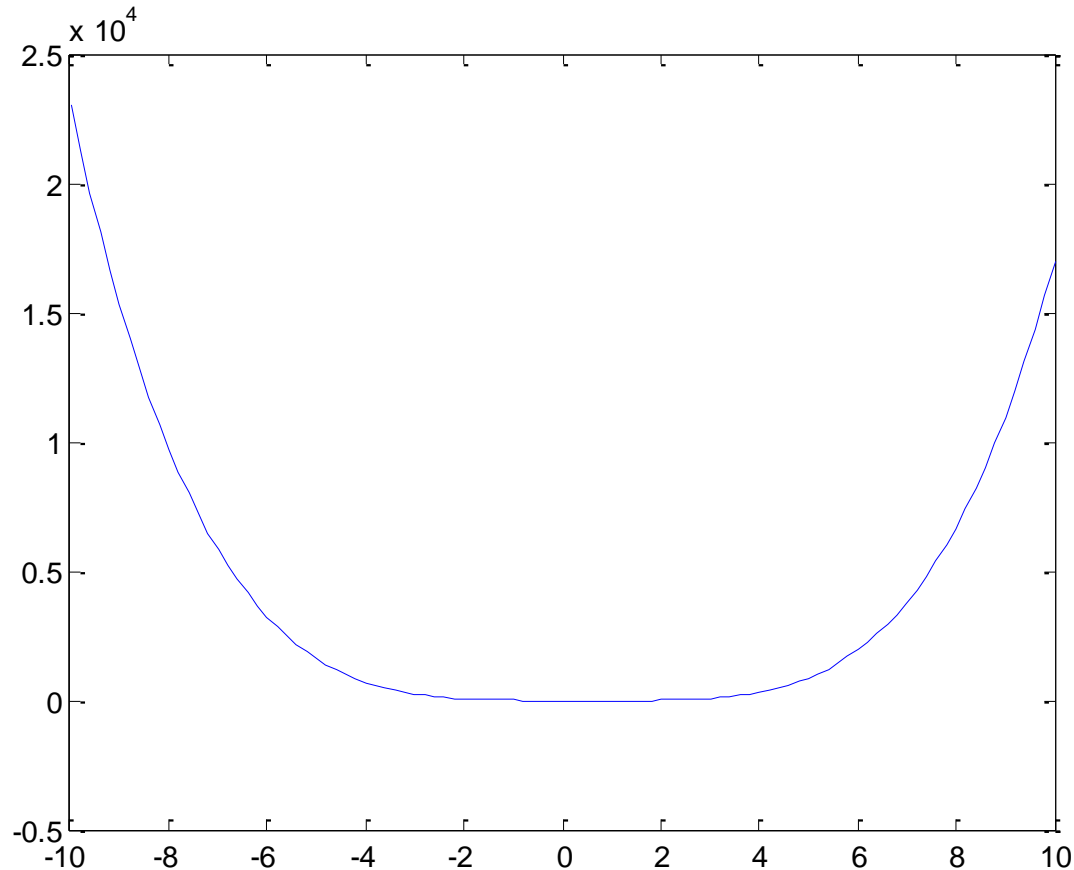
The screenshot shows the MATLAB script editor window titled 'C:\TETY\METY580\the_use_of_polyval.m'. The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, Desktop, Window, and Help. The toolbar contains various icons for file operations and execution. Below the toolbar is a calculator-like interface with a display showing '1.0' and various mathematical operators. The main editor area contains the following code:

```
1 - clear all, close all, clc
2 - x=linspace(-10,10,101)
3 - c=[2 -3 0 0 -4] % syntelestes polyonymou
4 - y=polyval(c,x) % polyonimo y=2x^4-3x^3-4
5 - plot(x,y) % plot function
```

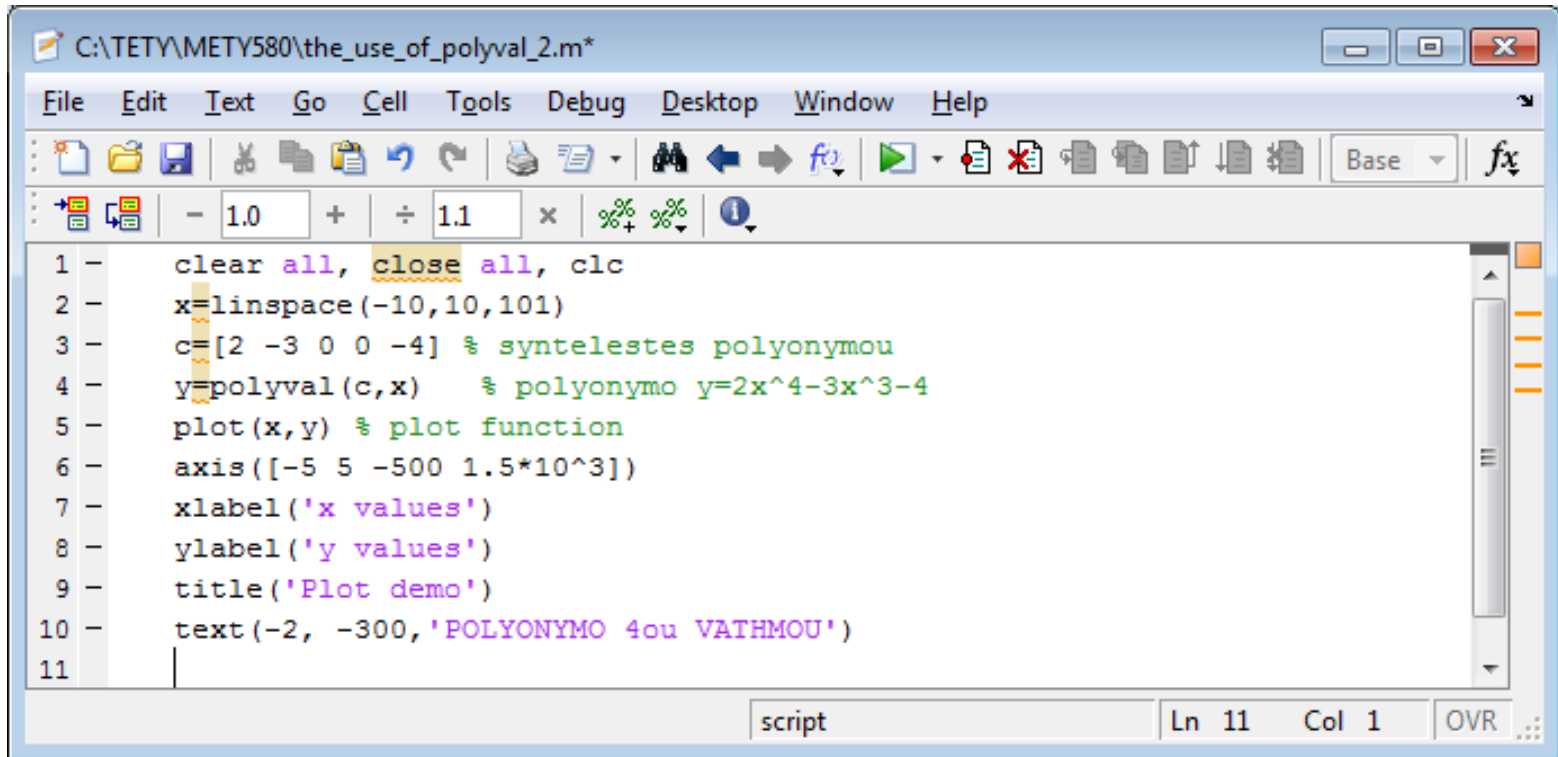
The status bar at the bottom indicates 'script', 'Ln 6', 'Col 1', and 'OVR'.

