دوره جامع پایتون:

بخش علوم داده

جلسه چهاردهم

دکتر ذبیح اله ذبیحی

ساخت آرایه با تابع arange

- numpy.arange(start, stop,step)

```
import numpy as np
x=np.arange(1, 10, 2)
print(x)
```

ساخت ارایه با تابع linspace

numpy.linspace(start, stop, num,endpoint)

Num تعداد اعداد مدنظر در بازه بین start تا stop است.

```
import numpy as np
x=np.linspace(1, 10, 4)

print(x)
```

ساخت ارایه با تابع logpace

numpy.logspace(start, stop, num, endpoint)

```
import numpy as np
x=np.logspace(1, 2, 3)

print(x)
```

حل معادلات دستگاهی

ax+by=c
dx+ey=f

حل با استفاده از تابع linalg.solve(x, y)

```
import numpy as np
# coefficients
i = np.array([[a, b], [d, e]])
# constants
j = np.array([c, f])

print("Solution of linear equations=", np.linalg.solve(i, j))
```

2x+y=-1

-3x+3y=0

```
import numpy as np
i= np.array([[2, 1], [-3, 3]])
j = np.array([-1, 0])
print("Solution of linear equations=", np.linalg.solve(i, j))
```

2x+y-z=1

x+2y+z=3

-2x+y+z=-3

```
import numpy as np
i= np.array([[2, 1,-1], [1,2,1],[-2,1,1]])
j = np.array([1,3,-3])
print("Solution of linear equations=", np.linalg.solve(i, j))
```

چاپ و مقدار دهی یک چند جمله ای

- poly1d
- ----------

```
import numpy as np
coeff=np.array([1,1,2,1])
x0=-1
p = np.poly1d(coeff)
print(np.poly1d(p))
print(p(x0))
```

ریشه چند جمله ای

p.r

ریشه های چند جمله ای

مقدارچند جمله ای در نقطه خاص

$$f(x) = a_1 + a_2x + a_3x^2 + \cdots + a_nx^n$$

```
import numpy as np
coeff=np.array([a_n,..., a_1])
y=np.polyval(coeff,x0)
```

مقدار تا در نقطه x0 را تعیین می کند

```
import numpy as np
coeff=np.array([1,1,2,1])
x0=-1
y=np.polyval(coeff,x0)
print(y)
```

مشتق چند جمله ای

$$f(x) = a_1 + a_2x + a_3x^2 + \cdots + a_nx^n$$

import numpy as np

coeff=np.poly1d([a_1,…, a_n])

d=np.polyder(coeff,m)

Print(d(x0))

M مرتبه مشتق و x0 نقطه ای که مقدار مشتق در آن مدنظر است

```
import numpy as np
f= np.poly1d([1,1,1,1])
f1 = np.polyder(f,1)
print(f1)
print(f1(0.5))
```

کمیت های آماری در numpy

- محاسبه میانگین mean
- محاسبه بیشنه مقدار max
- محاسبه کمینه مقدار min
- محاسبه میانه median
- محاسبه انحراف معیار std

```
import numpy as np
data1=[-12,4,8,2,0,0,2,-3,-1,4]
data2=np.array(data1)
s1=np.max(data2)
print("max=",s1)
s2=np.min(data2)
print("min=",s2)
s3=np.mean(data2)
print("mean=",s3)
s4=np.median(data2)
print("median=",s4)
s5=np.std(data2)
print("std=",s5)
```

کمیت های مالی در numpy

$$fv + pv(1 + rate)^{nper} + pmt * \frac{(1 + rate * when)}{rate * \left((1 + rate)^{nper} - 1\right)} = 0$$

اگر rate=0

$$fv + pv + pmt * nper = 0$$

Fv مقدار اینده

Pv مقدار فعلی

Rate نرخ بهره ماهانه

Nper طول دوره (ماه)

Pmt پرداختی

When اگر ۱ باشد ابتدای دوره(beng) و اگر صفر باشد انتهای دوره(end)

- numpy.fv(rate, nper, pmt, pv, when='end')
- numpy.pv(rate, nper, pmt, fv=0.0, when='end')
- numpy.npv(rate, values)
- numpy.pmt(rate, nper, pv, fv=0, when='end')
- numpy.ppmt(rate, per, nper, pv, fv=0.0, when='end')
- پرداخت در برابر اصل وام
- numpy.ipmt(rate, per, nper, pv, fv=0.0, when='end')
- numpy.nper(rate, pmt, pv, fv=0, when='end')
- numpy.rate(nper, pmt, pv, fv, when='end', guess=0.1, tol=1e-06, maxiter=100)
- numpy.irr(values)
- numpy.mirr(values, finance_rate, reinvest_rate)

نکته: برای ورژن های جدید

ابتدا ماژول numpy_financial را نصب کنید:

Pip install numpy_financial

در کدها از بخش زیر برای محاسبه کمیت های مالی استفاده کنید

Import numpy_financial as npf

انگاه توابع را بصورت زیر فراخوانی کنید

X=npf.fv(rate,nper,pmt,pv)

مثال

- اگر پس انداز مالی الان شخصی 200 دلار باشد و ماهانه بتواند 200 دلار ذخیره کند و بهره سالیانه 6 درصد باشد بعد از ده سال ارزش پولش چقدر است؟

- rate=0.06/12 , nper=10*12 , pmt-=-200 , pv=-200

```
import numpy as np
x=np.fv(0.06/12, 10*12, -200, -200)
print(x)
```

مثال

```
import numpy as np
rate= np.array((0.06, 0.07, 0.08))/12
x=np.fv(rate, 10*12, -200, -200)
print(x)
```

مثال

پرداخت ماهانه مورد نیاز برای پرداخت وام ۱۰۰۰۰۰ دلاری در مدت ۱۲ سال با نرخ سود سالانه ۸/۵٪ چقدر است؟

- Rate=0.085/12 , nper=12*12, pv=100000

```
import numpy as np
x=np.pmt(0.085/12, 12*12, 100000)
print(x)
```

Rate=0.085/12 , pv=1, nper=12*12, pv=100000

```
import numpy as np
x=np.pmt(0.085/12,1, 12*12, 100000)
print(x)
```

مثال

- اگر فقط ۲۰۰ دلار در ماه برای پرداخت وام دارید ، پرداخت وام ۱۰ هزار دلاری با سود ۸ درصد سالانه چقدر طول می کشد؟

Rate=0.08/12, pmt=-200, pv=10000

```
import numpy as np
print(np.nper(0.08/12, -200, 10000))
```

