Matplotlib Tutorial: 4. Labeling and Annotation

An important part of making readable plots is labeling and annotating the axes. We've already seen some of this with the `set_xlabel`, `set_ylabel`, and `set_title` commands. In this section we will cover text and annotation using the `text` and `annotate` commands, and we will cover the fine-tuning of axis tick labels using `Formatter` and `Locator` instances.

Again, we'll enter matplotlib inline mode & do some imports

In [1]:

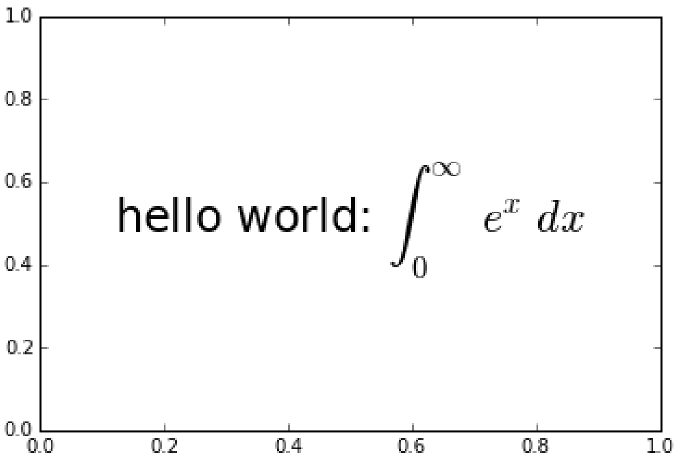
```
%matplotlib inline

from __future__ import print_function, division
import numpy as np
import matplotlib.pyplot as plt
```

Adding Text

Text can be added to the axes in several ways. The easiest way is to use the `text` command. Here's a basic version of the command:

In [2]:

```
fig, ax = plt.subplots()

ax.text(0.5, 0.5, 'hello world: $\int_0^\infty e^x dx$', size=24, ha='center', va='center');
```

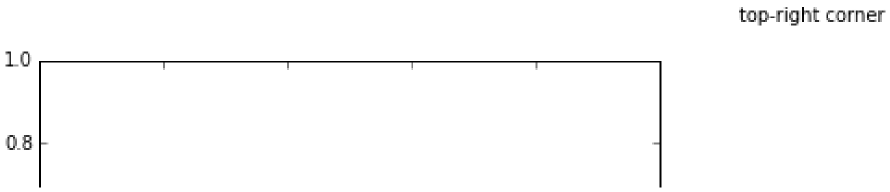


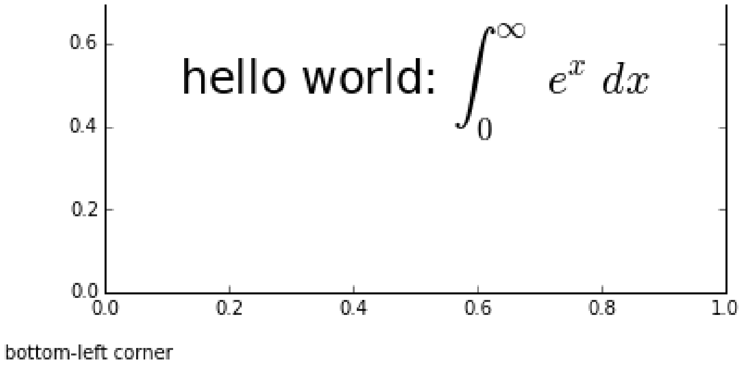
The above command places the text using data coordinates: that is, as we change the `x` and `y` limits the text will move around the axes. It is also possible to place text at a static location on the figure. The locations are between 0 and 1, from the bottom-left of the figure to the top-right:

In [3]:

```
fig.text(0, 0, 'bottom-left corner')
fig.text(1, 1, 'top-right corner', ha='left', va='top')
fig
```

Out[3]:

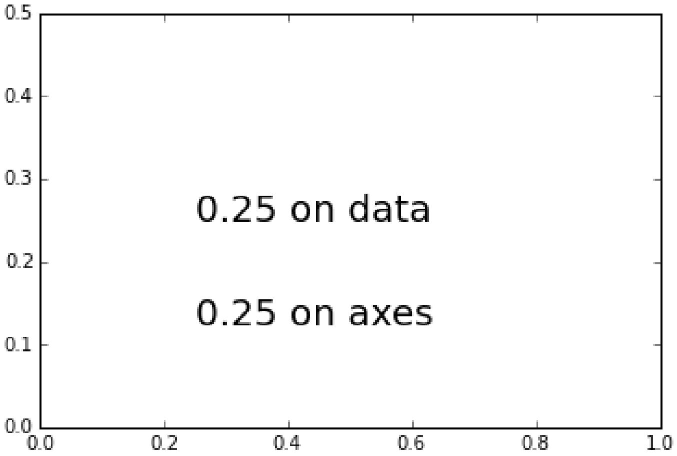




It is also possible to place text relative to the *axes* coordinates, but this is easier with the `annotate` command rather than the `text` command:

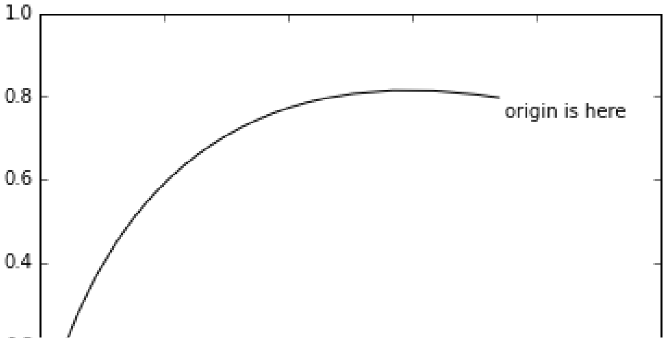
In [4]:
```
fig, ax = plt.subplots()

ax.annotate('0.25 on axes', (0.25, 0.25), textcoords='axes fraction', siz
e=20)
ax.annotate('0.25 on data', (0.25, 0.25), textcoords='data', size=20)
ax.set_ylim(0, 0.5);
```

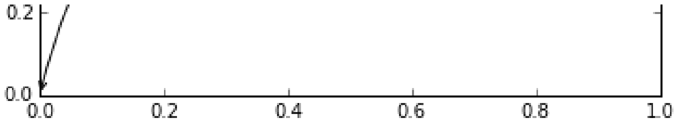
```
/Users/jakevdp/anaconda/envs/py3k/lib/python3.3/site-packages/matplotli
b/text.py:1788: UserWarning: You have used the `textcoords` kwarg, but no
t the `xytext` kwarg.  This can lead to surprising results.
  warnings.warn("You have used the `textcoords` kwarg, but not "
```



Annotate has some more powerful features as well: it can be used to automatically label parts of the axes with arrows.

In [5]:
```
fig, ax = plt.subplots()

ax.annotate('origin is here', (0, 0), (0.75, 0.75),
            arrowprops=dict(arrowstyle='->', connectionstyle='arc3, ra
d=0.5'),
            xycoords='data', textcoords='axes fraction');
```





There are a number of different arrow styles available: the online documentation has a good set of examples.

Controlling Axis Properties

Often you'd like to be able to fine-tune the tick labels on the axis, explicitly setting where they appear, adding minor ticks, or perhaps turning them off altogether. This is accomplished through the `Formatter` and `Locator` objects.

`Locator` objects control where ticks are located. Here are some of the available choices:

- `plt.MultipleLocator`: locate ticks at a multiple of some value
- `plt.MaxNLocator`: use a maximum number of ticks for the given plot range
- `plt.NullLocator`: do not add ticks to the plot

`Formatter` objects control what labels are shown at the tick locations. Some useful options are:

- `plt.FormatStrFormatter`: use a format string (like `'%.2g`) at each tick
- `plt.FuncFormatter`: specify a user-defined function
- `plt.NullFormatter`: do not label the ticks

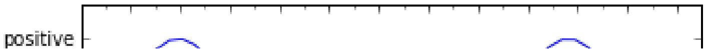
Any of these options may be applied to either major or minor ticks, using the functions

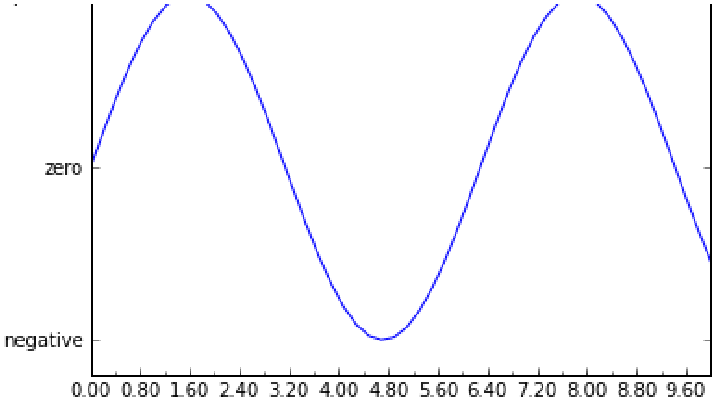
- `set_major_formatter`, `set_major_locator`
- `set_minor_formatter`, `set_minor_locator`

We'll see some examples below

In [6]:

```
fig, ax = plt.subplots()

x = np.linspace(0, 10)
ax.plot(x, np.sin(x))

ax.xaxis.set_major_locator(plt.MultipleLocator(0.8))
ax.yaxis.set_major_locator(plt.MaxNLocator(3))

ax.xaxis.set_minor_locator(plt.MultipleLocator(0.4))
ax.yaxis.set_minor_locator(plt.NullLocator())  # no ticks (default)

ax.xaxis.set_major_formatter(plt.FormatStrFormatter('%.2f'))  # float with two decimals


def tickformat(val, pos):
    if val > 0:
        return "positive"
    elif val < 0:
        return "negative"
    else:
        return "zero"

ax.yaxis.set_major_formatter(plt.FuncFormatter(tickformat))
ax.set_ylim(-1.2, 1.2);
```





Using these combinations (as well as other options we haven't discussed) leads to some very flexible plots.