

# Vẽ đồ thị trong Matlab

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# TRONG KHÔNG GIAN 2 CHIỀU

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## ■ Lệnh plot

`plot(x, f(x))`

Với:

$f(x)$  - hàm số cần vẽ

$x$  – vector miền giá trị của hàm  $f$

## Ví dụ

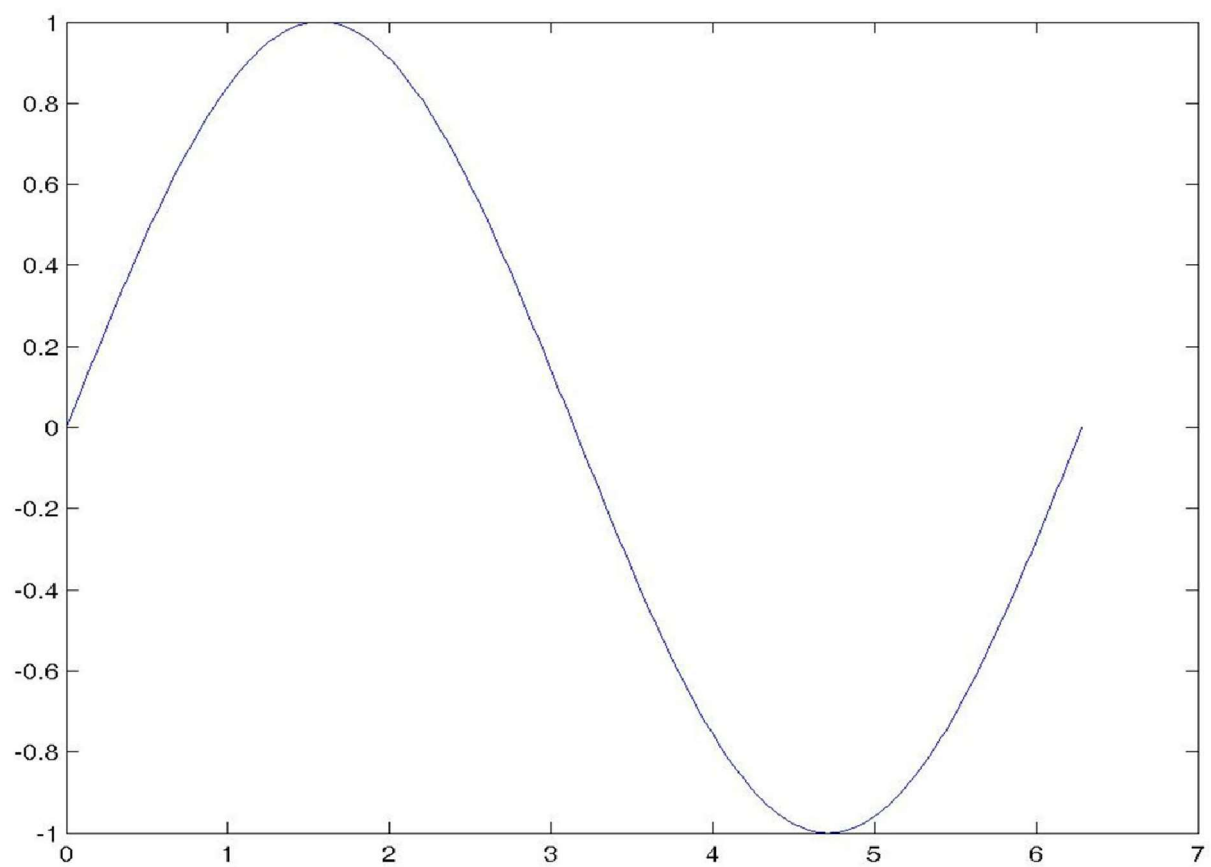
---

- Vẽ đồ thị của hàm  $y = \sin(x)$

```
x = 0:pi/100:2*pi;
```











```
y = sin(x);
```









```
plot(x, y)
```



- 
- Các tham số `plot(x, y, 'linestyle_marker_color')`

<i>linestyle</i>	
<code>\_'</code>	
<code>\_-\'</code>	
<code>\:\'</code>	
<code>\_.\'</code>	

<i>marker</i>			
<code>\+'</code>		<code>\h' / \hexagram'</code>	
<code>\o'</code>		<code>\^</code>	
<code>\*' /</code>	<code>*</code>	<code>\v</code>	
<code>\.' /</code>	<code>.</code>	<code>\&gt;</code>	
<code>\s' / \square'</code>		<code>\&lt;</code>	
<code>\d' / \diamond'</code>			
<code>\p' / \pentagram'</code>			

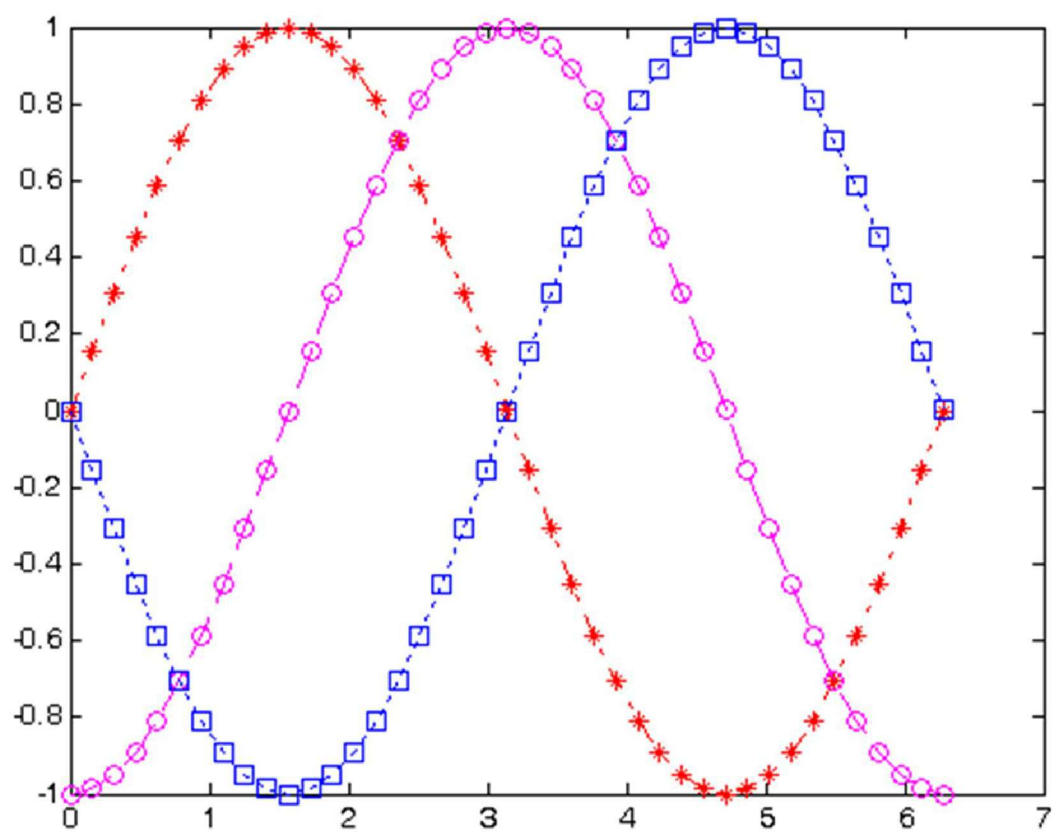
<i>color</i>	
<code>`r'</code> (red)	
<code>`k'</code> (black)	
<code>`w'</code> (white)	
<code>`y'</code> (yellow)	
<code>`c'</code> (cyan)	
<code>`b'</code> (blue)	
<code>`g'</code> (green)	
<code>`m'</code> (magenta)	

