Matplotlib

Matplot library

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

```
data = np.linspace(-np.pi,np.pi,256,endpoint=True)
```

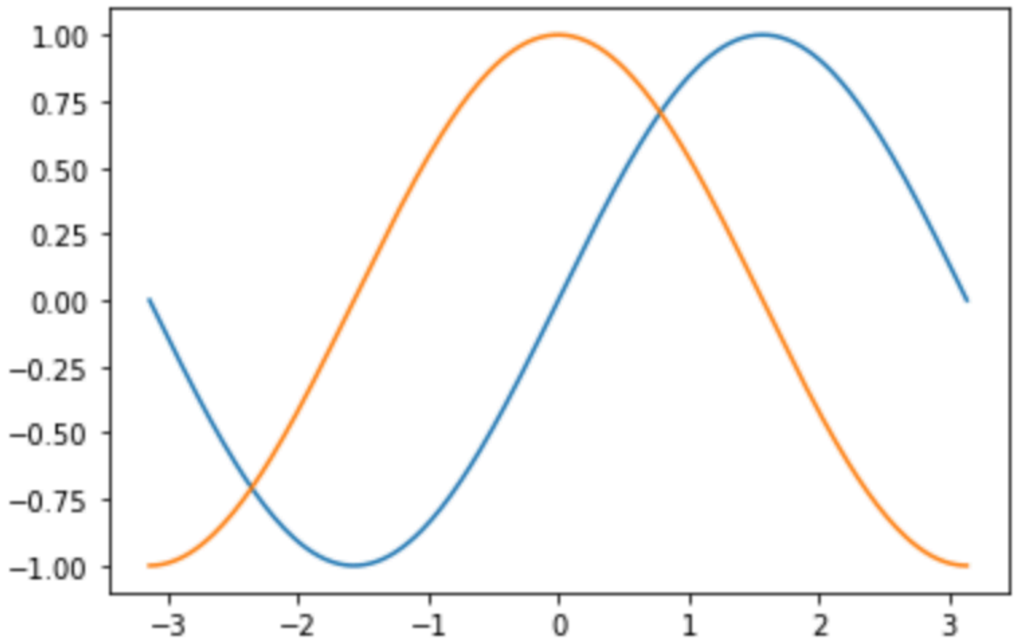
```
x,y,z = np.sin(data),np.cos(data),np.tan(data)
```

Matplot library - plot

```
data = np.linspace(-np.pi,np.pi,256,endpoint=True)
```

```
x,y,z = np.sin(data),np.cos(data),np.tan(data)
```

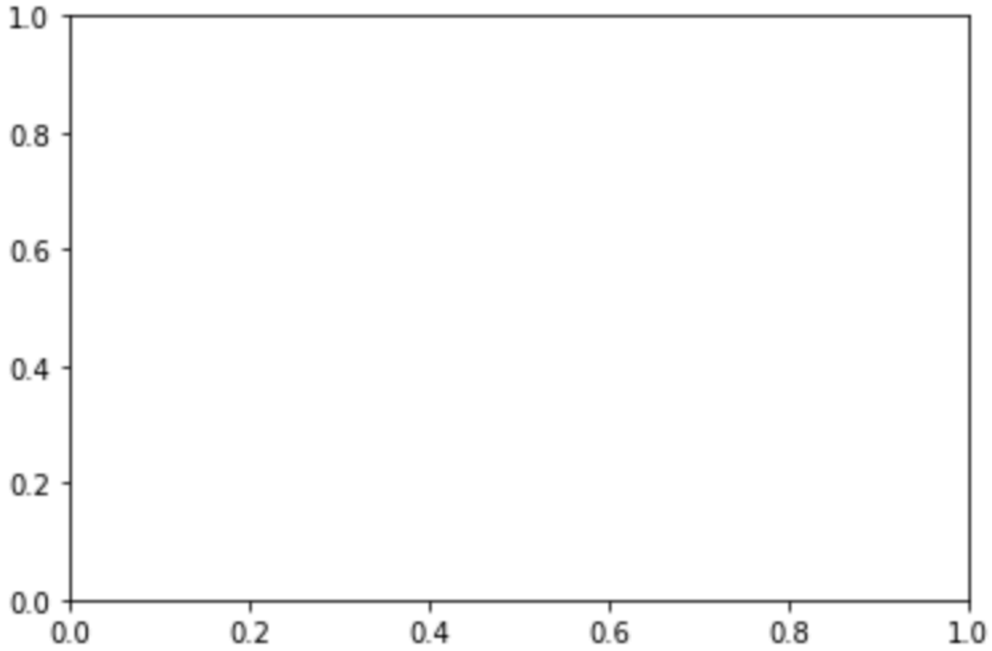
```
plt.plot(data,x)
plt.plot(data,y)

plt.show()
```



Matplot library - figure, subplot

```
# Create a figure of 8 x 6 inches, 80 dots per inch
plt.figure(figsize=(8,6),dpi=80)
```