Ορισμός και γραφικές παραστάσεις πολυωνυμικών συναρτήσεων στο matlab

Παράδειγμα: $y=2x^4-3x^3-4$



Επιλογές πλοταρίσματος

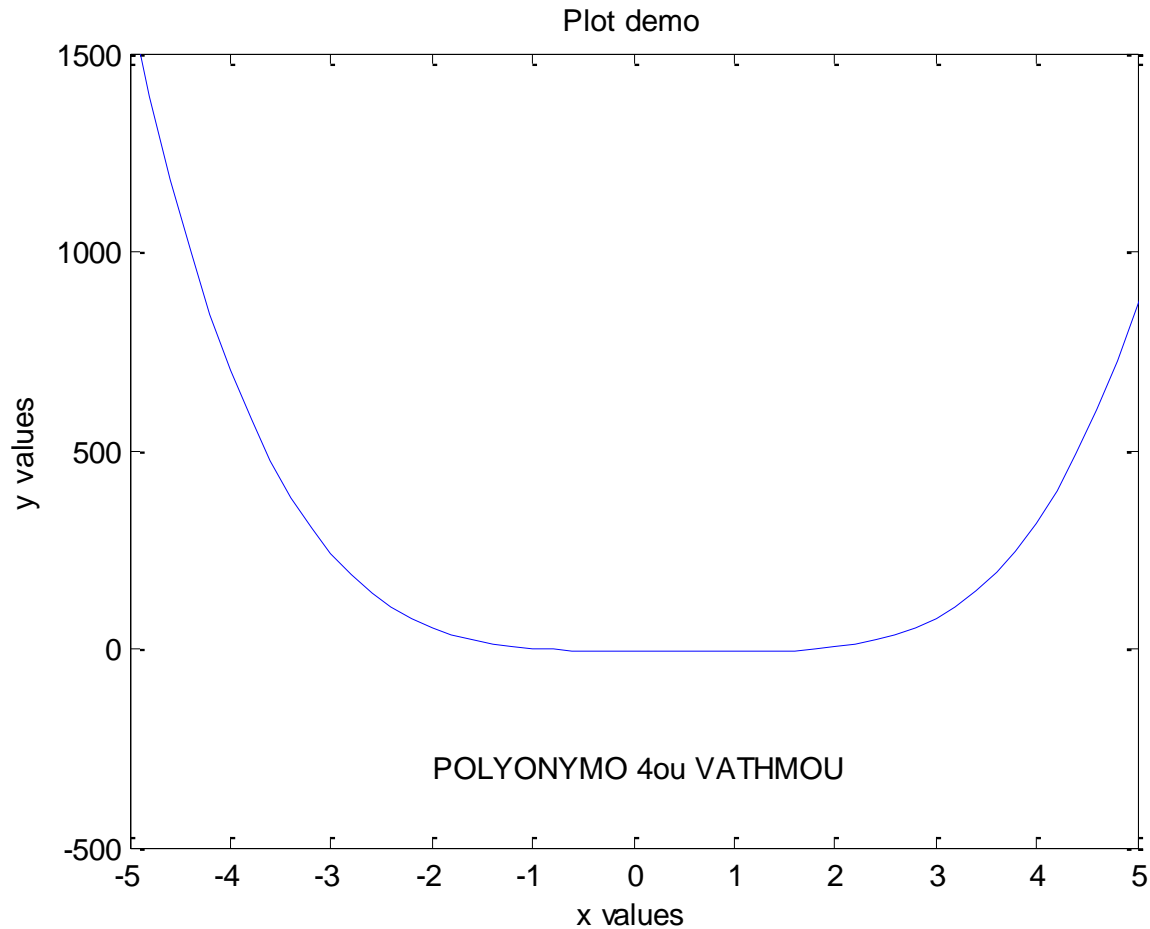


The image shows a screenshot of the MATLAB editor window. The title bar indicates the file path is C:\TETY\METY580\the_use_of polyval_2.m*. The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, Desktop, Window, and Help. The toolbar contains various icons for file operations, editing, and execution. Below the toolbar is a numeric keypad with values 1.0 and 1.1. The main editor area contains the following MATLAB code:

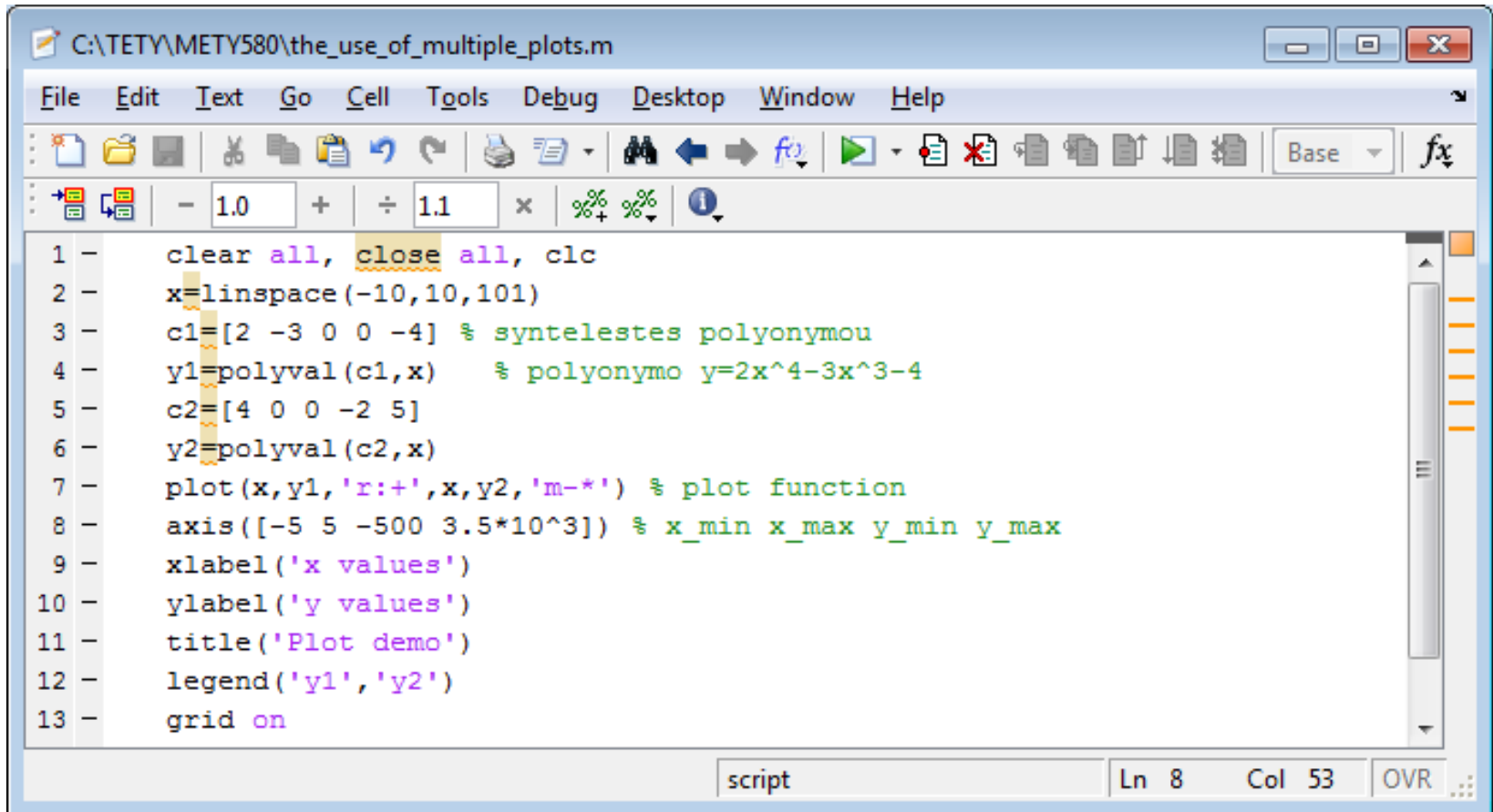
```
1 - clear all, close all, clc
2 - x=linspace(-10,10,101)
3 - c=[2 -3 0 0 -4] % syntelestes polyonymou
4 - y=polyval(c,x) % polyonymo y=2x^4-3x^3-4
5 - plot(x,y) % plot function
6 - axis([-5 5 -500 1.5*10^3])
7 - xlabel('x values')
8 - ylabel('y values')
9 - title('Plot demo')
10 - text(-2, -300, 'POLYONYMO 4ou VATHMOU')
11 -
```

The status bar at the bottom shows the current file is 'script', the cursor is at line 11, column 1, and the window is in 'OVR' (Overwrite) mode.

