Open MATLAB and create a new LiveScript. You will turn in a zip file containing your LiveScript and a PDF of the LiveScript output. All your work during this lab should be documented in your LiveScript.

Question 1 : **Vector Mathematics**

a) Create three vectors ax, bx, cx containing the values shown below.

$$\begin{aligned} ax &= [0,1,2,3,4,5,6,7,8,9] \\ bx &= [10.9,11.8,12.7,13.6,14.5,15.4,16.3,17.2,18.1,19.0] \\ cx &= [-5,0,5,3,0,-3,-1,0,1,0] \end{aligned}$$

b) Create a vector *ay* containing all the values in order from 1 to 150, and a vector *by* containing all the values from 1 to 150 counting by 0.75. *Hint: you shouldn't have to type all these in by hand!*

c) Demonstrate your ability at vector math by calculating :

- *pix*, which is *ax* with each element multiplied by 3.1415.
- *abx*, which is each element of *ax* multiplied by the matching element in *bx*.
- *acx*, which is each element of *ax* added to the matching element in *cx*.
- *ababx*, which is each element of *abx* squared.
- *byrt*, which has the square root of each element of *by*.

Question 2 : **Working with data** – Download the data file `lab0.csv` from the course Canvas site. This file contains data on the rate of cosmic rays observed as a function of altitude during a weather balloon flight.

a) Load the data file into MATLAB using `dlmread` or another data importation technique.

b) The first column contains the height of the balloon. Extract this column into a separate vector $h1$.

c) Due to the system in use, the height is reported in feet. Convert this into a new vector $h2$ in units of meters for proper SI analysis.

d) The second column contains the number of cosmic rays observed during a 2 minute period. Extract this column into a new vector $r1$.

e) Because this is a Poisson process (see the statistics notes), the uncertainty on the number of cosmic rays is the square root of the number observed ($\sigma_{r1} = \sqrt{r1}$). Construct a new $r1err$ vector to contain the uncertainty on the number of counts.

f) Convert the counts of cosmic rays and the uncertainty into units of Hz ($r2$ and $r2err$).

g) Make a plot with error bars showing the count in Hz as a function of altitude in meters.

Question 3 : **Working with matrices**

a) Create the matrix *mm*

$$mm = \begin{pmatrix} 7 & 4 & 2 \\ -1 & 5 & 5 \\ 2 & 3 & -9 \end{pmatrix}$$

b) Invert the matrix *mm* to create *mminv*

c) Demonstrate that *mminv* is the inverse of *mm*

Question 4 : **LiveScript Style and Formulae**

a) Add headings to your LiveScript, separate the sections, and add text to identify which question is being answered where.

b) Enter the following formulae into the LiveScript:

$$\begin{aligned} \sigma_f^2 &= \sigma_x^2 a^2/x^2 + \sigma_y^2 4b^2/y^2 \\ m_z &= \frac{2qRB}{c} \\ \chi^2 &= \sum \frac{(x_i - \bar{x})^2}{\sigma_i^2} \end{aligned}$$