## Ví dụ

---

```
x = 0:pi/20:2*pi;  
plot(x, sin(x), '-.*r');  
hold on  
plot(x, sin(x - pi/2), '--om');  
plot(x, sin(x - pi), ':bs');  
hold off
```





## Tùy chỉnh màu sắc và độ lớn nét vẽ

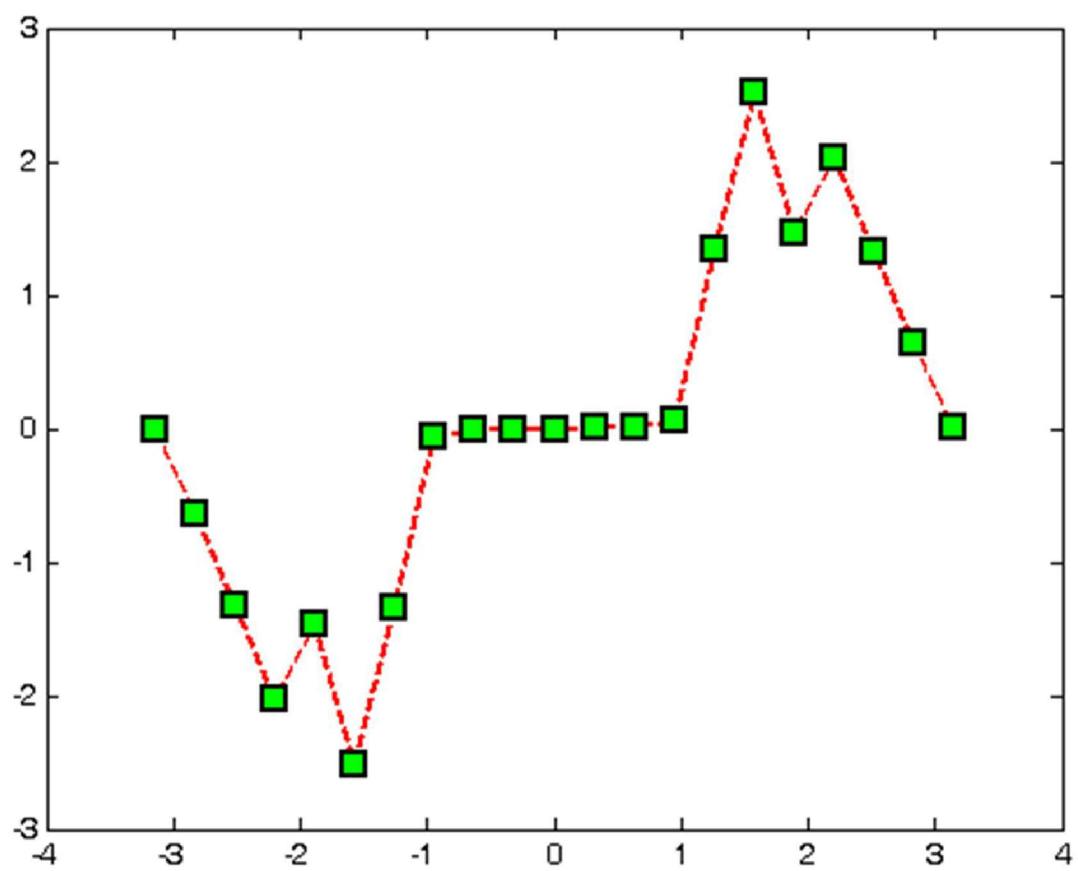
---

- `LineWidth` : độ rộng của nét vẽ, tính bằng pt.
- `MarkerEdgecolor`: màu của đường viền marker.
- `MarkerFacecolor`: màu bên trong marker.
- `Markersize`: độ lớn của marker, tính bằng pt.

## Ví dụ

---

```
x = -pi:pi/10:pi;  
y = tan(sin(x)) - sin(tan(x));  
plot(x,y, '-rs', 'LineWidth', ...  
      2, 'MarkerEdgecolor', ...  
      'k', 'MarkerFacecolor', ...  
      'g', 'Markersize', 10)
```



# Lệnh hold on

---

Khi muốn vẽ thêm đồ thị trên đồ thị hiện có, ta sử dụng lệnh hold on. Để tắt chế độ này, sử dụng hold off.

## ■ Ví dụ

```
x = 0:pi/10:2*pi;  
plot(x, sin(x), '->r')  
hold on  
t = 0:1:7;  
plot(t, 2*t, '-*b');
```

# Xác định tọa độ

---

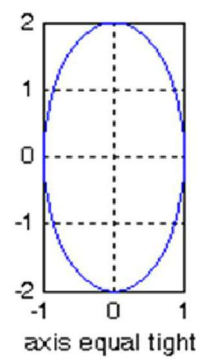
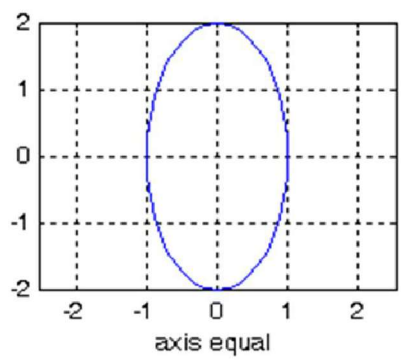
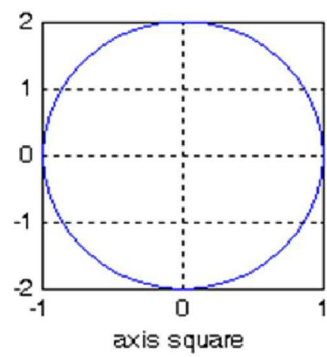
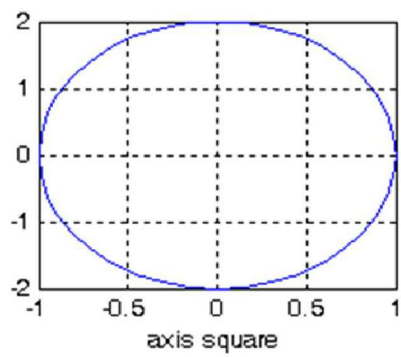
## ■ Lệnh axis

```
axis([xmin xmax ymin ymax])
```

## ■ Tùy chỉnh các kiểu trục tọa độ

- `axis on/off/auto`
- `axis normal/square/equal/tight`
- `axis ij/xy`
- `grid on/off`

# Ví dụ



# Xác định tọa độ

---

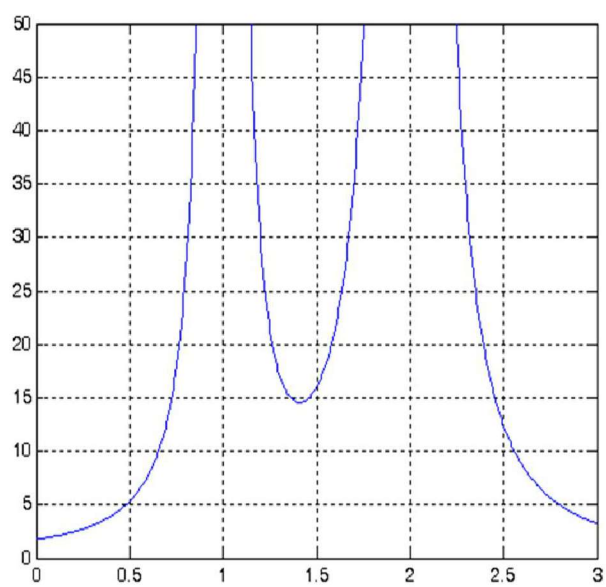
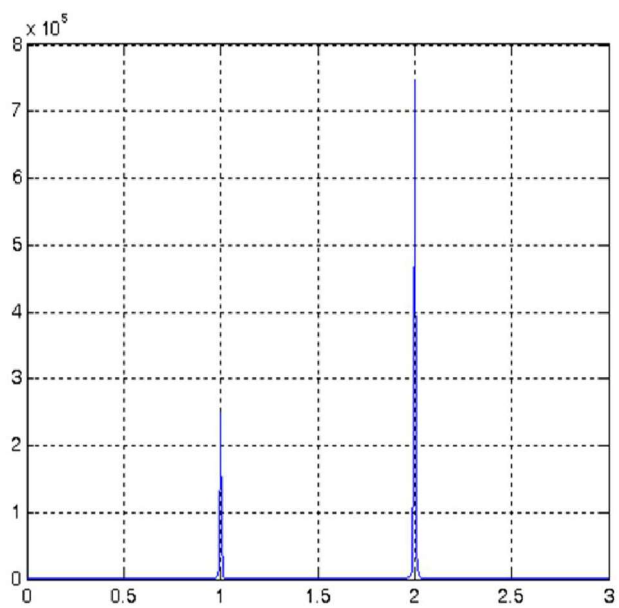
- `xlim([xmin xmax])`
- `ylim([ymin ymax])`

Xác định giới hạn của trục Ox và Oy.