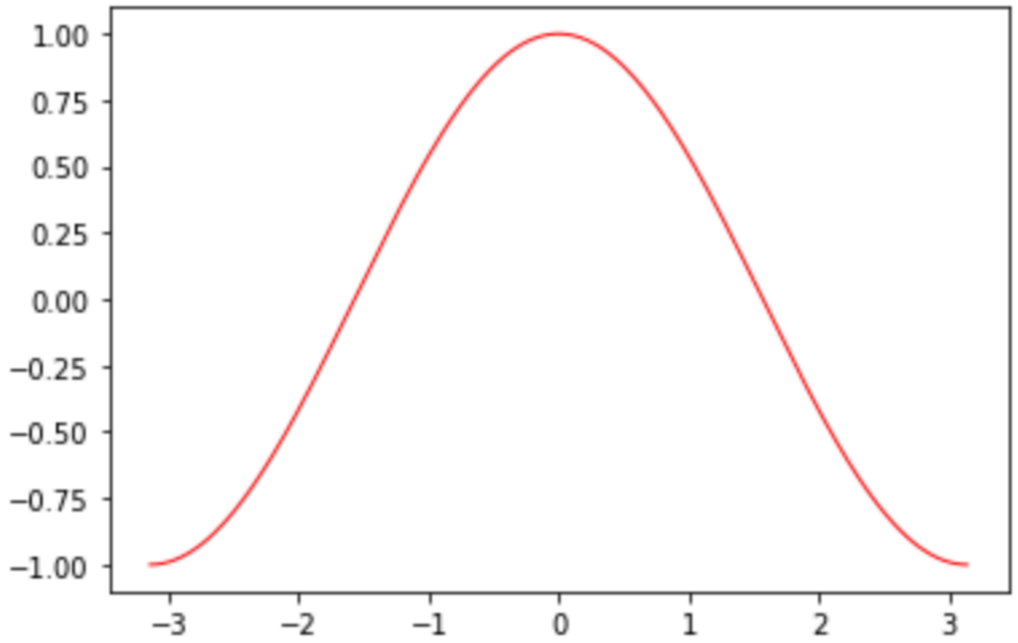
```
# Create a new subplot from a grid of 1 x 1
plt.subplot(1,1,1)
```



Matplot library - plot data

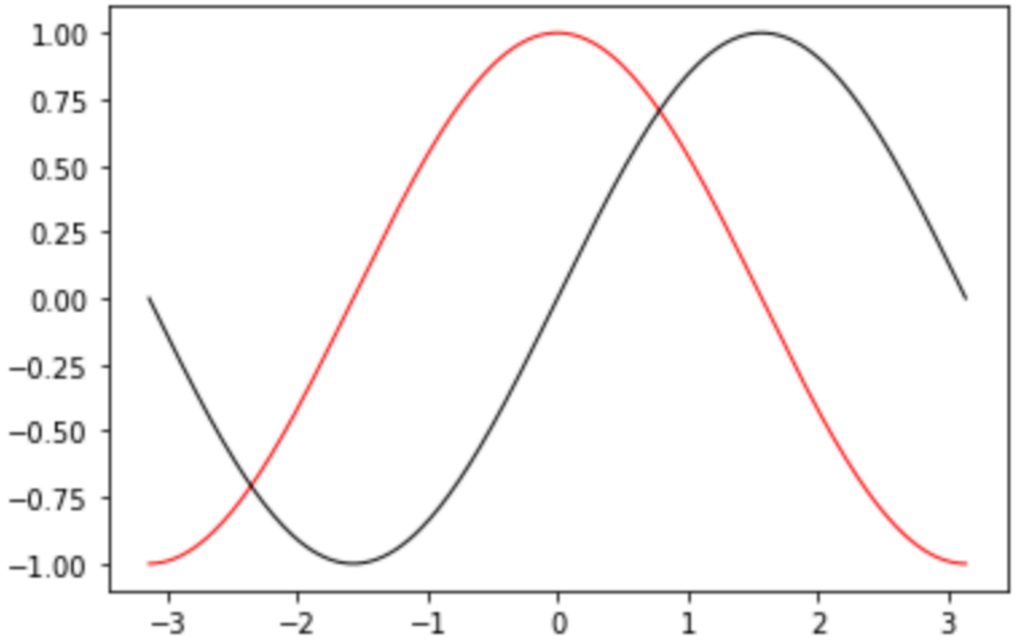
```
X = np.linspace(-np.pi,np.pi,256, endpoint=True)
cos_data,sin_data = np.cos(X),np.sin(X)
```

```
# Plot cosine with a red continuous line of width 1 (pixels)
plt.plot(X,cos_data,color="red",linewidth=1.0,linestyle="-")
```



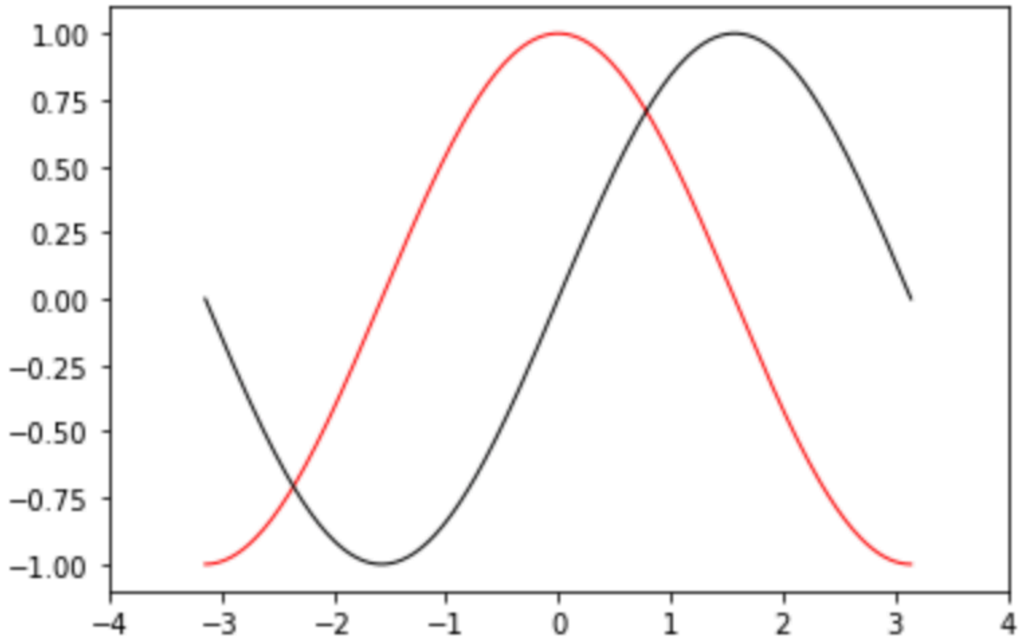
Matplot library - plot

```
# Plot sine with a black continuous line of width 1 (pixels)
plt.plot(X,sin_data,color="black",linewidth=1.0,linestyle="-")
```



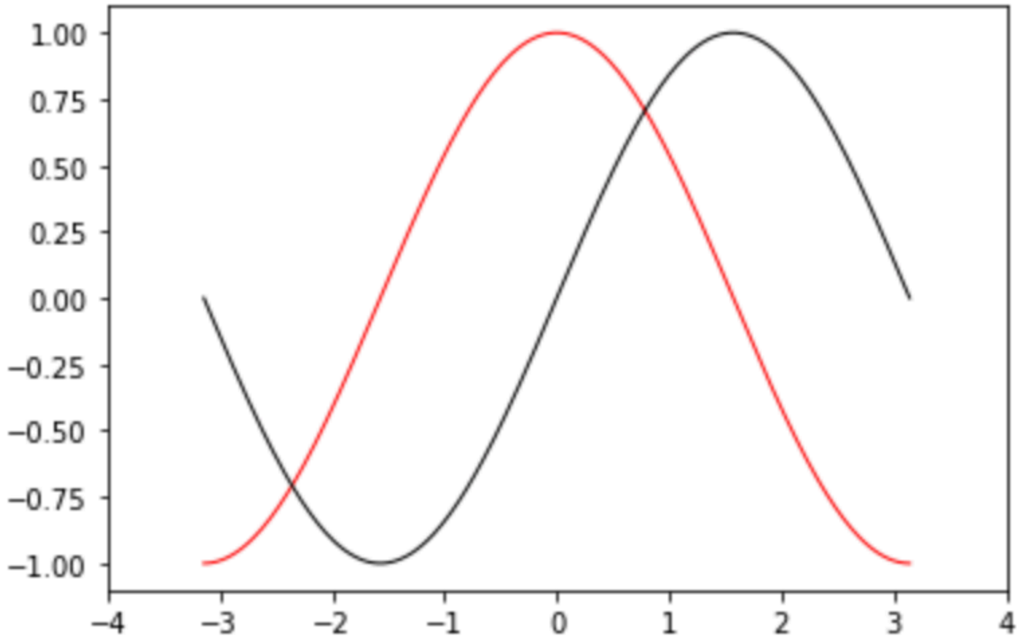
Matplot library - X limit

```
# Set x limits
plt.xlim(-4.0,4.0)
```



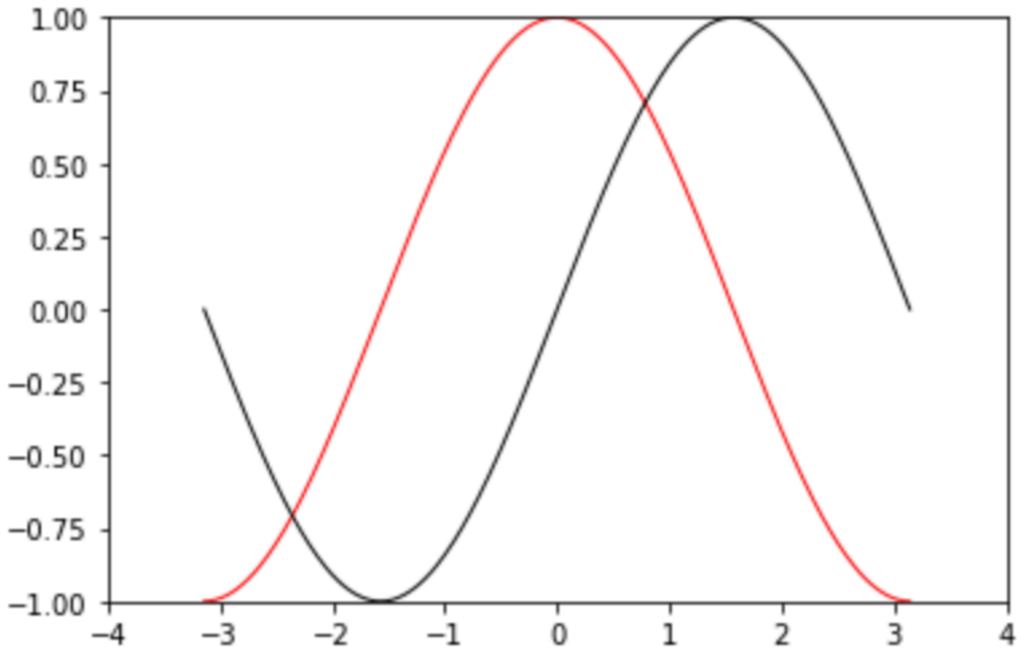
Matplot library - Xticks

```
# Set x ticks
plt.xticks(np.linspace(-4,4,9,endpoint=True))
```