Επιλογές πλοταρίσματος



Επιλογές πλοταρίσματος

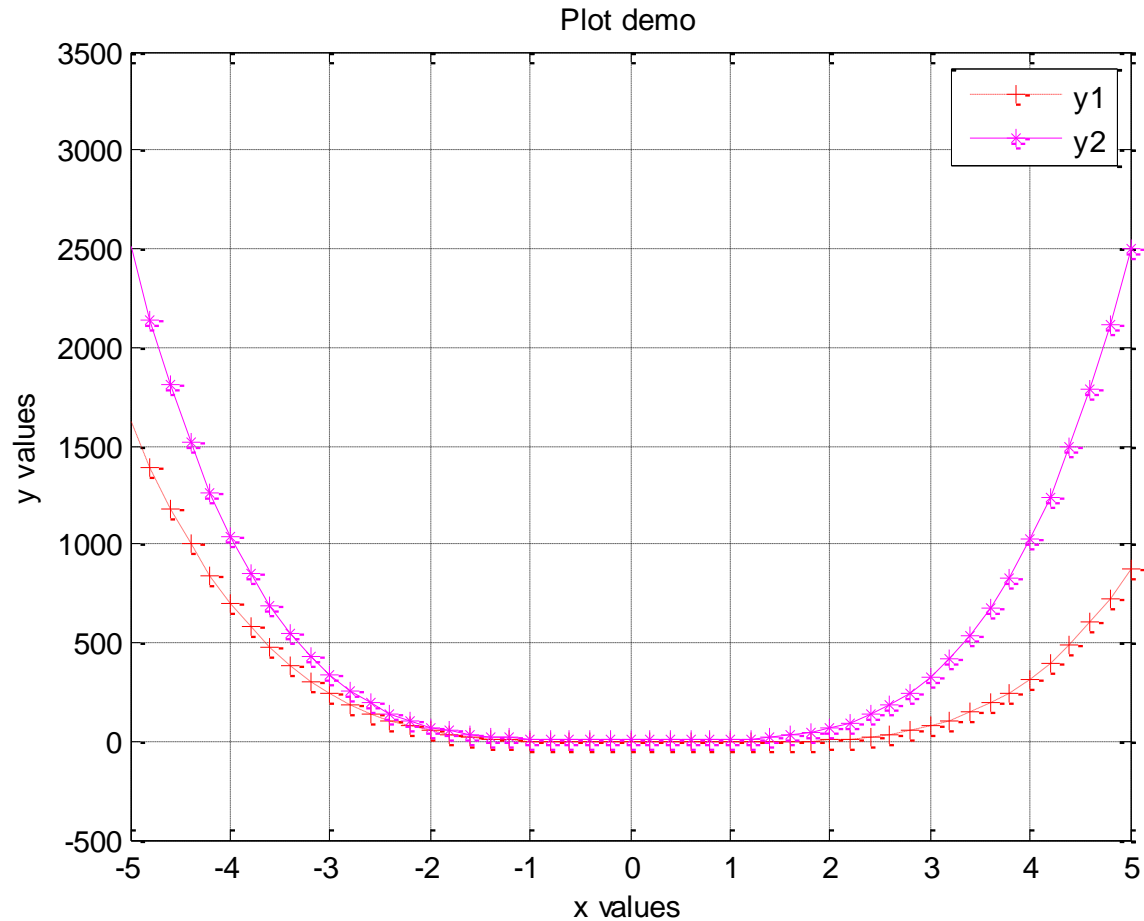


The image shows a screenshot of a MATLAB script editor window. The title bar indicates the file path: C:\TETY\METY580\the_use_of_multiple_plots.m. The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, Desktop, Window, and Help. The toolbar contains various icons for file operations, editing, and execution. Below the toolbar is a numeric keypad with values 1.0 and 1.1, and a 'x' button. The main editor area contains the following MATLAB code:

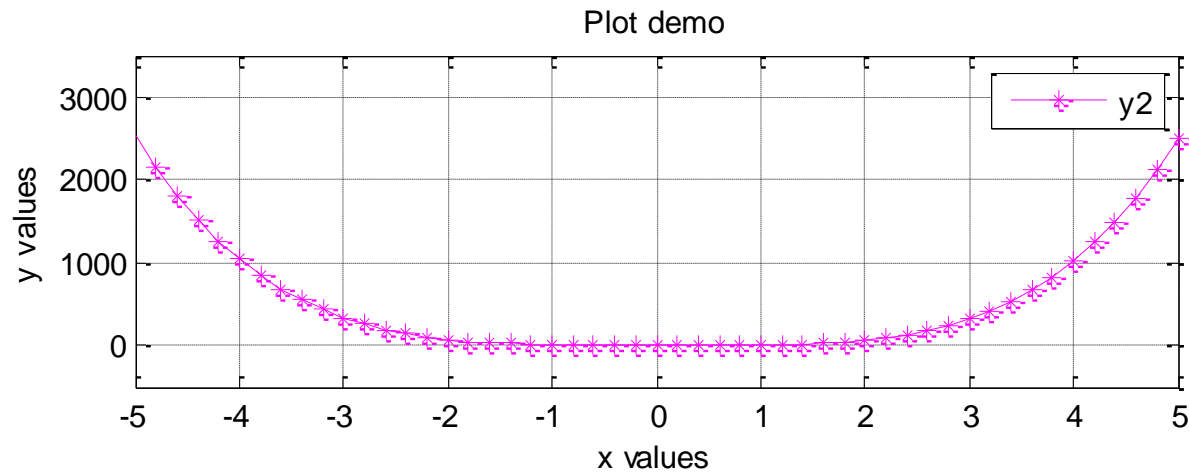
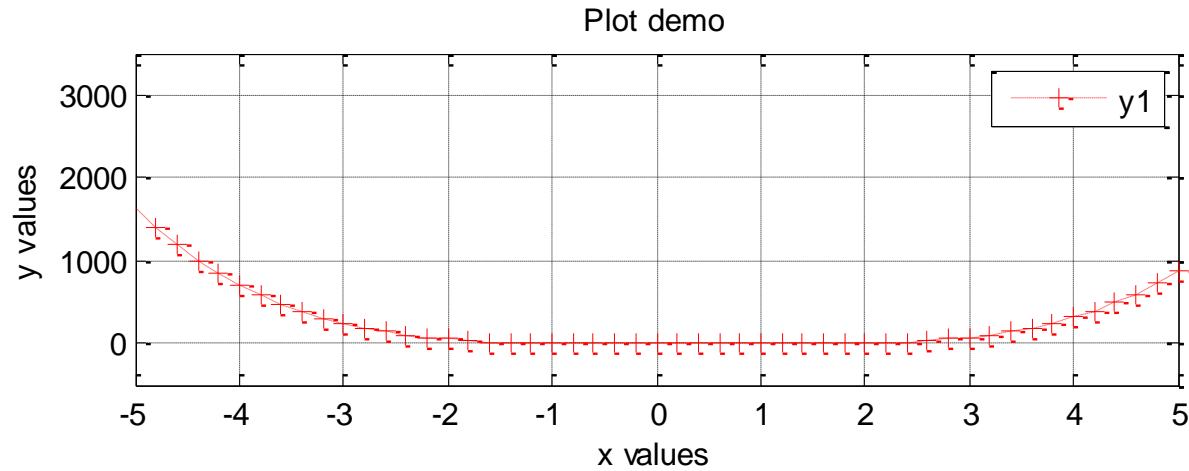
```
1 - clear all, close all, clc
2 - x=linspace(-10,10,101)
3 - c1=[2 -3 0 0 -4] % syntelestes polyonou
4 - y1=polyval(c1,x) % polyonimo y=2x^4-3x^3-4
5 - c2=[4 0 0 -2 5]
6 - y2=polyval(c2,x)
7 - plot(x,y1,'r:+',x,y2,'m-*') % plot function
8 - axis([-5 5 -500 3.5*10^3]) % x_min x_max y_min y_max
9 - xlabel('x values')
10 - ylabel('y values')
11 - title('Plot demo')
12 - legend('y1','y2')
13 - grid on
```