نصب ماژول matplotlib

- pip install matplotlib

فراخوانی ماژول matplotlib

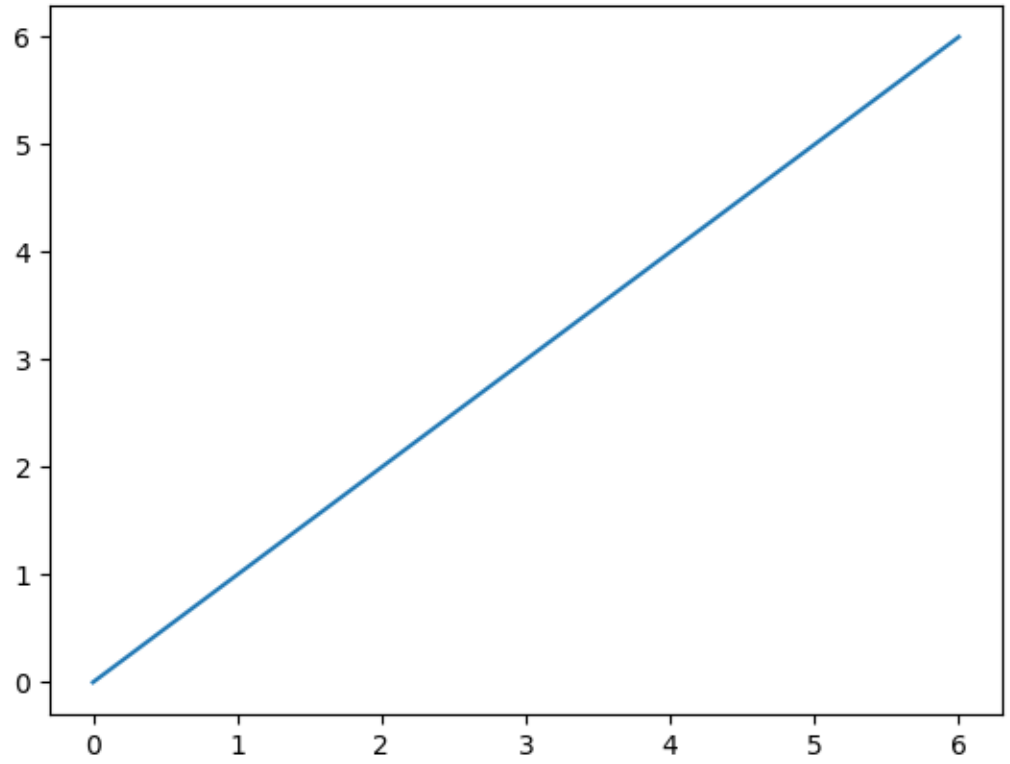
```
import matplotlib
```

ورژن نصب شده

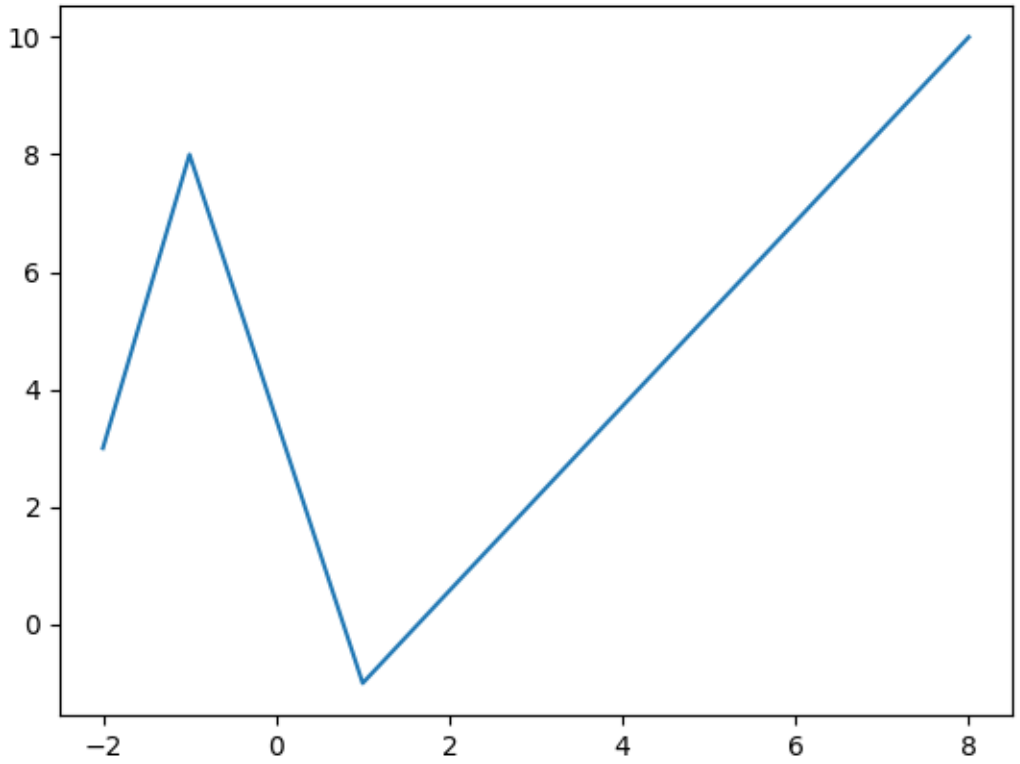
```
import matplotlib
print(matplotlib.__version__)
```

مثال

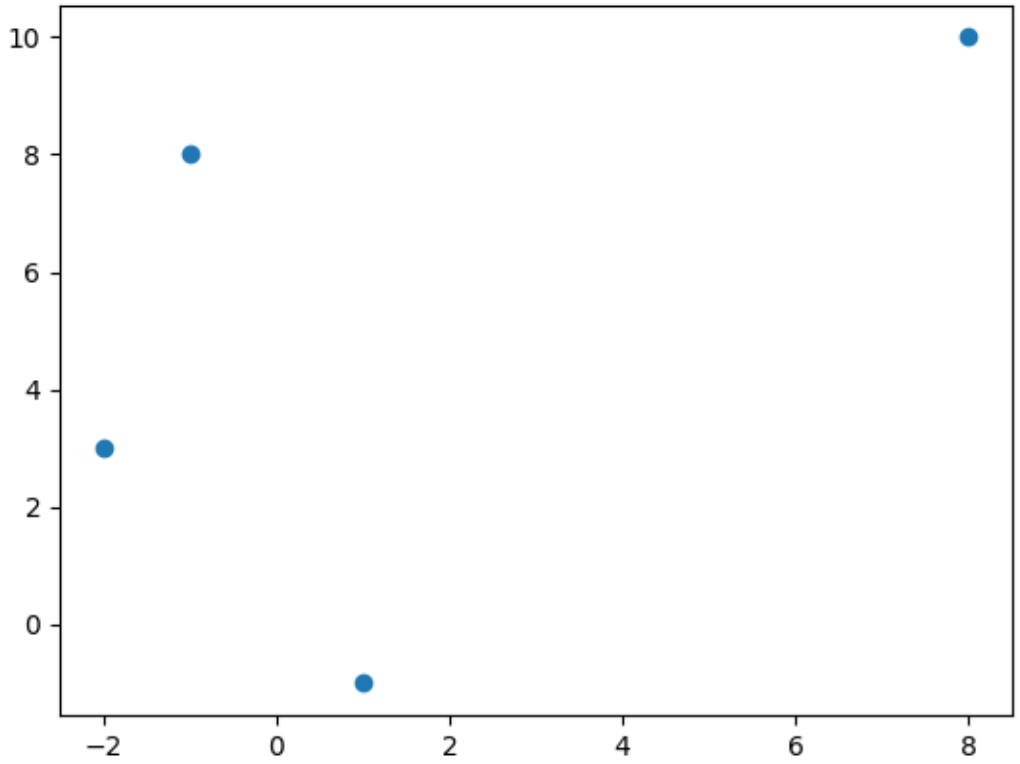
```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([0, 6])
y = np.array([0, 6])

plt.plot(x, y)
plt.show()
```



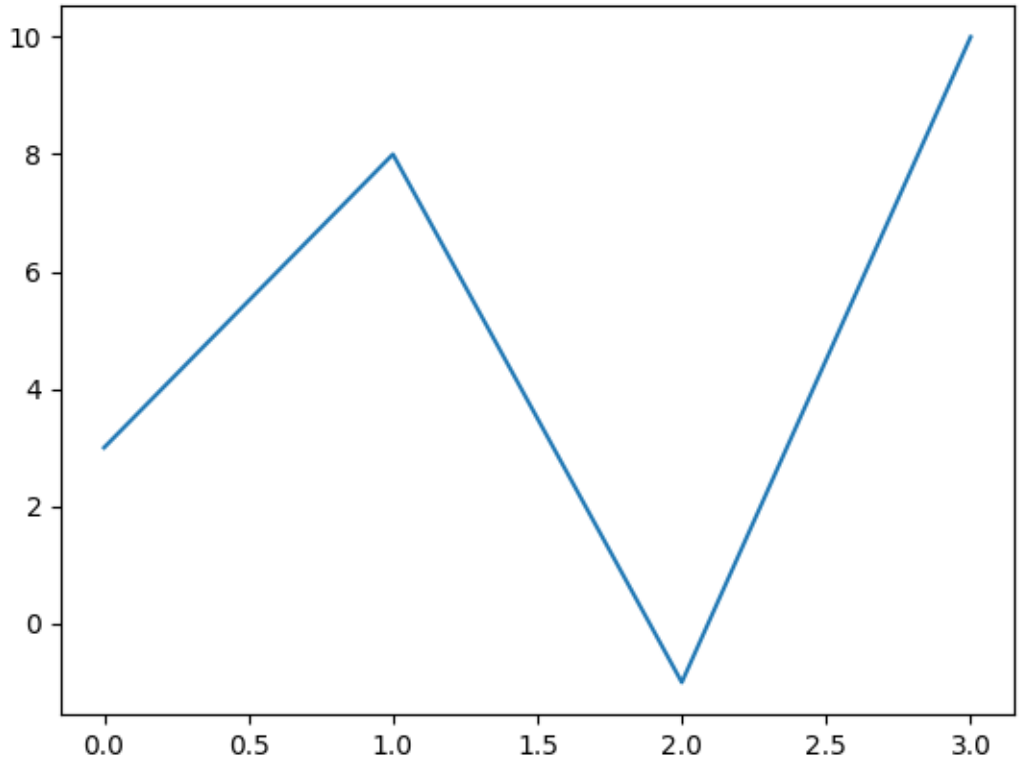
```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([-2, -1, 1, 8])
y = np.array([3, 8, -1, 10])

plt.plot(x, y)
plt.show()
```



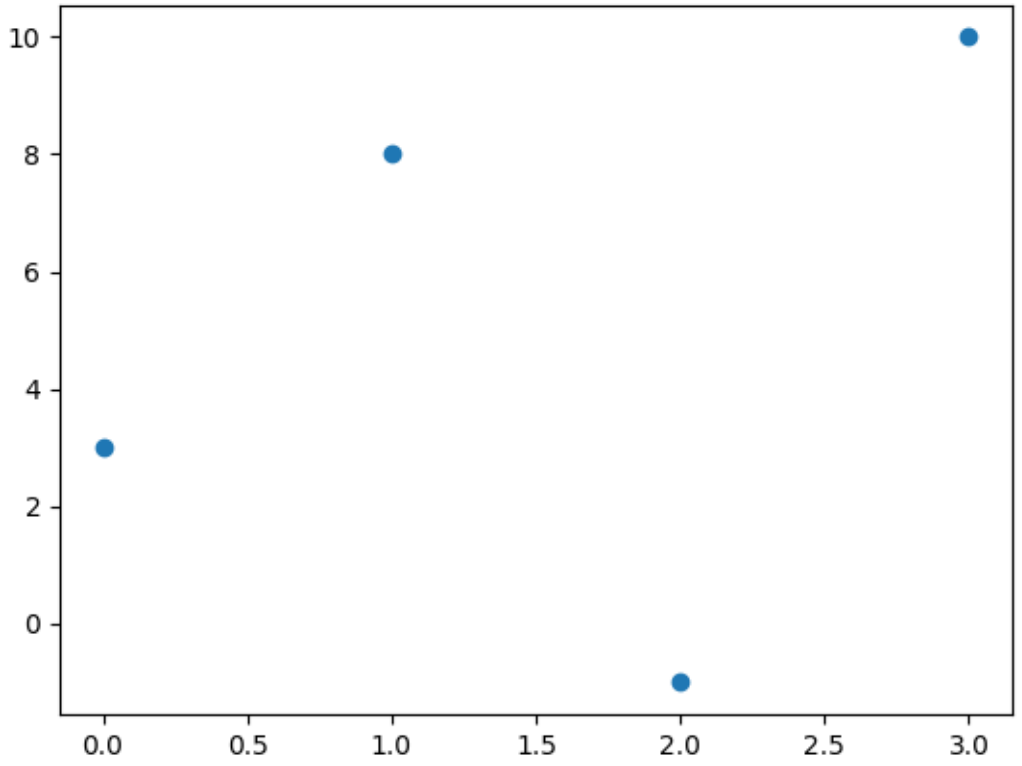
```
import matplotlib.pyplot as plt
import numpy as np

x = np.array([-2, -1, 1, 8])
y = np.array([3, 8, -1, 10])

plt.plot(x, y,"o")
plt.show()
```