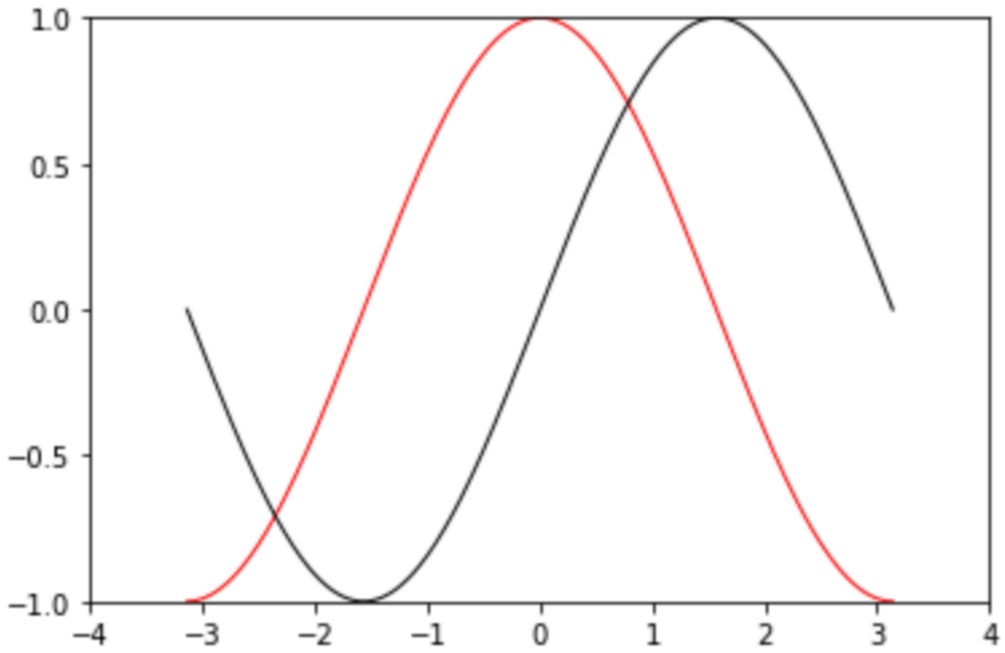
Matplot library - y limit

```
# Set y limits
plt.ylim(-1.0,1.0)
```



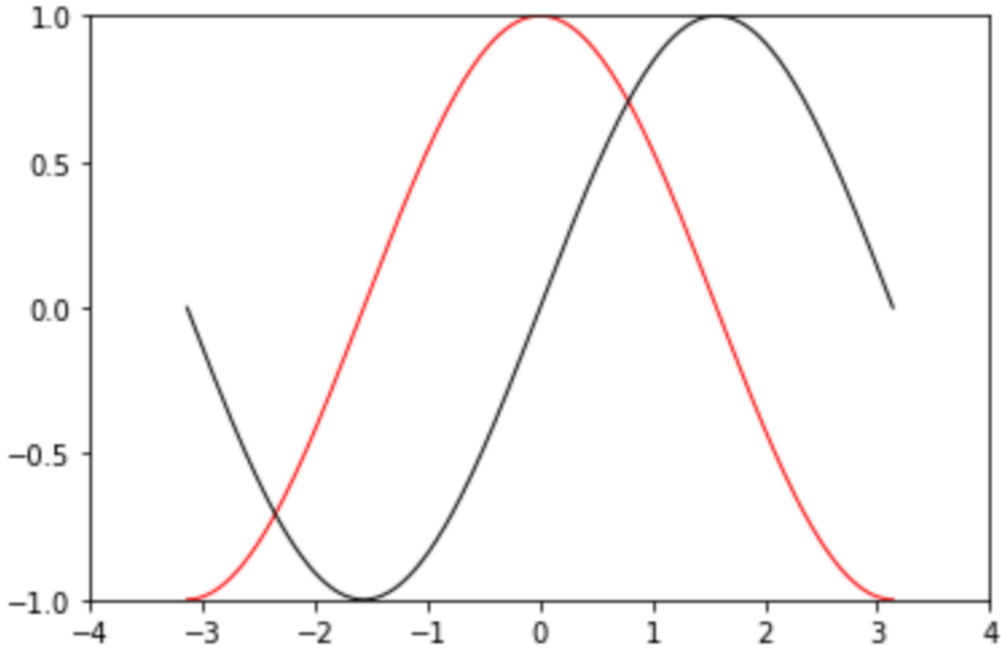
Matplot library - y ticks

```
# Set y ticks
plt.yticks(np.linspace(-1,1,5,endpoint=True))
```



