Taller 6

Métodos Computacionales para Políticas Públicas - URosario

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JUAN SEBASTIAN VALBUENA SILVA

JUANS.VALBUENA@UROSARIO.EDU.CO

Instrucciones:

- Guarde una copia de este *Jupyter Notebook* en su computador, idealmente en una carpeta destinada al material del curso.
- Modifique el nombre del archivo del *notebook*, agregando al final un guión inferior y su nombre y apellido, separados estos últimos por otro guión inferior. Por ejemplo, mi *notebook* se llamaría: mcpp_taller6_santiago_matallana
- Marque el *notebook* con su nombre y e-mail en el bloque verde arriba. Reemplace el texto "[Su nombre acá]" con su nombre y apellido. Similar para su e-mail.
- Desarrolle la totalidad del taller sobre este *notebook*, insertando las celdas que sea necesario debajo de cada pregunta. Haga buen uso de las celdas para código y de las celdas tipo *markdown* según el caso.
- Recuerde salvar periódicamente sus avances.
- Cuando termine el taller:
  1. Descárguelo en PDF. Si tiene algún problema con la conversión, descárguelo en HTML.
  2. Suba todos los archivos a su repositorio en GitHub, en una carpeta destinada exclusivamente para este taller, antes de la fecha y hora límites.

(Todos los ejercicios tienen el mismo valor.)

Resuelva la parte 1 de este documento.

```
In [4]: import numpy as np
        import scipy.linalg as la
        import matplotlib.pyplot as plt
```

```
In [5]: x= 82
```

1. What is command to compute the square of x? Its cube? np.square(x) np.power(x,3)

```
In [6]: import numpy as np
        import scipy.linalg as la
        import matplotlib.pyplot as plt
        np.square(x)

Out[6]: 6724
```

```
In [7]: np.power(x,3)

Out[7]: 551368
```

```
In [8]: theta=180
```

```
In [9]: np.sin(theta)

Out[9]: -0.8011526357338304
```

```
In [10]: np.cos(theta)

Out[10]: -0.5984600690578582
```

