

関数のグラフを描く

Matplotlib: Visualization with Python <https://matplotlib.org/>

```
# 基本
# グラフ描画ライブラリmatplotlibのpyplotモジュールをインポートして別名pltで参照
import matplotlib.pyplot as plt

# 数値計算ライブラリnumpyをインポートして別名npで参照
import numpy as np

# x軸: 角度, xは初項0.0, 公差1.0の等差数列で360.1未満からなる配列(numpy.ndarray)[0, 1, 2, ..., 299, 360]
x = np.arange(0.0, 360.1, 1.0)

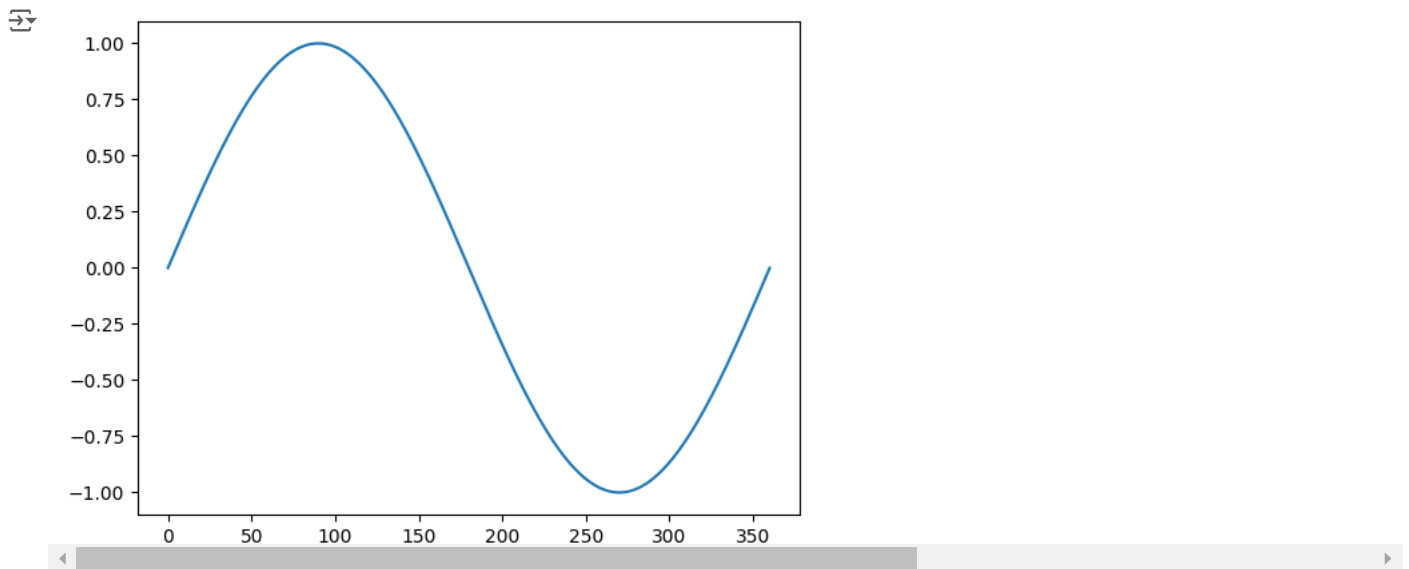
# np.pi:円周率, degree:角度(度数)をラジアンに変換する定数
degree = np.pi/180.0

# numpyの関数は引数が配列, この場合はx, の場合には、それぞれの配列要素に関数を適用した結果の値を要素とする配列が戻る
y = np.sin(x*degree) # yも配列

# plot -----
# fig:Figure描画画像全体, ax:Axes 一つのグラフ (複数のグラフでfigを構成することもできる。)
fig, ax = plt.subplots()

ax.plot(x, y) # xとyは配列

plt.show() # 描画命令
```



```
# 基本2: グラフを整える
import matplotlib.pyplot as plt # 1つのColabセッションでは1度importすると以後有効なので、この行と次の行は無くても良い
import numpy as np

angles = np.arange(0.0, 360.1, 1.0)

degree = np.pi/180.0
sin = np.sin(angles*degree)

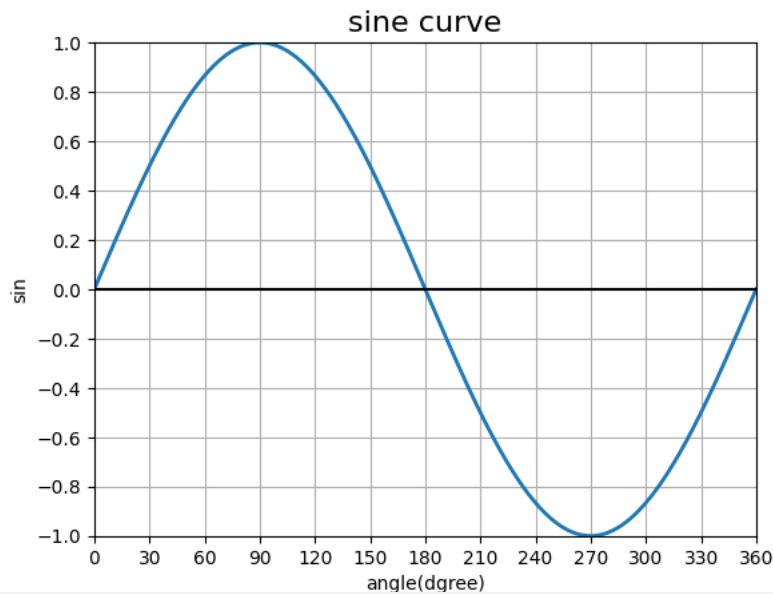
# plot -----
fig, ax = plt.subplots()

ax.plot(angles, sin, linewidth = 2.0)

# x軸, y軸の範囲, ticksマークの位置を指定
ax.set( xlim = (0, 360), xticks = np.arange(0, 361, 30),
        ylim = (-1, 1), yticks = np.arange(-1, 1.1, 0.2))
# x軸に太線を引く: plot([x1, x2], [y1, y2])
ax.plot([0, 360], [0, 0], linewidth = 1.5, color = "black")
# グリッドを描画
ax.grid(True)
# 軸ラベル
```

```
ax.set_xlabel('angle(dgree)')
ax.set_ylabel('sin')
# グラフのタイトル
ax.set_title('sine curve', fontsize = 16)

plt.show()
```



```
# 基本3: 複数のグラフをまとめて表示
```

```
# sin, cos, tan
import matplotlib.pyplot as plt
import numpy as np
```

```
angles = np.arange(-360, 360.1, 1.0)
```