## ■ Ví dụ

```
x = linspace(0,3,500);  
y = 1./(x - 1).^2 + 3./(x - 2).^2;  
plot(x,y); grid on;  
ylim([0 50]);
```





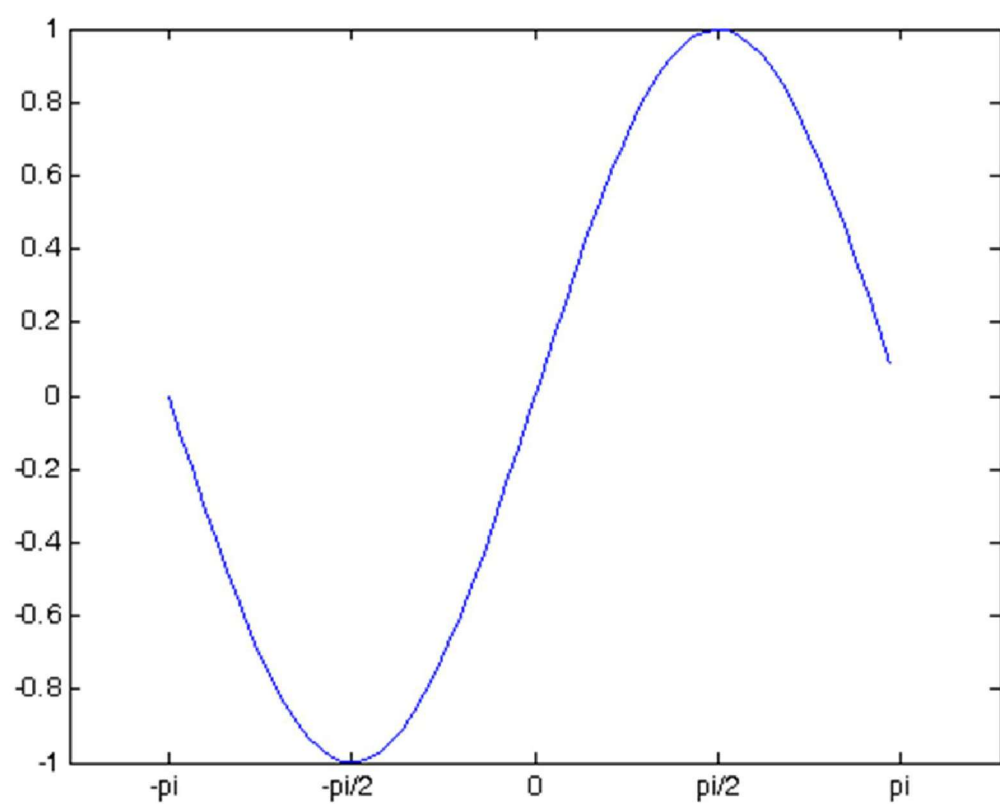
# Xác định tọa độ

---

- `xticks` và `yticks`

## ■ Ví dụ

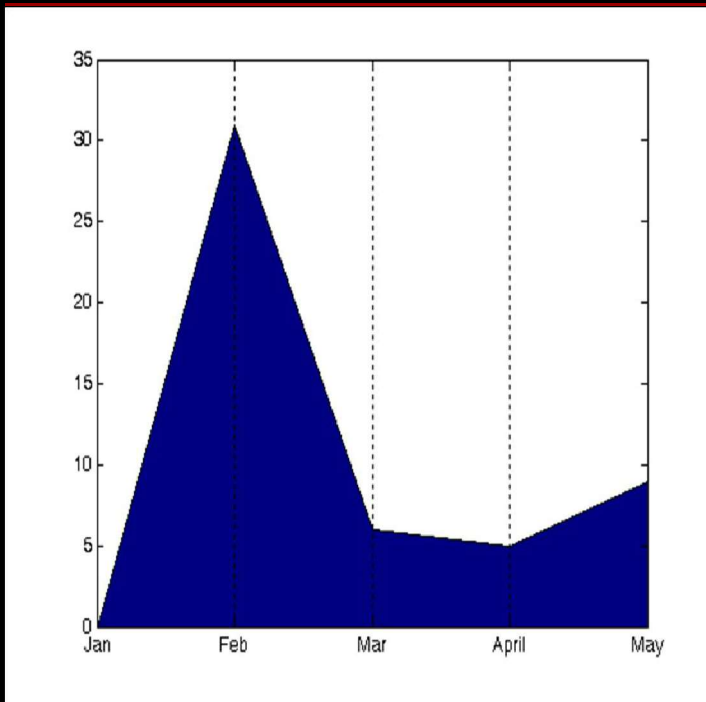
```
x = -pi:.1:pi;
y = sin(x);
plot(x,y)
set(gca,'XTick',-pi:pi/2:pi)
set(gca,'XTickLabel',...
    {'-pi','-pi/2','0','pi/2','pi'})
```



```

y = [0 31 6 5 9];area(y)
str = 'Jan|Feb|Mar|April|May|June';
set(gca,'xtick',1:6,...
'xticklabel',str,'xgrid','on','layer','top')

```



```

set(gca,'XTickLabel',...
{'1';'10';'100'})

```

```

set(gca,'XTickLabel',...
'1|10|100')

```

```

set(gca,'XTickLabel',...
[1;10;100])

```

```

set(gca,'XTickLabel',0:2)

```

```

set(gca,'XTickLabel',...
['1 ','10 ','100'])

