Problem statement An alien spaceship is found. A major part of the spaceship is a thin metal bar which is 120 meters long (metric aliens) with a cross-section of 1 square centimeter. The bar is heavy and has varying density. A metallurgist samples of the bar at 20 meter intervals, and finds the density of the samples (in grams per cubic centimeter).

Meter mark	**Density**	
0	30.4	
20	...	Data lost. (Stolen by aliens?)
40	46.5	
60	65.8	
80	29.2	
100	52.1	
120	...	Lunch break.

Estimate the total weight of the alien object. Is it likely that one person could lift it?

Problem statement a) Suppose $f(x)$ is defined on $0 \le x \le 1$ by the following rule:

$$f(x) \text{ is the first digit in the decimal expansion for } x.$$

For example, $f(1/2) = 5$ and $f(0.719) = 7$. Sketch the graph of $y = f(x)$ on the unit interval with appropriate scales for x and for y. Use a graphical interpretation of the definite integral to compute $\int_0^1 f(x)\,dx$.

c) Suppose the function $g(x)$ is defined as follows:

$$g(x) \text{ is the second digit in the decimal expansion for } x.$$

For example, $g(0.437) = 3$. Compute $\int_0^1 g(x)\,dx$. Again, a graph may help.

Problem statement a) Graph $f(x) = 2 - |x|$ in the interval $-1 \le x \le 3$. Compute $\int_{-1}^3 f(x)\,dx$.

b) Graph $g(x) = \big|2 - |x|\big|$ in the interval $-1 \le x \le 3$. Compute $\int_{-1}^3 g(x)\,dx$.

c) Graph $h(x) = |2 - x|$ in the interval $-1 \le x \le 3$. Compute $\int_{-1}^3 h(x)\,dx$.

Problem statement a) There are values of the constants A and B so that the derivative of $Axe^x + Be^x$ is xe^x. Find these values.

b) Compute $\displaystyle\int_1^2 xe^x\,dx$.

Happy Thanksgving!