Por defecto, se realiza el método en grados (180) pero es posible pasarlo a radianes.

```
In [11]: meshpoints= np.linspace(-1,1,500)
```

```
In [12]: print (meshpoints)
```

```
[-1.         -0.99599198 -0.99198397 -0.98797595 -0.98396794 -0.9799599
2
 -0.9759519  -0.97194389 -0.96793587 -0.96392786 -0.95991984 -0.9559118
2
 -0.95190381 -0.94789579 -0.94388778 -0.93987976 -0.93587174 -0.9318637
3
 -0.92785571 -0.9238477  -0.91983968 -0.91583166 -0.91182365 -0.9078156
3
 -0.90380762 -0.8997996  -0.89579158 -0.89178357 -0.88777555 -0.8837675
4
 -0.87975952 -0.8757515  -0.87174349 -0.86773547 -0.86372745 -0.8597194
4
 -0.85571142 -0.85170341 -0.84769539 -0.84368737 -0.83967936 -0.8356713
4
 -0.83166333 -0.82765531 -0.82364729 -0.81963928 -0.81563126 -0.8116232
5
 -0.80761523 -0.80360721 -0.7995992  -0.79559118 -0.79158317 -0.7875751
5
 -0.78356713 -0.77955912 -0.7755511  -0.77154309 -0.76753507 -0.7635270
5
 -0.75951904 -0.75551102 -0.75150301 -0.74749499 -0.74348697 -0.7394789
6
 -0.73547094 -0.73146293 -0.72745491 -0.72344689 -0.71943888 -0.7154308
6
 -0.71142285 -0.70741483 -0.70340681 -0.6993988  -0.69539078 -0.6913827
7
 -0.68737475 -0.68336673 -0.67935872 -0.6753507  -0.67134269 -0.6673346
7
 -0.66332665 -0.65931864 -0.65531062 -0.65130261 -0.64729459 -0.6432865
7
 -0.63927856 -0.63527054 -0.63126253 -0.62725451 -0.62324649 -0.6192384
```

```
8
 -0.61523046 -0.61122244 -0.60721443 -0.60320641 -0.5991984  -0.5951903
8
 -0.59118236 -0.58717435 -0.58316633 -0.57915832 -0.5751503  -0.5711422
8
 -0.56713427 -0.56312625 -0.55911824 -0.55511022 -0.5511022  -0.5470941
9
 -0.54308617 -0.53907816 -0.53507014 -0.53106212 -0.52705411 -0.5230460
9
 -0.51903808 -0.51503006 -0.51102204 -0.50701403 -0.50300601 -0.498998
 -0.49498998 -0.49098196 -0.48697395 -0.48296593 -0.47895792 -0.4749499
 -0.47094188 -0.46693387 -0.46292585 -0.45891784 -0.45490982 -0.4509018
 -0.44689379 -0.44288577 -0.43887776 -0.43486974 -0.43086172 -0.4268537
1
 -0.42284569 -0.41883768 -0.41482966 -0.41082164 -0.40681363 -0.4028056
1
 -0.3987976  -0.39478958 -0.39078156 -0.38677355 -0.38276553 -0.3787575
2
 -0.3747495  -0.37074148 -0.36673347 -0.36272545 -0.35871743 -0.3547094
2
 -0.3507014  -0.34669339 -0.34268537 -0.33867735 -0.33466934 -0.3306613
2
 -0.32665331 -0.32264529 -0.31863727 -0.31462926 -0.31062124 -0.3066132
3
 -0.30260521 -0.29859719 -0.29458918 -0.29058116 -0.28657315 -0.2825651
3
 -0.27855711 -0.2745491  -0.27054108 -0.26653307 -0.26252505 -0.2585170
3
 -0.25450902 -0.250501   -0.24649299 -0.24248497 -0.23847695 -0.2344689
4
 -0.23046092 -0.22645291 -0.22244489 -0.21843687 -0.21442886 -0.2104208
4
 -0.20641283 -0.20240481 -0.19839679 -0.19438878 -0.19038076 -0.1863727
5
 -0.18236473 -0.17835671 -0.1743487  -0.17034068 -0.16633267 -0.1623246
5
 -0.15831663 -0.15430862 -0.1503006  -0.14629259 -0.14228457 -0.1382765
5
 -0.13426854 -0.13026052 -0.12625251 -0.12224449 -0.11823647 -0.1142284
```

```
6
 -0.11022044 -0.10621242 -0.10220441 -0.09819639 -0.09418838 -0.0901803
6
 -0.08617234 -0.08216433 -0.07815631 -0.0741483  -0.07014028 -0.0661322
6
 -0.06212425 -0.05811623 -0.05410822 -0.0501002  -0.04609218 -0.0420841
7
 -0.03807615 -0.03406814 -0.03006012 -0.0260521  -0.02204409 -0.0180360
7
 -0.01402806 -0.01002004 -0.00601202 -0.00200401  0.00200401  0.0060120
2
  0.01002004  0.01402806  0.01803607  0.02204409  0.0260521   0.0300601
2
  0.03406814  0.03807615  0.04208417  0.04609218  0.0501002   0.0541082
2
  0.05811623  0.06212425  0.06613226  0.07014028  0.0741483   0.0781563
1
  0.08216433  0.08617234  0.09018036  0.09418838  0.09819639  0.1022044
1
  0.10621242  0.11022044  0.11422846  0.11823647  0.12224449  0.1262525
1
  0.13026052  0.13426854  0.13827655  0.14228457  0.14629259  0.1503006
  0.15430862  0.15831663  0.16232465  0.16633267  0.17034068  0.1743487
  0.17835671  0.18236473  0.18637275  0.19038076  0.19438878  0.1983967
9
  0.20240481  0.20641283  0.21042084  0.21442886  0.21843687  0.2224448
9
  0.22645291  0.23046092  0.23446894  0.23847695  0.24248497  0.2464929
9
  0.250501    0.25450902  0.25851703  0.26252505  0.26653307  0.2705410
8
  0.2745491   0.27855711  0.28256513  0.28657315  0.29058116  0.2945891
8
  0.29859719  0.30260521  0.30661323  0.31062124  0.31462926  0.3186372
7
  0.32264529  0.32665331  0.33066132  0.33466934  0.33867735  0.3426853
7
  0.34669339  0.3507014   0.35470942  0.35871743  0.36272545  0.3667334
7
```

```
  0.37074148  0.3747495   0.37875752  0.38276553  0.38677355  0.3907815
6
  0.39478958  0.3987976   0.40280561  0.40681363  0.41082164  0.4148296
6
  0.41883768  0.42284569  0.42685371  0.43086172  0.43486974  0.4388777
6
  0.44288577  0.44689379  0.4509018   0.45490982  0.45891784  0.4629258
5
  0.46693387  0.47094188  0.4749499   0.47895792  0.48296593  0.4869739
5
  0.49098196  0.49498998  0.498998    0.50300601  0.50701403  0.5110220
4
  0.51503006  0.51903808  0.52304609  0.52705411  0.53106212  0.5350701
4
  0.53907816  0.54308617  0.54709419  0.5511022   0.55511022  0.5591182
4
  0.56312625  0.56713427  0.57114228  0.5751503   0.57915832  0.5831663
3
  0.58717435  0.59118236  0.59519038  0.5991984   0.60320641  0.6072144
3
  0.61122244  0.61523046  0.61923848  0.62324649  0.62725451  0.6312625
3
  0.63527054  0.63927856  0.64328657  0.64729459  0.65130261  0.6553106
2
  0.65931864  0.66332665  0.66733467  0.67134269  0.6753507   0.6793587
2
  0.68336673  0.68737475  0.69138277  0.69539078  0.6993988   0.7034068
1
  0.70741483  0.71142285  0.71543086  0.71943888  0.72344689  0.7274549
1
  0.73146293  0.73547094  0.73947896  0.74348697  0.74749499  0.7515030
1
  0.75551102  0.75951904  0.76352705  0.76753507  0.77154309  0.7755511
  0.77955912  0.78356713  0.78757515  0.79158317  0.79559118  0.7995992
  0.80360721  0.80761523  0.81162325  0.81563126  0.81963928  0.8236472
9
  0.82765531  0.83166333  0.83567134  0.83967936  0.84368737  0.8476953
9
  0.85170341  0.85571142  0.85971944  0.86372745  0.86773547  0.8717434
```

