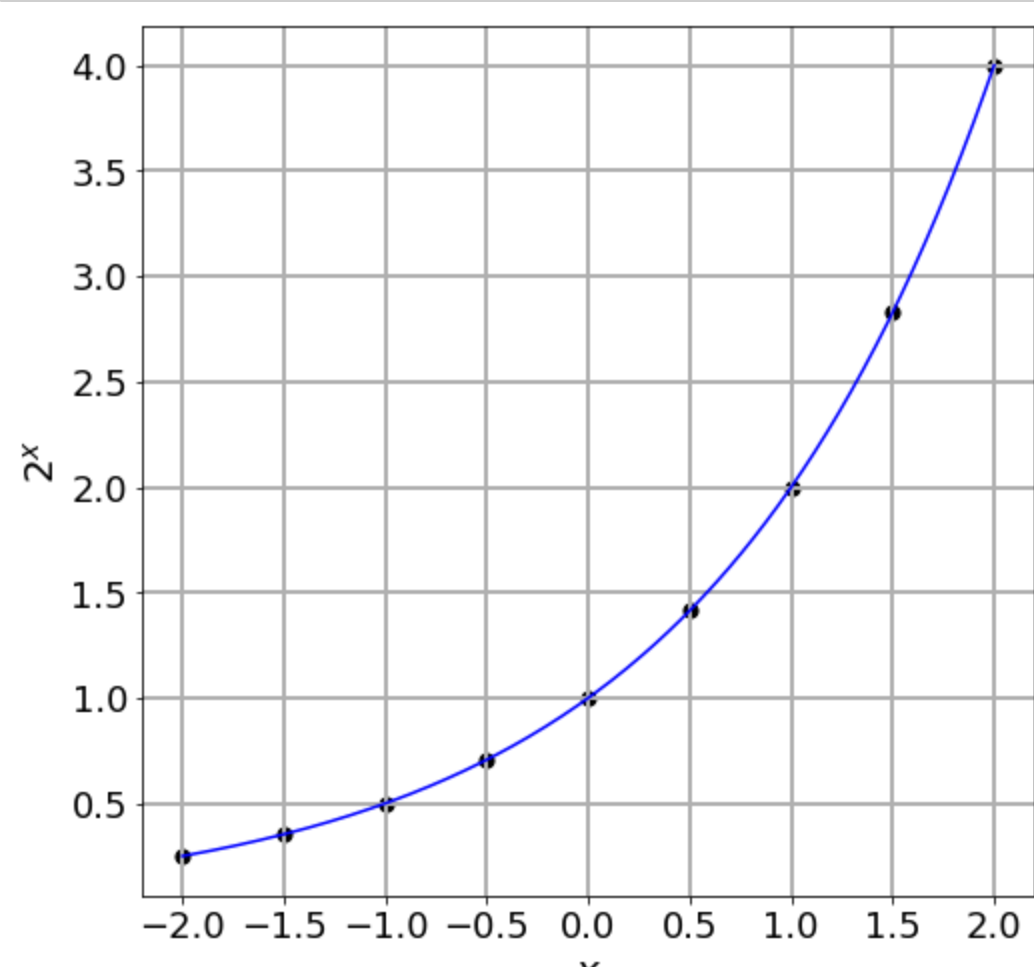


5장 로그함수와 지수함수

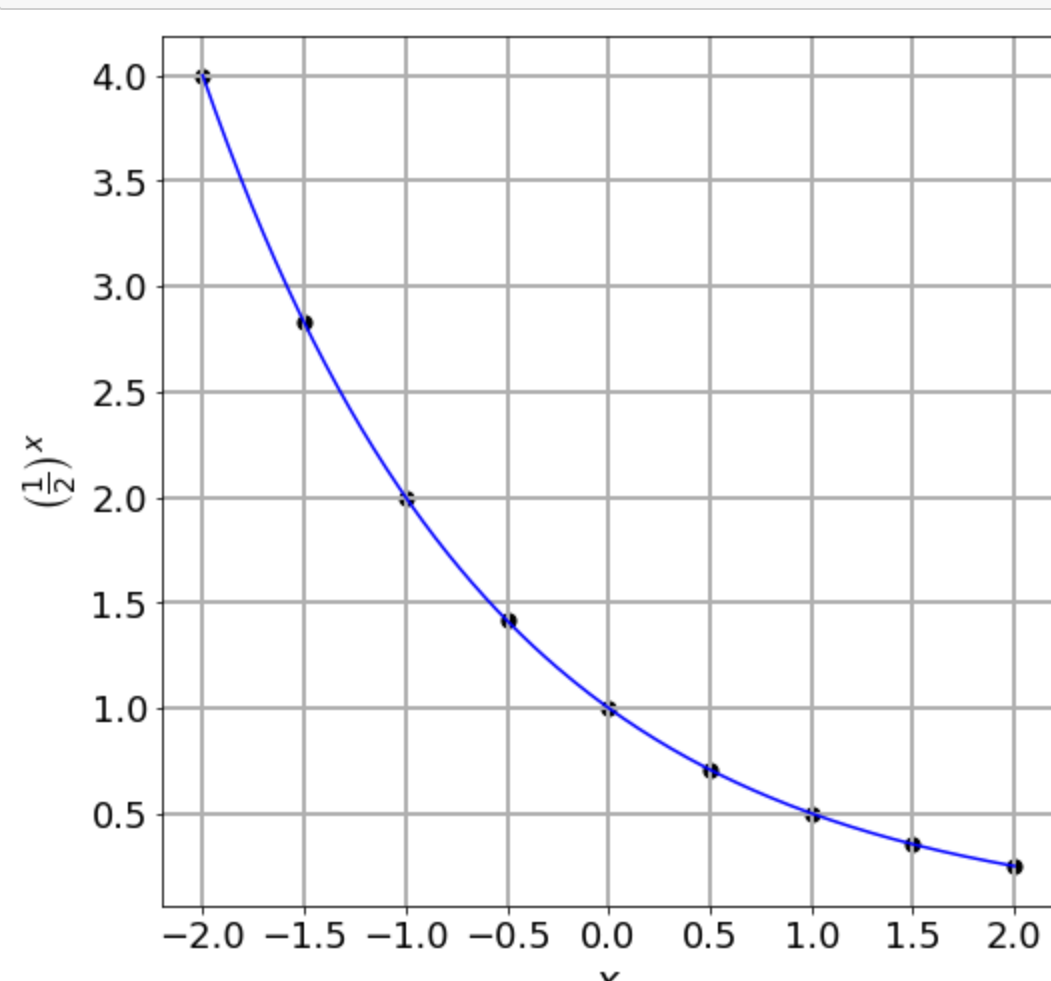
```
In [1]: # 파이썬 라이브러리 선언
import matplotlib inline
import numpy as np
import matplotlib.pyplot as plt
```

```
In [2]: # PDF 출력
from IPython.display import set_matplotlib_formats
set_matplotlib_formats('png', 'pdf')
```

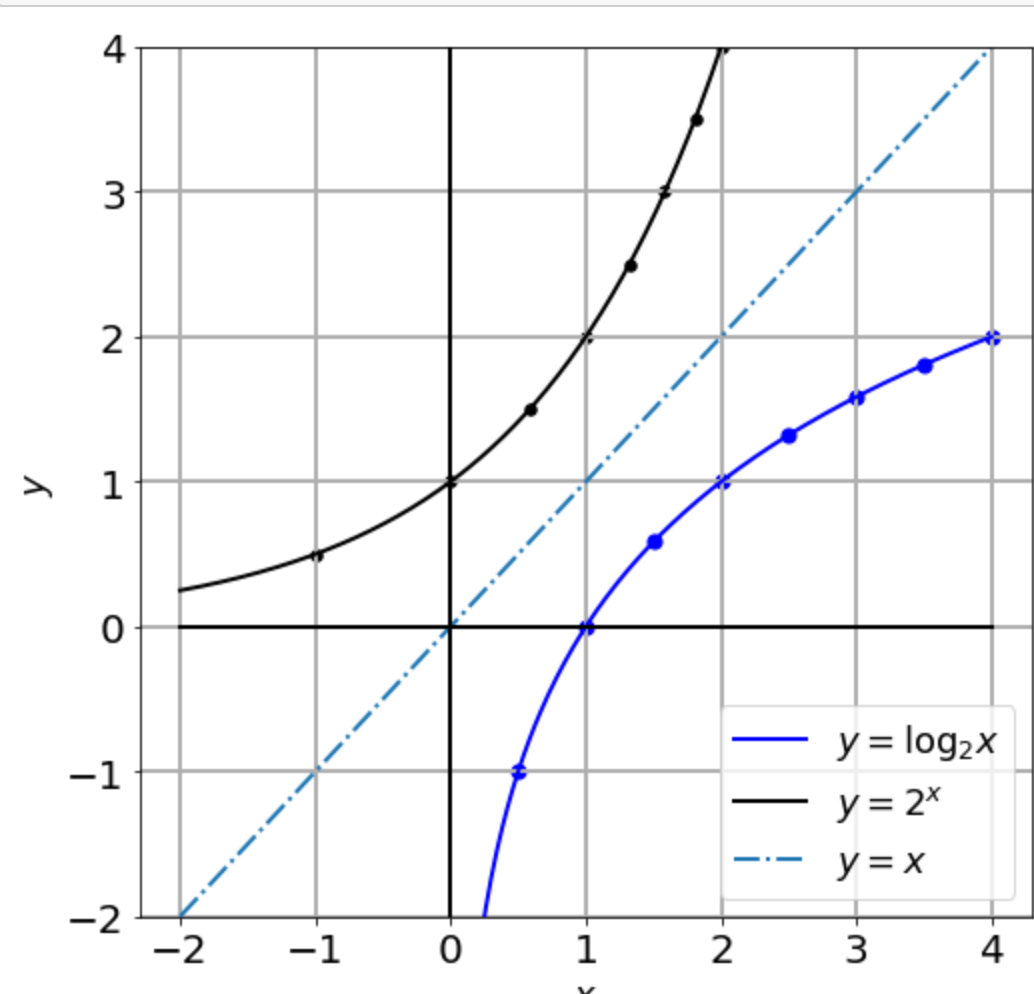
```
In [3]: # 그림 5-1
# 지수함수의 그래프 1
x = np.linspace(-2, 2, 200)
y = 2**x
x1 = np.linspace(-2, 2, 9)
y1 = 2**x1
plt.figure(figsize=(8, 8))
plt.plot(x, y, c='b')
plt.xticks(size=18)
plt.yticks(size=18)
plt.grid(which='major', linestyle='-', lw=2)
plt.scatter(x1, y1, s=50, c='k')
plt.xlabel('$x$', fontsize=20)
plt.ylabel('$2^x$', fontsize=20)
plt.show()
```



```
In [4]: # 그림 5-2
# 지수함수의 그래프 2
x = np.linspace(-2, 2, 200)
y = (1/2)**x
