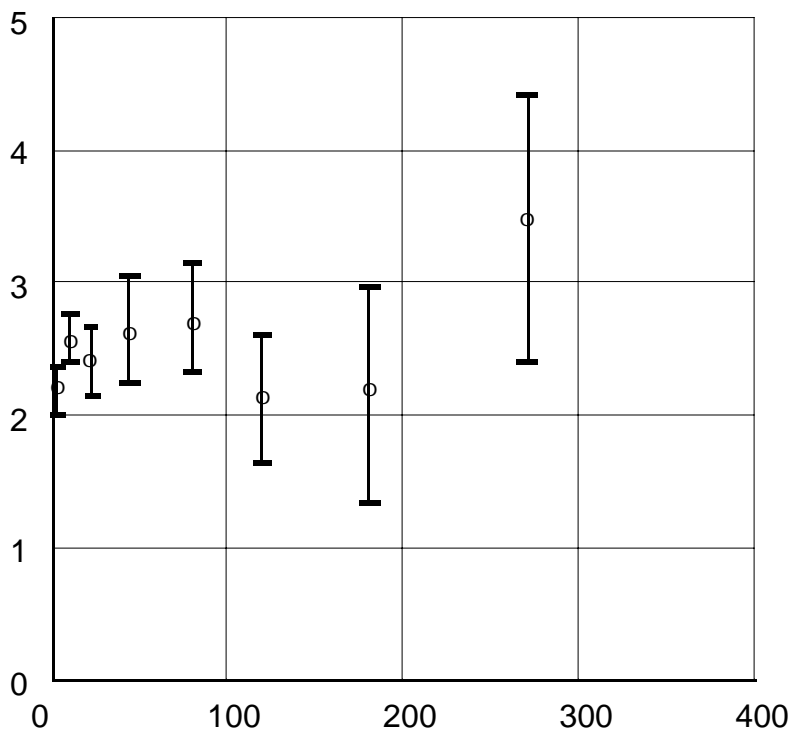


If the numbers that you are plotting on a graph have uncertainties that are great enough to notice then those uncertainties are indicated by “error bars” on the graph. The example below was copied carefully from an article in *SCIENTIFIC AMERICAN*, a respected journal read by literate people all over the world. (To avoid distracting you, I have deleted the title and labels from the graph.)



1. The “controlled” variable on this graph is the one that should be named on the _____al axis. (horizontal, vertical) See #6 on page 7.
2. The “dependent” variable is the one that should be named on the _____al axis. It is also the one that should have been mentioned _____ in the title of the graph. (first, last)
3. This graph indicates that the _____ variable was measured with fairly good precision, but the _____ variable was much more difficult to measure and therefore had a much greater uncertainty. (We would use “range” form to list the values of that variable in a data table.)
4. If *both* variables had great uncertainties we would have to use both horizontal and vertical error bars on the graph to indicate their ranges. If only the controlled variable had significant uncertainty then the error bars on the graph would be _____al, as on page 9.
5. According to the article, some people suspect that the relation described by the graph above is linear. Do you agree? If so, please draw a reasonable straight line on the graph to illustrate your opinion. If not, then draw a curve on the graph to describe the relation that you perceive.
6. If you believe that the line drawn in #5 is correct and you want to *minimize* the value of the dependent variable, what numerical value must you choose for the controlled variable? _____
Would your answer be different if you knew the title of the graph? ___