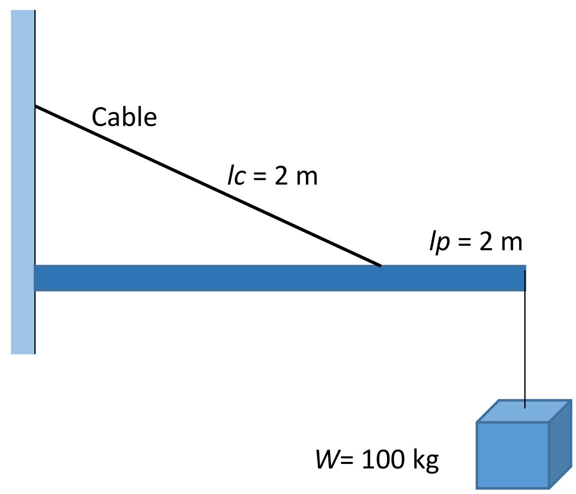
ENES 103

Potential Projects

1. Temperature readings were done every hour and stored in a vector called *readings*. Write a function called *halffit* that receives this vector as an argument and uses quadratic interpolation (second order) to determine what the temperature was every half hour between the actual recorded temperatures. The function then plots, on one graph, the original temperature readings (using a 'o' for the points), the interpolated temperatures at the half hours (using a '+' for these points), and the quadratic curve that was used for the interpolation. Put a legend on the graph to distinguish them. The number of hours that was used for the original vector may not be assumed

2. A 100-kg object is to be hung from the end of a rigid 2-meter horizontal pole of negligible weight, as shown in the figure. The pole is attached to a wall by a pivot and is supported by a 2-meter cable that is attached to the wall at a higher point. The tension on this cable is given by the equation

$$T = \frac{W \cdot lc \cdot lp}{d\sqrt{lp^2 - d^2}}$$



where *T* is the tension in the cable, *W* is the weight of the object, *lc* is the length of the cable, *lp* is the length of the pole, and *d* is the distance along the pole at which the cable is attached. Write a program to determine the distance *d* at which to attach the cable to the pole in order to minimize the tension on the cable. To do this, he program should calculate the tension on the cable at regular 0.1 m intervals from *d* = 0.3 m to *d* = 1.8 m, and should locate the position *d* that produces the minimum tension. Also, the program should plot the tension on the cable as a function of *d*, with appropriate titles and axis labels.

3. The acceleration due to the Earth's gravity at any height h above the surface of the Earth is given by the equation

$$g = -G\frac{M}{(R+h)^2}$$

where G is the gravitational constant (6.672×10^{-11} N·m^2/kg^2), M is the mass of the Earth (5.98×10^{24} kg), R is the mean radius of the Earth (6371 km) and h is the height above the Earth's surface. If M is measured in kg and R and h in meters, then the resulting acceleration will be in units of meters per second squared. Write a program to calculate the acceleration due to the Earth's gravity in 500 km increments at heights from 0 km to 40,000 km above the surface of the Earth. Print out the results in a table of height versus acceleration with appropriate labels, including the units of the output values. Plot the data as well with appropriate axes labels.

Your report should include:

- Title page: Title, course number, date, names of group members and submission date.
- Summary of your approach to the solution.
- Results and discussion of results.

Your grade will be based on the following rubric

Presentation ……………………………………………………….	10 Points
Robustness and effectiveness of the program……….	30 points
Results………………………………………………………………..	40 points
Discussion of approach to solution and results……..	20 points