x1 = np.linspace(-2, 2, 9)
y1 = (1/2)**x1
plt.figure(figsize=(8, 8))
plt.plot(x, y, c='b')
plt.scatter(x1, y1, s=50, c='k')
plt.yticks(size=18)
plt.grid(which='major', linestyle='-', lw=2)
plt.xlabel('$x$', fontsize=20)
plt.ylabel(r'$\frac{1}{2}^x$', fontsize=20)
plt.show()
```



```
In [5]: # 그림 5-5
# 로그함수의 그래프
x = np.linspace(0, 4, 200)
xx = np.linspace(-2, 2, 200)
x0 = np.delete(x, 0)
y0 = np.log2(x0)
x1 = np.linspace(0, 4, 9)
y2 = np.log2(x2)
plt.figure(figsize=(8, 8))
plt.plot(x0, y0, c='b', label='$y=\log_2(x)$', lw=2)
plt.plot(xx, 2**xx, c='k', label='$y=2^x$', lw=2)
plt.plot([-2, 4], [-2, 4], linestyle='-', label='$y=x$', lw=2)
plt.plot([-2, 4], [0, 0], lw=2, c='k')
plt.plot([0, 0], [-2, 4], lw=2, c='k')
plt.scatter(x2, y2, s=50, c='b')
plt.xticks(size=20)
plt.yticks(size=20)