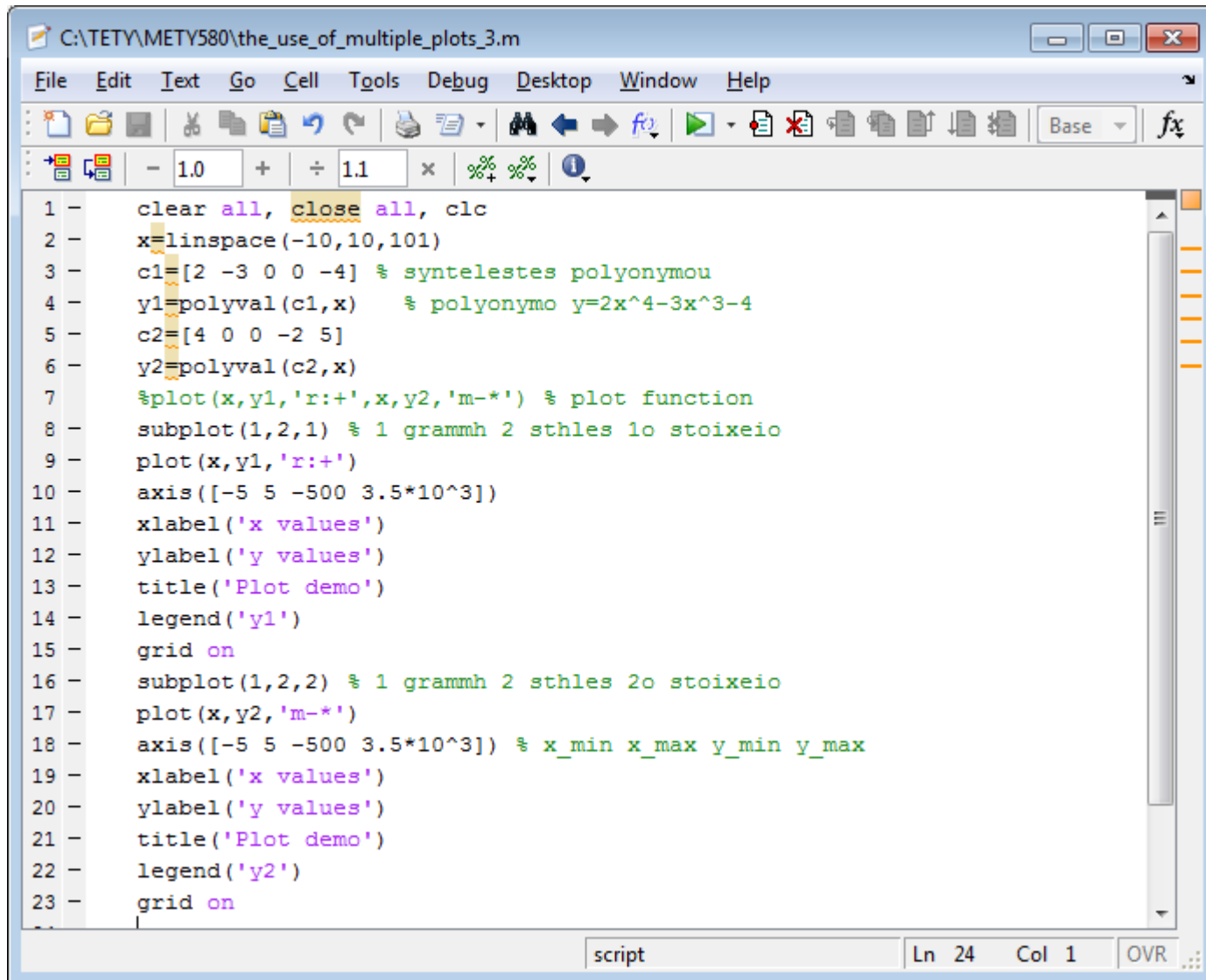
The status bar at the bottom shows 'script', 'Ln 8', 'Col 53', and 'OVR'.

Επιλογές πλοταρίσματος



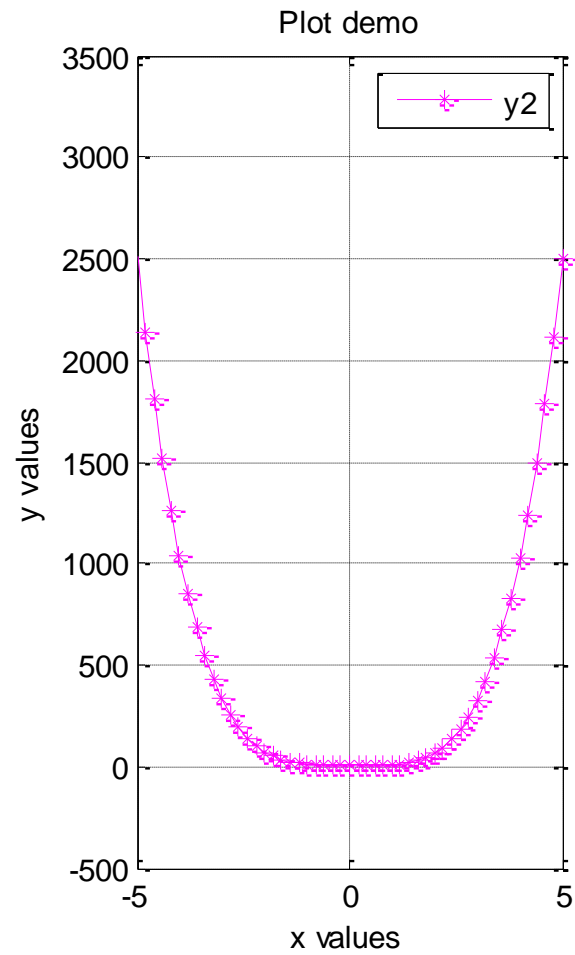
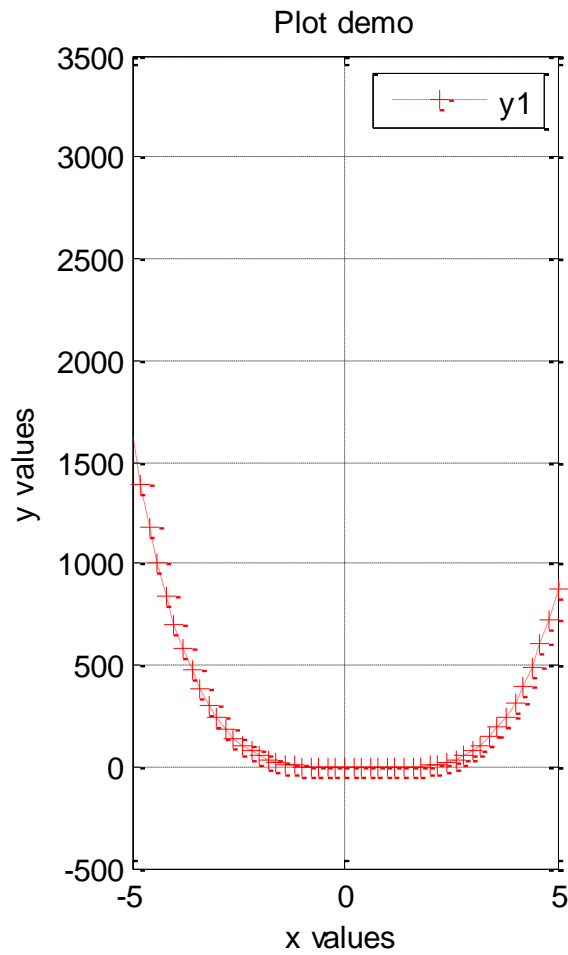
2 γραμμές 1 στήλη



