Gaussian (normal) distribution

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
from scipy import stats
```

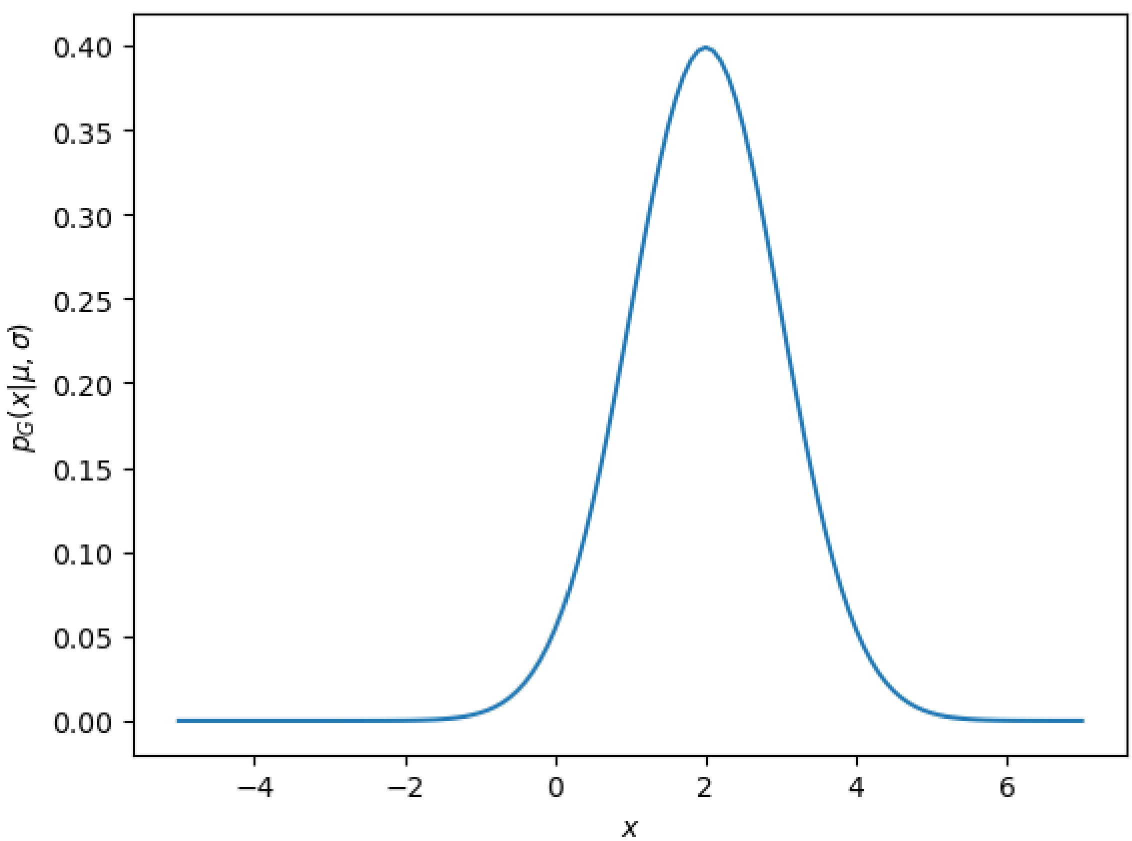
A gaussian distribution is characterized by the mean μ and standard deviation σ. See:

https://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.norm.html

In [2]:
```
# mean = 2, sigma = 1
mu  = 2.0
sig = 1.0
x = np.arange(-5.0, 7.1, 0.1)
p = stats.norm.pdf(x, loc=mu, scale=sig)
#print(x, p)
```

In [3]:
```
plt.plot(x, p)
plt.xlabel('$x$')
plt.ylabel('$p_G(x|\mu, \sigma)$')
```

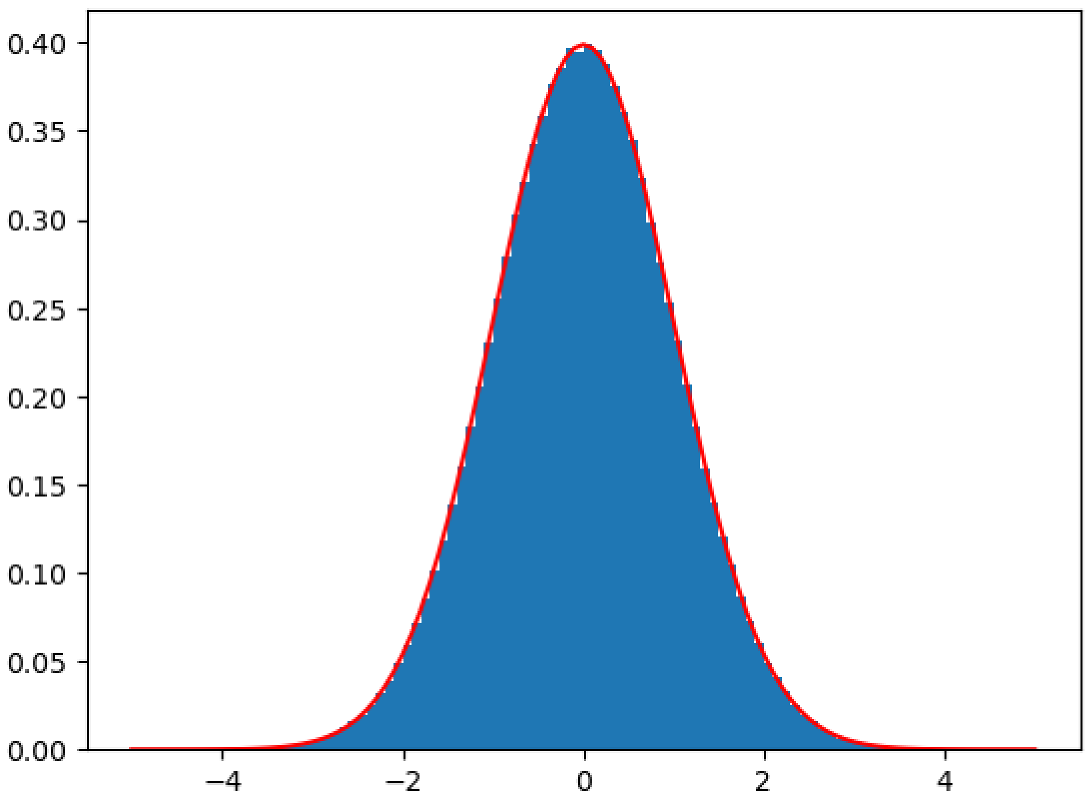
Out[3]:
```
Text(0, 0.5, '$p_G(x|\\mu, \\sigma)$')
```



As with other PDFs, you can sample x values from a gaussian PDF with `np.random.normal`.

In [4]:
```
np.random.seed(12345)