plt.ylim(-2, 4)
plt.grid(which='major', linestyle='-', lw=2)
plt.xlabel('$x$', fontsize=18)
plt.ylabel('$y$', fontsize=18)
plt.legend(fontsize=18)
plt.show()
```

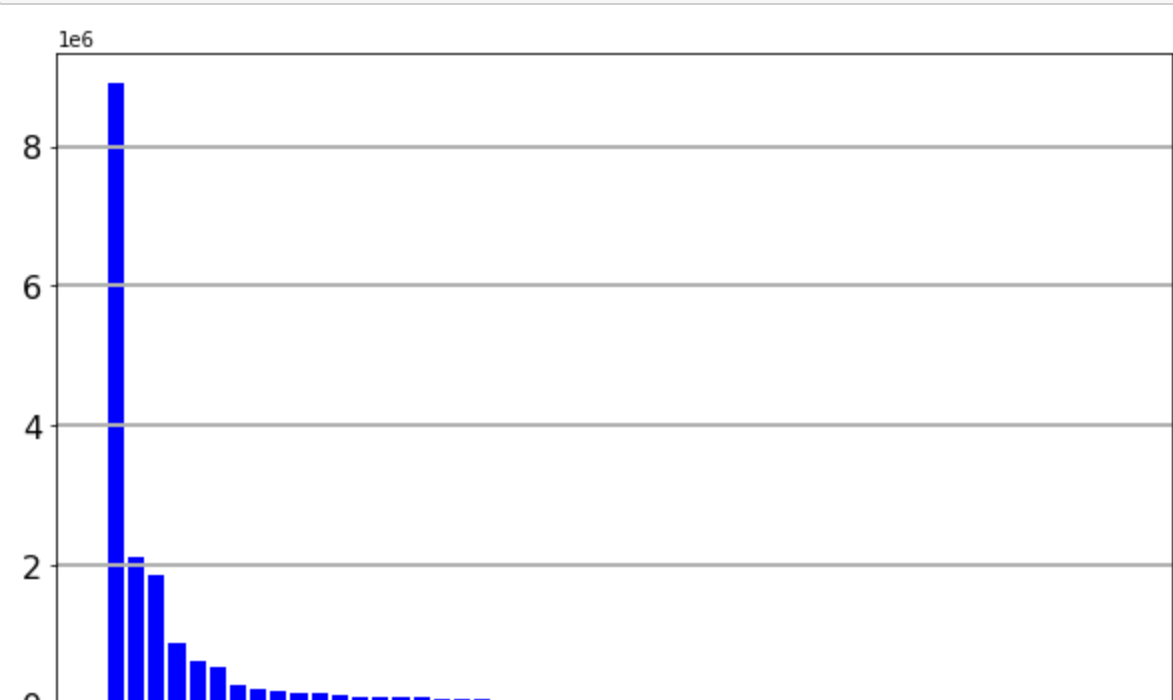


```
In [6]: # 로그함수의 응용
sell_list = [[9804, 8981004], [9907, 2120993], [9983, 3061017], [1332, 873298], [1332, 639853],
[9909, 528394], [1417, 283236], [1391, 239561], [9974, 493966], [9994, 367334],
[1419, 157081], [9997, 146083], [9993, 114111], [9977, 105954], [1413, 105007],
[9991, 90729], [9982, 77821], [9995, 77581], [1352, 73761], [9979, 63957],
[1379, 63119], [1377, 61844], [1376, 57848], [9996, 56747], [1426, 55504],
[1414, 53250], [9996, 48598], [9967, 34353], [9976, 33581], [1407, 32753],
[9978, 29919], [9996, 21387], [1430, 20946], [1418, 10982], [1381, 10802],