Matplot library - show and save

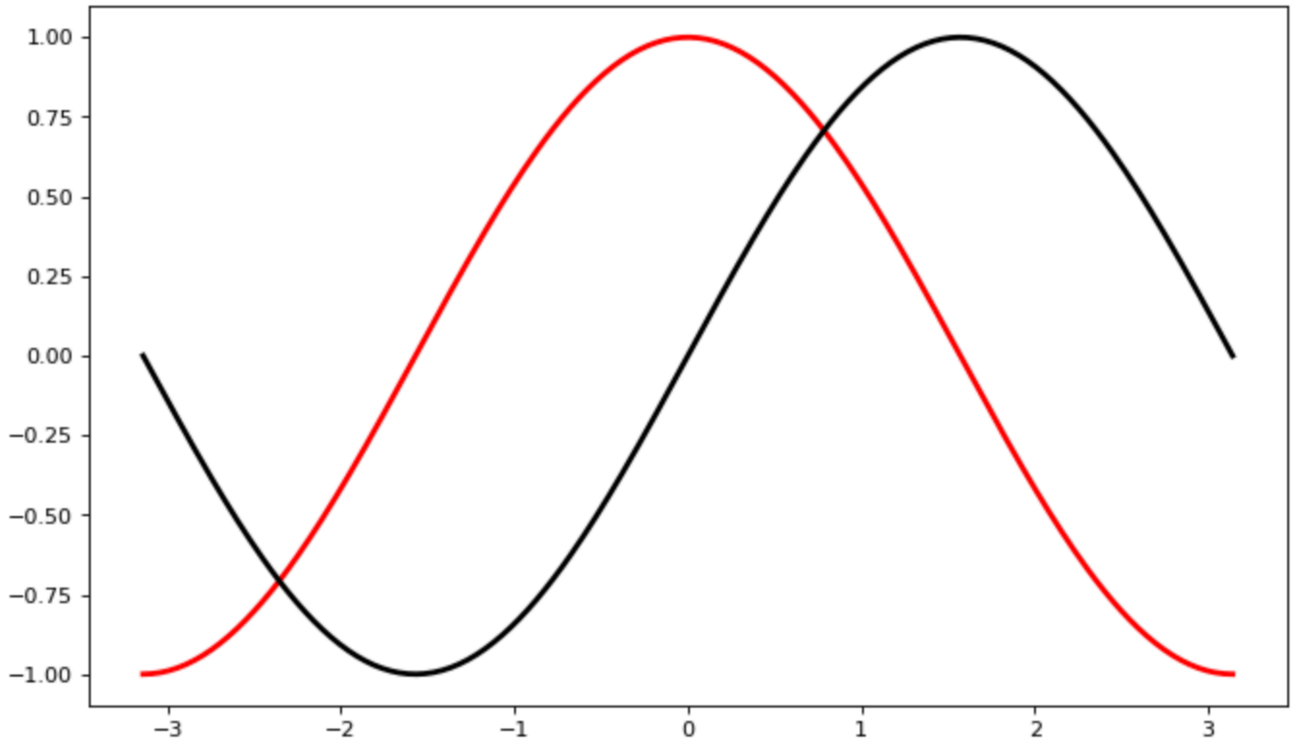
```
# Show result on screen
plt.show()
```




```
# Save figure using 72 dots per inch
# plt.savefig("sines-cosines",dpi=72)
```

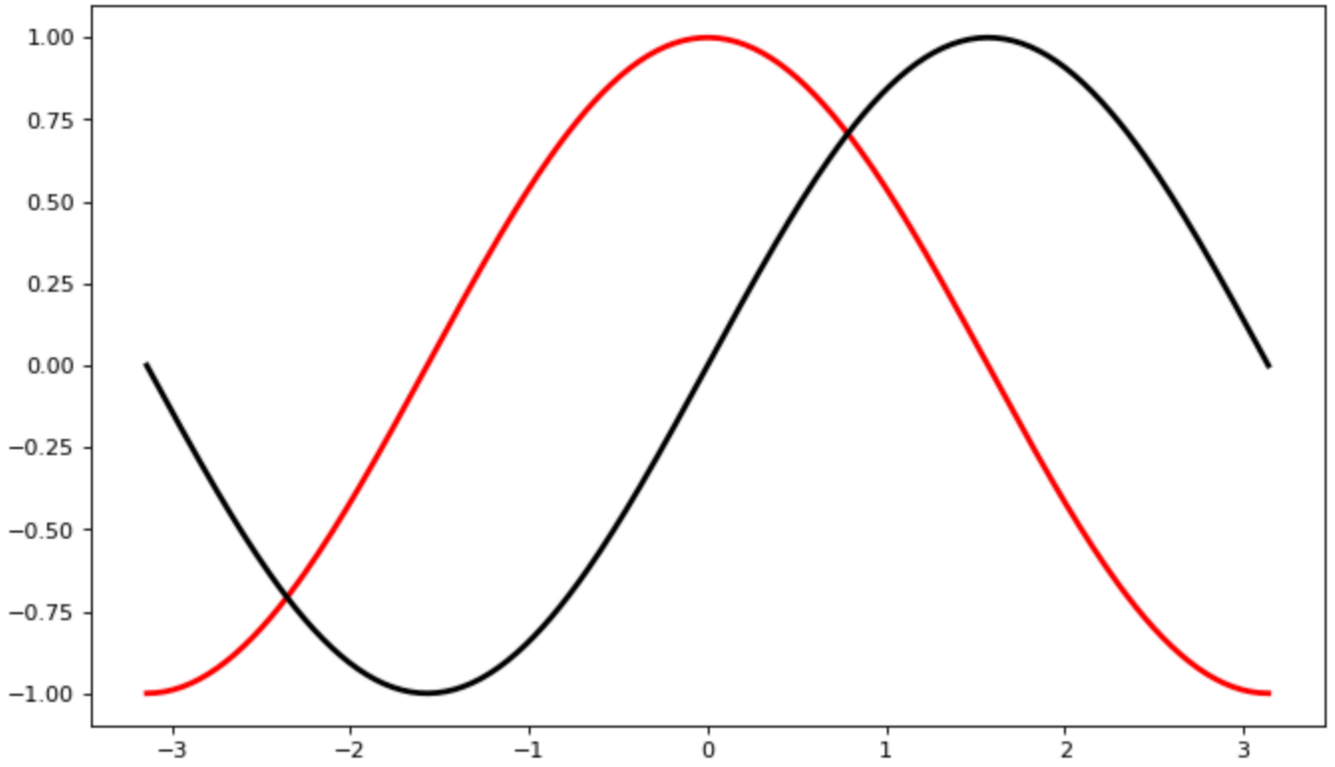
Matplot library - plot in a figure

```
plt.figure(figsize=(10,6), dpi=80)
# Change the line width
plt.plot(X,cos_data,color="red", linewidth=2.5, linestyle="-")
plt.plot(X,sin_data,color="black", linewidth=2.5,linestyle="-")
```