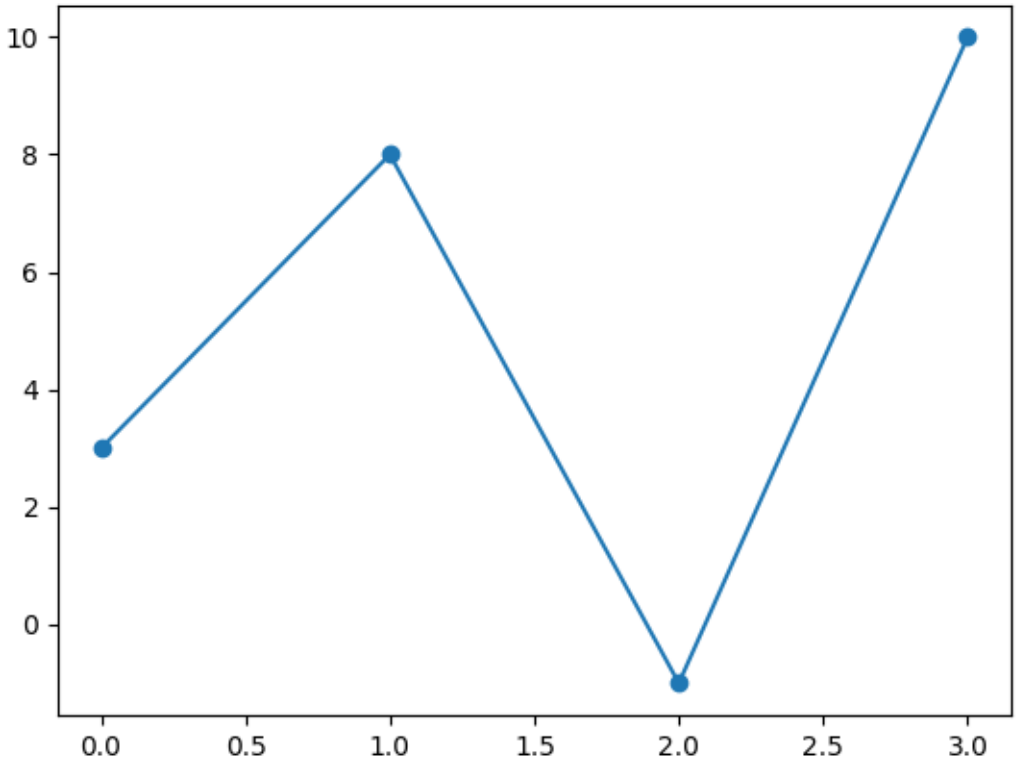
```
import matplotlib.pyplot as plt
import numpy as np

y = np.array([3, 8, -1, 10])

plt.plot(y)
plt.show()
```



```
import matplotlib.pyplot as plt
import numpy as np

y = np.array([3, 8, -1, 10])

plt.plot(y,"o")
plt.show()
```

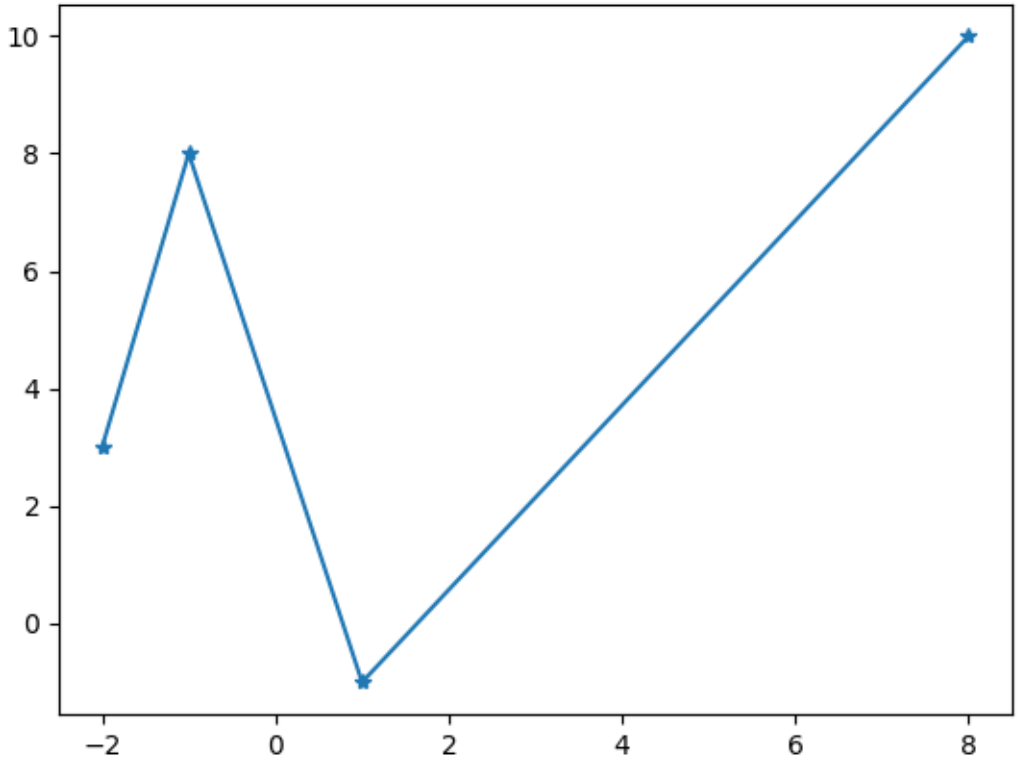


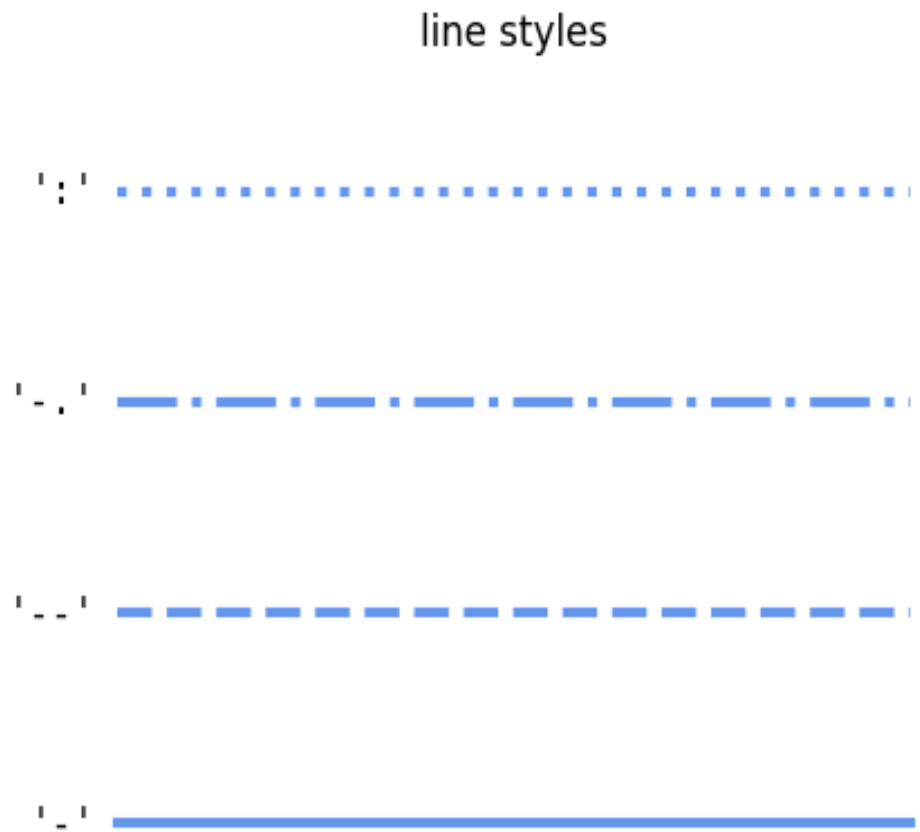
```
import matplotlib.pyplot as plt
import numpy as np

y = np.array([3, 8, -1, 10])

plt.plot(y,marker="o")
plt.show()
```




marker = '^'
marker = '3'
marker = 'P'
marker = 'x'
marker = '_'
marker = 'v'
marker = '2'
marker = 'p'
marker = '+'
marker = '|'
marker = 'o'
marker = '1'
marker = 's'
marker = 'H'
marker = 'd'
marker = ','
marker = '>'
marker = '8'
marker = 'h'
marker = 'D'
marker = '.'
marker = '<'
marker = '4'
marker = '*'
marker = 'X'

```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])

y = np.array([3, 8, -1, 10])

plt.plot(x,y,marker="*")
plt.show()
```



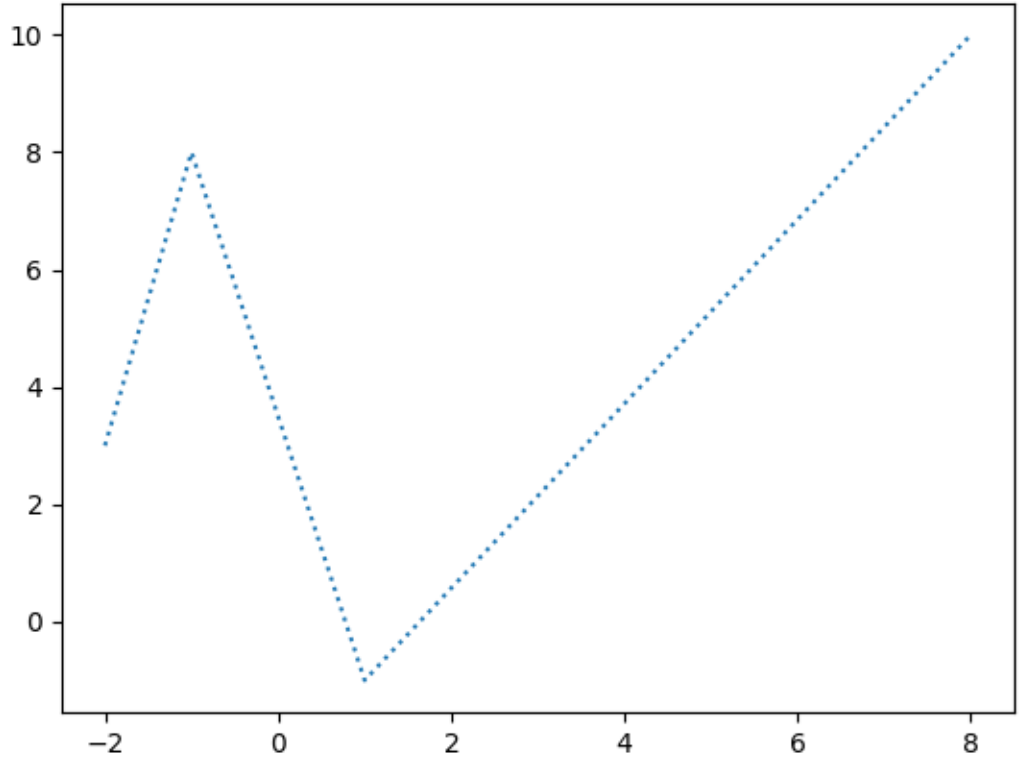

line styles
':'
'-.'
'--'
'-'

linestyle can be written as ls.

dotted can be written as :.

dashed can be written as --.

