Question 1

a)

```
ax = 0:9
```

```
ax = 1×10
     0     1     2     3     4     5     6     7     8     9
```

```
bx = 10.9:0.9:19.0
```

```
bx = 1×10
   10.9000   11.8000   12.7000   13.6000   14.5000   15.4000   16.3000   17.2000 ⋯
```

```
cx = [-5 0 5 3 0 -3 -1 0 1 0]
```

```
cx = 1×10
    -5     0     5     3     0    -3    -1     0     1     0
```

b)

```
ay = 1:150
```

```
ay = 1×150
     1     2     3     4     5     6     7     8     9    10    11    12    13 ⋯
```

```
by = 1:0.75:150
```

```
by = 1×199
    1.0000    1.7500    2.5000    3.2500    4.0000    4.7500    5.5000    6.2500 ⋯
```

c)

```
pix = ax .* 3.1415
```

```
pix = 1×10
         0    3.1415    6.2830    9.4245   12.5660   15.7075   18.8490   21.9905 ⋯
```

```
abx = ax .* bx
```

```
abx = 1×10
         0   11.8000   25.4000   40.8000   58.0000   77.0000   97.8000  120.4000 ⋯
```

```
acx = ax + cx
```

```
acx = 1×10
    -5     1     7     6     4     2     5     7     9     9
```

```
ababx = abx .^ 2
```

ababx = 1×10

10^4 ×

```
         0    0.0139    0.0645    0.1665    0.3364    0.5929    0.9565    1.4496 ···
```

```
byrt = sqrt(by)
```

```
byrt = 1×199
    1.0000    1.3229    1.5811    1.8028    2.0000    2.1794    2.3452    2.5000 ···
```

Question 2

a) Reading the data into a matrix

```
data = dlmread('lab0.csv',',',1,0)
```

```
data = 40×2
        2500           3
        5000           3
        7500           1
       10000           3
       12500           7
       15000           5
       17500           4
       20000           1
       22500           4
       25000          11
     ⋮
```

b) Extracting first column (heights of the balloon in feet)

```
h1 = data(:,1)
```

```
h1 = 40×1
        2500
        5000
        7500
       10000
       12500
       15000
       17500
       20000
       22500
       25000
     ⋮
```

c) One foot equals 0.3048 meters

```
h2 = h1 .* 0.3048
```

```
h2 = 40×1
         762
        1524
        2286
        3048
```

```
        3810
        4572
        5334
        6096
        6858
        7620
      ⋮
```

d) Extracting second column (number of cosmic rays observed during a 2 minute period)

```
r1 = data(:,2)
```

```
r1 = 40×1
     3
     3
     1
     3
     7
     5
     4
     1
     4
    11
     ⋮
```

e) Uncertainty of the number of cosmic rays is the square root of the number of rays

```
r1err = sqrt(r1)
```

```
r1err = 40×1
    1.7321
    1.7321
    1.0000
    1.7321
    2.6458
    2.2361
    2.0000
    1.0000
    2.0000
    3.3166
     ⋮
```

f) Converting counts of cosmic rays and their uncertainties into Hz by dividing by 120 seconds

```
r2 = r1 ./ 120
```

```
r2 = 40×1
    0.0250
    0.0250
    0.0083
    0.0250
    0.0583
    0.0417
    0.0333
    0.0083
    0.0333
```

```
    0.0917
     ⋮
```

```
r2err = r1err ./ 120
```

```
r2err = 40×1
    0.0144
    0.0144
    0.0083
    0.0144
    0.0220
    0.0186
    0.0167
    0.0083
    0.0167
    0.0276
     ⋮
```

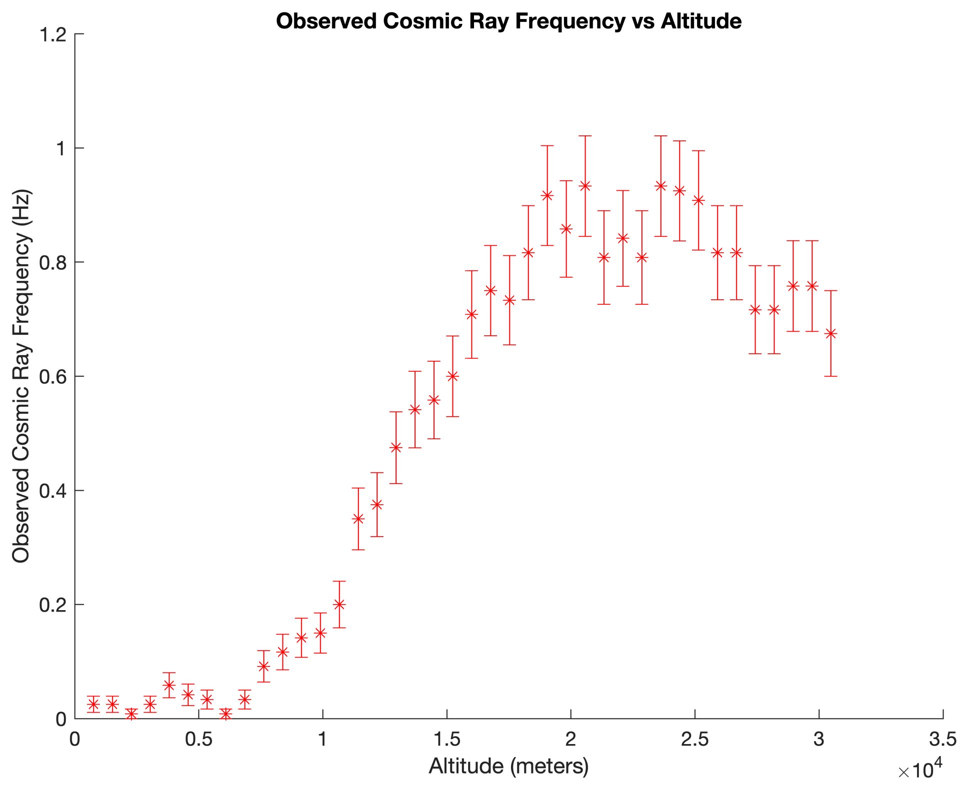
g) Plot with error bars showing the count in Hz as a function of altitude in meters

```
hold on

errorbar(h2,r2,r2err,'r*','LineStyle','none')

title('Observed Cosmic Ray Frequency vs Altitude')
xlabel('Altitude (meters)')
ylabel('Observed Cosmic Ray Frequency (Hz)')

hold off
```



Question 3

a) Creating matrix mm

```
mm = [7 4 2;-1 5 5;2 3 -9]
```

```
mm = 3×3
     7     4     2
    -1     5     5
     2     3    -9
```

b) Inverting matrix mm to create mminv

```
mminv = inv(mm)
```

```
mminv = 3×3
    0.1357   -0.0950   -0.0226
   -0.0023    0.1516    0.0837
    0.0294    0.0294   -0.0882
```

c) Proof that mminv is the inverse of mm. A matrix times its inverse must equal the identity matrix.

```
id = mm * mminv
```

```
id = 3×3
    1.0000   -0.0000    0.0000
   -0.0000    1.0000   -0.0000
   -0.0000   -0.0000    1.0000
```

Question 4

a) Yep

b) $\sigma_f^2 = \frac{\sigma_x^2 a^2}{x^2} + \frac{\sigma_y^2 4b^2}{y^2}$

$m_z = \frac{2\mathrm{qRB}}{c}$

$\chi^2 = \Sigma \frac{(x_i - \overline{x})^2}{\sigma_i^2}$