[1429, 10652], [1384, 10582], [9972, 15173], [9980, 13401], [1408, 10599],
[9969, 8791], [9982, 7281], [9986, 6944], [9973, 5420], [1380, 5399],
[1385, 4623], [1431, 3763], [1392, 3722], [1401, 2608], [1400, 2363]]
```

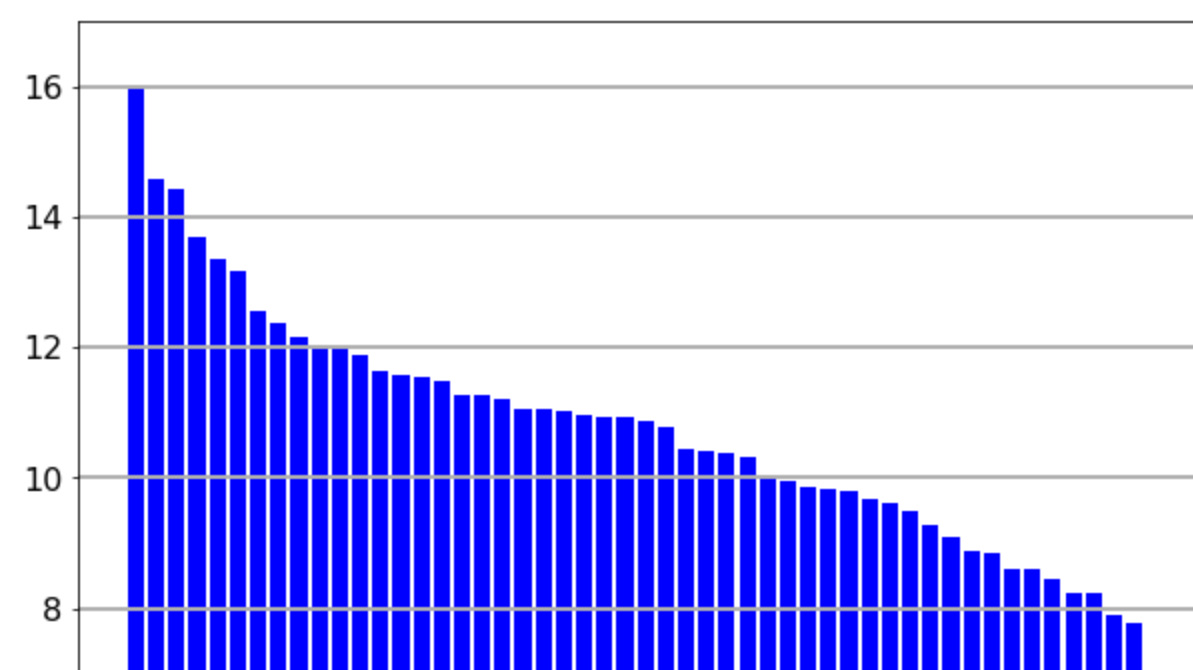
```
In [7]: import numpy as np
import matplotlib.pyplot as plt
sell_np = np.array(sell_list)
```

```
In [8]: sell_np = np.array(sell_list)
index = range(sell_np.shape[0])
sc_label = ['for x in sell_np[:,1]]
```

```
In [9]: # 일반적인 막대 그래프
plt.figure(figsize=(10, 6))
plt.bar(index, sell_np[:,1], tick_label=sc_label, color='b')
plt.grid(lw=2)
plt.xticks([])
plt.yticks(size=16)
plt.show()
```



```
In [10]: # 로그 단위의 막대 그래프
plt.figure(figsize=(10, 8))
plt.bar(index, np.log(sell_np[:,1]), tick_label=sc_label, color='b')
plt.ylim(7, 17)