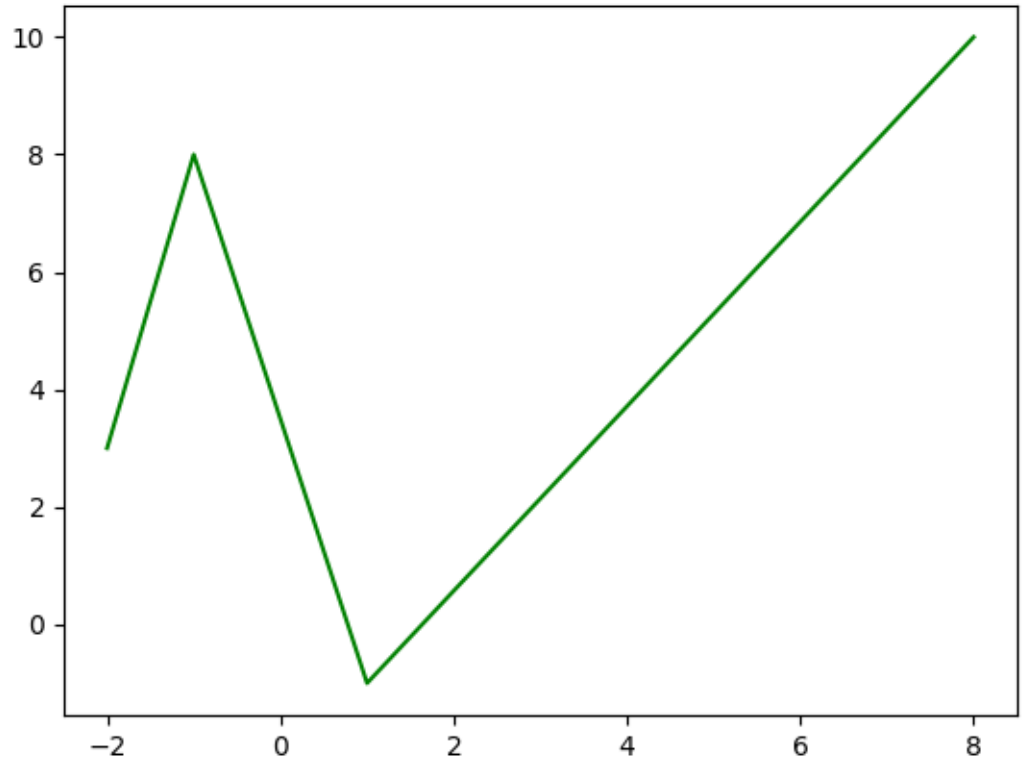
```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])

y = np.array([3, 8, -1, 10])

plt.plot(x,y,":")
plt.show()
```



انتخاب رنگ

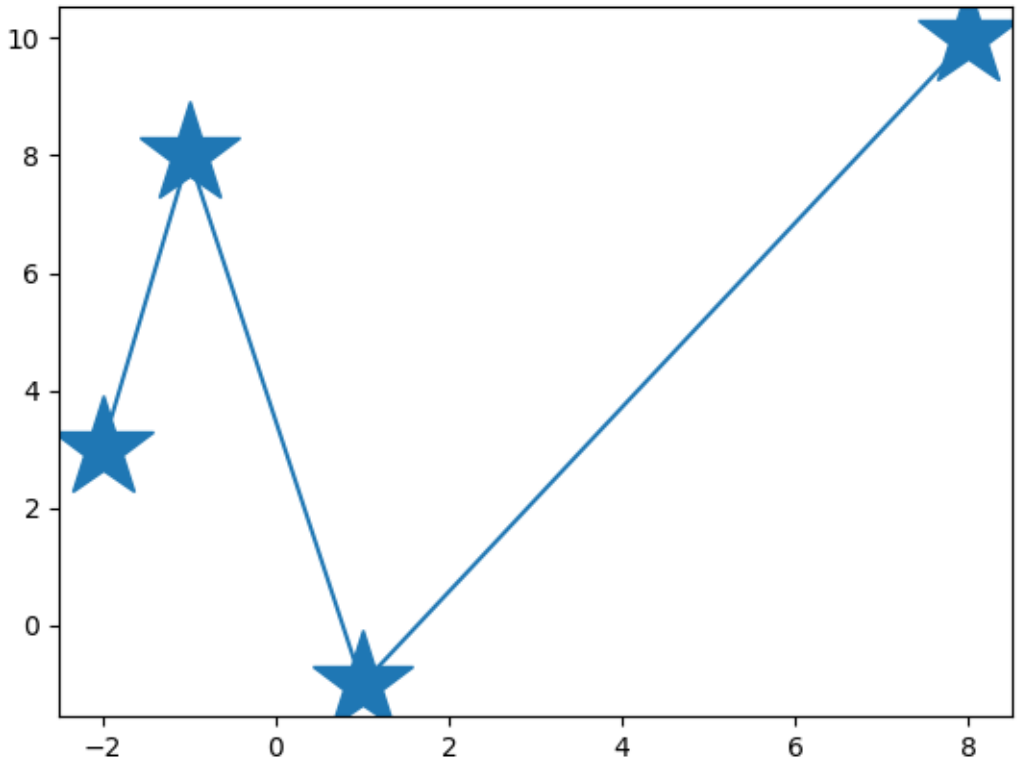
Color Syntax	Description
'r'	Red
'g'	Green
'b'	Blue
'c'	Cyan
'm'	Magenta
'y'	Yellow
'k'	Black
'w'	White

```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])

y = np.array([3, 8, -1, 10])

plt.plot(x,y,"g")
plt.show()
```

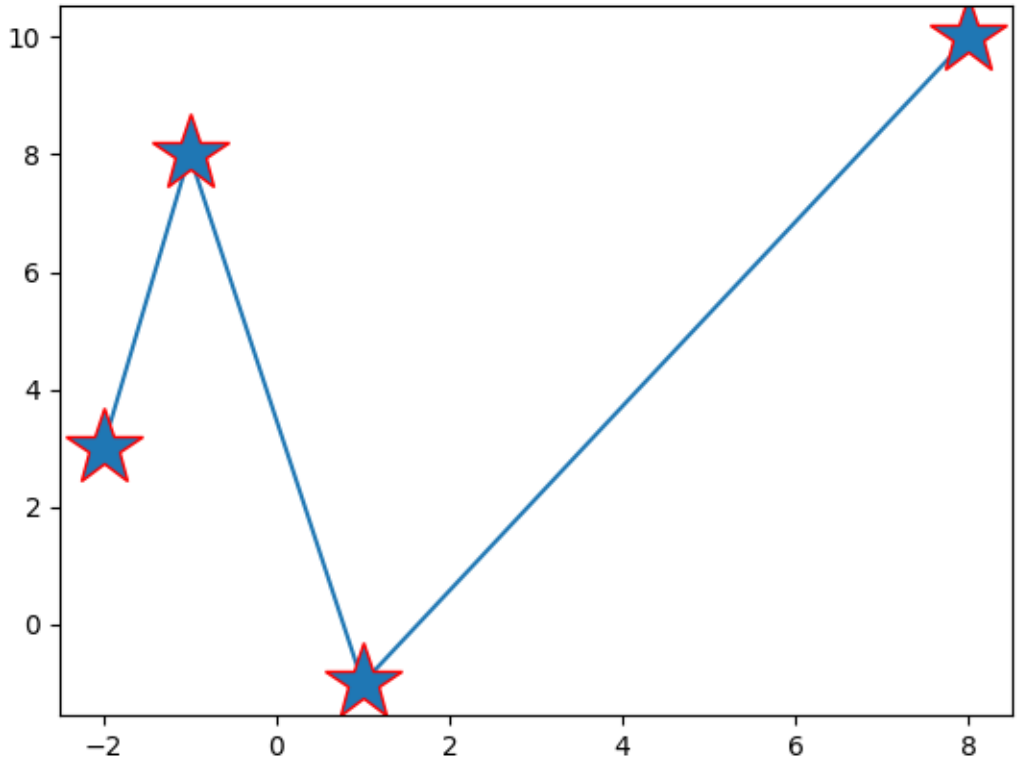


اندازه قلم

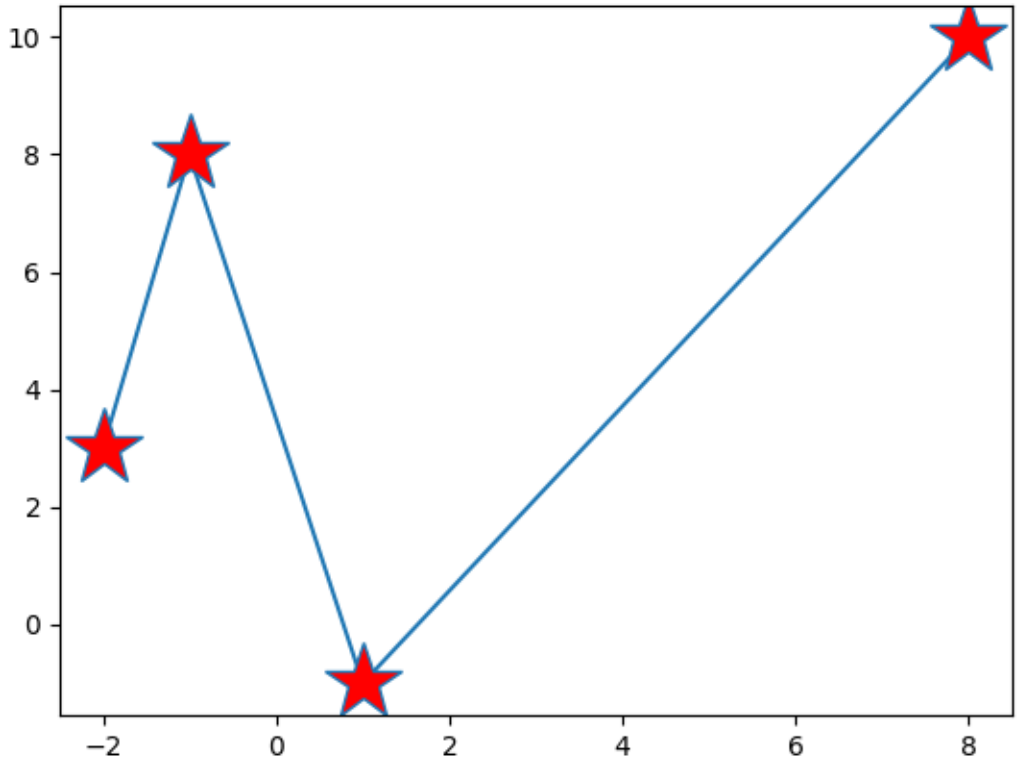
```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])

y = np.array([3, 8, -1, 10])

plt.plot(x,y,marker="*",ms=40)
plt.show()
```



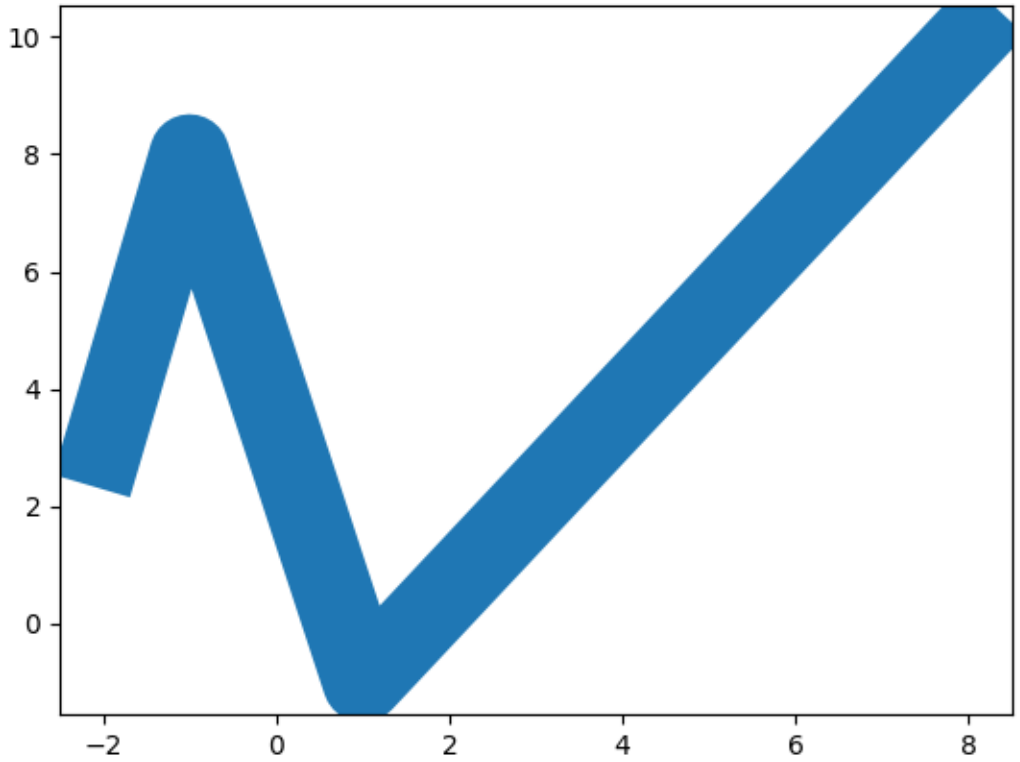
```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])

y = np.array([3, 8, -1, 10])

plt.plot(x,y, marker = '*', ms = 30, mec = 'r')
plt.show()
```



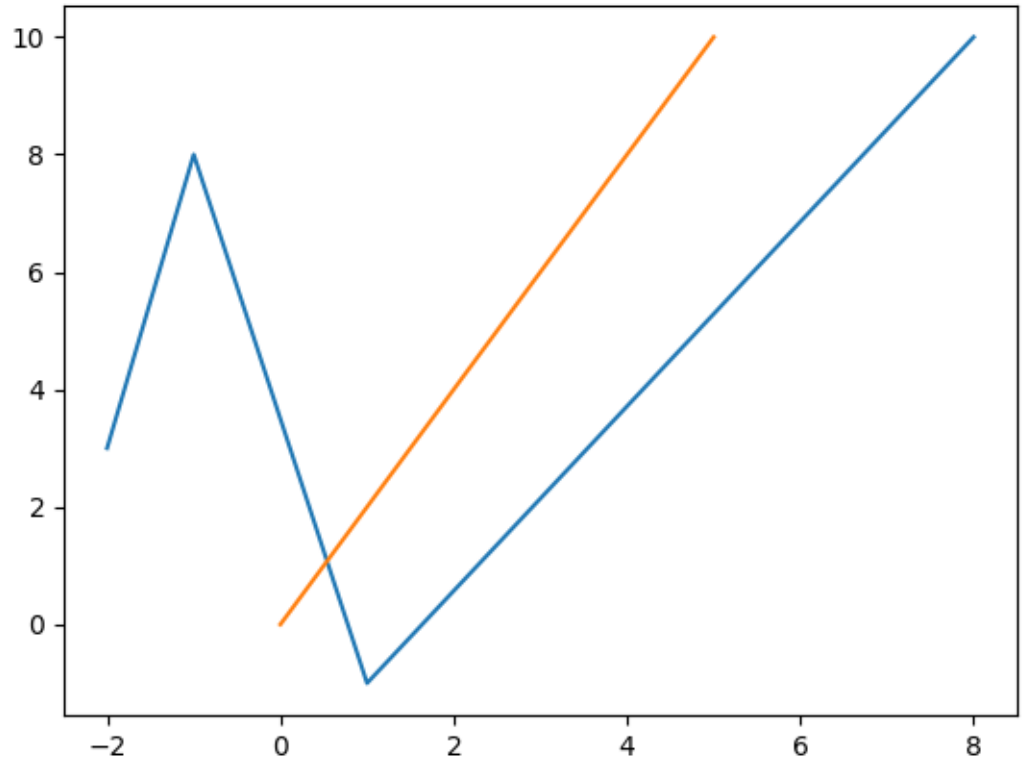
```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])

y = np.array([3, 8, -1, 10])

plt.plot(x,y, marker = '*', ms = 30, mfc = 'r')
plt.show()
```



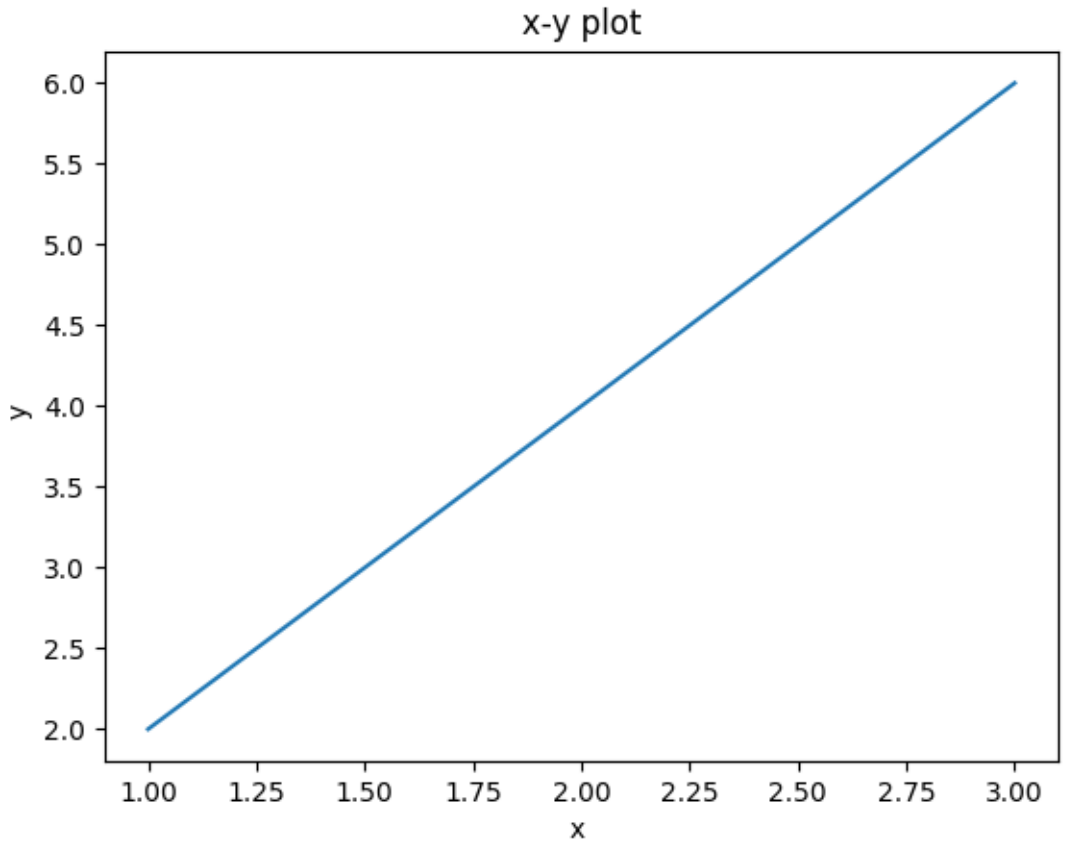
```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])

y = np.array([3, 8, -1, 10])

plt.plot(x,y, linewidth=30 )
plt.show()
```