```

# Chú thích trên đồ thị

---

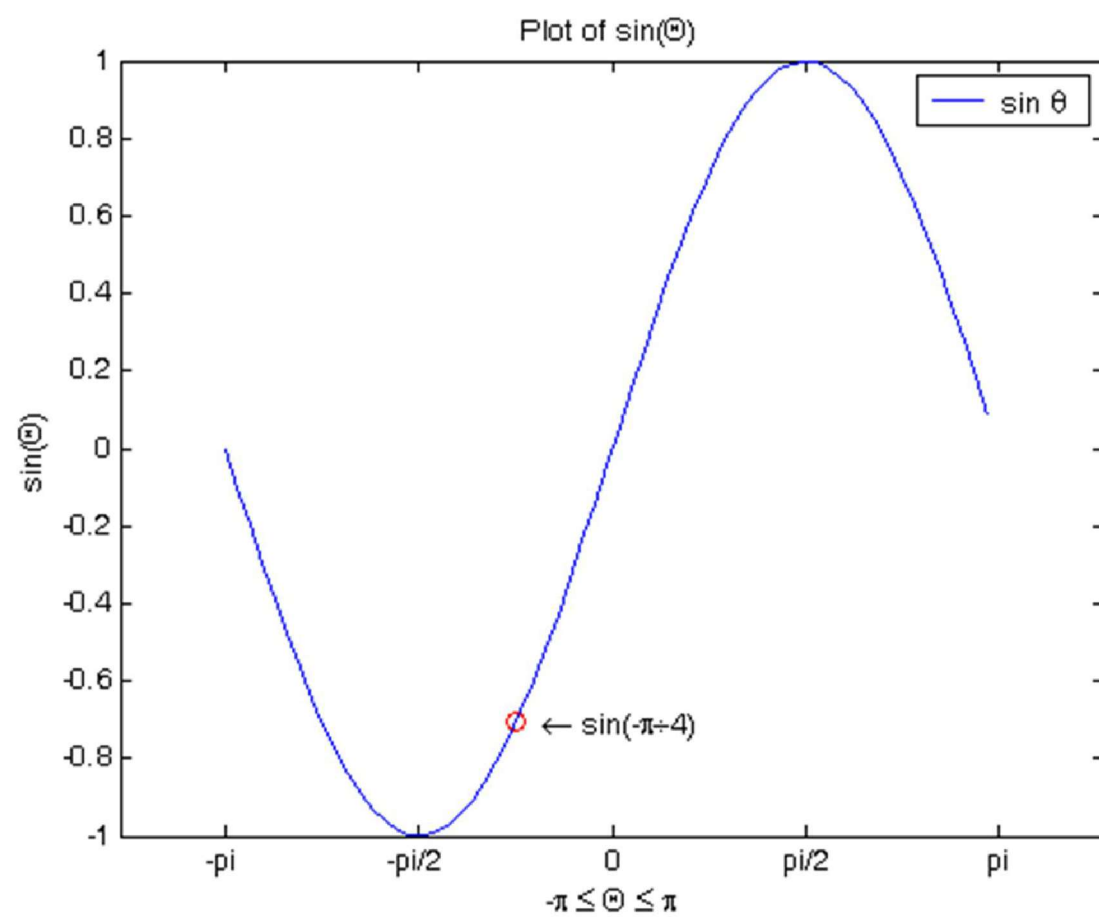
## ➤ Các lệnh

- `xlabel; ylabel`
- `title`
- `legend`
- `text; gtext;`

# Ví dụ

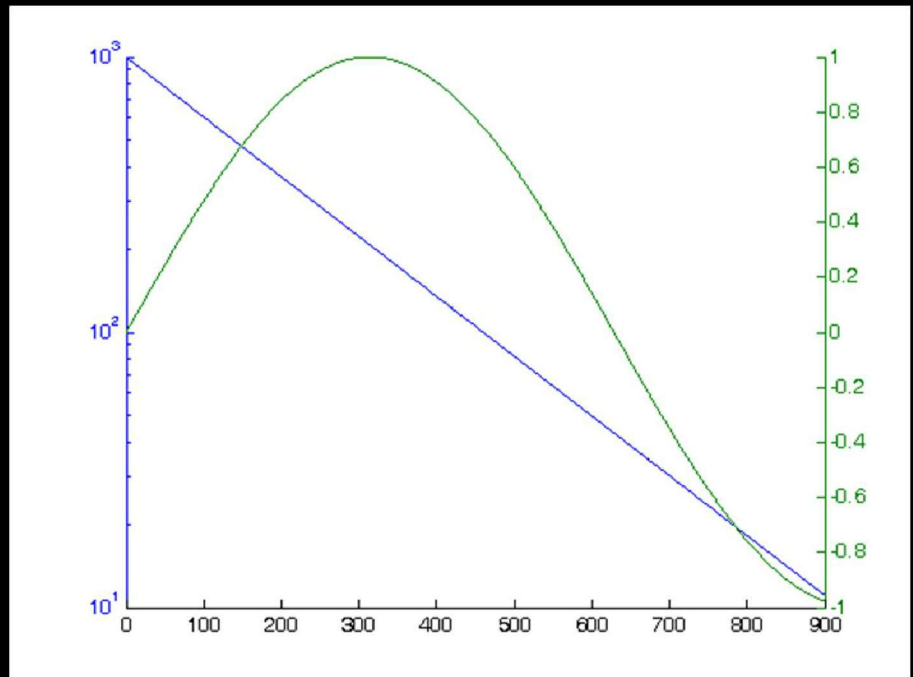
---

```
x = -pi:.1:pi;t = -pi/4;
y = sin(x);
plot(x,y)
set(gca,'XTick',-pi:pi/2:pi)
set(gca,'XTickLabel',{'-pi','pi/2','0','pi/2','pi'})
xlabel('-\pi \leq \Theta \leq \pi')
ylabel('sin(\Theta)')
title('Plot of sin(\Theta)')
text(-pi/4,sin(-pi/4),'\leftarrow sin(\pi\div4)',...
'HorizontalAlignment','left')
legend('sin \theta')
hold on
plot(t, sin(t),'or')
```



## plotyy - Vẽ đồ thị trên 2 trục tọa độ khác nhau

```
t=0:900; A=1000;  
a=0.005; b=0.005;  
y1 = A*exp(-a*t);  
y2 = sin(b*t);  
plotyy(t,y1,t,y2,...  
    'semilogy','plot')
```





## subplot – vẽ nhiều đồ thị trong cùng một cửa sổ

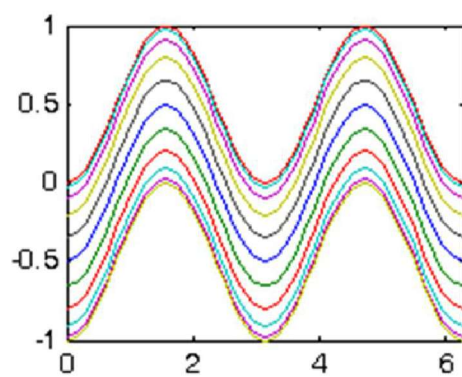
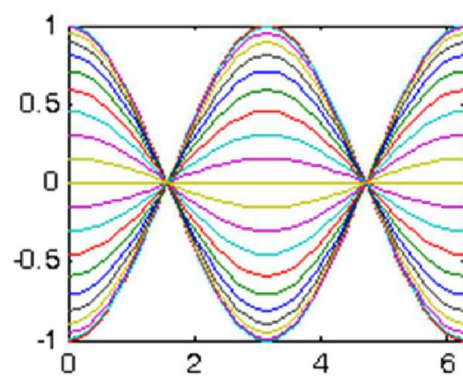
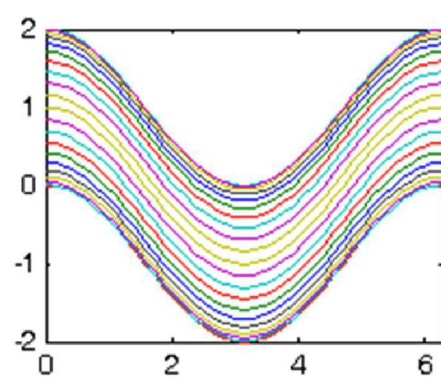
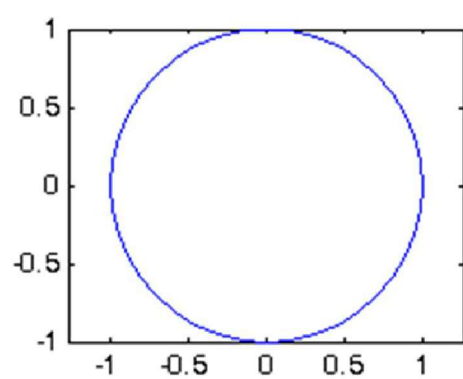
---