plt.grid(lw=2)
plt.xticks([])
plt.yticks(size=16)
plt.show()
```



네이피어 상수

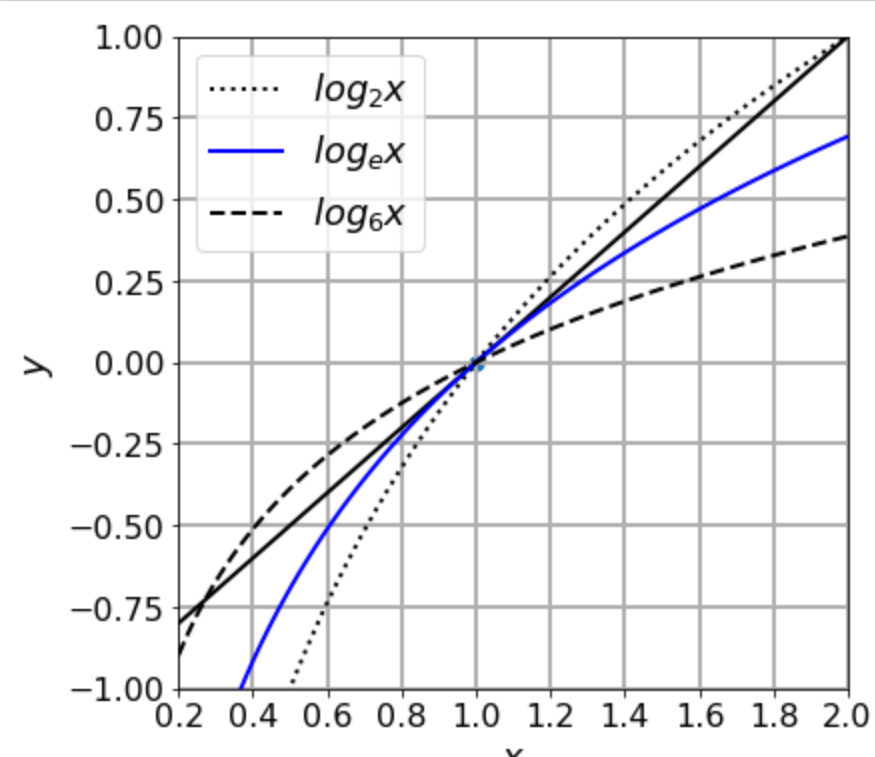
```
In [11]: import numpy as np
np.set_printoptions(precision=10)
x = np.logspace(0, 11, 12, base=0.1, dtype='float64')
y = np.power(1+x, 1/x)
for i in range(11):
    print('x = %12.10f y = %12.10f' % (x[i], y[i]))

x = 1.0000000000 y = 2.0000000000
x = 0.1000000000 y = 2.5827424691
x = 0.0100000000 y = 2.7048138294
x = 0.0010000000 y = 2.7469239322
x = 0.0001000000 y = 2.7781456268
x = 0.0000100000 y = 2.792682372
x = 0.0000010000 y = 2.7928046091
x = 0.0000001000 y = 2.7928149441
x = 0.0000000100 y = 2.792817983
x = 0.0000000010 y = 2.792820526
x = 0.0000000001 y = 2.792820532
```

로그함수 그래프를 겹쳐 그린 모습

```
In [12]: xx = np.linspace(0.2, 2.0, 100)