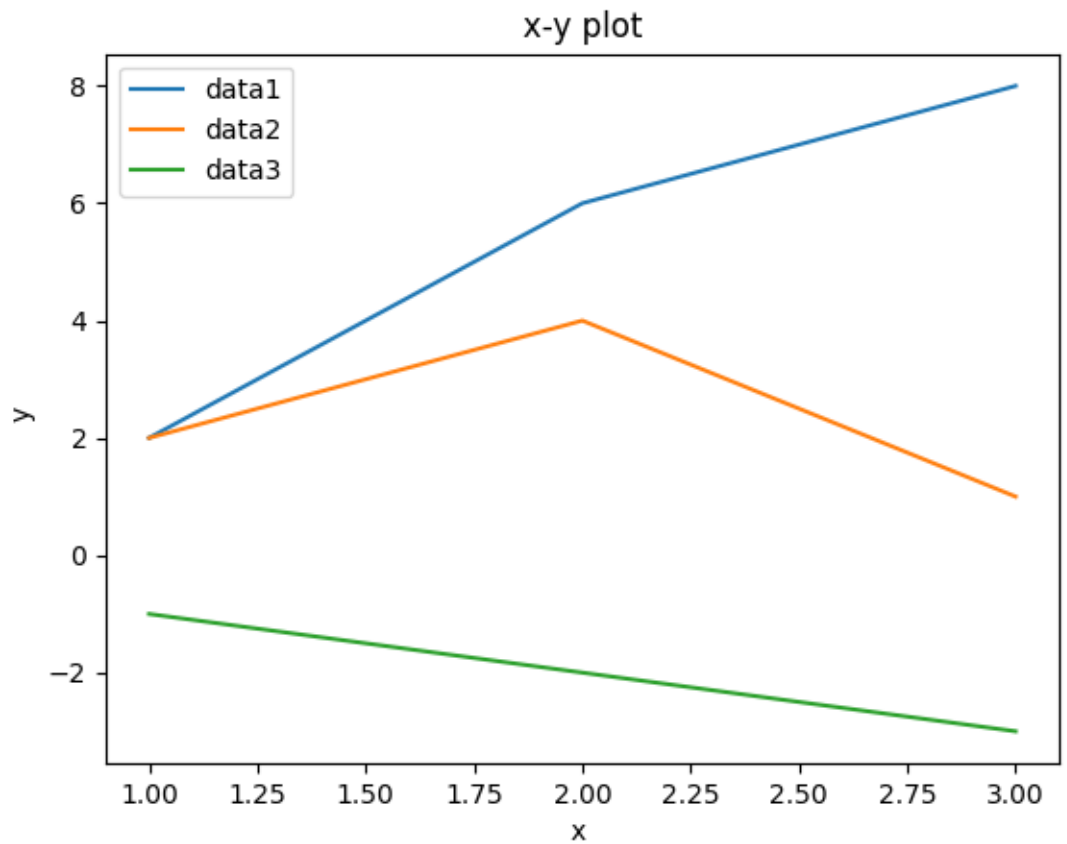
```
import matplotlib.pyplot as plt
import numpy as np
x1 = np.array([-2, -1, 1, 8])
y1= np.array([3, 8, -1, 10])

x2 = np.array([0,1,2,3,4,5])
y2= np.array([0,2,4,6,8,10])

plt.plot(x1,y1)
plt.plot(x2,y2)
plt.show()
```



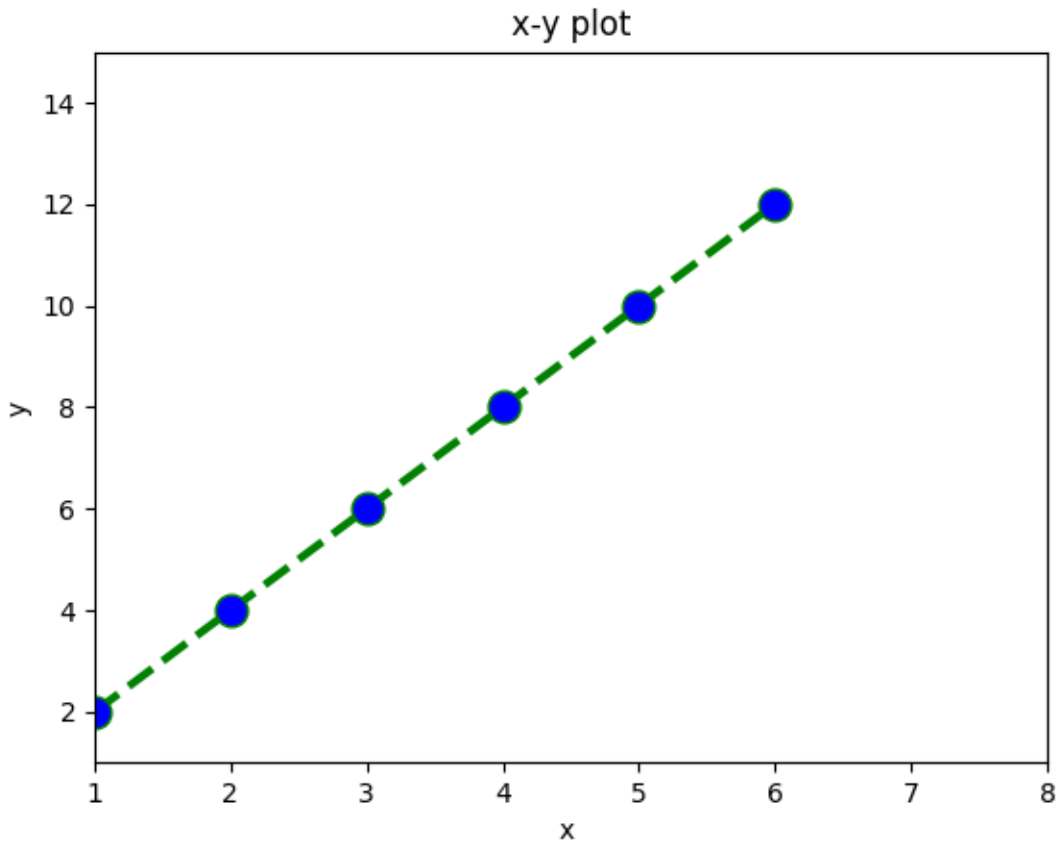
```
import matplotlib.pyplot as plt
x = [1,2,3]
y = [2,4,6]

plt.plot(x, y)

plt.xlabel('x ')
plt.ylabel('y ')

plt.title('x-y plot')

plt.show()
```



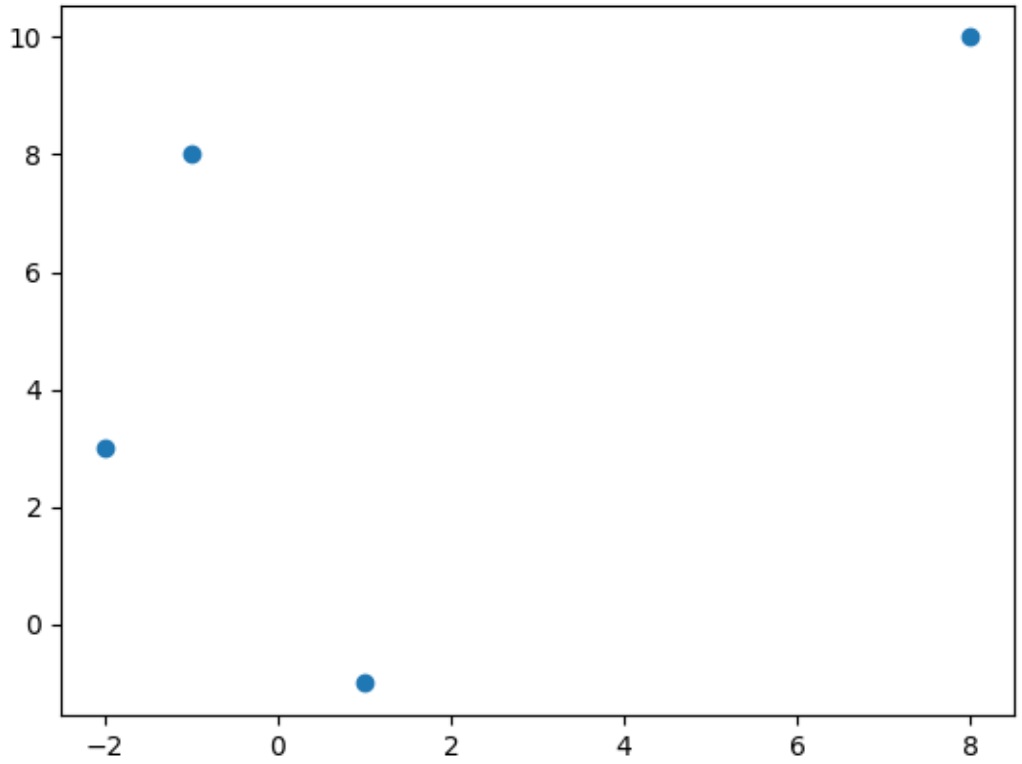
```
import matplotlib.pyplot as plt

x1 = [1,2,3]
y1 = [2,6,8]
plt.plot(x1, y1, label = "data1")

x2 = [1,2,3]
y2 = [2,4,1]

plt.plot(x2, y2, label = "data2")

x2 = [1,2,3]
y2 = [-1,-2,-3]
plt.plot(x2, y2, label = "data3")

plt.xlabel('x ')
plt.ylabel('y ')

plt.title('x-y plot')
plt.legend()
plt.show()
```