Matplot library - plot

```
# Make some space in the x width and y width
plt.xlim(X.min()*1.1,X.max()*1.1)
plt.ylim(cos_data.min()*1.1,cos_data.max()*1.1)
```

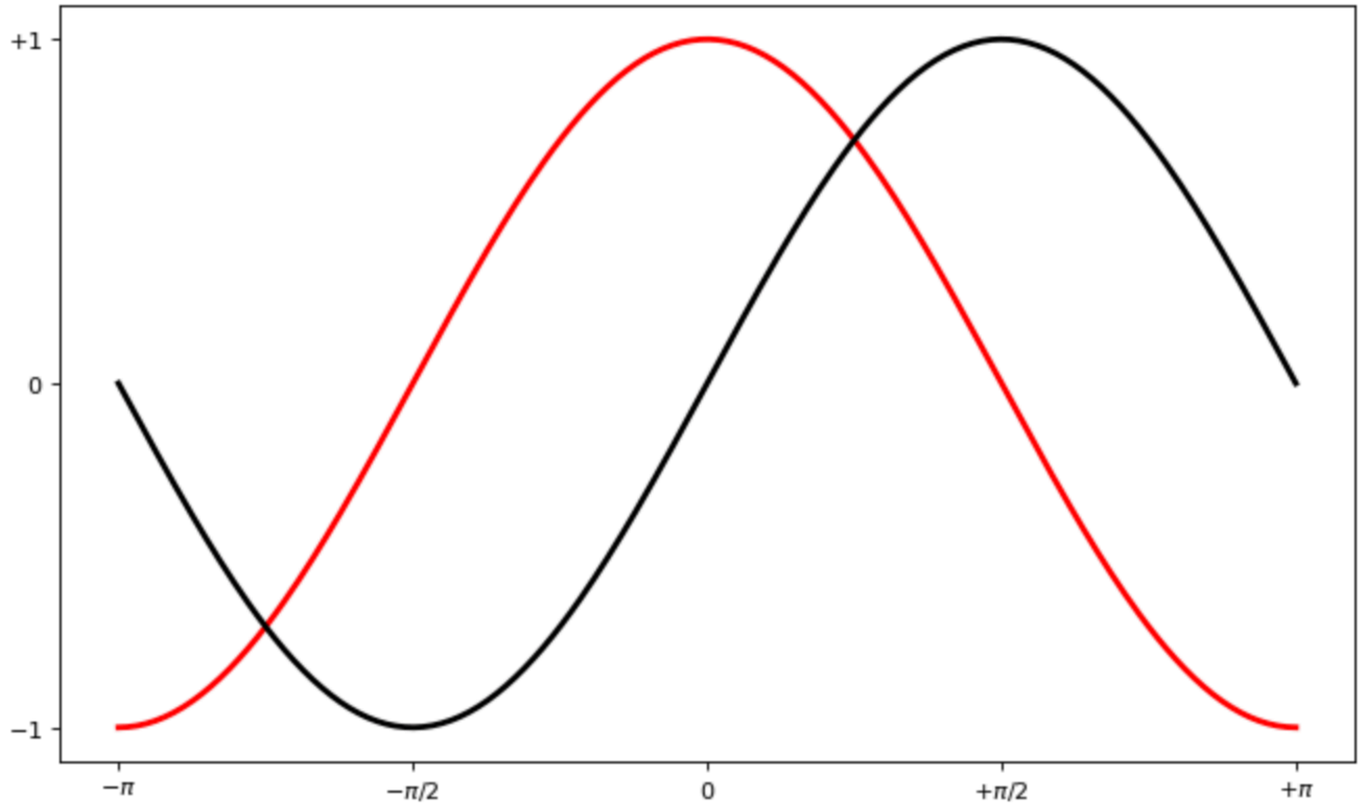


Matplot library - update ticks

```
# Adjust ticks so that we can see pi/2 and -pi/2
plt.xticks([-np.pi,-np.pi/2,0,np.pi/2,np.pi])
plt.yticks([-1,0,1])
```

