Use Maple to do the following:

- Find the average population density, $\overline{P}$, from $t=0$ to $t=T$ for a termite mound with the following population density:

  $$P(t)=\frac{10000e^{0.198t}}{\pi(t+4)^2}$$

  (NOTE: You will need to type assuming T > 0 after the integral command in Maple.)
  Notice that $\overline{P}$ is a function of T.
  Make a graph of $P(t)$ (from $t=0$ to $t=20$) and make a graph of $\overline{P}(T)$ (from $T=0$ to $T=20$).
  Compare these two graphs and describe the differences between them in biological terms.
- Find the formula for the volume of a football formed by rotating the graph of $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ (i.e. $y=\frac{b}{a}\sqrt{a^2-x^2}$) from $x=-a$ to $x=a$ about the x-axis.
  Use this formula to find the volume of a football where $a=5.5$ inches and $b=2.5$ inches.
- Find the formula for the volume of a crater shaped like a spherical cap with rim radius, a, and height/depth, h, by rotating the graph of $x^2+y^2=r^2$ (i.e. $y=\sqrt{r^2-x^2}$) from $x=r-h$ to $x=r$ about the x-axis where $r^2=a^2+(r-h)^2$.
  (NOTE: The formula must be in terms of a and h, not r.)
  Use this formula to find the volume of Meteor Crater, which has rim radius of 625 meters and depth of 170 meters.
  (See the figures on the back of the page.)
- Find the formula for the volume of the solid formed by rotating the graph of $y=r\cdot\sqrt[n]{\frac{x}{h}}$ from $x=0$ to $x=h$ about the x-axis.
  Use this formula to find the formula for blood flow rate when the velocity profile is $v=k(R^n-r^n)$. See problems 33 and 34 on page 239 of the textbook. Also, see pages 234 and 235 in the textbook for an explanation of Poiseuille's Law for rate of flow.

What you need to turn in:

- Everything you produced with Maple (solved equations, answers, graphs, etc.). You can just print out your Maple output.
- Your answers to the above problems. You may include these in your Maple document.

Due Date: Tuesday, November 14, 2006

FIG. 5.1

Meteor Crater, northern Arizona. (Photograph provided by Meteor Crater Enterprises, Inc.)

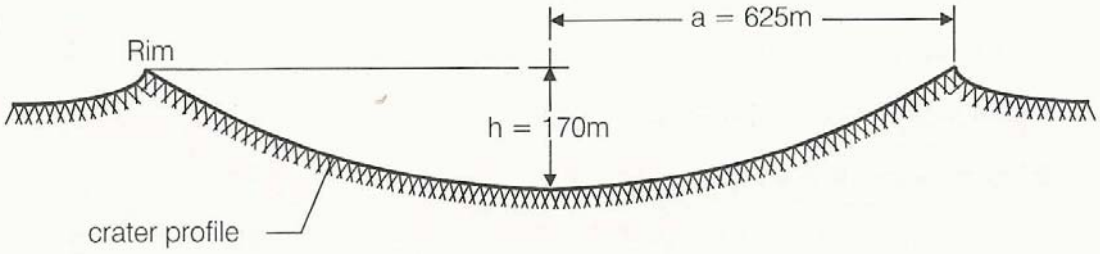

FIG. 5.2

Cross section of the Meteor Crater of Arizona

(source: Towing Icebergs, Falling Dominoes, and Other Adventures in Applied Mathematics by Robert B. Banks)