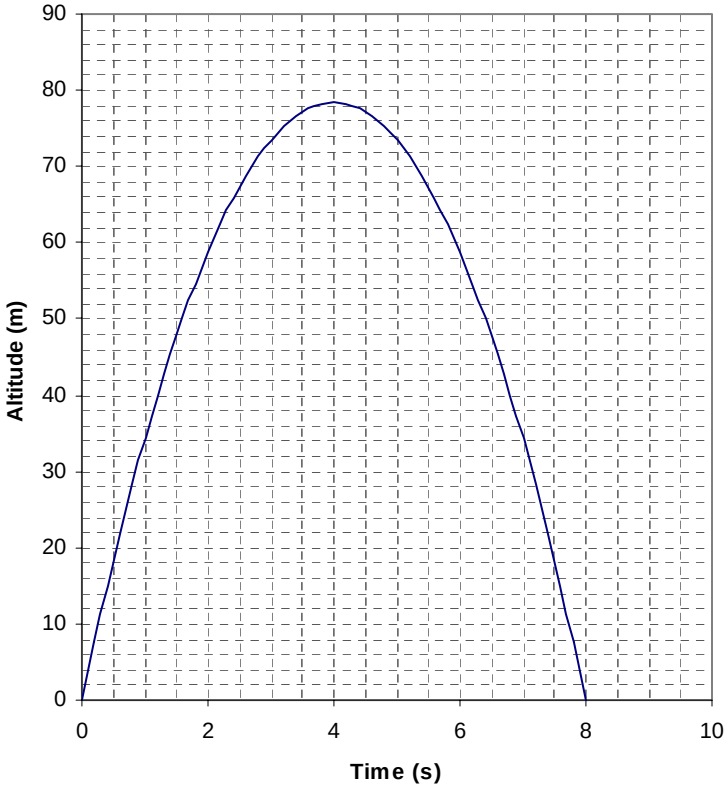
At the California Institute of Technology (Caltech) in the 1990's, a simmering feud between two dormitories erupted into open warfare, with one dormitory—Dabney House—employing a legendary Caltech weapon, a liquid nitrogen-powered orange Cannon. (For pictures of an actual Dabney House orange cannon, see http://www.ugcs.caltech.edu/~dei/theleft/theleft.html)

The Dabney House Irregulars fire the cannon straight up. The orange's height is measured using video capture technology, and is plotted as a function of time on the graph below.



1. We're concerned with the orange's velocity at the moment of impact. To that end, one Irregular argues that at time t = 4 sec, the orange's height was 78.4 m, and at time t = 8 sec, the orange hit the ground.

a. Calculate the orange's *average* velocity over the interval [4,8].
b. Draw the line on the graph whose *slope* represents your answer in part (a). Use the graph to compare the orange's impact speed to the value you found in part (a).

2. In order to get a better estimate, another student find the average speed over the interval [6,8].

a. Compute the result.
b. Draw the corresponding line on the graph, and compare the result to the actual impact speed.

3. What could you do to get a better approximation with the available data?

4. Carry out the suggestion in 3c: compute a better approximation to the orange's velocity at the moment of impact. In a sentence or two, state (a) why your approximation is better and (b) how you could improve your method to find a better approximation still.