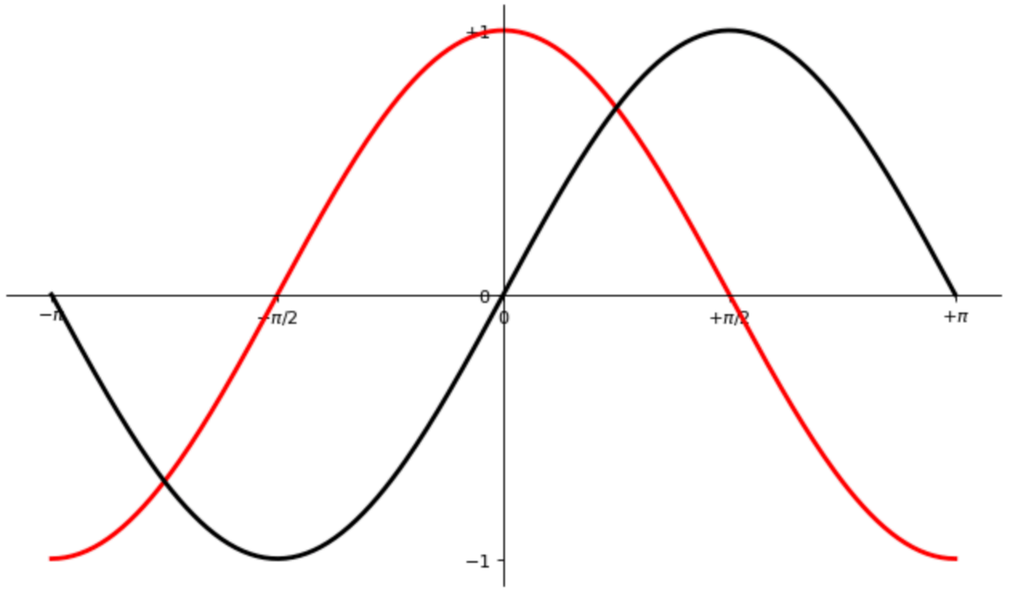
Matplot library - tick labels using latex

```
# Set tick labels
plt.xticks([-np.pi,-np.pi/2,0,np.pi/2,np.pi],
           [r'$-\pi$',r'$-\pi/2$',r'$0$',r'$+\pi/2$',r'$+\pi$'])
plt.yticks([-1,0,1],[r'$-1$',r'$0$',r'$+1$'])
```



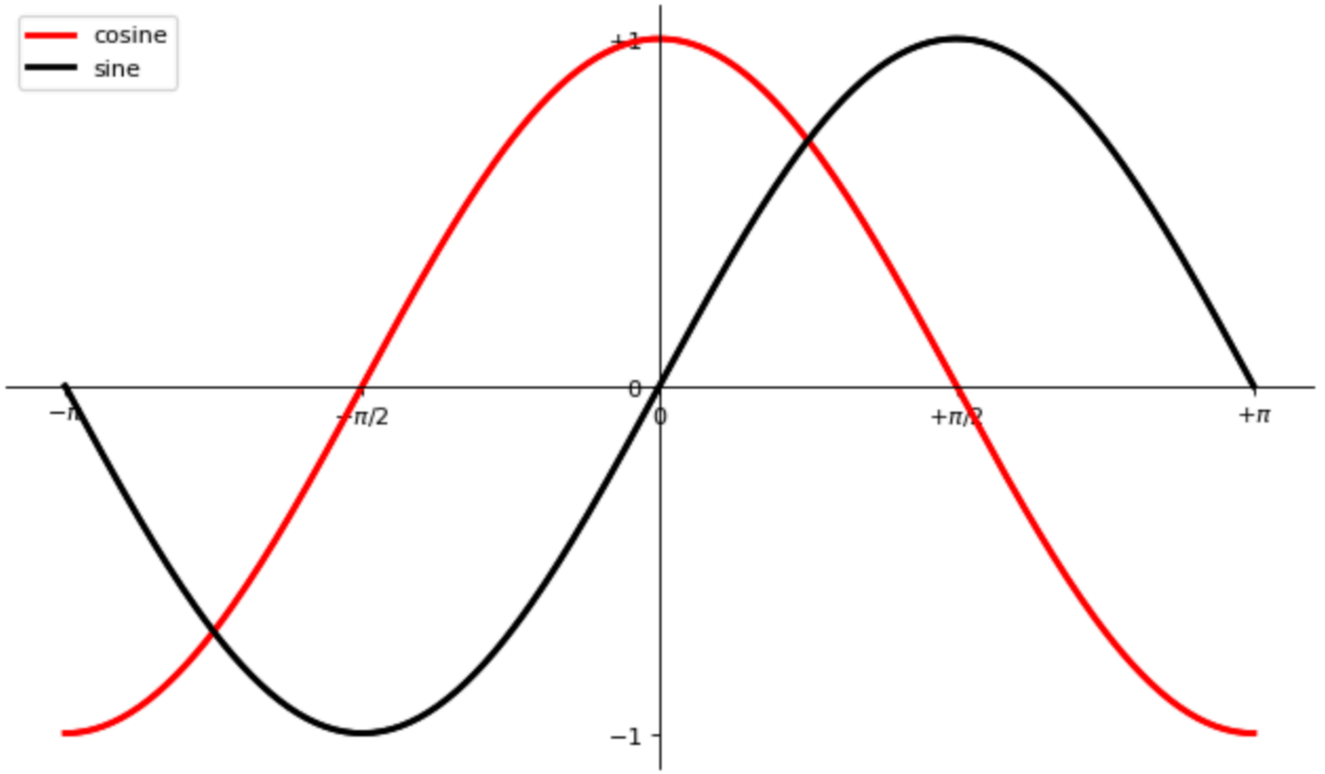
Matplot library - Update axis

```
# get current axis (gca)
ax = plt.gca()
# Get rid of the right and the top
ax.spines['right'].set_color('none')
ax.spines['top'].set_color('none')
ax.xaxis.set_ticks_position('bottom')
ax.spines['bottom'].set_position(('data',0))
ax.yaxis.set_ticks_position('left')
ax.spines['left'].set_position(('data',0))
```