yy1 = np.log(xx) / np.log(2.0)
yy2 = np.log(xx)
yy3 = np.log(xx) / np.log(6.0)
```

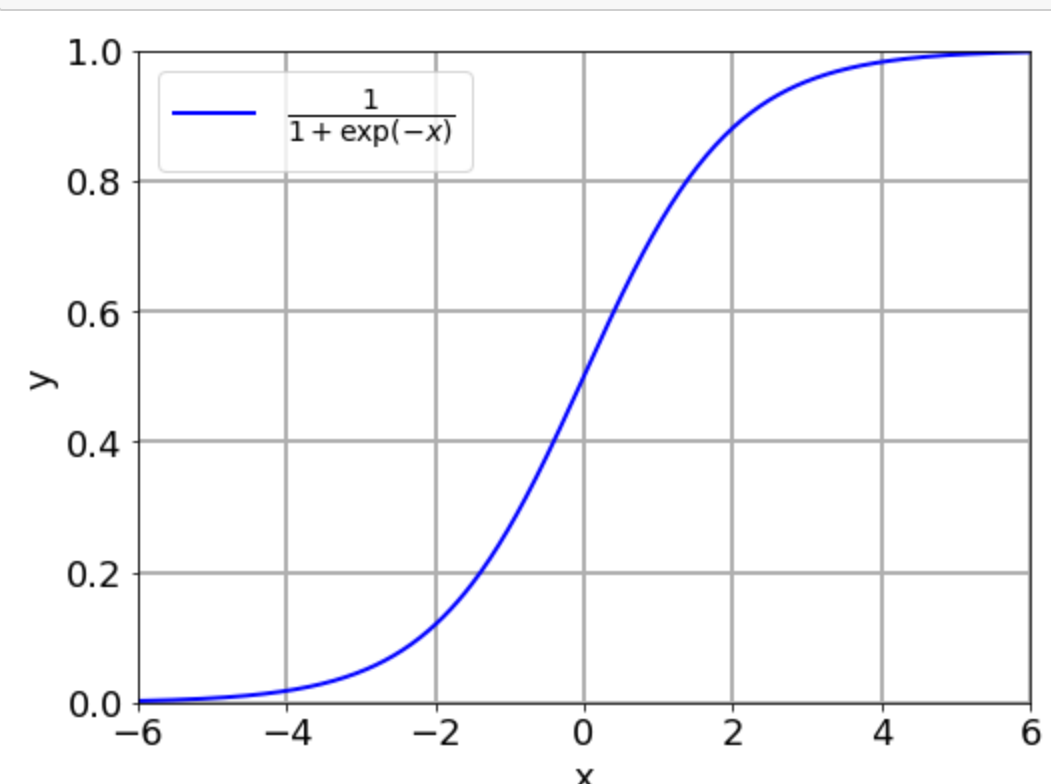
```
In [13]: # 그림 5-8
plt.figure(figsize=(6, 6))
plt.ylim(-1.0, 1.0)
plt.xlim(0.2, 2.0)
plt.xlabel('$x$', fontsize=18)
plt.ylabel('$y$', fontsize=18)
plt.grid(lw=2)
plt.plot([0.2, 2.0], [-0.8, 1.0], 'b-', lw=2, c='black')
plt.plot(xx, yy1, linestyle='dotted', c='black', lw=2, label='$\log_2(x)$')
plt.plot(xx, yy2, linestyle='solid', c='b', lw=2, label='$\log(e)x$')
plt.plot(xx, yy3, linestyle='dashed', c='black', lw=2, label='$\log_6(x)$')
plt.scatter(1.0, 0.5, s=50)
plt.xticks(size=16)
plt.yticks(size=16)
plt.legend(fontsize=18)
plt.show()
```



시그모이드 함수

```
In [14]: xx = np.linspace(-6, 6, 500)
yy = 1 / (np.exp(-xx) + 1)
```

```
In [15]: # 그림 5-10
plt.figure(figsize=(8, 6))