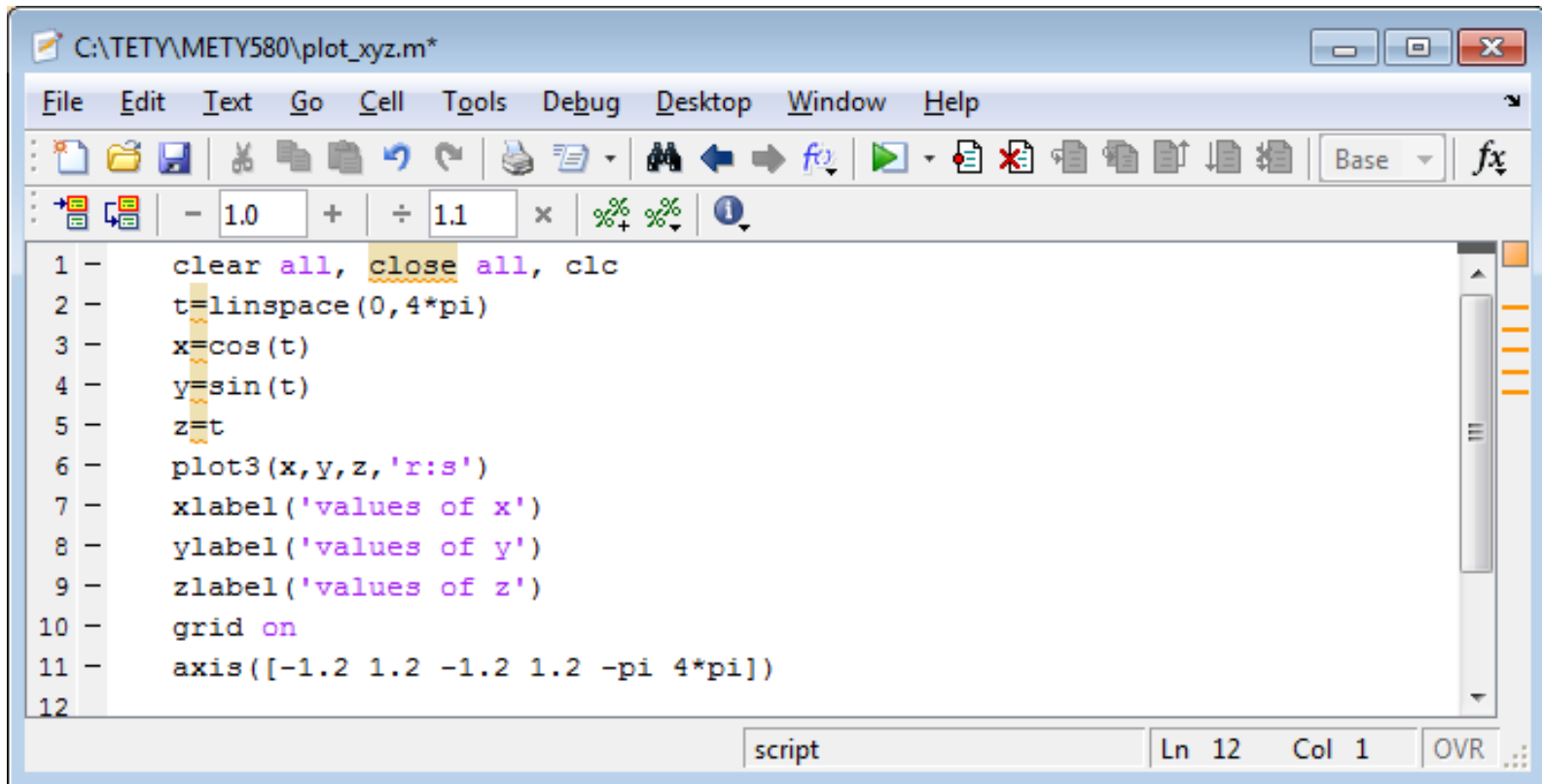


```
C:\TETY\METY580\the_use_of_multiple_plots_3.m
File Edit Text Go Cell Tools Debug Desktop Window Help
Base fx
- 1.0 + ÷ 1.1 × %/% %/% ⓘ
1 - clear all, close all, clc
2 - x=linspace(-10,10,101)
3 - c1=[2 -3 0 0 -4] % syntelestes polyonymou
4 - y1=polyval(c1,x) % polyonimo y=2x^4-3x^3-4
5 - c2=[4 0 0 -2 5]
6 - y2=polyval(c2,x)
7 - %plot(x,y1,'r:+',x,y2,'m-*) % plot function
8 - subplot(1,2,1) % 1 grammh 2 sthles 1o stoixeio
9 - plot(x,y1,'r:+')
10 - axis([-5 5 -500 3.5*10^3])
11 - xlabel('x values')
12 - ylabel('y values')
13 - title('Plot demo')
14 - legend('y1')
15 - grid on
16 - subplot(1,2,2) % 1 grammh 2 sthles 2o stoixeio
17 - plot(x,y2,'m-*)
18 - axis([-5 5 -500 3.5*10^3]) % x_min x_max y_min y_max
19 - xlabel('x values')
20 - ylabel('y values')
21 - title('Plot demo')
22 - legend('y2')
23 - grid on
script Ln 24 Col 1 OVR
```

1 γραμμή 2 στήλες



plot3

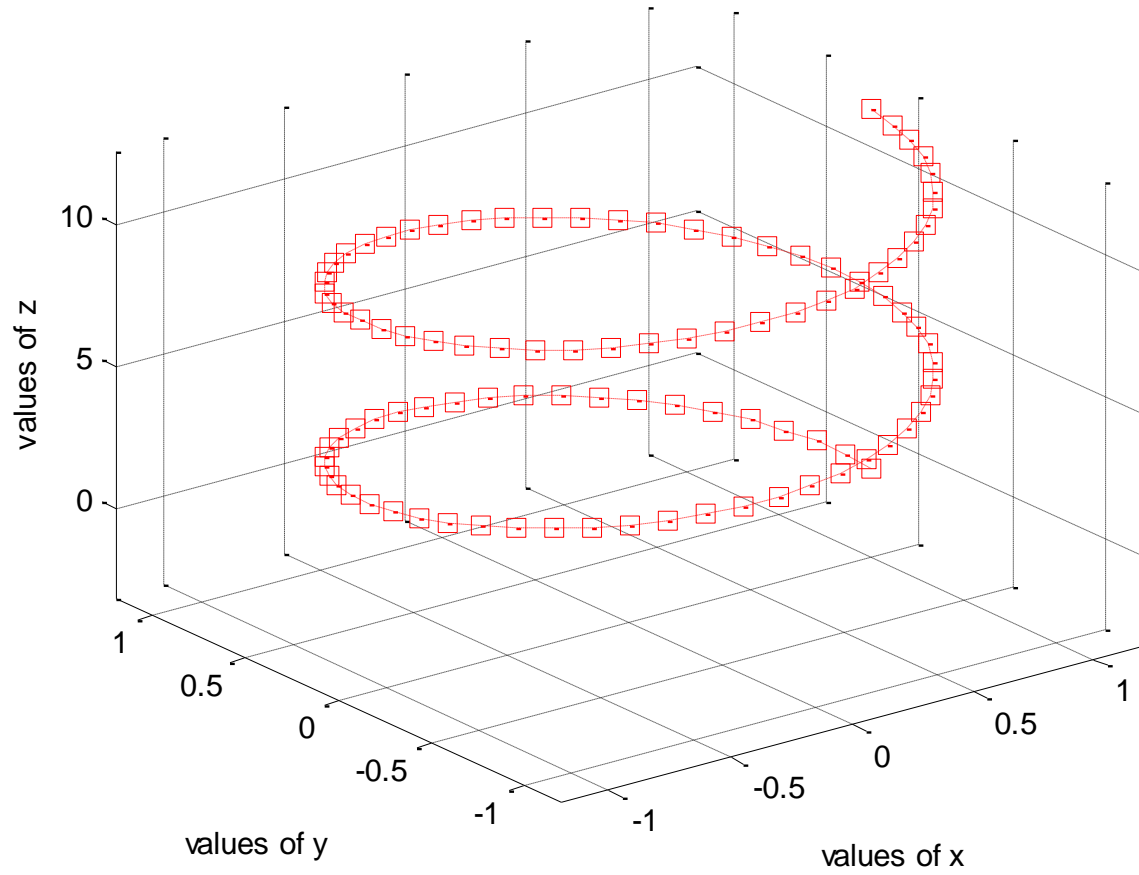


The image shows a screenshot of the MATLAB script editor window. The window title is "C:\TETY\METY580\plot_xyz.m*". The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, Desktop, Window, and Help. The toolbar contains various icons for file operations, editing, and execution. The script editor shows the following code:

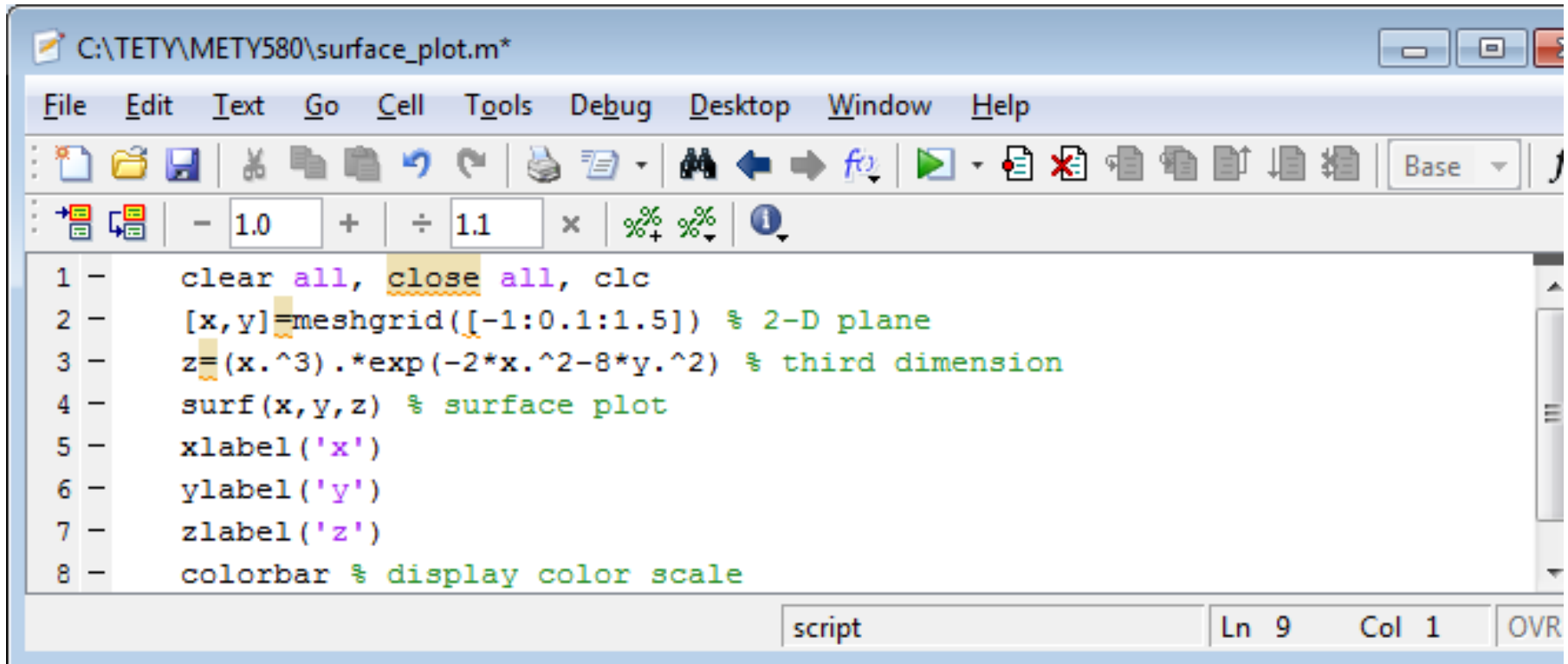
```
1 - clear all, close all, clc
2 - t=linspace(0,4*pi)
3 - x=cos(t)
4 - y=sin(t)
5 - z=t
6 - plot3(x,y,z,'r:s')
7 - xlabel('values of x')
8 - ylabel('values of y')
9 - zlabel('values of z')
10 - grid on
11 - axis([-1.2 1.2 -1.2 1.2 -pi 4*pi])
12
```

The status bar at the bottom indicates "script", "Ln 12", "Col 1", and "OVR".

plot3



Surface plot

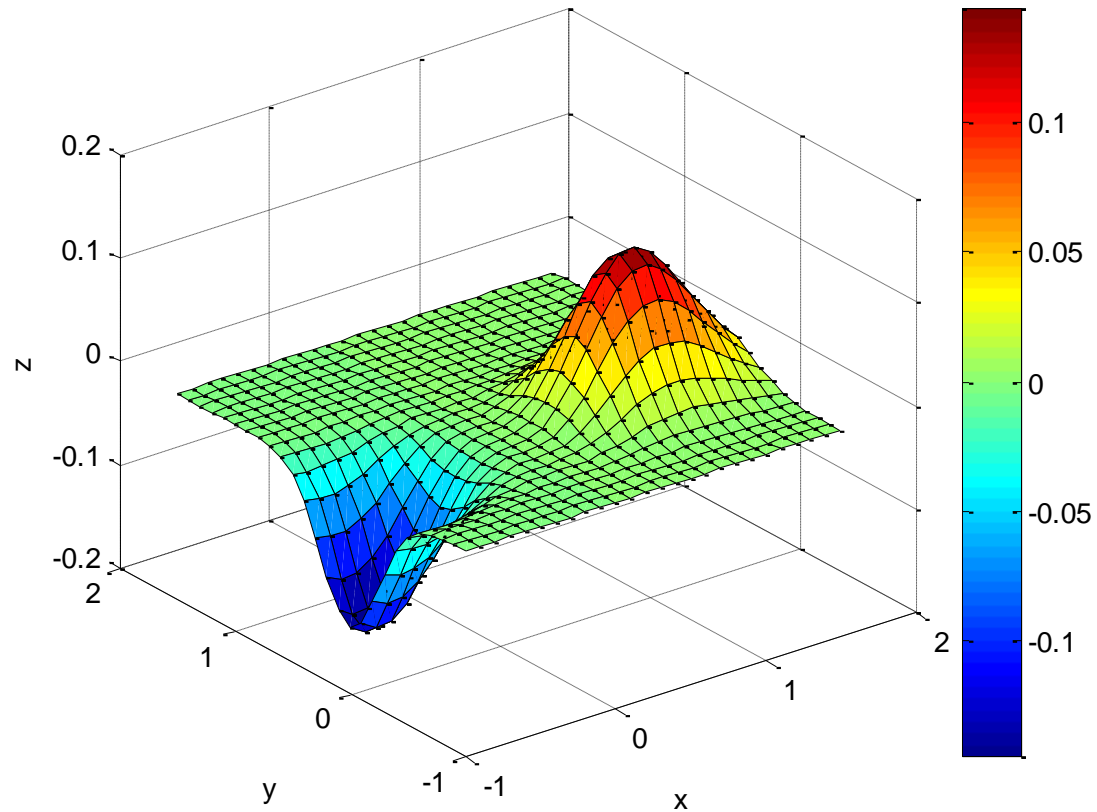


The image shows a screenshot of a MATLAB script editor window. The title bar indicates the file path is C:\TETY\METY580\surface_plot.m*. The menu bar includes File, Edit, Text, Go, Cell, Tools, Debug, Desktop, Window, and Help. The toolbar contains various icons for file operations, editing, and execution. Below the toolbar is a numeric keypad with values 1.0, 1.1, and a percentage sign. The main editor area contains the following MATLAB code:

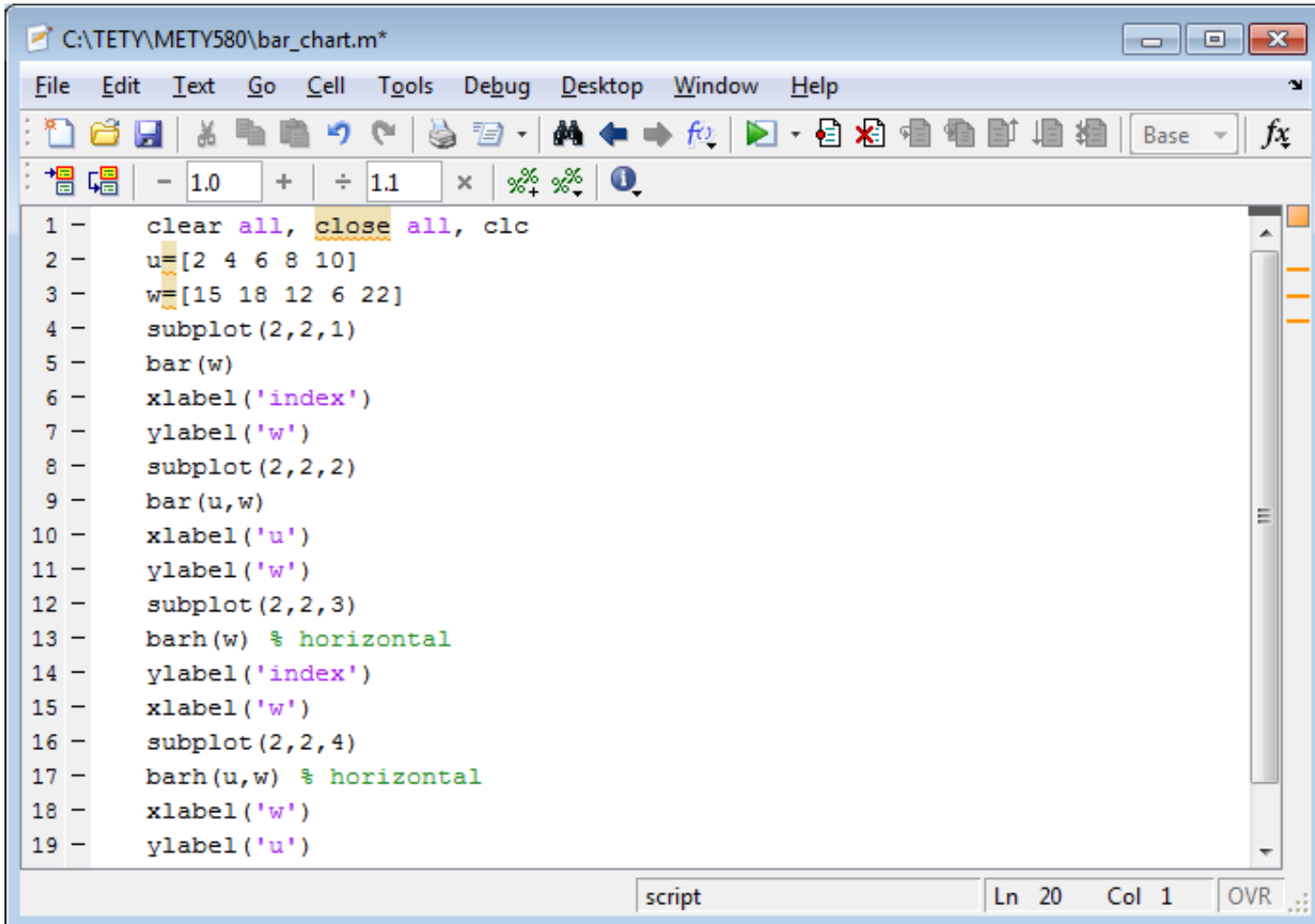
```
1 - clear all, close all, clc
2 - [x,y]=meshgrid([-1:0.1:1.5]) % 2-D plane
3 - z=(x.^3).*exp(-2*x.^2-8*y.^2) % third dimension
4 - surf(x,y,z) % surface plot
5 - xlabel('x')
6 - ylabel('y')
7 - zlabel('z')
8 - colorbar % display color scale
```

The status bar at the bottom shows 'script', 'Ln 9', 'Col 1', and 'OVR'.

Surface plot

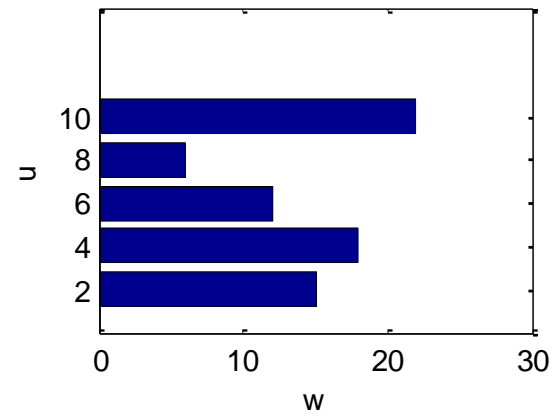
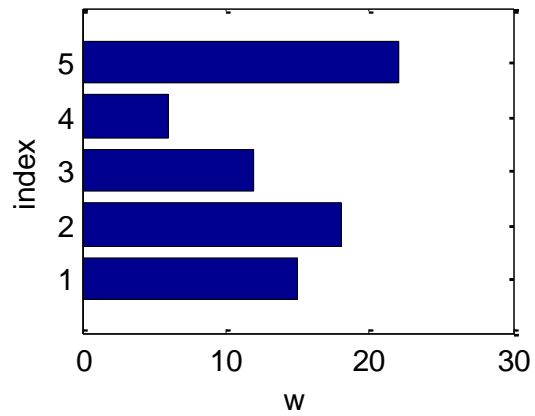
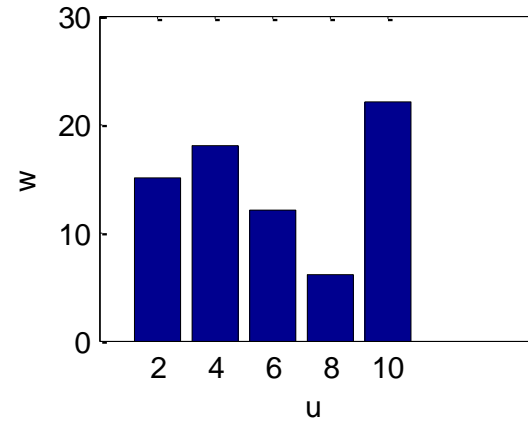
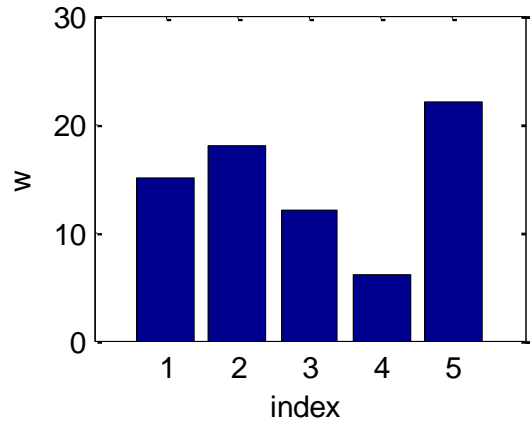


Bar chart



```
C:\TETY\METY580\bar_chart.m*
File Edit Text Go Cell Tools Debug Desktop Window Help
1 - clear all, close all, clc
2 - u=[2 4 6 8 10]
3 - w=[15 18 12 6 22]
4 - subplot(2,2,1)
5 - bar(w)
6 - xlabel('index')
7 - ylabel('w')
8 - subplot(2,2,2)
9 - bar(u,w)
10 - xlabel('u')
11 - ylabel('w')
12 - subplot(2,2,3)
13 - barh(w) % horizontal
14 - ylabel('index')
15 - xlabel('w')
16 - subplot(2,2,4)
17 - barh(u,w) % horizontal
18 - xlabel('w')
19 - ylabel('u')
script Ln 20 Col 1 OVR ...
```

Bar chart



Εύρεση ριζών πολυωνύμου- συνάρτηση `roots`

Πολυώνυμο $P(x)=x^2-1$

Κώδικας

1. `clear all, close all, clc`
2. `c=[1 0 -1]`
3. `roots(c)`

Αποτέλεσμα

`c =`
1 0 -1

`ans =`

-1
1

Εύρεση ριζών πολυωνύμου- συνάρτηση roots

Πολυώνυμο $P(x)=2x^3+x^2-1$

Κώδικας

1. clear all, close all, clc
2. $c=[2 \ 1 \ 0 \ -1]$
3. roots(c)

