Abstract

By extending the spring at certain intervals, we were able to measure the force needed to extend the spring and in turn were able to find the relationship between force and extension by graphing force versus extension. We were also able to find, using the graph, the individual spring's spring constant. This has many implications for bed and couch manufacturers so they can find the maximum force for the bed before it collapses or compresses too much.

Problem

What is the relationship between the force taken to extend the spring a certain distance and that distance? What is the spring's universal spring constant?

Anticipated Results

I anticipate that it will take more force to extend the spring farther and the relationship between force and extension to be a root relationship. I believe this because when you pull something, at first, it seems to take a great deal of force but after a while it seems to take less and less force.

Experimental Design

The apparatus used in this experiment includes a force meter, a go link and a meter stick. This experiment is a controlled, qualitative experiment so the variables are as follows. The manipulated variable is the extension of the spring, the responding variable is the force used to extend the spring and the controlled variables are the time we spent to balance out the force meter in order to get an accurate reading and the origin of the spring on the table. There are no mathematical procedures used in this lab. Before the lab, we assumed that all of the electronic devices would be in working order, the force meter would be zeroed before the lab, the spring would only extended and wouldn't move positions and our extension would be accurately measured.

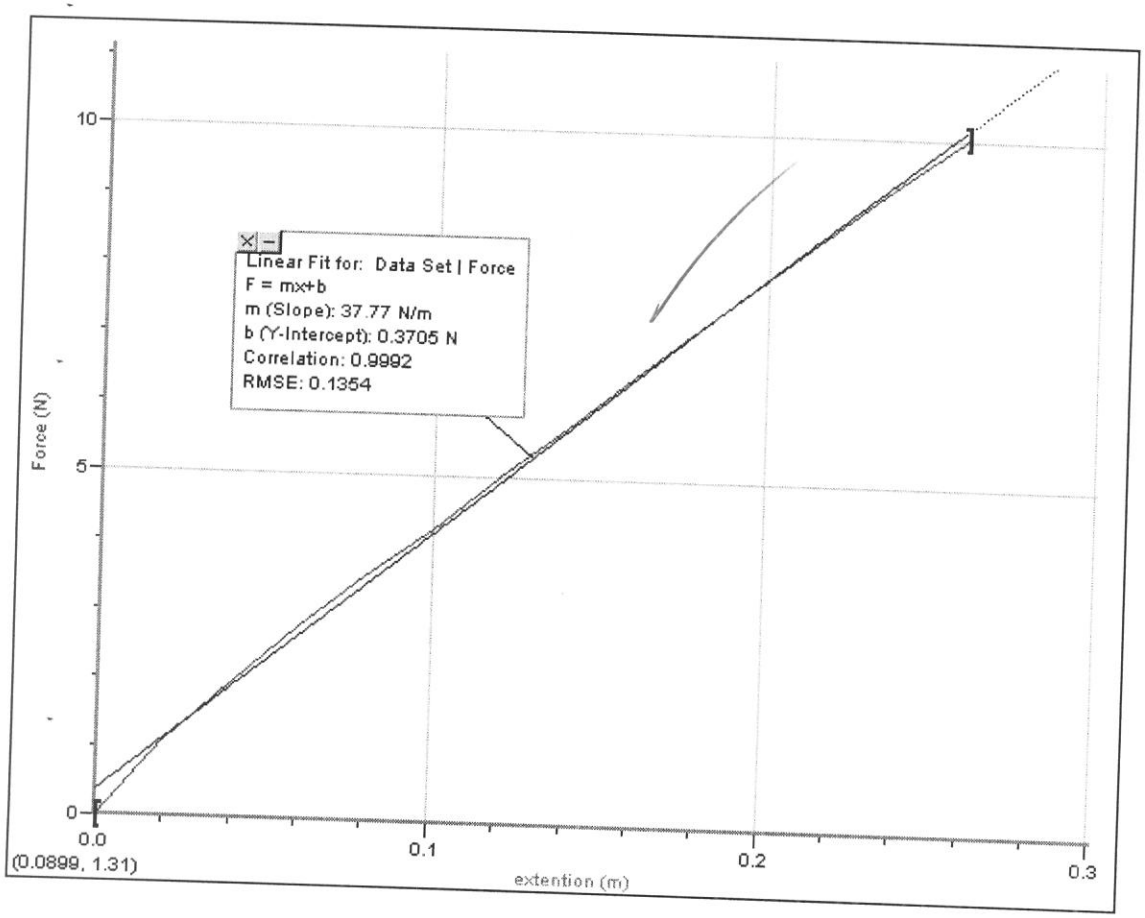
Procedure

Log on to computer, and then attach a go link into the computer, then the force meter into the go link. Open up Logger Pro and verify that a force is being read. Get a stand and C-clamp it to a desk or table. Attach the spring to the stand. Get a ruler and place the end of the meter stick at the end of the spring. Tape the meter stick to the table or desk so it doesn't shift. Zero the force meter and extend the spring 0.02m. Record the force into a table with the extension. Continue to extend the spring at 0.02m intervals and record each force. Ten or so extensions is ideal. Place the recordings on to a graph in Logger Pro. It should be Force versus Extension graph. Straighten the graph if necessary and find the line of best fit. Put the data from the line into the equation $\mathbf{y = mx + b}$. Take down all of equipment and put it away.

Observations

Extension (m)	Force (N)
0.0200	1.11
0.0400	1.96
0.0600	2.77
0.0800	3.53
0.100	4.23
0.120	4.99
0.140	5.71
0.160	6.46
0.180	7.19
0.200	7.92
0.220	8.66
0.240	9.36
0.260	10.1

Analysis



Findings and Discussion

After performing the lab, we obtained the equation of our force versus extension graph. It is as follows:

Force = 37.7extension + .371

The universal spring constant of our spring was 37.7 N/m. We also found that the relationship between force and extension is linear. This doesn't match our predictions. Our hypothesis should have been that force and extension have a linear relationship.

Evaluation

The meter stick that we used was readable to the nearest millimetre so the number of significant digits allowed is three. There was no standard value for this experiment because every group had a different spring; therefore, there is no percent error for this lab. I believe that our lab is reliable because our results were similar to the two other groups with springs were close to the same length as ours and we also had thirteen data points. Hooke's law is supported by our results.

Conclusion

Our findings have many practical applications such as couch and bed manufacturers who need to find what force on the couch or bed will make the spring compress to a certain point. A source of error that was not considered before the lab was that the spring may have been stretched out of shape so our results could be skewed.