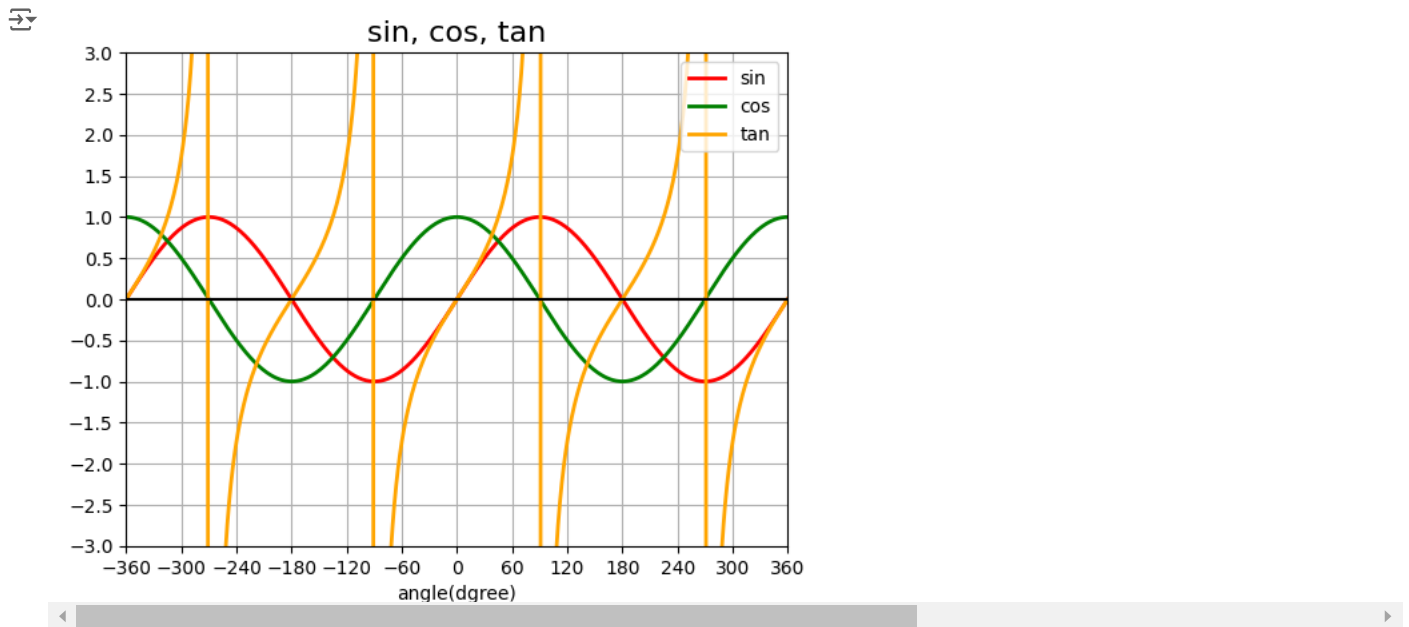
```
degree = np.pi/180.0
sin = np.sin(angles*degree)
cos = np.cos(angles*degree)
tan = np.tan(angles*degree)
```

```
# plot -----
fig, ax = plt.subplots()
```

```
# labelとcolorを指定
ax.plot(angles, sin, linewidth = 2.0, label="sin", color="red")
ax.plot(angles, cos, linewidth = 2.0, label="cos", color="green")
ax.plot(angles, tan, linewidth = 2.0, label="tan", color="orange")
```

```
# x軸, y軸の範囲, ticksマークの位置を指定
ax.set( xlim = (-360, 360), xticks = np.arange(-360, 361, 60),
        ylim = (-3, 3), yticks = np.arange(-3, 3.1, 0.5))
# x軸に太線を引く: plot([x1, x2], [y1, y2])
ax.plot([-360, 360], [0, 0], linewidth = 1.5, color = "black")
# グリッドを描画
ax.grid(True)
# 軸ラベル
ax.set_xlabel('angle(dgree)')
# グラフのタイトル
ax.set_title('sin, cos, tan', fontsize = 16)
# 凡例 plotのlabelとcolorの指定の対応が表示される
ax.legend(loc='upper right')
```

```
plt.show()
```



```
# titleにTexで数式を埋め込む $Texコード$
# 正規分布
import matplotlib.pyplot as plt
import numpy as np

x = np.arange(-4.0, 4.0, 0.1)
y = (1/(2*np.pi)**0.5) * np.exp(-x*x/2)

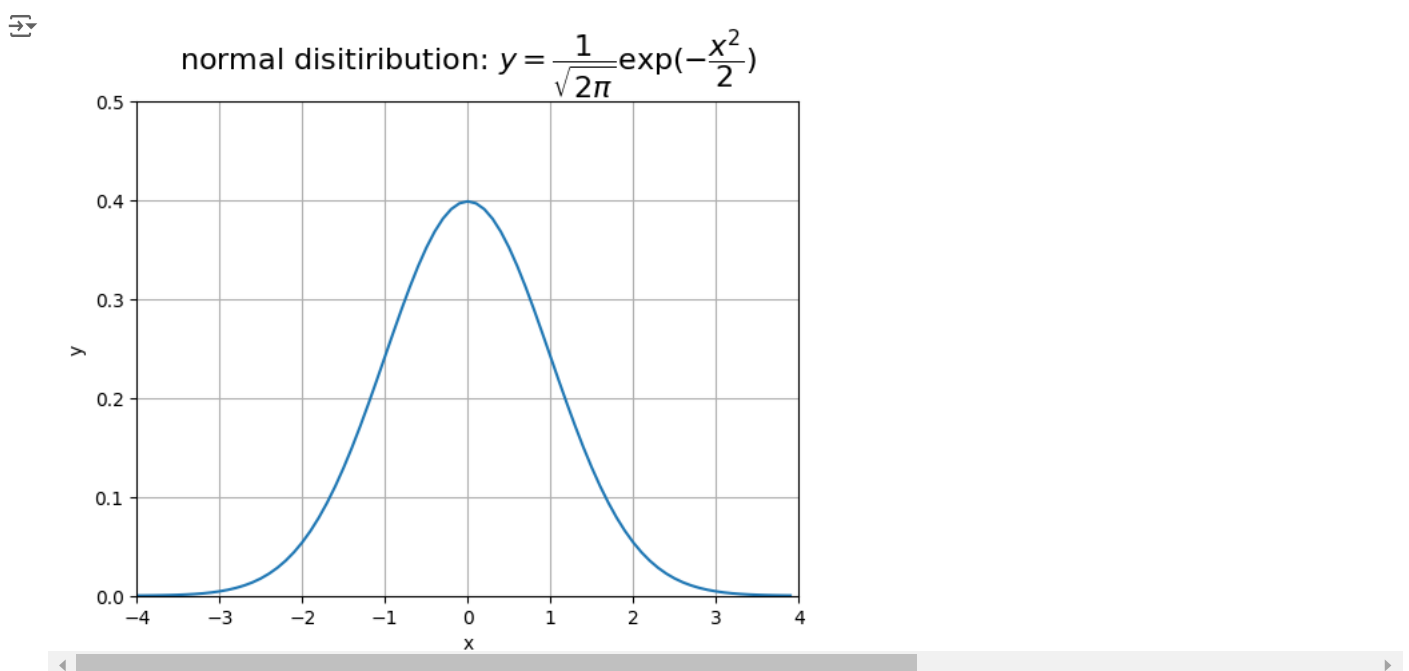
# plot -----
fig, ax = plt.subplots()

ax.plot(x, y)
ax.axis([-4, 4, 0, 0.5])
ax.grid(True)

ax.set_xlabel('x')
ax.set_ylabel('y')

#                               $ tex コード $
ax.set_title('normal disitiribution: $ y = \frac{1}{\sqrt{2\pi}} \exp(-\frac{x^2}{2}) $', fontsize = 16)

plt.show()
```



```
# グラフのタイトルやラベルに日本語フォントを使う。
import matplotlib.pyplot as plt
# matplotlibを日本語化するライブラリをインストール, !で始まるコマンドはシステムコマンド
```

```
!pip install japanize-matplotlib
import japanize_matplotlib # japanize_matplotlibをインポート
import numpy as np
```

```
angle = np.arange(0.0, 360.1, 1.0)
degree = np.pi/180.0
sin = np.sin(angle*degree)
```

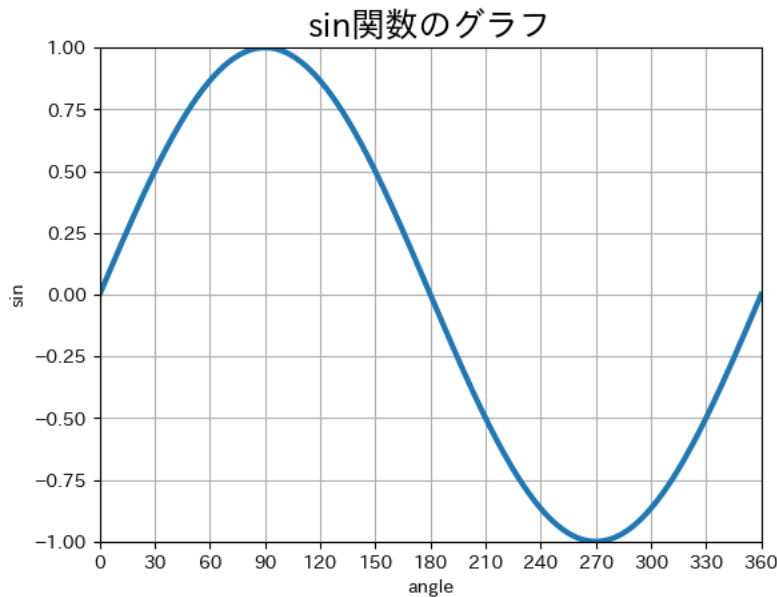
```
# plot -----
fig, ax = plt.subplots()
```

```
ax.plot(angle, sin, linewidth = 3) # 線の幅:3
ax.axis([0, 360, -1, 1]) # グラフ: x軸, y軸の範囲指定
ax.grid(True) # グリッド描画
```

```
ax.set_xticks( np.arange(0, 361, 30) ) # 0から361まで増分30の等差数列の配列: 360では360が含まれないことに注意
ax.set_xlabel('angle') # x軸のラベル指定
ax.set_ylabel('sin') # y軸のラベル指定
ax.set_title('sin関数のグラフ', fontsize = 18) # グラフのタイトル指定: 日本語フォントが使える
```

```
plt.show()
```

```
Requirement already satisfied: japanize-matplotlib in /usr/local/lib/python3.10/dist-packages (1.1.3)
Requirement already satisfied: matplotlib in /usr/local/lib/python3.10/dist-packages (from japanize-matplotlib) (3.7.1)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (1.3.0)
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (4.53.1)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (1.4.7)
Requirement already satisfied: numpy>=1.20 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (1.26.4)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (24.1)
Requirement already satisfied: pillow>=6.2.0 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (9.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (3.1.4)
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.10/dist-packages (from matplotlib->japanize-matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib->japanize-matplotlib)
```



```
# 減衰振動
```

```
import matplotlib.pyplot as plt
!pip install japanize-matplotlib # installも1つColabセッションで有効なので、この行は無くても良い
import japanize_matplotlib # japanize_matplotlibをインポート
import pandas as pd
```

```
gamma = 0.3
def f(t): # 関数fを定義
    return np.exp(-gamma*t) * np.cos(2 * np.pi * t) # 減衰振動
```

```
t = np.arange(0.0, 10.0, 0.01)
```

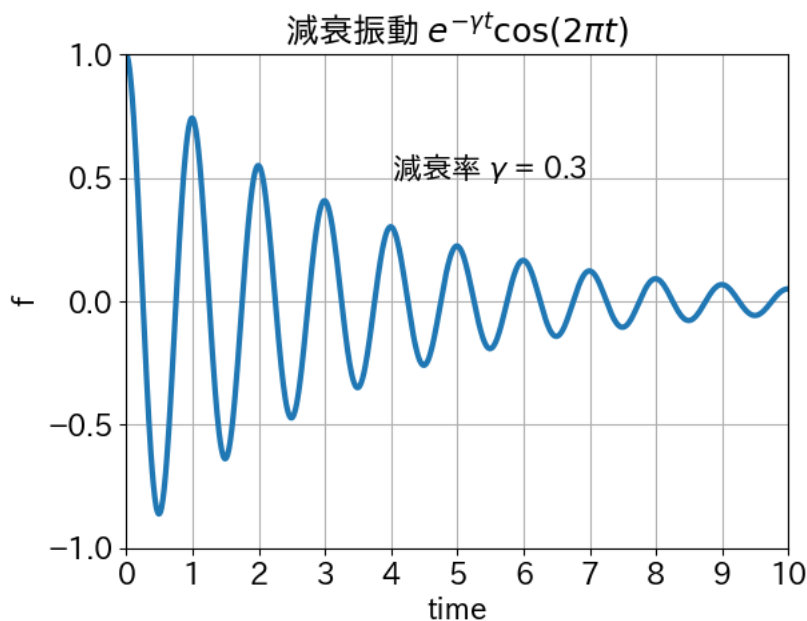
```
fig, ax = plt.subplots()
ax.plot(t, f(t), linewidth = 3)
ax.grid(True)
```

```
ax.set_xlabel('time', fontsize = 16)
ax.set_ylabel('f', fontsize = 16)
ax.set_title('減衰振動 $e^{-\gamma t} \cos(2 \pi t)$', fontsize = 18)
```

```
ax.set_xticks( np.arange(0, 10.1, 1.0) )
ax.set_yticks( np.arange(-1.0, 1.1, 0.5) )
ax.set_xlim(0.0, 10.0)
ax.set_ylim(-1.0, 1.0)
ax.tick_params(labelsize = 16)
ax.text(4.0, 0.5, '減衰率  $\gamma = 0.3$ ', fontsize = 16)
```

```
plt.show()
```

```
Requirement already satisfied: japanize-matplotlib in /usr/local/lib/python3.10/dist-packages (1.1.3)
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```