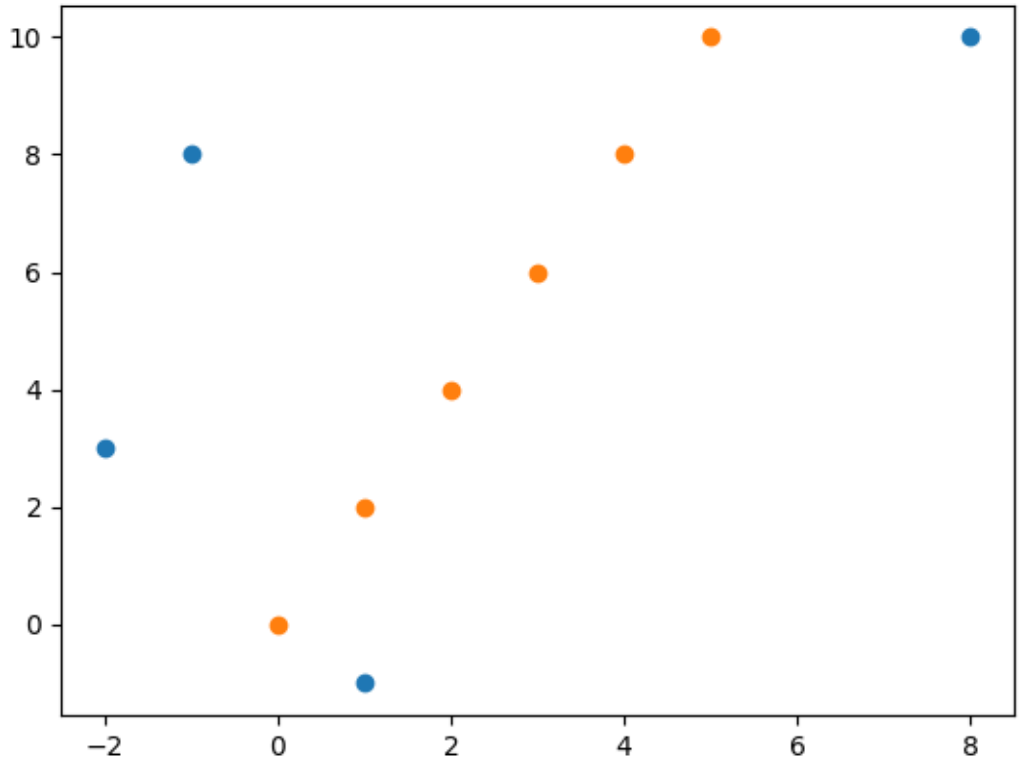
```
import matplotlib.pyplot as plt

x = [1,2,3,4,5,6]
y = [2,4,6,8,10,12]

plt.plot(x, y, color='green', linestyle='dashed', linewidth = 3,
                                    marker='o', markerfacecolor='blue', markersize=12)

plt.ylim(1,15)
plt.xlim(1,8)

plt.xlabel('x ')
plt.ylabel('y')

plt.title('x-y plot')

plt.show()
```



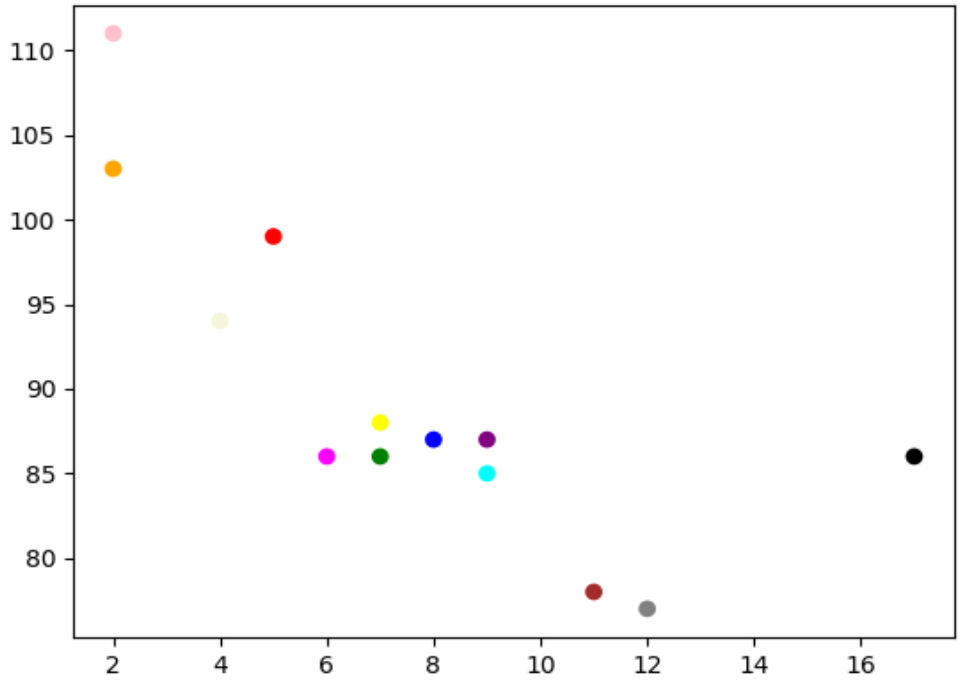
```
import matplotlib.pyplot as plt
import numpy as np
x = np.array([-2, -1, 1, 8])
y = np.array([3, 8, -1, 10])

plt.scatter(x, y)
plt.show()
```



```
import matplotlib.pyplot as plt
import numpy as np
x1 = np.array([-2, -1, 1, 8])
y1= np.array([3, 8, -1, 10])

x2 = np.array([0,1,2,3,4,5])
y2= np.array([0,2,4,6,8,10])

plt.scatter(x1,y1)
plt.scatter(x2,y2)
plt.show()
```

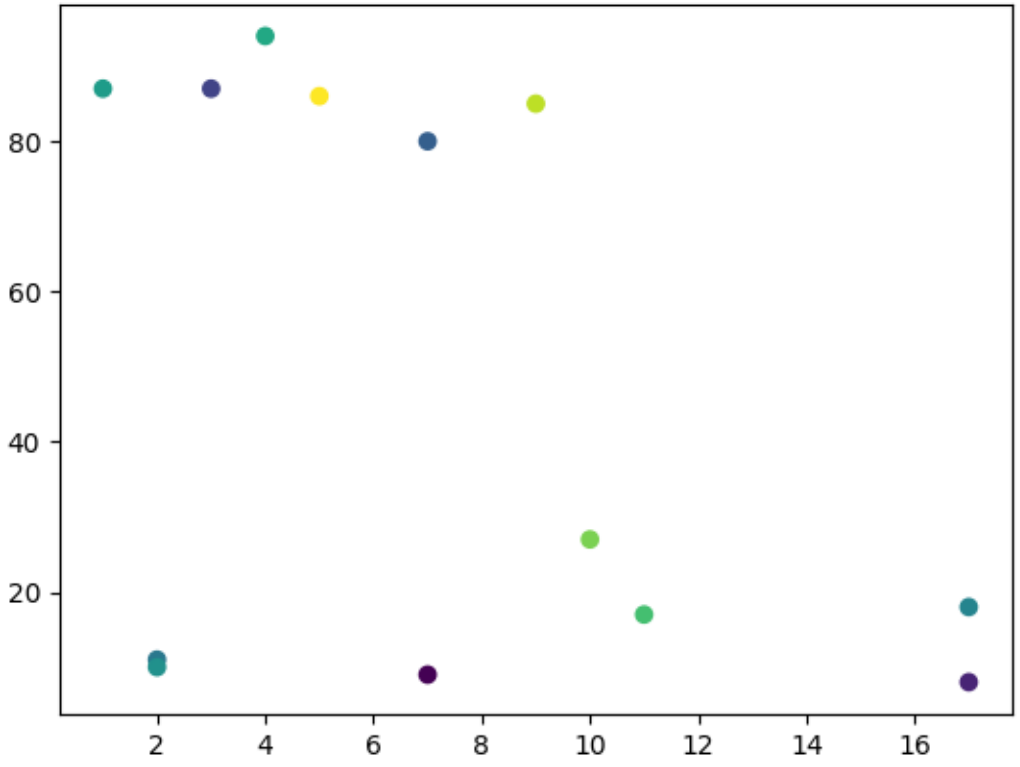


```
import matplotlib.pyplot as plt
import numpy as np
```




```
x = np.array([5,7,8,7,2,17,2,9,4,11,12,9,6])
y = np.array([99,86,87,88,111,86,103,87,94,78,77,85,86])
colors = np.array(["red","green","blue","yellow","pink",
"black","orange","purple","beige","brown","gray","cyan","magenta"])
plt.scatter(x, y, c=colors)
plt.show()
```

```
import matplotlib.pyplot as plt
import numpy as np



x = np.array([7,17,3,7,2,17,2,1,4,11,10,9,5])
y = np.array([9,8,87,80,11,18,10,87,94,17,27,85,86])
colors = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])

plt.scatter(x, y, c=colors, cmap='viridis')

plt.show()
```



```
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import numpy as np
```
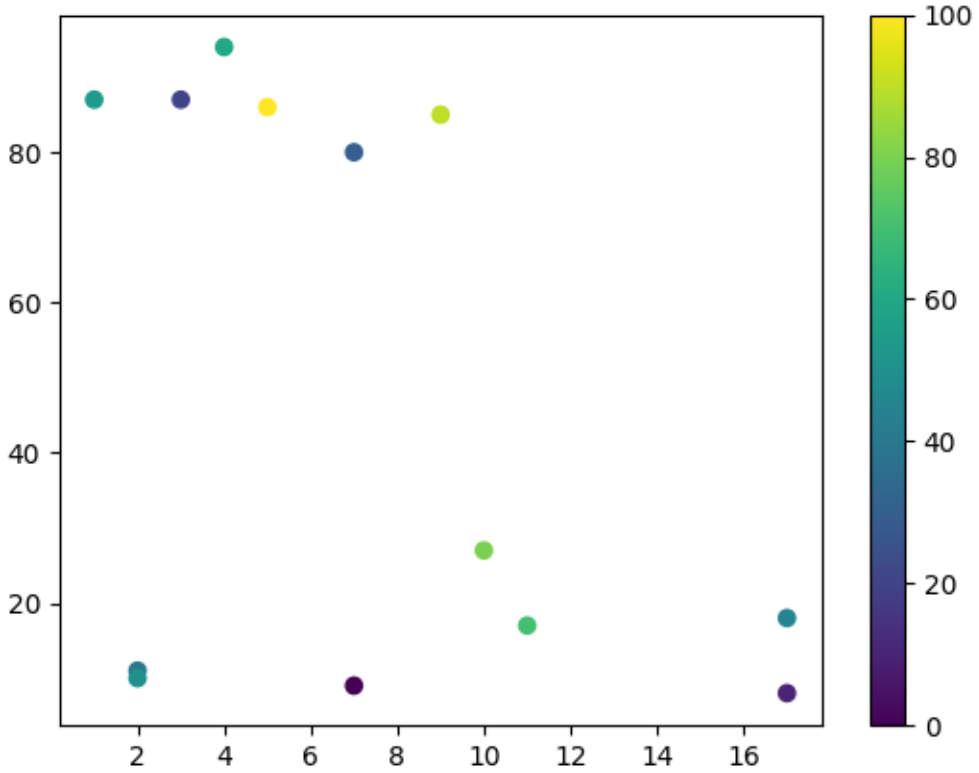
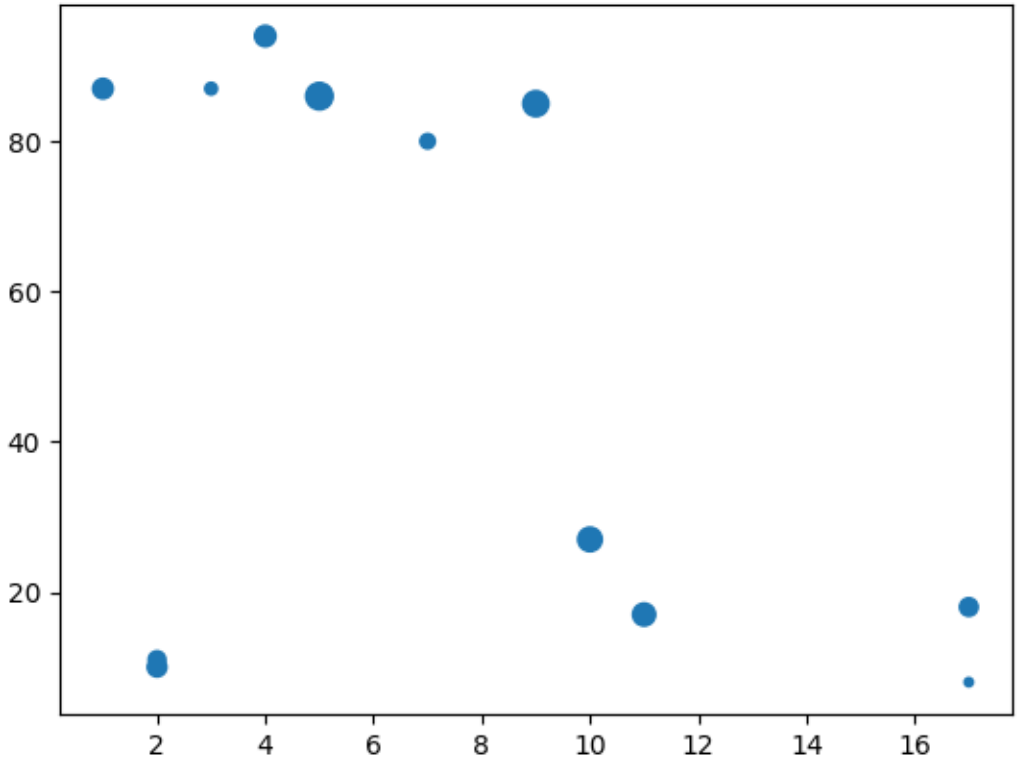