➤ `subplot(m,n,p)`

■ Ví dụ

```
t = 0:pi/20:2*pi;
[x,y] = meshgrid(t);
subplot(2,2,1)
plot(sin(t),cos(t))
axis equal
subplot(2,2,2)
z = sin(x)+cos(y);
plot(t,z)
axis([0 2*pi -2 2])
```

```
subplot(2,2,3)
z = sin(x).*cos(y);
plot(t,z)
axis([0 2*pi -1 1])
subplot(2,2,4)
z = (sin(x).^2)-(cos(y).^2);
plot(t,z)
axis([0 2*pi -1 1])
```



# TRONG KHÔNG GIAN 3 CHIỀU

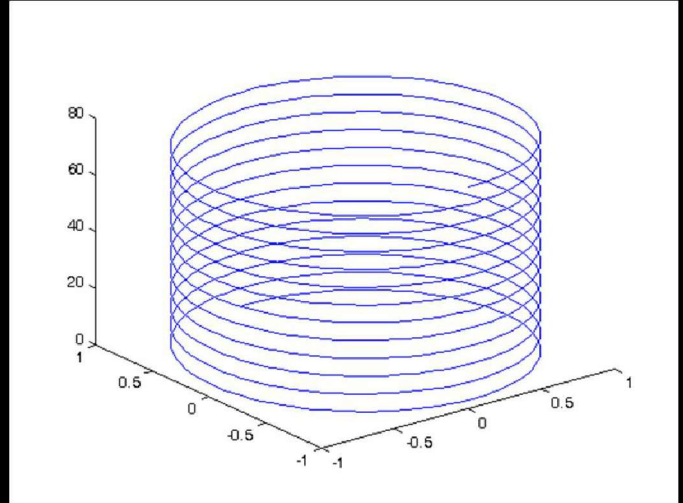
---

➤ `plot3(x, y, z)`

Ta cần xác định các vector  $x, y, z$ . Để vẽ mặt  $(x, y, z=f(x,y))$ , lệnh `meshgrid(x, y)` sẽ tạo ra mảng  $X, Y$  từ miền giá trị của  $x, y$ .

■ Ví dụ

```
t = 0:0.02*pi:25*pi;  
x = sin(t); y = cos(t);  
z = t;  
plot3(x, y, z);
```

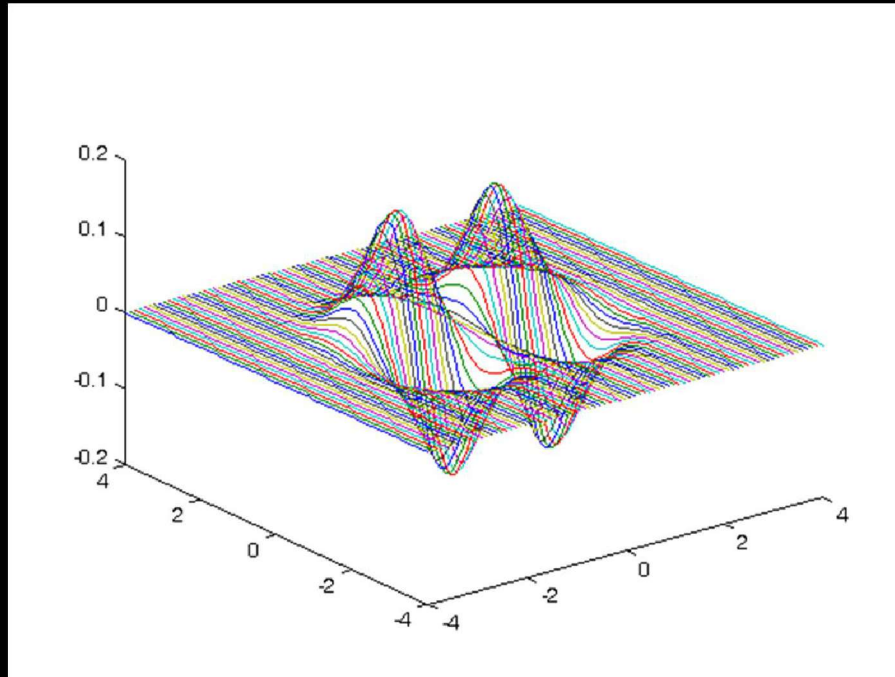


■ Vẽ mặt:  $z(x,y)=x^2ye^{-x^2-y^2}$  với  $-4 \leq x \leq 4$  và  $-4 \leq y \leq 4$ .

```
[x,y]=meshgrid([-4:0.1:4]);
```

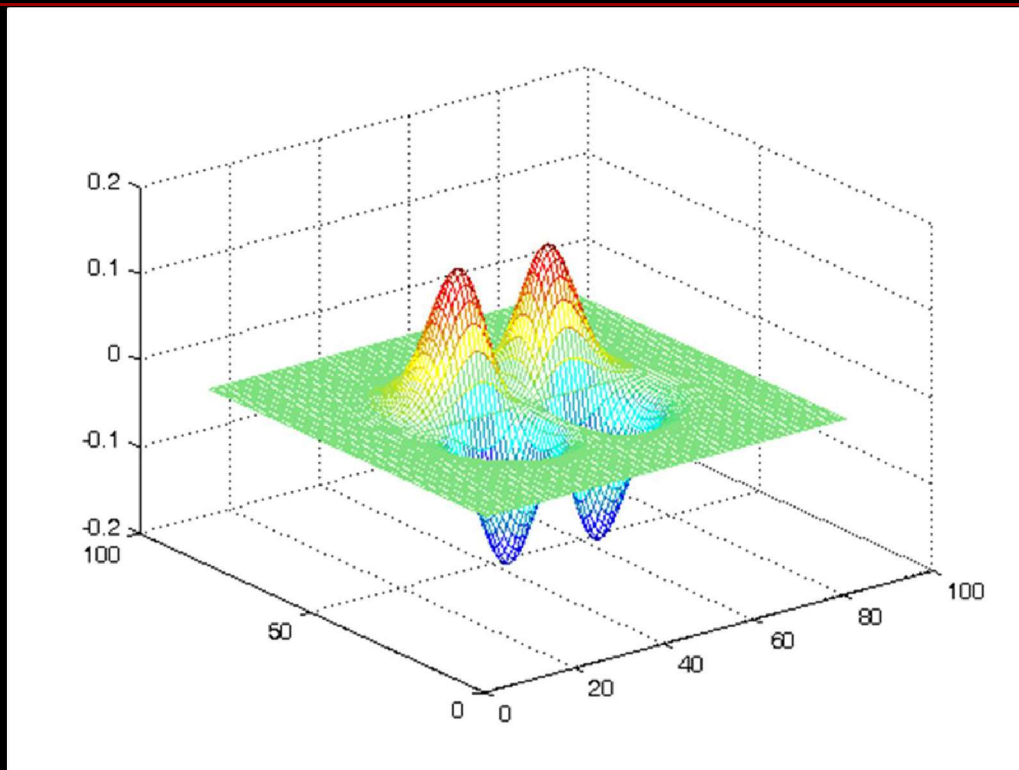
```
z=x.*x.*y.*exp(-x.^2-y.^2);
```

```
plot3(x,y,z)
```