plt.ylim(0.0, 1.0)
plt.xlim(-6, 6)
plt.xlabel('$x$', fontsize=18)
plt.ylabel('$y$', fontsize=18)
plt.xticks(size=18)
plt.yticks(size=18)
plt.grid(lw=2)
plt.plot(xx, yy, c='b', lw=2, label=r'$\frac{1}{1+\exp(-x)}$', lw=2)
plt.legend(fontsize=20)
plt.show()
```



```
In [16]: plt.figure(figsize=(8, 6))
plt.ylim(-5, 3)
plt.xlim(-3, 3)
plt.xticks(np.linspace(-3, 3, 13))
plt.yticks(np.linspace(-3, 3, 13))
plt.xlabel('$x$', fontsize=14)
plt.ylabel('$y$', fontsize=14)
plt.xticks(size=16)
plt.yticks(size=16)
plt.grid()
plt.plot(xx, yy, c='b', label=r'$\frac{1}{1+\exp(-x)}$', lw=1)
plt.plot(xx, xx, c='k', label=r'$y = x$', lw=1)
plt.plot([-3, 3], [6, 0], c='k')
plt.plot([0, 0], [-3, 3], c='k')
plt.plot([-3, 3], [1, 1], linestyle='--', c='k')
plt.legend(fontsize=18)
plt.show()
```