# Let's sample from a Gaussian distribution with mean=0, sigma=1
mean = 0.0
std  = 1.0
d1 = np.random.normal(loc=mean, scale=std, size=1000000)

# Create bins of x values
nx = np.arange(-5.0, 5.1, 0.1)

# Let's plot the normalized histogram of the samples
n1, bins1, patches1 = plt.hist(d1, bins=nx, density=True)

# and overplot the analytical Gaussian PDF.
ny = stats.norm.pdf(nx, mean, std)
plt.plot(nx, ny, color='r')
```

Out[4]: [<matplotlib.lines.Line2D at 0x1c2f79150>]

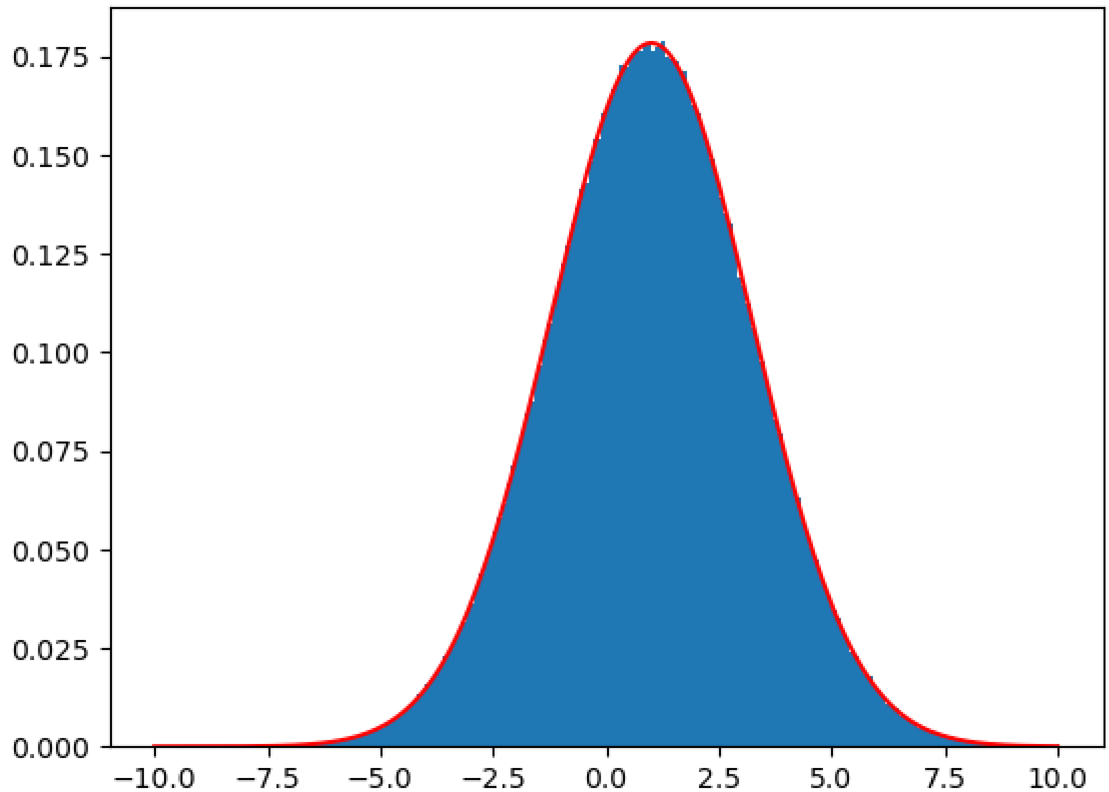


Now let's see what happens with we sample from two different gaussians (μ_1, σ_1) and (μ_2, σ_2) and plot the distribution of the difference $\mu_1 - \mu_2$. You can see that the result is a new gaussian with a mean of $\mu_1 - \mu_2$ and standard deviation of $\sqrt{\sigma_1^2 + \sigma_2^2}$.

In [5]:
```
np.random.seed(12345)

mean1 = 2.0
std1  = 1.0
d1 = np.random.normal(loc=mean1, scale=std1, size=1000000)

mean2 = 1.0
std2  = 2.0
```

```
d2 = np.random.normal(loc=mean2, scale=std2, size=1000000)

d3 = d1-d2

nx = np.arange(-10.0, 10.1, 0.1)
ny = stats.norm.pdf(nx, mean1-mean2, np.sqrt(std1**2 + std2**2))
n1, bins1, patches1 = plt.hist(d3,
                               bins=nx,
                               density=True)
plt.plot(nx, ny, color='r')
```

Out[5]: [<matplotlib.lines.Line2D at 0x1c309a3b0>]



In [ ]: