CLIMBING MOUNT EVEREST

Goal: In this project your group will develop a rule of thumb for hikers and mountain climbers to use to calculate altitude based upon changes atmospheric pressure (which can be measured instrumentally). There are serious health issues, ranging from severe headaches to death, related to height and atmospheric pressure, so you will also test your rule of thumb using data from mountains accross the world in order to see if it is safe for public use. Finally, you will write up a brief "consumer report" including how to use your hikers rule of thumb and how accurate it is.

Names and Primary Reponsibilities of Group Members:

Main Computation Analyst:

Geometer/Math Modeler:

Recorder/Advertizing Consultant:

Technology Operator/Product Testing :

Modeling Stage: The following diagram illustrates the relationship between atmospheric pressure and altitude. In order to construct a rule of thumb which will be a linearization of this function, the *Math Modeler* must guide the group in finding a formula/model which closely resembles this curve.

1. With atmospheric pressure (in mb) as the independent variable and altitude (in ft) as the dependent variable, find a logarithmic model $y = a\ln(bx) + c$ for the curve shown above. Note that the curve goes through the points (100mb ,58200ft) and (300mb, 32500ft). Use $b = \frac{1}{100}$ and use the first point to show $c = 58200$. Then use the second point to find a.

2. The *technology operator* should use a graphing utility, plot your curve over the same interval as in the above graph and make a visual comparison to roughly determine accuracy.

Development Stage: Now that you have a mathematical formula describing the relationship between altitude and atmospheric pressure, it is time to develop with the guidance of the *computation analyst* a "rule of thumb" which will be used by hikers to approximate their altitudes based upon changes in atmospheric pressure as they hike.

1. 400mb is a key pressure level. Use the logarithmic model to determine the altitude which corresponds to $x = 400mb$.

2. Compute the linearization of the function at this pressure level. This serves a hiker's "rule of thumb" invented by your team.

Testing Stage: An approximating tool is only useful if the user knows how accurate it is. Your group is ready for *product testing* using real-life data.

1. The summit of Mt. Everest is 10 km or approximately 32,500 ft above sea level. The pressure there is only 300 mb, that is one third of the amount of air available at sea level. What altitude reading does your linearization give the hiker at pressure level 300mb? How far off is it?

2. The accompanying chart contains a list of "ailments" that occur at various altitudes as well as means taken by climbers to overcome these obstacles. An altitude of 26,000 ft, which corresponds to 396 mb, is the begining of what hikers call the "Death Zone." Use your rule of thumb/linearization to compute the altitude at that pressure. Is your linearization accurate enough to warn hikers of when thay are entering the "Death Zone"?

3. In a similar manner, determine if your linearization would adequately warn a climber of when he/she will have trouble walking or experience extreme cold.

Presenting Stage: With the help of he entire team, the *advertising consultant* will write a consumer report blurb explaining how to use your hiker's rule of thumb. Include an accuracy report.

Altitude (ft)	Health Issue	Mountain	Height at Summit
5,000	Labored Breathing	Mt. Mitchell	6,684
7,500	Slight Headache		
12,500	Serious Headache	Mt. Whitney	14,494
14,000	Trouble Walking	Matterhorn	15,000
18,000	Extreme Cold, Little Air	Mt. McKinley	20,320
26,000	Loss of Digits, Death	Mt. Everest	32,500

Interesting Facts:

- Mountaineers go slowly from 10,000 ft to 15,000 ft, resting for a few days at each height.
- Planes to Atlanta reach a height of 24,000 ft.
- In 1953 two guys attempted a 26,000 ft climb with oxygen. They both lost all fingers and toes.
- Everest was first climbed without oxygen by Reinhold Messner in 1978. He took 3 steps and rested for several minutes then 3 more.... He is considered by climbers to be superhuman.
- Only 1000 people have summited Mt. Everest. 300 people have died trying.