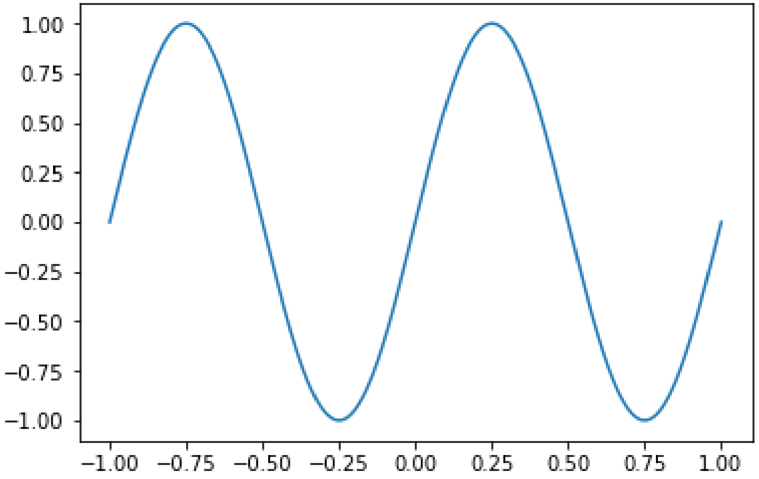
```
 9
  0.8757515   0.87975952  0.88376754  0.88777555  0.89178357  0.8957915
 8
  0.8997996   0.90380762  0.90781563  0.91182365  0.91583166  0.9198396
 8
  0.9238477   0.92785571  0.93186373  0.93587174  0.93987976  0.9438877
 8
  0.94789579  0.95190381  0.95591182  0.95991984  0.96392786  0.9679358
 7
  0.97194389  0.9759519   0.97995992  0.98396794  0.98797595  0.9919839
 7
  0.99599198  1.        ]
```

In [13]:
```
meshpoints[54]
```

Out[13]:
```
-0.7835671342685371
```

In [14]:
```
import math
math.pi
pi = math.pi
```

In [15]:
```
plt.plot(meshpoints,np.sin(2*pi*meshpoints))
plt.savefig('sin.png')
```



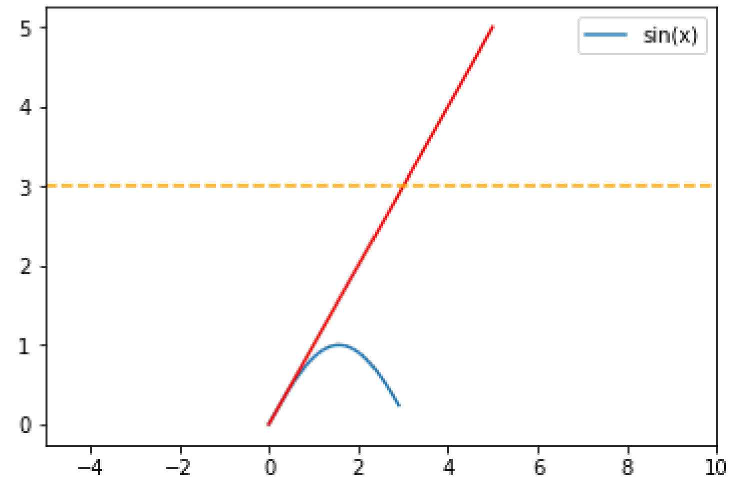
Resuelva los ejercicios de las secciones 4.1, 5.1, 6.1, 7.4 y 8.5 de este documento.

4.1 Exercises

1. Plot a simple graph of a sinus function in the range 0 to 3 with a step size of 0.01.
2. Make the line red. Add diamond-shaped markers with size of 5.
3. Add a legend and a grid to the plot.

In [16]:

```
import matplotlib.pyplot as plt
import numpy as np
x = np.arange(0,3,0.1)
y = np.sin(x)
z = np.arange(0,6)
q = np.arange(0,2)
plt.plot(x,y, label="sin(x)")
plt.plot(z,"r")
plt.axhline(3, color="orange", linestyle="--")
plt.xlim(-5, 10)
plt.legend();
plt.show()
```

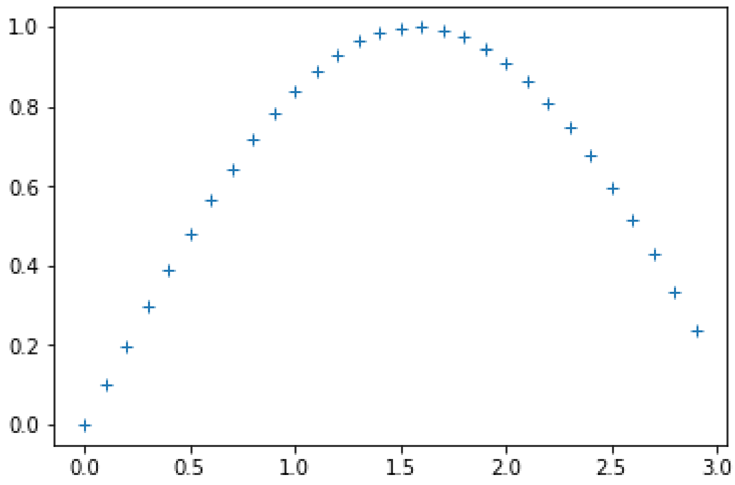


5.1 Exercise

1. Apply different line styles to a plot. Change line color and thickness as well as the size and the kind of the marker. Experiment with different styles.