## Dùng lệnh mesh(z)

---

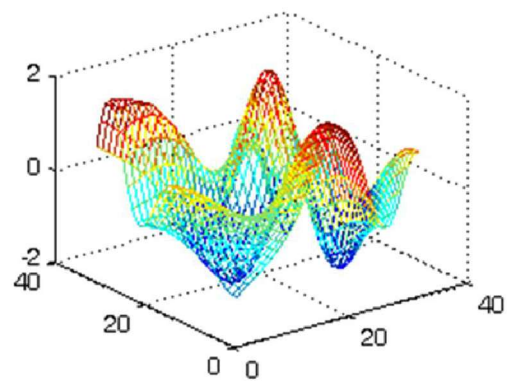
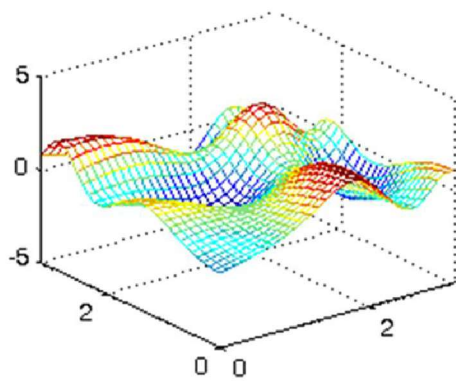
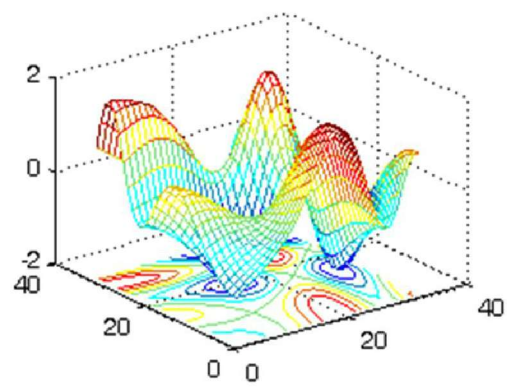
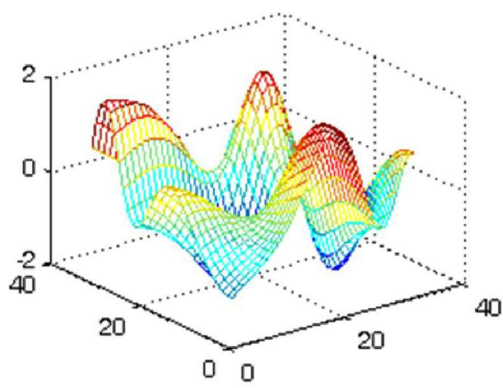


## ■ Ví dụ

Vẽ mặt  $z = \sin(y^2 - x) - \cos(y - x^2)$  với  $x, y \in [0, \pi]$

---

```
x=0:0.1:pi;y=0:0.1:pi;  
[X,Y]=meshgrid(x,y);  
Z=sin(Y.^2+X)-cos(Y-X.^2);  
subplot(221);mesh(Z);  
subplot(222);meshc(Z);  
subplot(223);mesh(x,y,Z);  
axis([0 pi 0 pi -5 5]);  
subplot(224);mesh(Z);hidden off
```



# Một số lệnh vẽ đồ thị trong 3 - D

---

- `plot3`
- `contour` / `contourf` / `contour3`
- `mesh` / `meshc` / `meshz`
- `surf` / `surfc`
- `waterfall`
- `bar3` / `bar3h`
- `pie3` / `fill3`
- `comet3` / `scatter3` / `stem3`