Matplot library - legend

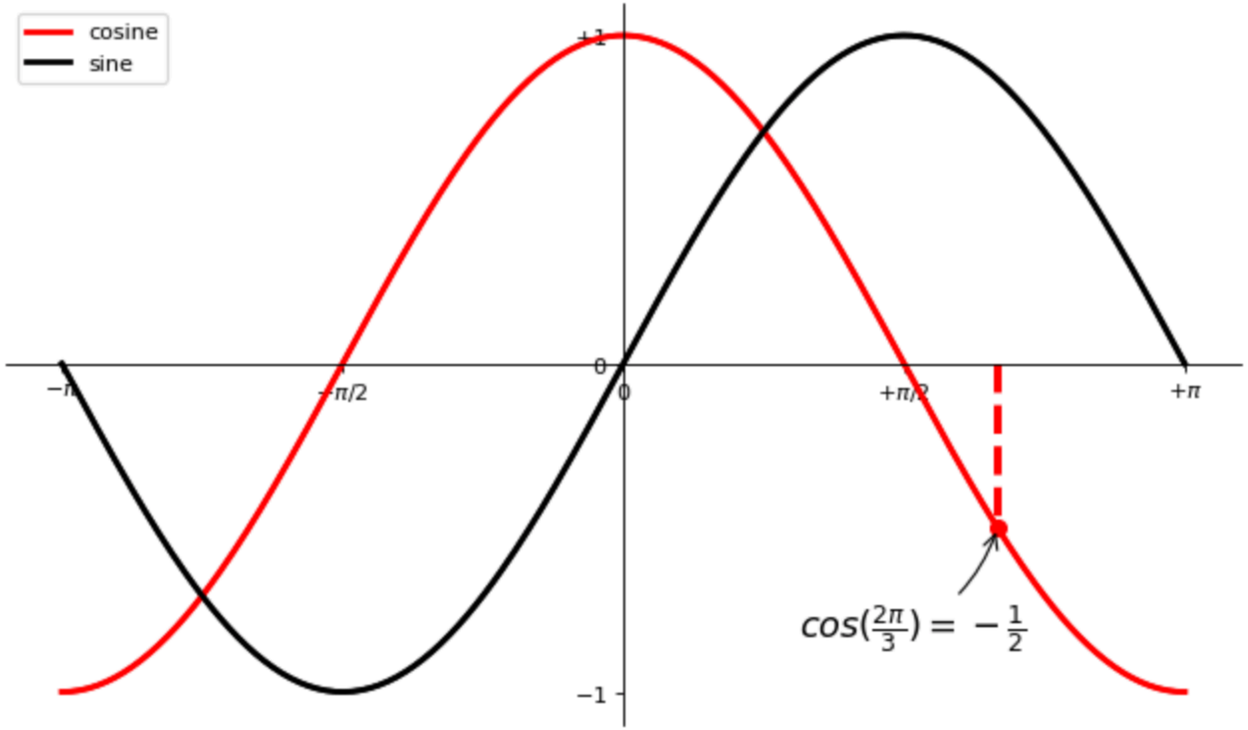
```
# Add a legend in the upper left corner
plt.plot(X,cos_data,color="red", linewidth=2.5, linestyle="-",label="cosine")
plt.plot(X,sin_data,color="black", linewidth=2.5,linestyle="-",label="sine")
plt.legend(loc='upper left')
```



Matplot library - annotate

```
t = 2 * np.pi/3
```

```
plt.annotate(r'$cos(\frac{2\pi}{3})=-\frac{1}{2}$',
             xy = (t,np.cos(t)),xycoords='data',
             xytext=(-90,-50),textcoords='offset points', fontsize=16,
             arrowprops=dict(arrowstyle="->",connectionstyle="arc3,rad=.2"))
```



Matplot library - annotate

```
plt.plot([t,t],[0, np.sin(t)],color='black',linewidth=3.5,linestyle="--")
plt.scatter([t, ],[np.sin(t),],50,color='black')

plt.annotate(r'$sin(\frac{2\pi}{3})=\frac{\sqrt{3}}{2}$',
             xy = (t,np.sin(t)),xycoords='data',
             xytext=(+10,30),textcoords='offset points', fontsize=16,
             arrowprops=dict(arrowstyle="->",connectionstyle="arc3,rad=.2"))
```