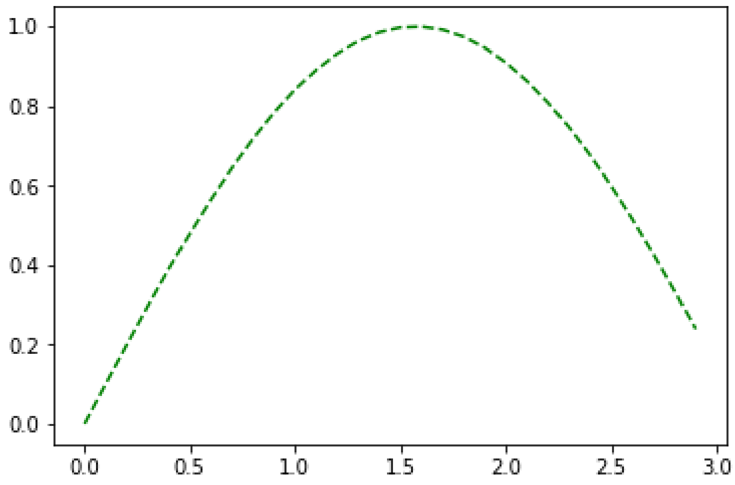
Aplicar diferentes estilos de línea a un plot. Cambie el color y el grosor de la línea, así como el tamaño y el tipo de marcador. Experimenta con diferentes estilos.

In [17]:
```
plt.plot(x, y, "+");
```



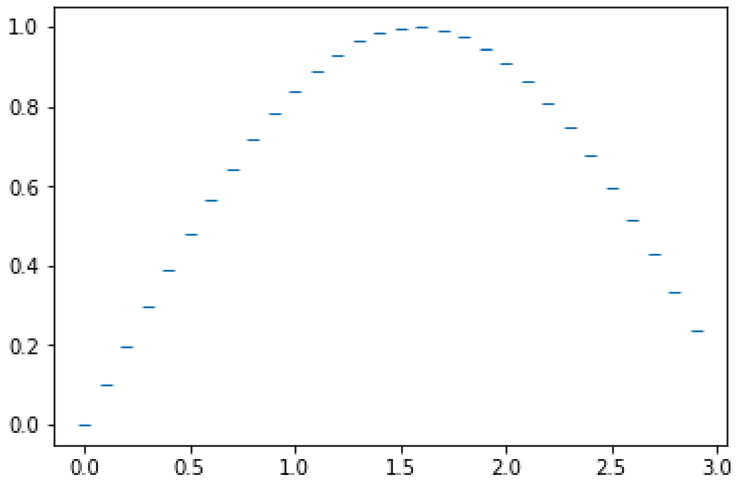
In [18]:

```
plt.plot(x, y, "g--");
```



In [19]:

```
plt.plot(x, y, "_");
```



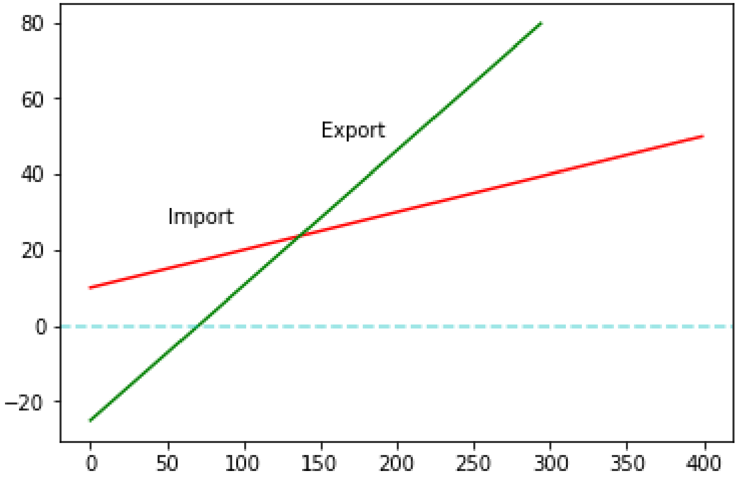
6.1 Exercise

1. Annotate a line at two places with text. Use green and red arrows and align it according to figure points and data. Anota una línea en dos lugares con texto. Usa flechas verdes y rojas y alinéala según la figura. Puntos y datos.

In [20]:
```
import numpy as np
import scipy.linalg as la
import matplotlib.pyplot as plt
xyz = np.arange(10,50,0.1)
zxy = np.arange(-25,80,0.356)
```

In [21]:
```
plt.plot(xyz,"r",);
plt.plot(zxy, "g");
plt.axhline(0, color="c", linestyle="--", alpha= 0.5);
plt.figtext(0.25,0.5 , 'Import',)
plt.annotate('Export', xy=(150, 50))
```

Out[21]:
```
Text(150, 50, 'Export')
```



7.4 Exercises

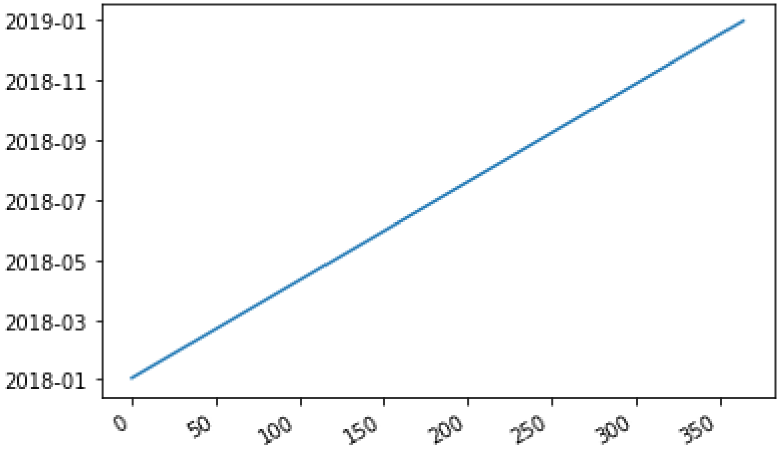
1. Plot a graph with dates for one year with daily values at the x axis using the built-in module datetime.
2. Format the dates in such a way that only the first day of the month is shown.
3. Display the dates with and without the year. Show the month as number and as first three letters of the month name

Dibuje un gráfico con las fechas de un año con valores diarios en el eje x usando el datetime del módulo incorporado.

