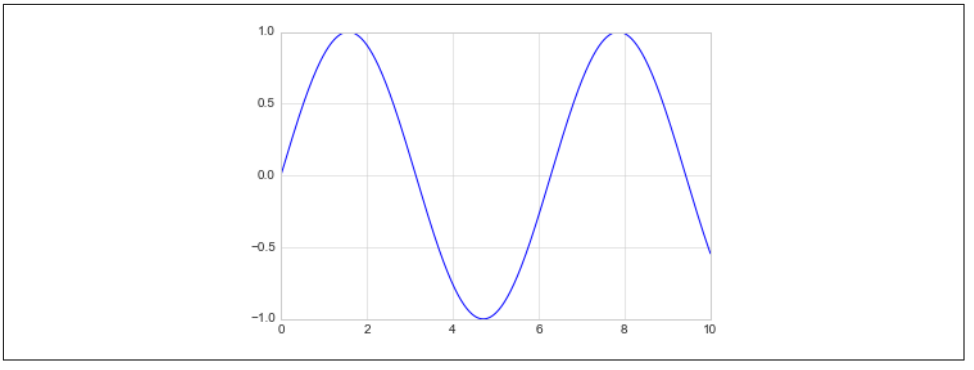

Figure 4-15. Example of a "tight" layout

It allows even higher-level specifications, such as ensuring an equal aspect ratio so that on your screen, one unit in `x` is equal to one unit in `y` (Figure 4-16):

```
In[13]: plt.plot(x, np.sin(x))
        plt.axis('equal');
```

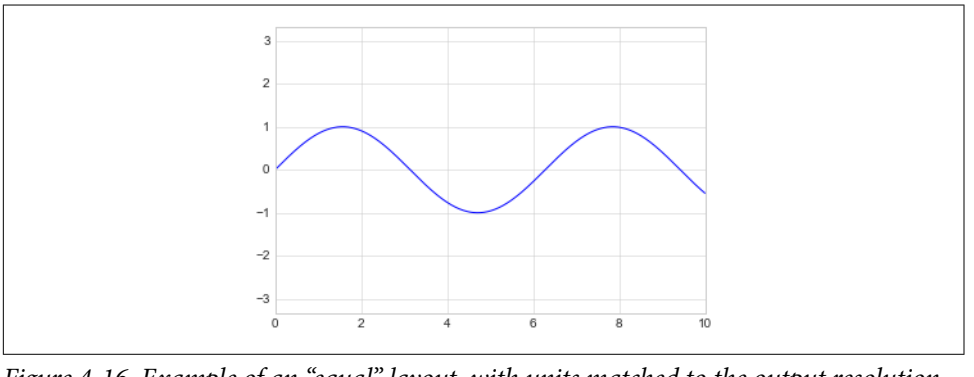

Figure 4-16. Example of an "equal" layout, with units matched to the output resolution

For more information on axis limits and the other capabilities of the `plt.axis()` method, refer to the `plt.axis()` docstring.

Labeling Plots

As the last piece of this section, we'll briefly look at the labeling of plots: titles, axis labels, and simple legends.

Titles and axis labels are the simplest such labels—there are methods that can be used to quickly set them (Figure 4-17):

```
In[14]: plt.plot(x, np.sin(x))
        plt.title("A Sine Curve")
```

```
plt.xlabel("x")
plt.ylabel("sin(x)");
```

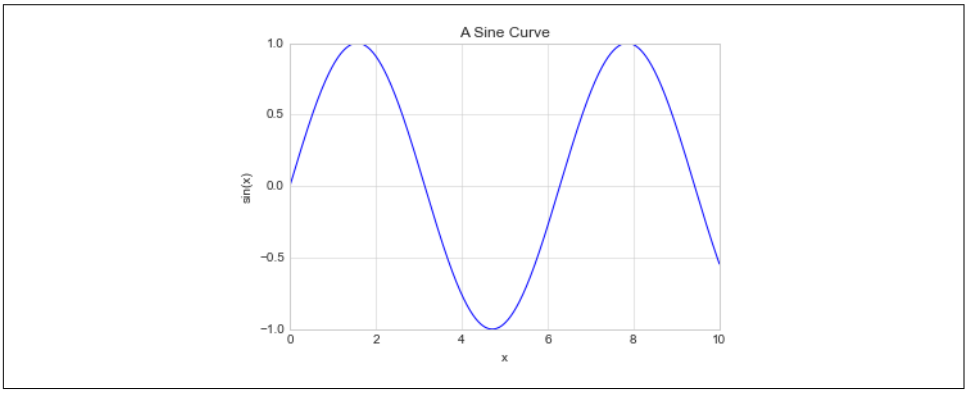

Figure 4-17. Examples of axis labels and title

You can adjust the position, size, and style of these labels using optional arguments to the function. For more information, see the Matplotlib documentation and the docstrings of each of these functions.

