**Problem statement** A freely falling body starting from rest has velocity $v = gt$ and displacement $s = \frac{1}{2}gt^2$ where $t$ is the time elapsed since rest. Suppose the freely falling body starts at rest and falls 1,000 feet.

a) Calculate the time $T$ (in seconds) this takes (here $g = 32$ ft/s$^2$) and the *time average* of the velocity of the body: $v_{\text{time aver}} = \frac{1}{T}\int_0^T v(t)\,dt$. Draw a graph of the function $v(t)$ for $0 \le t \le T$. Find the time $t$ when $v(t) = v_{\text{time aver}}$ and give a graphical interpretation.

b) Find a formula for the velocity as a function $f(s)$ of displacement $s$, and calculate the *distance average* of the velocity: $v_{\text{dist aver}} = \frac{1}{1000}\int_0^{1000} f(s)\,ds$. Draw a graph of the function $v = f(s)$ for $0 \le s \le 1000$. Find the distance $s$ that the body has fallen when $f(s) = v_{\text{dist aver}}$ and give a graphical interpretation.

**Note** $v_{\text{dist aver}} \neq v_{\text{time aver}}$! Every user of statistics (this means, essentially, every person in this course) should do this problem. Averages can be difficult to understand.