# Homework Assignment 1

Uploaded your solutions as `ipynb` Jupyter notebook file to [http://bCourses.berkeley.edu](http://bCourses.berkeley.edu).

## (1) Here is a useful operator *= (2pts):

*Enter the following commands:*

```
a = 1
b = a
a *= 2
print(a)
print(b)
```

*Explain with your own word what does the operator does!*

## (2) Let us apply this operator of a 1D Numpy array (2pts):

*After loading Numpy as in the lab assignment enter the following commands:*

```
a = np.array( [ 1, 2, 3, 3, 5, 5 ] )
b = a
a *=2
print(a)
print(b)
```

*Wait something went "wrong". Explain why the behavior of the arrays is different from the behavior of the numbers above. Then correct these commands above so that the behavior of 'a' and 'b' is the same as above.*

## (3) Vectors in 2D (6pts):
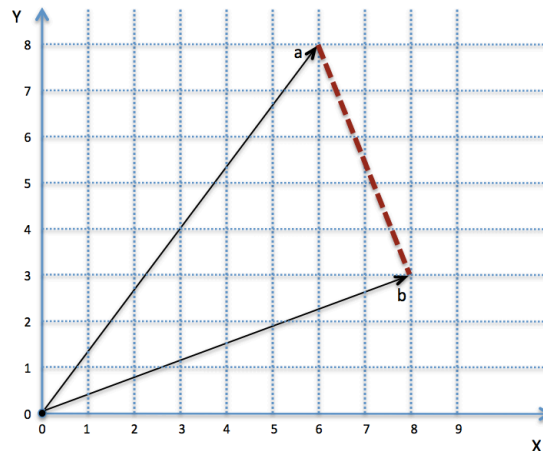


Vectors are essentially lists of numbers but they can also have a geometric meaning if one assigns the first number to *x* and the second number to the *y* coordinate. Please assign the (x=6,y=8) vector to a 1D Numpy array *a*. Print the length of this vector using the Numpy function `np.linalg.norm()`.

Assign vector *b* according to the diagram above and then compute the distance between points *a* and *b* with only just one line of code without reentering the coordinates of *a* and *b*.

## (4) 2D plots (6pts):

Make a XY plot for the functions

$f(x) = 3 \cos(x)$
$f(x) = 2 \cos(2x)$
$f(x) = \cos(3x)$

The x values should be in degrees (not radians) and vary between 0 and 360. Please use different lines styles for each function. Label every curve as well as your axes. Use at least 100 points per curve.

## (5) More 2D plots (8pts):

Make one 2D plot for $0 \le x \le 1$ containing the following 6 functions

$f(x) = x$
$g(x) = r x (1-x)$

with $r = \{0.5, 1.5, 2.5, 3.5, \text{and } 4\}$. Label the axes, choose very different line styles for every curve, and add a legend that specifiy $r$ in each case. Explain for what values of r do the curves f(x) and g(x) intersect?

## (6) Even More 2D plots (8pts):

Produce and submit a second graph that shows the function h(x) versus x for all five $r$ values:

$g(x) = r x (1-x)$
$h(x) = h(g(x)) = r g(x) ( 1-g(x) )$

## (7) Plotting the world's $CO_2$ record (6pts):

In the lab, we practiced plotting the world's temperature data. Now we want to repeat these steps with the world's $CO_2$ data that is stored in columns 1 and 2 in a file `ice_core_CO2_data.txt`. Download this file and generate a plot $CO_2$ contents versus time. As in the lab, add a shaded region that illustrates the deviations from the averaged $CO_2$ contents.

*When you are done, click "Kernel->Restart & Run All" and only then submit your notebook file to bCourses.*