When multiple lines are being shown within a single axes, it can be useful to create a plot legend that labels each line type. Again, Matplotlib has a built-in way of quickly creating such a legend. It is done via the (you guessed it) `plt.legend()` method. Though there are several valid ways of using this, I find it easiest to specify the label of each line using the `label` keyword of the plot function (Figure 4-18):

```
In[15]: plt.plot(x, np.sin(x), '-g', label='sin(x)')
        plt.plot(x, np.cos(x), ':b', label='cos(x)')
        plt.axis('equal')

        plt.legend();
```

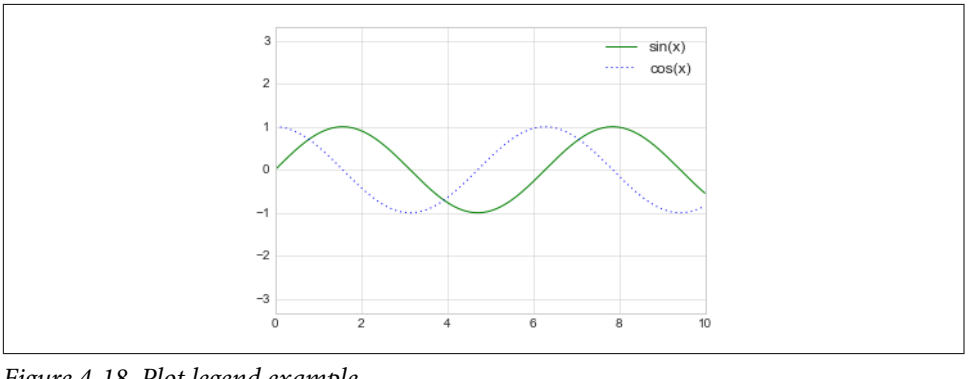

Figure 4-18. Plot legend example

As you can see, the `plt.legend()` function keeps track of the line style and color, and matches these with the correct label. More information on specifying and formatting plot legends can be found in the `plt.legend()` docstring; additionally, we will cover some more advanced legend options in "Customizing Plot Legends" on page 249.

Matplotlib Gotchas

While most `plt` functions translate directly to `ax` methods (such as `plt.plot()` → `ax.plot()`, `plt.legend()` → `ax.legend()`, etc.), this is not the case for all commands. In particular, functions to set limits, labels, and titles are slightly modified. For transitioning between MATLAB-style functions and object-oriented methods, make the following changes:

- `plt.xlabel()` → `ax.set_xlabel()`
- `plt.ylabel()` → `ax.set_ylabel()`
- `plt.xlim()` → `ax.set_xlim()`
- `plt.ylim()` → `ax.set_ylim()`
- `plt.title()` → `ax.set_title()`

In the object-oriented interface to plotting, rather than calling these functions individually, it is often more convenient to use the `ax.set()` method to set all these properties at once (Figure 4-19):

```
In[16]: ax = plt.axes()
        ax.plot(x, np.sin(x))
        ax.set(xlim=(0, 10), ylim=(-2, 2),
               xlabel='x', ylabel='sin(x)',
               title='A Simple Plot');
```

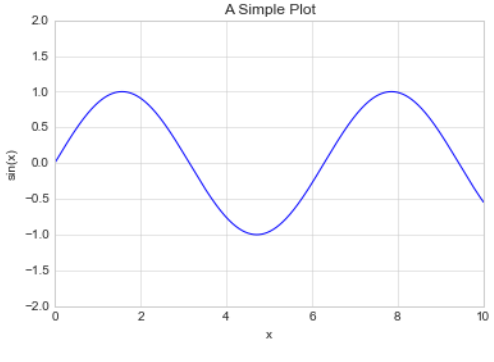

Figure 4-19. Example of using ax.set to set multiple properties at once

Simple Scatter Plots

Another commonly used plot type is the simple scatter plot, a close cousin of the line plot. Instead of points being joined by line segments, here the points are represented individually with a dot, circle, or other shape. We'll start by setting up the notebook for plotting and importing the functions we will use:

```
In[1]: %matplotlib inline
       import matplotlib.pyplot as plt
       plt.style.use('seaborn-whitegrid')
       import numpy as np
```

Scatter Plots with plt.plot

In the previous section, we looked at `plt.plot`/`ax.plot` to produce line plots. It turns out that this same function can produce scatter plots as well (Figure 4-20):

```
In[2]: x = np.linspace(0, 10, 30)
       y = np.sin(x)

       plt.plot(x, y, 'o', color='black');
```

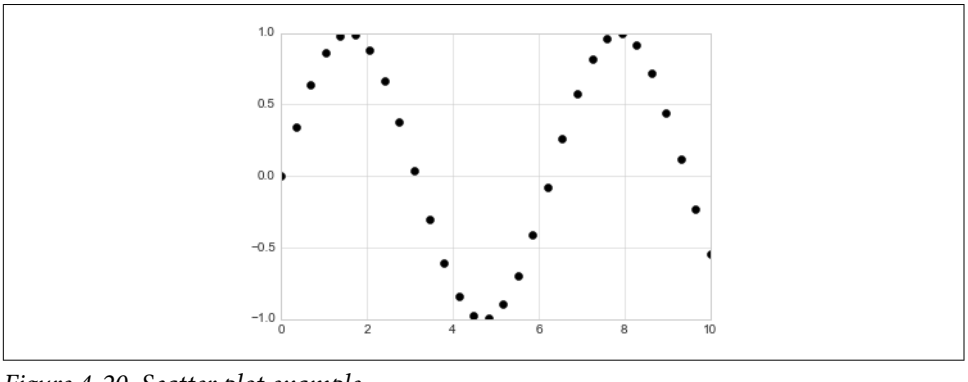

Figure 4-20. Scatter plot example

The third argument in the function call is a character that represents the type of symbol used for the plotting. Just as you can specify options such as `'-'` and `'--'` to control the line style, the marker style has its own set of short string codes. The full list of available symbols can be seen in the documentation of `plt.plot`, or in Matplotlib's online documentation. Most of the possibilities are fairly intuitive, and we'll show a number of the more common ones here (Figure 4-21):

```
In[3]: rng = np.random.RandomState(0)
       for marker in ['o', '.', ',', 'x', '+', 'v', '^', '<', '>', 's', 'd']:
           plt.plot(rng.rand(5), rng.rand(5), marker,
                    label="marker='{0}'".format(marker))
```