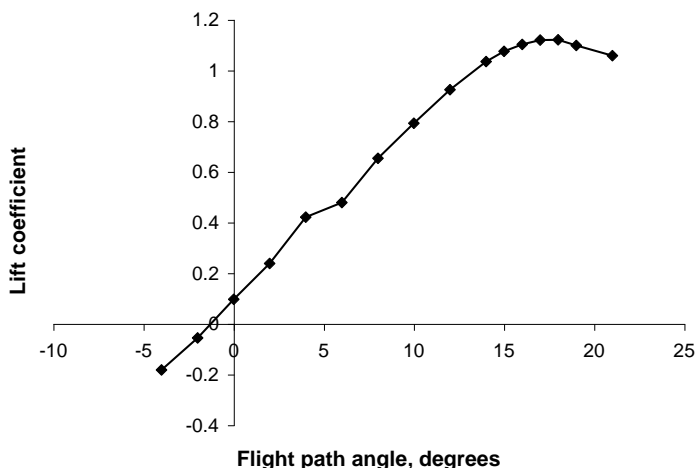


## Programming Assignment 10 - Due Thursday April 9

Wind tunnels are used in the aviation industry to determine the functional characteristics of accurately scaled models of aircraft before building full scale versions. One important functional characteristic is the *lift coefficient* as a function of the angle of climb (flight path angle). A typical data set from a wind tunnel is shown here.



Mathematical models that describe the aircraft behavior under various circumstances are developed from data such as this. This is the basis of flight simulators that are used to train pilots before they ever actually fly the plane.

Such models need to determine the lift coefficient as a function of flight path angle for angle values that lie between the data points. One method of doing this is *linear interpolation*. Given the x-coordinate that lies between two known data points  $(x_1, y_1)$  and  $(x_2, y_2)$ , the estimated y-coordinate is given by

$$y = y_1 + (x - x_1)(y_2 - y_1) / (x_2 - x_1)$$

which is obtained from straight-forward manipulation of the equation of a line.

The lift coefficient can be used to determine a drag potential by the following equation  
$$\text{drag} = (\text{lift coefficient}) * \sin(\text{flight path angle})$$

Design a program that will do the following:

1. Read the file **liftdata.dat** (Take the data at the end of these to make the data file.) which contains (flight path angle, lift coefficient) data pairs.
2. Use this data together with the above equation to compute the drag as a function of flight path angle from -3 to 20 degrees in increments of 0.25 degrees (remember: the sin function argument is radians, not degrees).
3. Write the (flight path angle, drag) data pairs to a file named **out.dat**
4. Import the out.dat file into Excel.
5. Create a graph of the drag vs flight path angle.

### Hand in:

In a folder submit the .cpp file and the excel file.

Data file

-4.0	-0.182
-2.0	-0.056
0.0	0.097
2.0	0.238
4.0	0.421
6.0	0.479
8.0	0.654
10.0	0.792
12.0	0.924
14.0	1.035
15.0	1.076
16.0	1.103
17.0	1.120
18.0	1.121
19.0	1.099
21.0	1.059