```
# 原点で不連続な関数
```

```
import matplotlib.pyplot as plt
!pip install japanize-matplotlib
import japanize_matplotlib
import numpy as np
```

```
# plot:2つのグラフを横に配置 (1行2列の配置) -----
```

```
fig, ax = plt.subplots(1, 2, squeeze=False) # subplots(nrows, ncols) nrows×ncols
```

```
# 1つ目のグラフ
```

```
x1 = np.arange(-1.0, 1.0, 0.001)
y1 = np.sin(1/x1)
ax[0, 0].plot(x1, y1)
ax[0, 0].grid(True) # グリッド描画
```

```
ax[0, 0].set_xlim(-1.0, 1.0)
ax[0, 0].set_ylim(-1.0, 1.0)
ax[0, 0].set_xlabel('x') # x軸のラベル指定
ax[0, 0].set_ylabel('y') # y軸のラベル指定
ax[0, 0].set_title('sin(1/x)のグラフ', fontsize = 12)
```

```
# 2つ目のグラフ
```

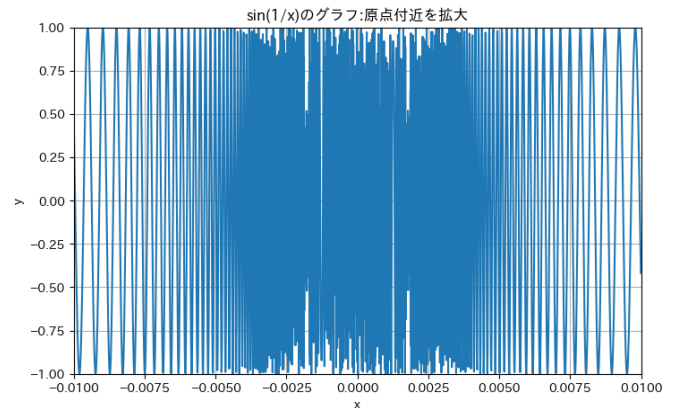
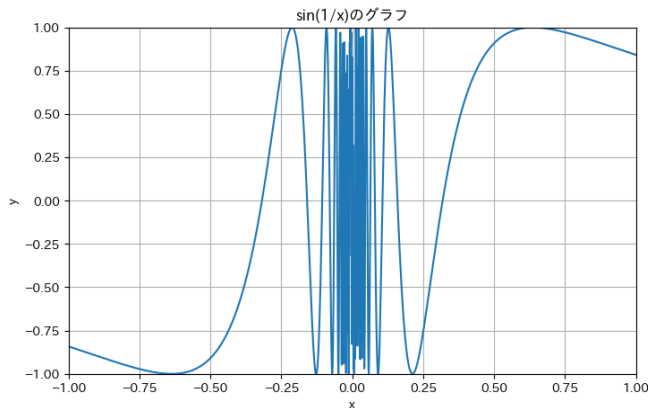
```
x2 = np.arange(-0.01, 0.01, 0.00001)
y2 = np.sin(1/x2)
ax[0, 1].plot(x2, y2)
ax[0, 1].grid(True) # グリッド描画
```

```
ax[0, 1].set_xlim(-0.01, 0.01)
ax[0, 1].set_ylim(-1.0, 1.0)
ax[0, 1].set_xlabel('x') # x軸のラベル指定
ax[0, 1].set_ylabel('y') # y軸のラベル指定
```

```
ax[0, 1].set_title('sin(1/x)のグラフ:原点付近を拡大', fontsize = 12)
```

```
fig.set_size_inches(18, 5) # figureのサイズを指定:横に拡大  
plt.show()
```

```
Requirement already satisfied: japanize-matplotlib in /usr/local/lib/python3.10/dist-packages (1.1.3)  
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Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.7->matplotlib->japanize-matplotlib)
```



```
# 原点で連続な関数
```

```
import matplotlib.pyplot as plt  
!pip install japanize-matplotlib  
import japanize_matplotlib  
import numpy as np
```

```
# plot:2つのグラフを横に配置 -----
```

```
fig, ax = plt.subplots(1, 2, squeeze=False) # subplots(nrows, ncols) nrows×ncols
```

```
# 1つ目のグラフ
```

```
x1 = np.arange(-1.0, 1.0, 0.001)  
y1 = x1*np.sin(1/x1) # numpy.ndarray同士の掛け算は、それぞれの要素同士の掛け算の配列になる。  
ax[0, 0].plot(x, y)  
ax[0, 0].grid(True) # グリッド描画
```

```
ax[0, 0].set_xlim(-1.0, 1.0)  
ax[0, 0].set_ylim(-1.0, 1.0)  
ax[0, 0].set_xlabel('x') # x軸のラベル指定  
ax[0, 0].set_ylabel('y') # y軸のラベル指定  
ax[0, 0].set_title('x*sin(1/x)のグラフ', fontsize = 12)
```

```
# 2つ目のグラフ
```

```
x2 = np.arange(-0.25, 0.25, 0.0001)  
y2 = x2*np.sin(1/x2)  
ax[0, 1].plot(x2, y2)  
ax[0, 1].grid(True) # グリッド描画
```

```
ax[0, 1].set_xlim(-0.25, 0.25)  
ax[0, 1].set_ylim(-0.25, 0.25)  
ax[0, 1].set_xlabel('x') # x軸のラベル指定  
ax[0, 1].set_ylabel('y') # y軸のラベル指定  
ax[0, 1].set_title('x*sin(1/x)のグラフ:原点付近を拡大', fontsize = 12)
```

```
fig.set_size_inches(18, 5) # figureのサイズを指定:横に拡大  
plt.show()
```

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