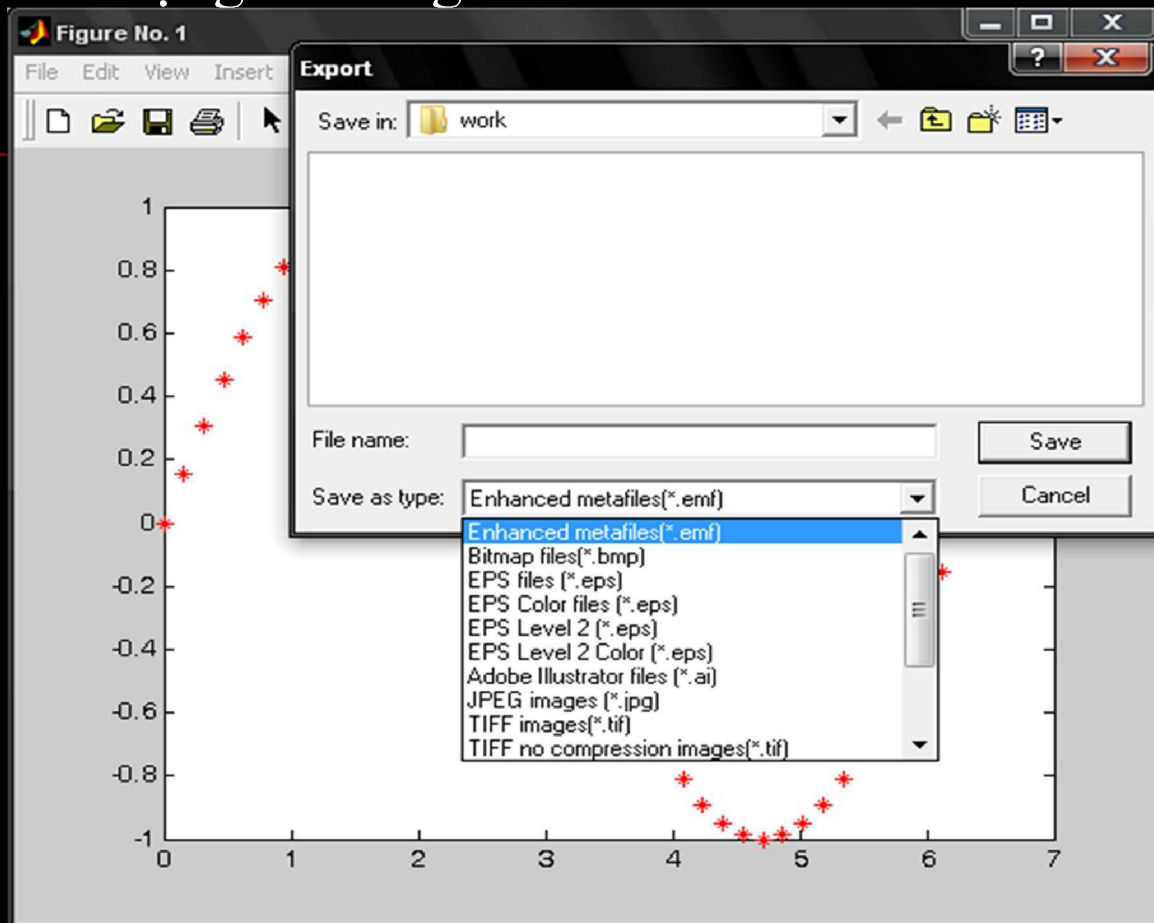
# In và xuất đồ thị

---

## ■ Dùng lệnh

```
print -dtiff -r200 mygraph.tiff  
print -deps2 mygraph.eps  
...
```

## ■ Sử dụng Plotting Tools



# Các dạng đồ thị đặc biệt khác

---

## ■ Đồ thị dạng cột

```
bar(X, Y)
```

```
X = 1:M
```

Y : Ma trận cỡ  $M \times N$

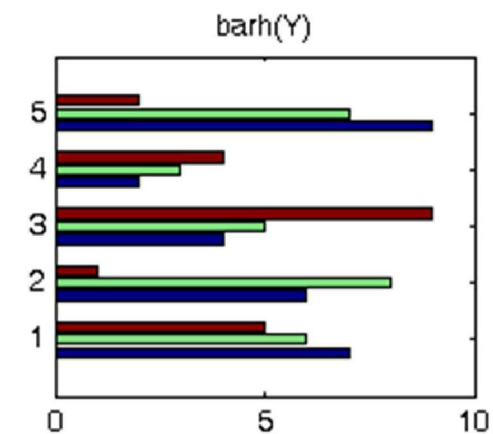
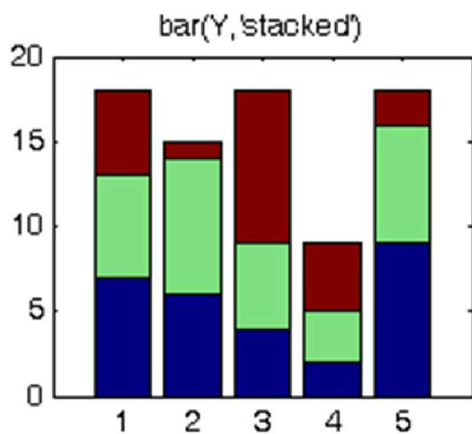
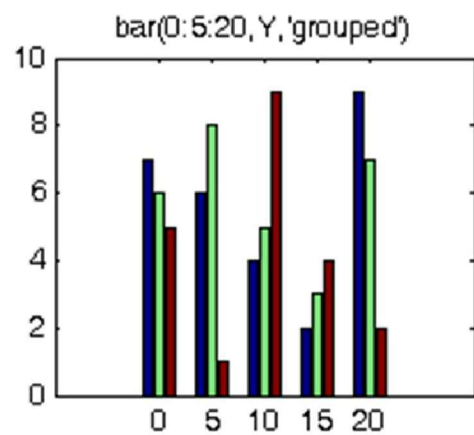
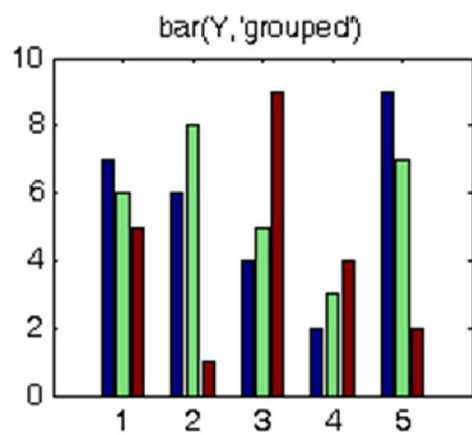
## Tùy chọn khác

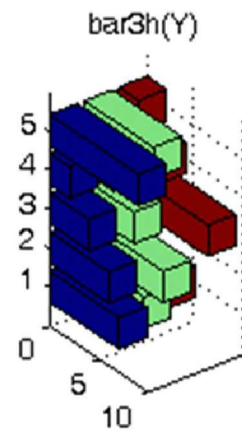
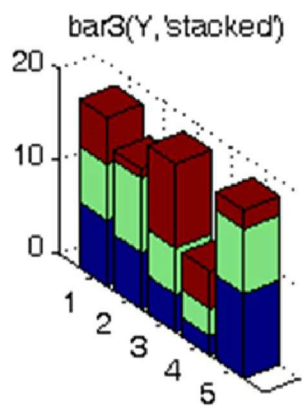
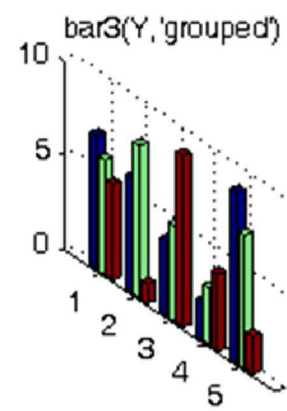
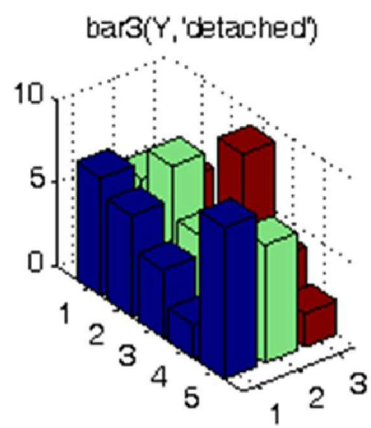
```
barh / bar3 / bar3h
```

```
'stacked', 'grouped', 'detached'
```

# Ví dụ

```
Y=[7 6 5;6 8 1;4 5 9;2 3 4;9 7 2]
subplot(221);bar(Y);
title('bar(Y, ''grouped'')')
subplot(222);bar(0:5:20,Y);
title('bar(0:5:20,Y, ''grouped'')')
subplot(223);bar(Y,'stacked');
title('bar(Y, ''stacked'')')
subplot(224);barh(Y);title('barh(Y)')
subplot(221);bar3(Y,'detached');
title('bar3(Y, ''detached'')')
subplot(222);bar3(Y,'grouped');
title('bar3(Y, ''grouped'')')
subplot(223);bar3(Y,'stacked');
title('bar3(Y, ''stacked'')')
subplot(224);bar3h(Y);title('bar3h(Y)')
```





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## ■ Biểu đồ quạt

`pie(X, str)`

`X`: vectơ dữ liệu

`str`: chuỗi chứa nhãn của đồ thị

Tùy chọn khác

`pie3`

# Ví dụ

---

```
Y = [12 20 15 25 78]
```

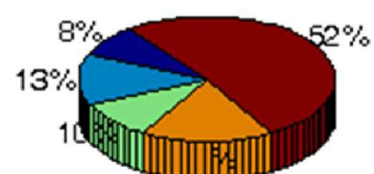
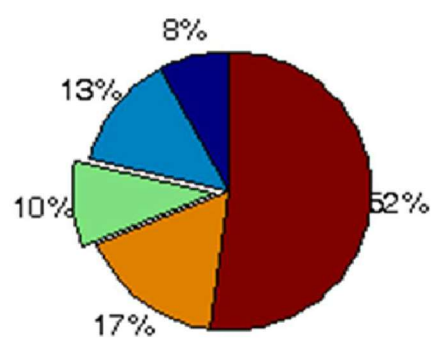
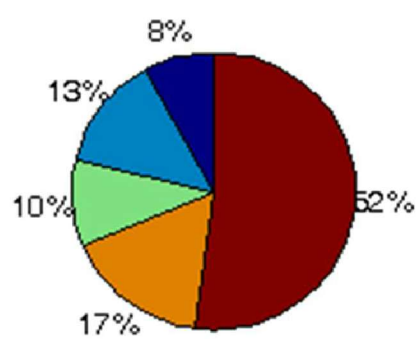
```
pie(Y)
```

```
pie(Y,{'Giai tich','Dai so','Xac suat',...  
'Co hoc','Tin hoc'})
```

```
pie3(Y)
```

```
pie(Y,[0 0 1 0 1])
```