In [99]:

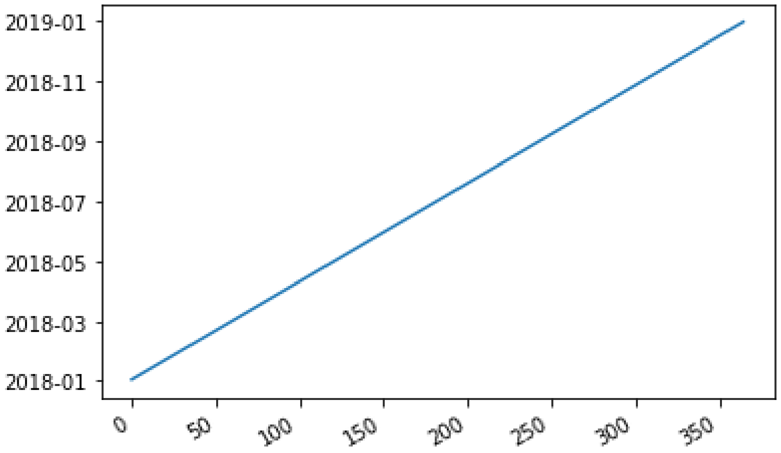
```
import matplotlib
import numpy as np
import datetime
import matplotlib.pyplot as plt
from datetime import timedelta
from datetime import datetime
date = np.datetime64('2018-01', "D")
x= date + np.arange(365)
y= np.arange(365)
```

```
plt.plot(x)
plt.gcf().autofmt_xdate()
plt.show()
```



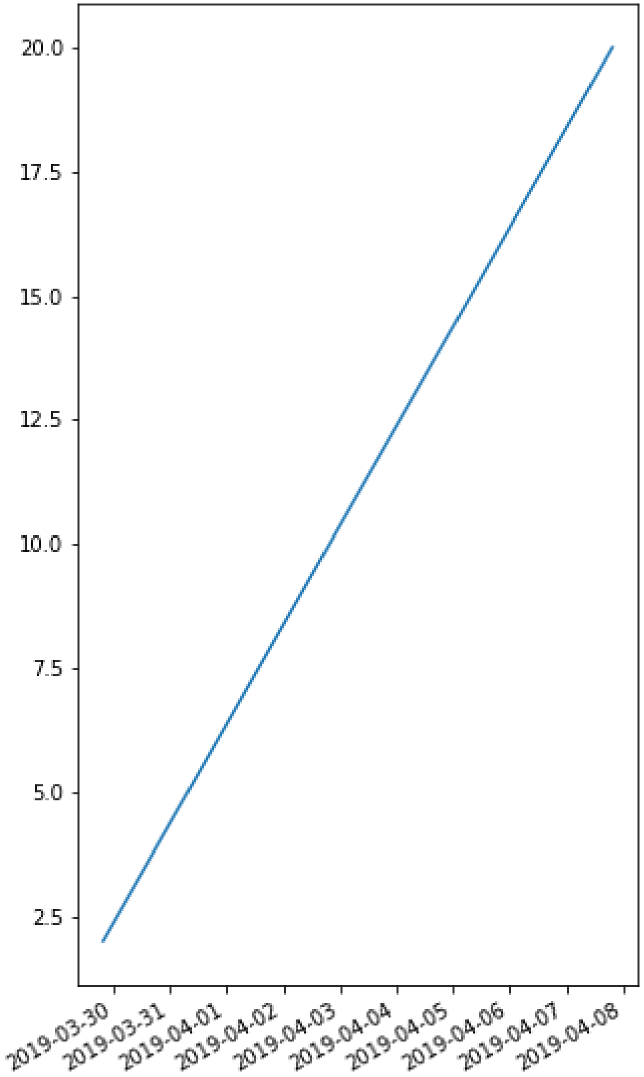
In [72]:

```
import matplotlib
import numpy as np
import datetime
import matplotlib.pyplot as plt
from datetime import timedelta
from datetime import datetime
date = np.array('2018-01-01', dtype=np.datetime64)
x= date + np.arange(365)
plt.plot(x)
plt.gcf().autofmt_xdate()
plt.show()
```



In [261]:

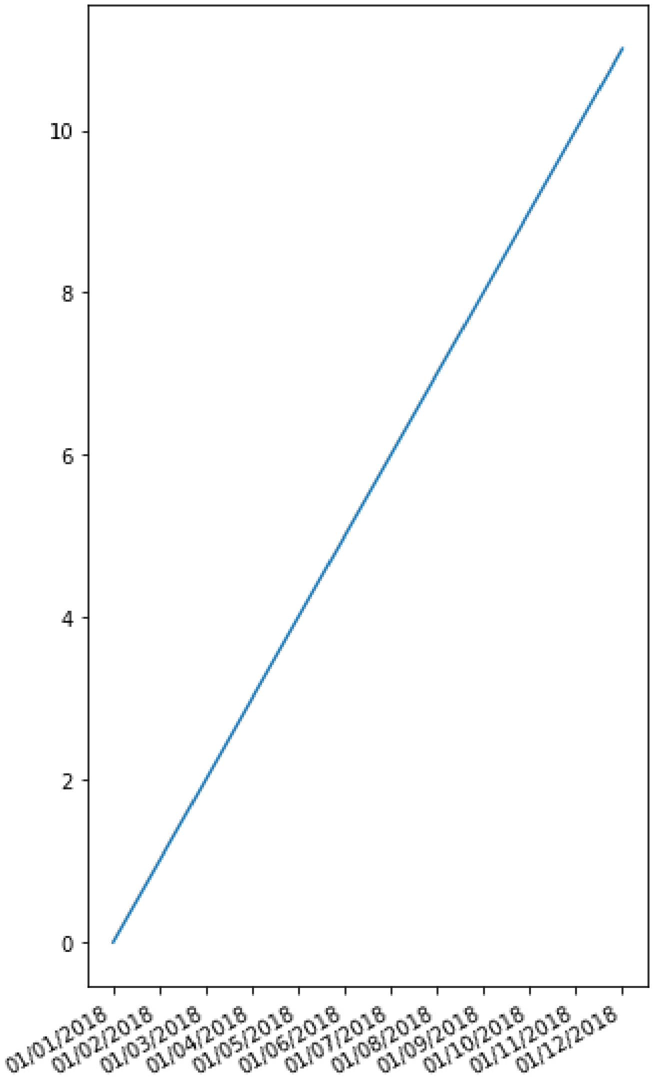
```
import matplotlib
import matplotlib.pyplot as plt
import numpy as np
import datetime

y = [ 2,4,6,8,10,12,14,16,18,20 ]
x = [datetime.datetime.now() + datetime.timedelta(days=i) for i in range(len(y))]

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



Formatee las fechas de tal manera que solo se muestre el primer día del mes

In [289]:
```
import datetime as dt
```

```python
import matplotlib.pyplot as plt
import matplotlib.dates as mdates
dates = ['01/01/2018','01/02/2018','01/03/2018','01/04/2018','01/05/2018','01/06/2018','01/07/2018','01/08/2018','01/09/2018','01/10/2018','01/11/2018','01/12/2018']
x = [dt.datetime.strptime(d,'%m/%d/%Y').date() for d in dates]
y = range(len(x))
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%m/%d/%Y'))
plt.gca().xaxis.set_major_locator(mdates.DayLocator())
plt.plot(x,y)
plt.gcf().autofmt_xdate()
```

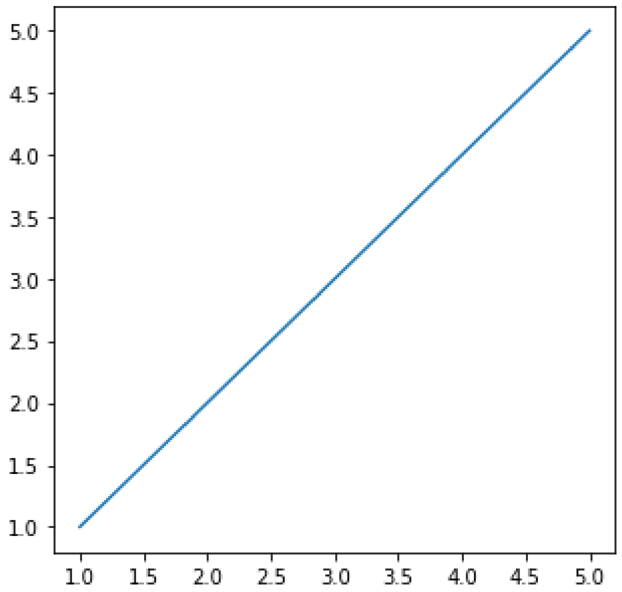


8.5 Exercises

1. Draw two figures, one 5 by 5, one 10 by 10 inches.
2. Add four subplots to one figure. Add labels and ticks only to the outermost axes.
3. Place a small plot in one bigger plot.

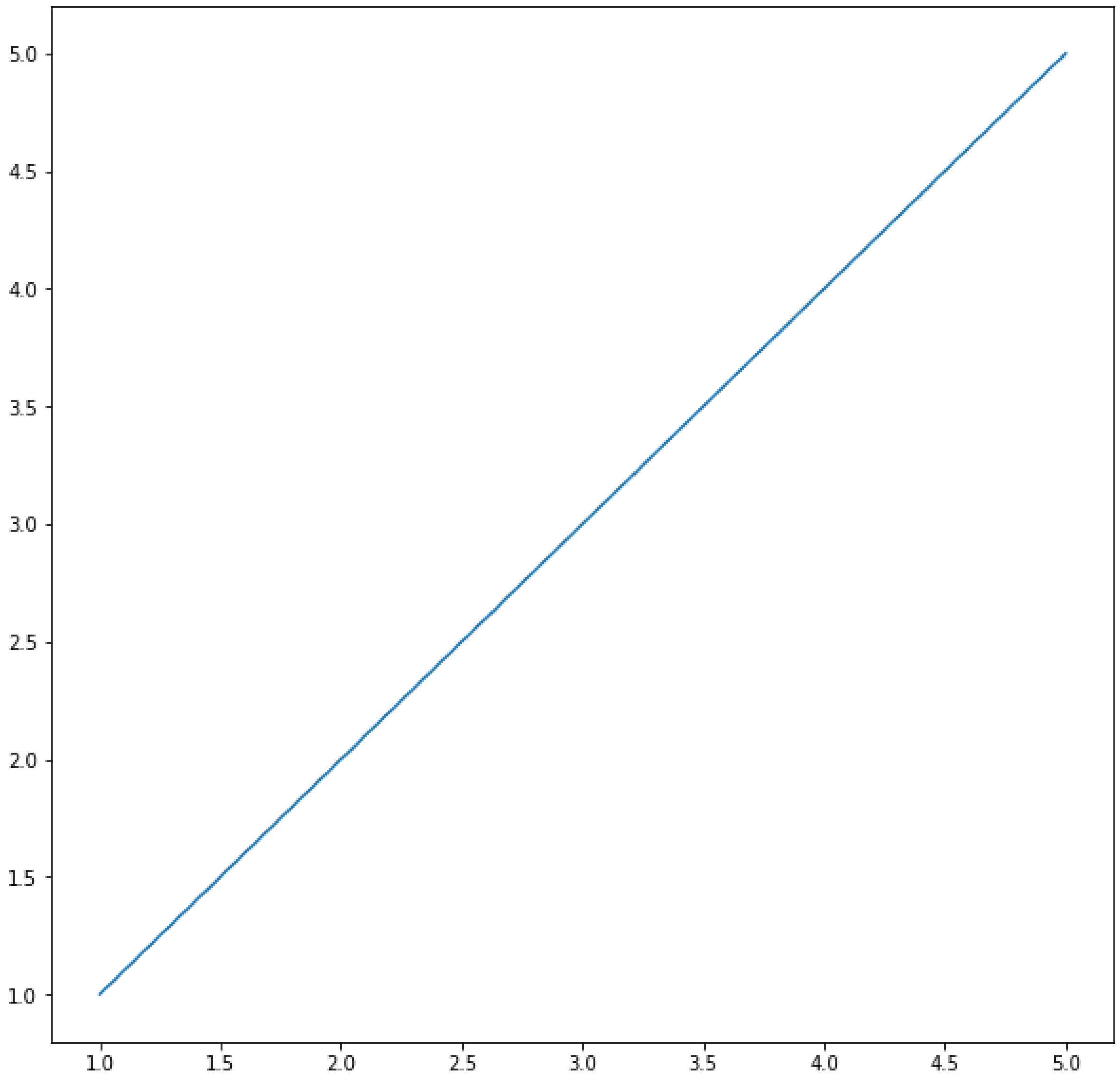
In [156]:

```python
from matplotlib import pyplot as plt
plt.figure(figsize=(5,5))
x = [1,2,3,4,5]
plt.plot(x, x)
plt.show()
```



In [157]:

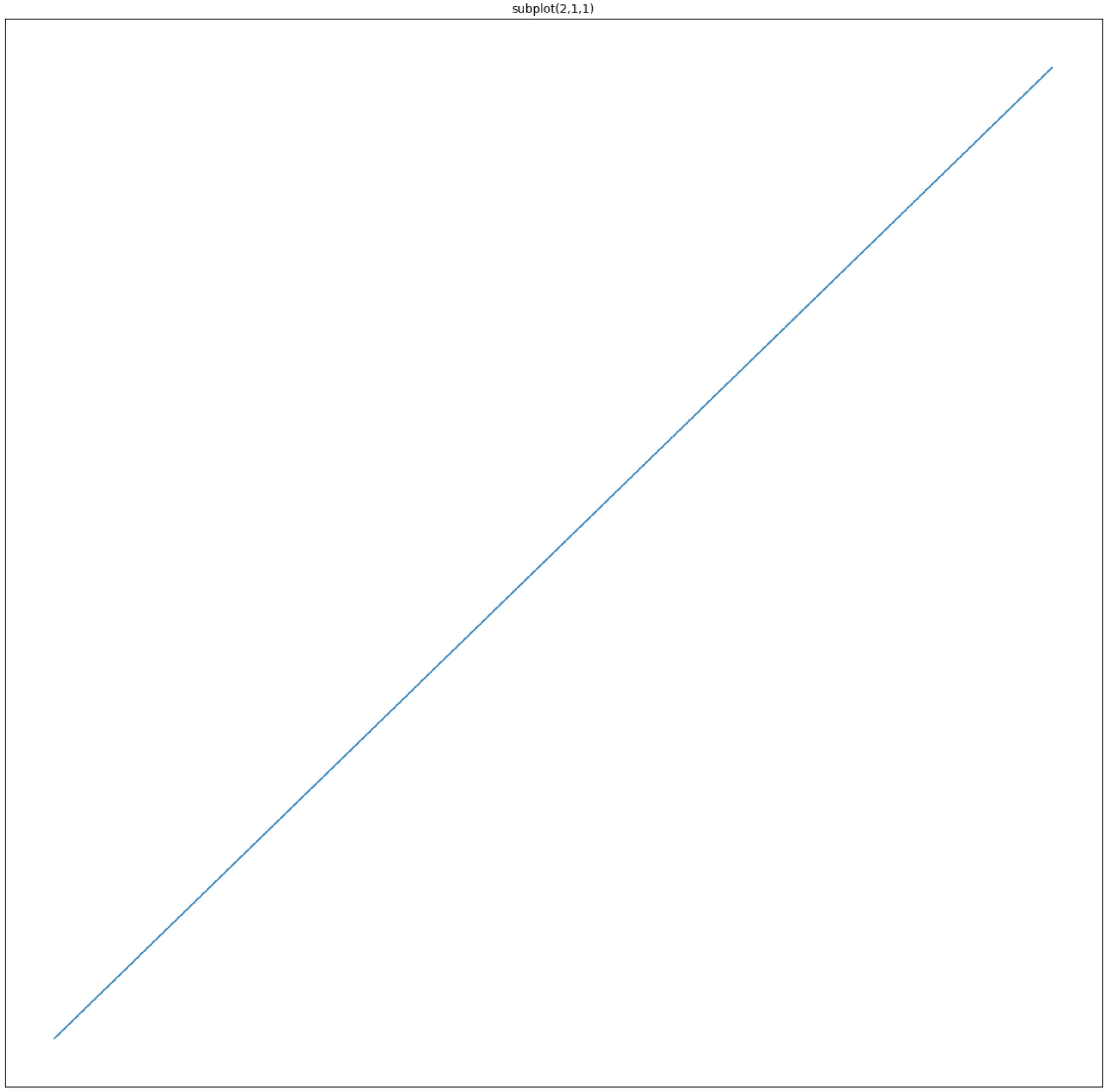
```python
from matplotlib import pyplot as plt
plt.figure(figsize=(10,10))
x = [1,2,3,4,5]
plt.plot(x, x)
plt.show()
```



In [188]:

```
import matplotlib.pyplot as plt
import pylab as plt
from pylab import *
from matplotlib import pyplot as plt
```

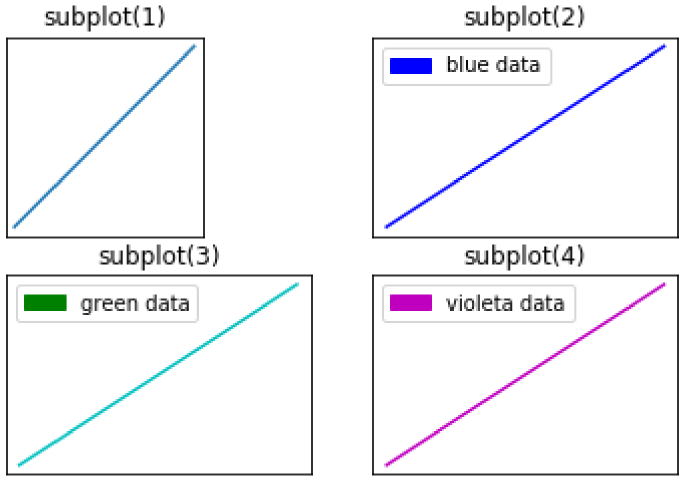
```
plt.figure(figsize=(20,20))
x = [1,2,3,4,5]
s = [1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20]
xticks([]), yticks([])
title('subplot(2,1,1)')
plt.plot(x)
plt.show()
```



1. Add four subplots to one figure. Add labels and ticks only to the outermost axes.
2. Agregue cuatro subplots a una figura. Agregue etiquetas y marcas solo a los ejes más externos.

In [268]:

```
from pylab import *
import matplotlib.pyplot as plt
import matplotlib.patches as mpatches
import matplotlib.pyplot as plt

plt.figure(figsize=( 6,4))
t = arange(0.0, 20.0, 1)
s = [1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20]

subplot(2,3,1)
xticks([]), yticks([])
title('subplot(1)')
plot(t,s)

subplot(2,2,2)
xticks([]), yticks([])
title('subplot(2)')
plot(t,s,'b-')
redpatch = mpatches.Patch(color="b", label= "blue data")
plt.legend(handles=[redpatch])

subplot(2,2,3)
xticks([]), yticks([])
title('subplot(3)')
plot(t,s,'c-')
redpatch = mpatches.Patch(color="g", label= "green data")
plt.legend(handles=[redpatch])

subplot(2,2,4)
xticks([]), yticks([])
title('subplot(4)')

plot(t,s,'m-')
redpatch = mpatches.Patch(color="m", label= "violeta data")
plt.legend(handles=[redpatch])
show()
```

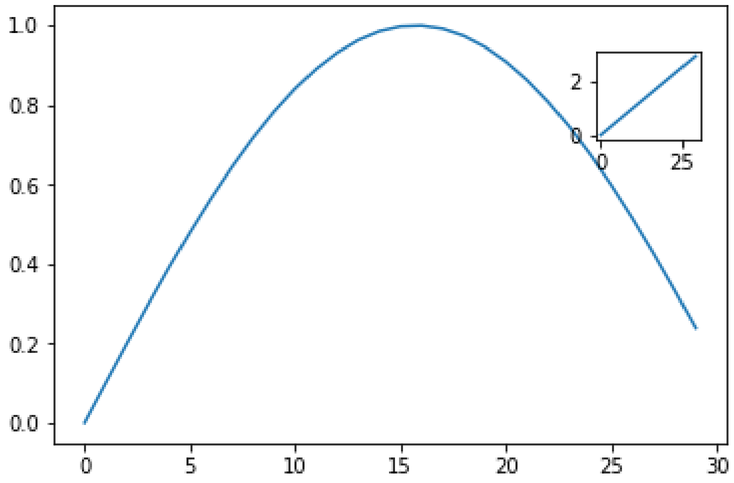


In [44]:

```
ax1 = plt.axes()
ax2 = plt.axes([0.75, 0.65, 0.12, 0.15])
ax1.plot(y,)
ax2.plot(x,)
```

Out[44]:

```
[<matplotlib.lines.Line2D at 0xa006208>]
```


1.0
0.8
0.6
0.4
0.2
0.0
0
5
10
15
20
25
30
2
0
0
25