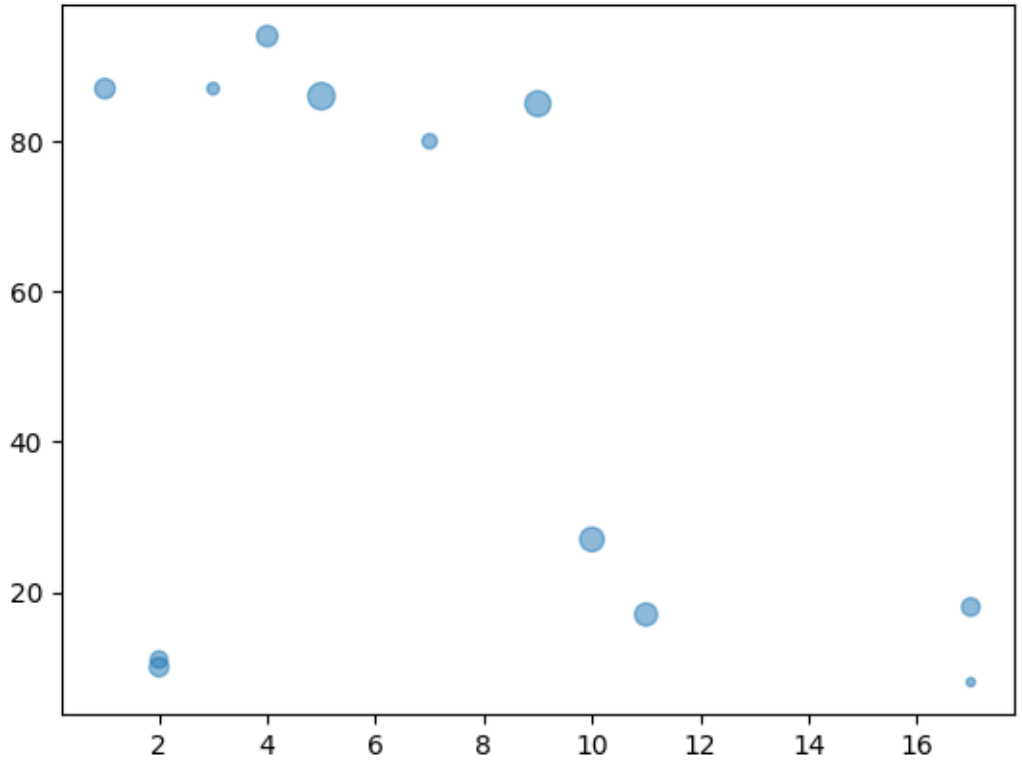

```
x = np.array([7,17,3,7,2,17,2,1,4,11,10,9,5])
y = np.array([9,8,87,80,11,18,10,87,94,17,27,85,86])
colors = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])

plt.scatter(x, y, c=colors, cmap='viridis')
plt.colorbar()
plt.show()
```

```
import matplotlib.pyplot as plt
import numpy as np
```



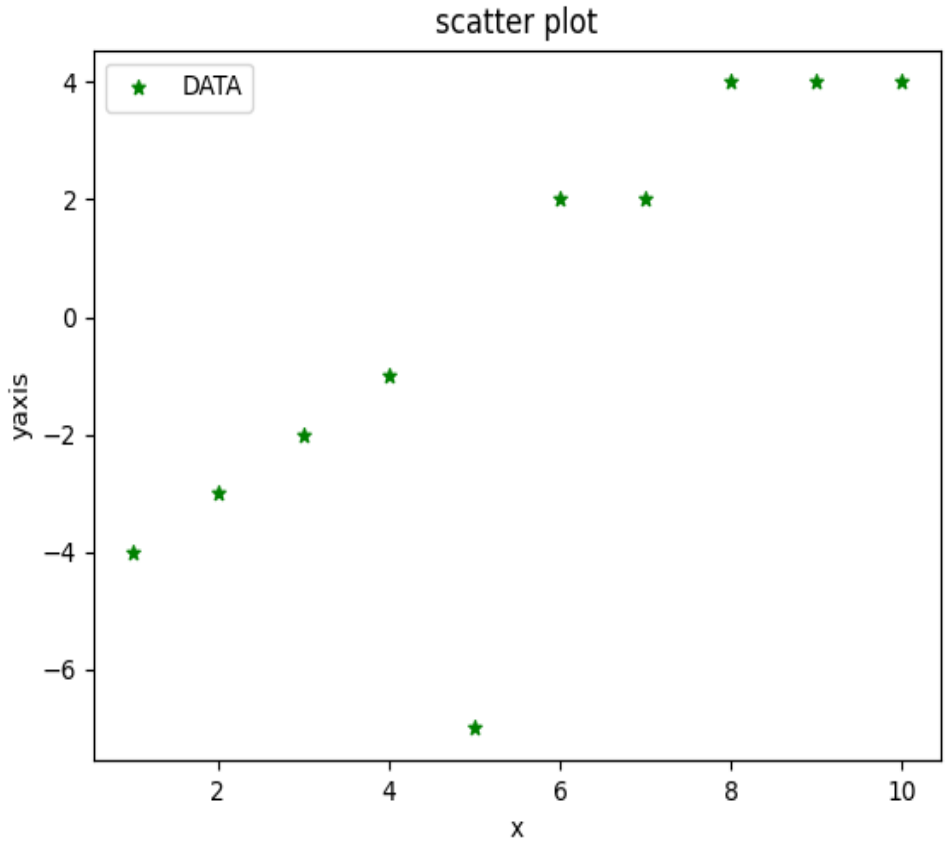

```
x = np.array([7,17,3,7,2,17,2,1,4,11,10,9,5])
y = np.array([9,8,87,80,11,18,10,87,94,17,27,85,86])
sizes = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])

plt.scatter(x, y, s=sizes)
plt.show()
```

```
import matplotlib.pyplot as plt
import numpy as np
```




```
x = np.array([7,17,3,7,2,17,2,1,4,11,10,9,5])
y = np.array([9,8,87,80,11,18,10,87,94,17,27,85,86])
sizes = np.array([0, 10, 20, 30, 40, 45, 50, 55, 60, 70, 80, 90, 100])

plt.scatter(x, y, s=sizes,alpha=0.5)
plt.show()
```

```
import matplotlib.pyplot as plt

x = [1,2,3,4,5,6,7,8,9,10]
y = [-4,-3,-2,-1,-7,2,2,4,4,4]

plt.scatter(x, y, label= "DATA", color= "green", marker= "*", s=30)

plt.xlabel('x')
plt.ylabel('yaxis')
plt.title('scatter plot')
plt.legend()
plt.show()
```



تمرین

- مقدار x، y و z را تعیین کنید.

- 2x+4y+2z=15
- 2x+y+2z=-5
- 4x+y-2z=0

تمرین

- چند جمله ای $3x^2 + 2x - 1 = 0$ را در نظر بگیرید.
- ریشه های این تابع را بدست آورید.
- مقدار تابع و مشتق تابع در نقطه 2- را تعیین کنید

تمرین

- ارزش فعلی (مثلاً سرمایه گذاری اولیه) سرمایه گذاری که پس از ۱۰ سال پس انداز ۱۰۰ دلار در هر ماه ، در کل باید ۱۵۶۹۲/۹۳ دلار باشد ، چقدر است؟ فرض کنید نرخ بهره ۵٪ (سالانه) باشد.