Αποτέλεσμα

c =

2 1 0 -1

ans =

-0.5786 + 0.6526i

-0.5786 - 0.6526i

0.6573

Εύρεση ριζών πολυωνύμου- συνάρτηση fzero

Πολυώνυμο $P(x)=2x^3+x^2-1$

Κώδικας

```
1 clear all, close all, clc
2 myfun = @(x) 2*x.^3+x.^2-1;
3 x = fzero(myfun,[-1 1])
```

Αποτέλεσμα

```
x =
0.6573
```

Αναζητούμε τις ρίζες του πολυωνύμου κοντά στο διάστημα $[-1 1]$.
Προσδιορίστηκε μόνο η πραγματική ρίζα

Επίλυση υπερβατικής «transcendental» εξίσωσης [παράδειγμα $x=\tan(x)$] με χρήση της `fzero`

Κώδικας

1. `clear all, close all, clc`
2. `myfun = @(x) x-tan(x);`
3. `x = fzero(myfun,pi)`

Αποτέλεσμα

$$x = 4.4934 \quad (=1.43 \pi)$$

Στην ουσία αναζητούμε τη ρίζα της συνάρτησης $x-\tan(x)$ κοντά στην τιμή $x=\pi$

Επίλυση υπερβατικής «transcendental» εξίσωσης [παράδειγμα $\sin(x)=x$] με χρήση της `solve`

Κώδικας

1. `clear all, close all, clc`
2. `syms x;`
3. `s='sin(x)=x'`
4. `solve(s)`

Αποτέλεσμα

`s =`

`sin(x)=x`

`ans =`

`matrix([[0]])` → δηλαδή $x=0$

Επίλυση υπερβατικής «transcendental» εξίσωσης [παράδειγμα $\sin(x)=x^2-1$] με χρήση της `solve`

Κώδικας

1. `clear all, close all, clc`
2. `syms x;`
3. `s='sin(x)=x^2-1'`
4. `solve(s)`

Αποτέλεσμα

`s =`

`sin(x)=x^2-1`

`ans =`

`matrix([[-0.63673265080528201088799090383828]])` →

δηλαδή $x = -0.63673$

Πίνακες

Ορισμός πίνακα

```
>> A = [2 5 3; 1 1 4]
```

```
A = 2   5   3  
     1   1   4
```

Επιλογή σειράς

```
>> A(2, :)
```

```
ans =
```

```
1   1   4
```

Επιλογή στήλης

```
>> A(:, 3)
```

```
ans =
```

```
3
```

```
4
```

Πίνακες

```
>> A = zeros(4) % 4x4 πίνακας με μηδενικά στοιχεία  
>> m =1:4;  
>> A(:, 2) = m'; % δεύτερη στήλη  
>> A(2, :) = m; % δεύτερη γραμμή
```

```
A =  
  0  1  0  0  
  1  2  3  4  
  0  3  0  0  
  0  4  0  0
```

Πίνακες

```
>> A = [1 2; 3 4]
>> B = [1 1; 1 3]
>> A.^B
```

```
ans =
     1     2
     3    64
```

```
>> A = [1 2; 3 4]
>> B = A.^2
```

```
ans =
     1     4
     9    16
```

```
>> A = [1 2; 3 4]
>> B = 2.^A
```

```
ans =
     2     4
     8    16
```

Πίνακες - επίλυση συστημάτων εξισώσεων

Πρώτο σύστημα

$$2x+3y=7$$

$$x-y=1$$

Δεύτερο σύστημα

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

$$x-y=8$$

$$\begin{pmatrix} 2 & 3 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 7 & -2 \\ 1 & 8 \end{pmatrix}$$

$$A=[2 \ 3; \ 1 \ -1]$$

$$B=[7 \ -2; \ 1 \ 8]$$

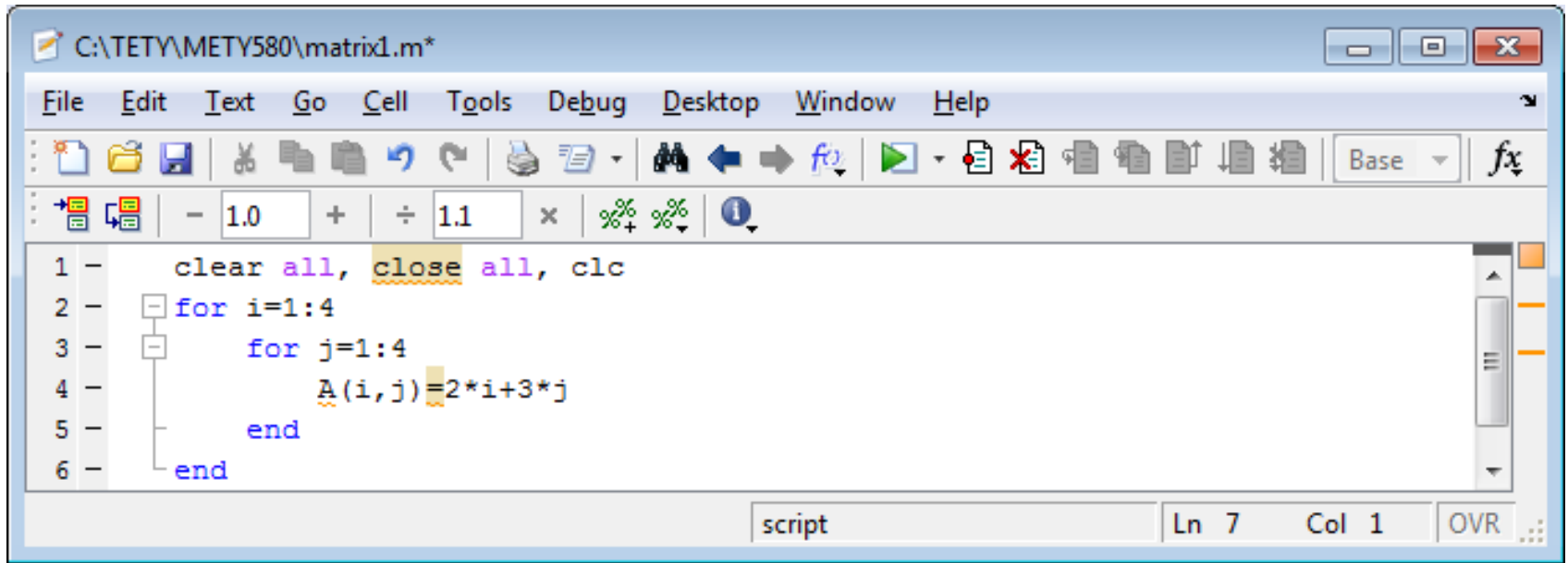
$$X=A \setminus B$$

X=

$$\begin{matrix} 2.0000 & 4.4000 \end{matrix}$$

$$\begin{matrix} 1.0000 & -3.6000 \end{matrix}$$

Ορισμός πίνακα με χρήση nested loops



```
C:\TETY\METY580\matrix1.m*
File Edit Text Go Cell Tools Debug Desktop Window Help
- 1.0 + ÷ 1.1 x % %
1 - clear all, close all, clc
2 - for i=1:4
3 -     for j=1:4
4 -         A(i,j)=2*i+3*j
5 -     end
6 - end
script Ln 7 Col 1 OVR
```

Αποτέλεσμα:

A =

5	8	11	14
7	10	13	16
9	12	15	18
11	14	17	20

Προσπέλαση αρχείου filename.dat που βρίσκεται σε τυχαία θέση στο σκληρό δίσκο (π.χ. c:\folder\) και πλοτάρισμα των στοιχείων του (π.χ. για αρχείο με δύο στήλες δεδομένων, πλοτάρισμα των στοιχείων της δεύτερης στήλης σα συνάρτηση των στοιχείων της πρώτης)

```
load c:\folder\filename.dat -ascii  
plot(filename(:,1),filename(:,2))
```

Στοιχεία πρώτης στήλης



Στοιχεία δεύτερης στήλης

**Σας ευχαριστώ !
Καλή ενασχόληση με το Matlab !**