## ■ Đồ thị dạng vùng

`area(x)`

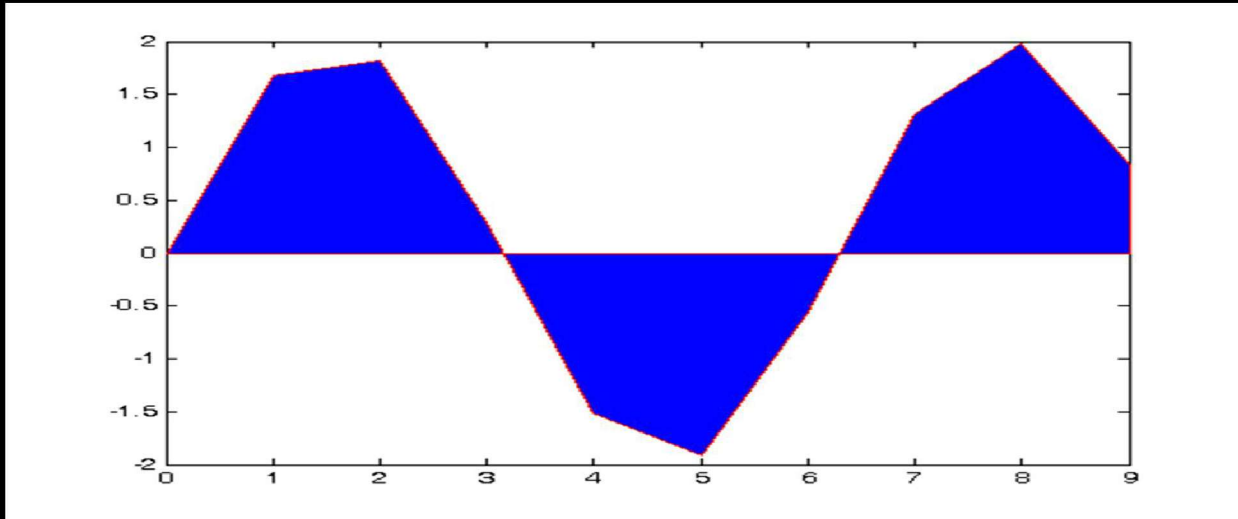
`area(x,y)`

---

## ■ Ví dụ

```
x = [0:9]; y = 2*sin(x);
```

```
area(x,y,'Facecolor','blue','Edgecolor','red');
```



```
sales = [51.6 82.4 90.8 59.1 47.0];
x = 90:94;
profits = [19.3 34.2 61.4 50.5 29.4];
area(x,sales,'FaceColor',[.5 .9 .6],'EdgeColor','b',...
'LineWidth',2)
hold on
area(x,profits,'FaceColor',[.9.85.7],'EdgeColor','y',...
'LineWidth',2)
hold off
set(gca,'XTick',[90:94])
set(gca,'Layer','top')
gtext('\leftarrow Sales')
gtext('Profits')
gtext('Expenses')
xlabel('Years','FontSize',14)
ylabel('Expenses + Profits = Sales in
1,000's','FontSize',14)
```



## ■ Đồ thị của dữ liệu rời rạc

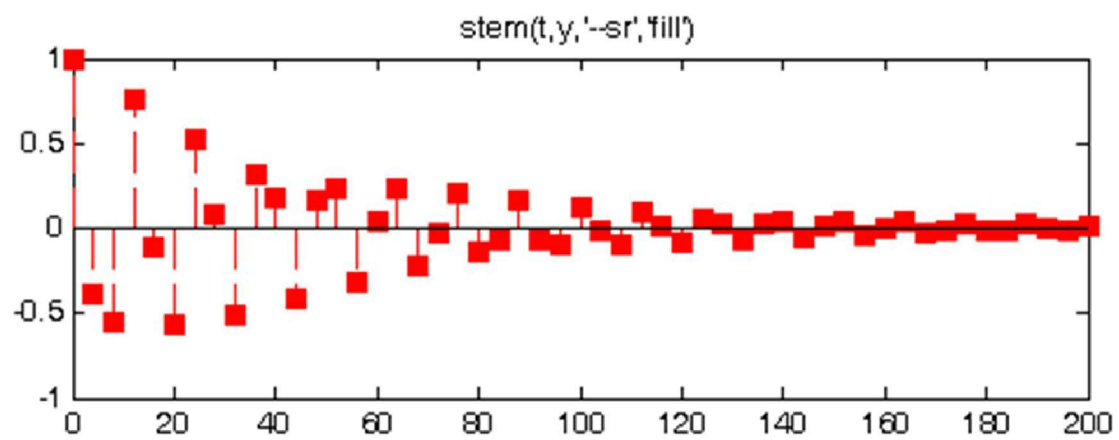
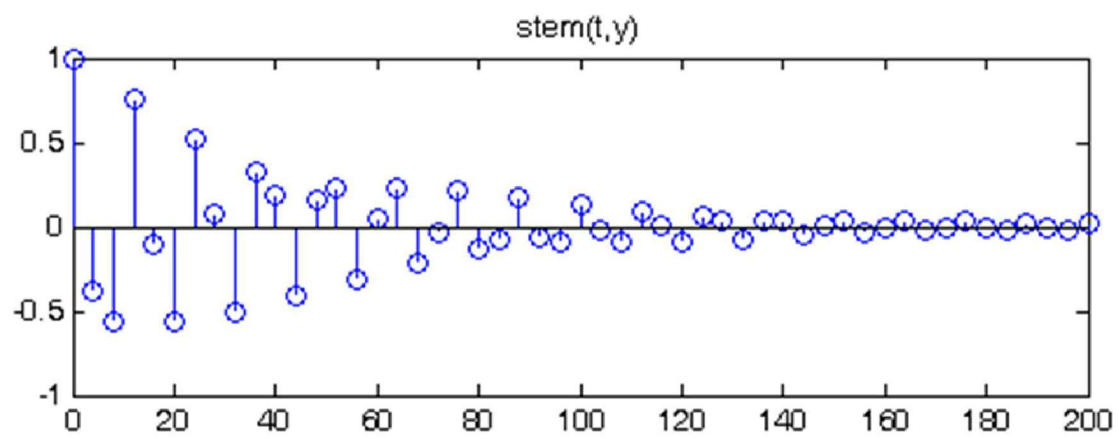
stem / stem3 : đồ thị dạng rời rạc trong 2D / 3D

stair : đồ thị bậc thang

---

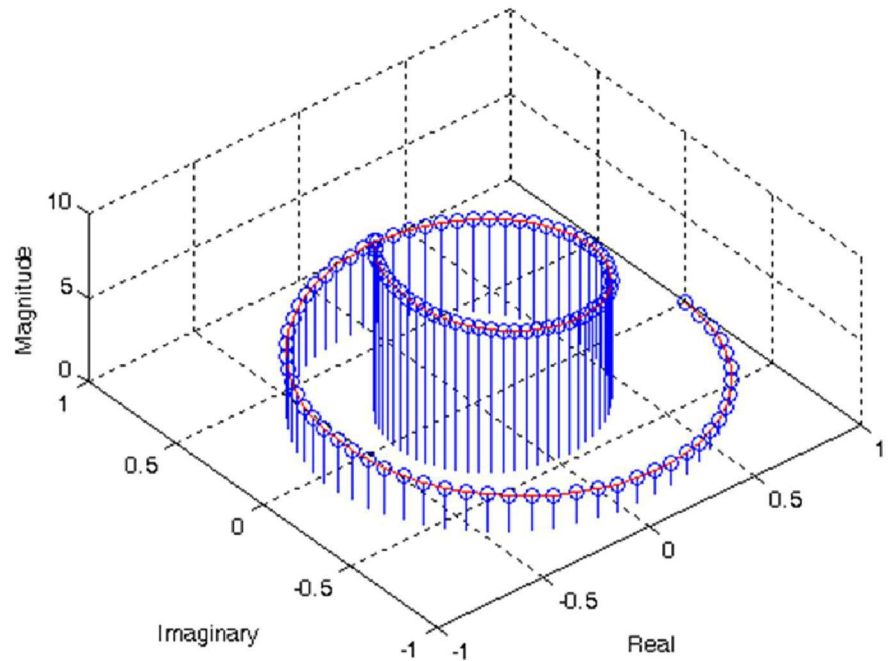
## ■ Ví dụ

```
alpha = .02; beta = .5; t = 0:4:200;  
y = exp(-alpha*t).*cos(beta*t);  
subplot(2,1,1);stem(t,y);  
title('stem(t,y)')  
subplot(2,1,2);  
stem(t,y,'-sr','fill');  
title('stem(t,y,''-sr','fill')')
```



## ■ Trong 3-D

```
t = 0:.1:10;  
s = 0.1+i;  
y = exp(-s*t);  
stem3(real(y),...  
imag(y),t)  
hold on  
plot3(real(y),...  
imag(y),t,'r')  
hold off  
view(-39.5,62)  
xlabel('Real')  
ylabel('Imaginary')  
zlabel('Magnitude')
```



## ■ Dạng bậc thang

---

```
alpha = 0.01;
beta = 0.5;t = 0:10;
f = exp(-alpha*t).*sin(beta*t);
stairs(t,f)
hold on;
plot(t,f,'--*');
hold off
label = 'Stairstep plot of
e^{-(\alpha*t)}sin\beta*t';
text(0.5,-0.2,label,'FontSize',14);
xlabel('t = 0:10','FontSize',14);
axis([0 10 -1.2 1.2])
```



