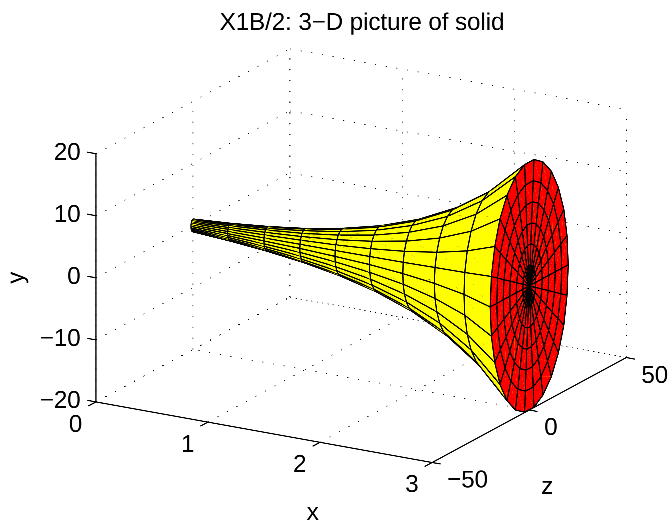
Spring 2005 Math 152
Exam 1B: Extras
Mon, 21/Feb ©2005, Art Belmonte

Selected Three-Dimensional Plots

All plots were rendered with **MATLAB**.

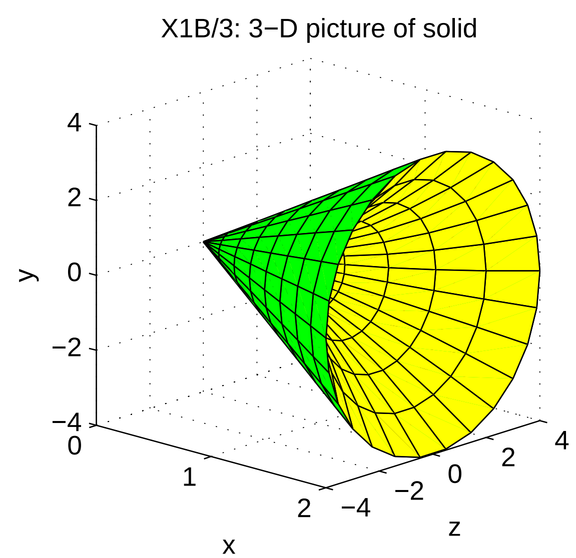
Problem 2

Here is a 3-D plot of the solid of revolution.



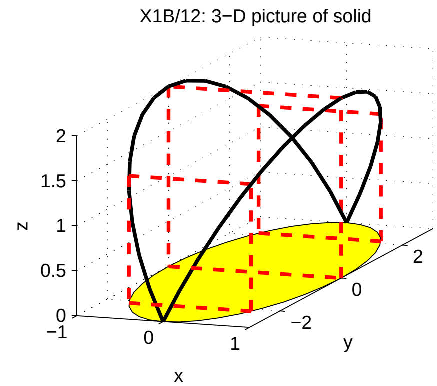
Problem 3

Here is a 3-D plot of the solid of revolution.

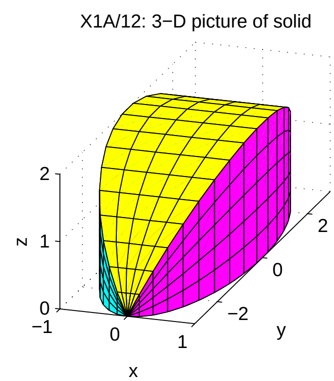


Problem 12

Here is a picture of the solid showing its elliptical base, its two upper edge boundaries, and a few square cross-sections.

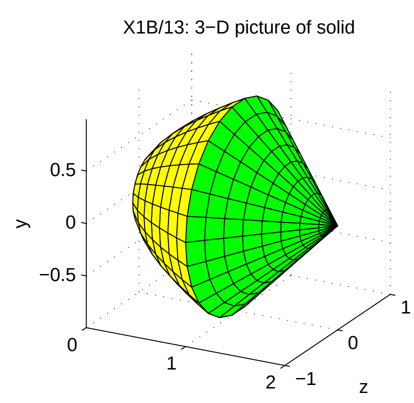


Here's another plot showing the surface patches (faces) of the solid. Clearly, this is NOT a solid of revolution!



Problem 13

Here is a 3-D plot of the solid of revolution.



(Turn the page for an alternative solution to Problem 13.)

Problem 13 via disks instead of shells

If one used cylindrical shells, then the volume involves computing *one* integral, as shown in the main solutions.

Many if not most students did this problem via disks instead. Note that while this method gets the job done, one must evaluate *two* integrals.

$$\begin{aligned}
V &= \int_a^b \pi r^2 \, dx + \int_b^c \pi r^2 \, dx \\
&= \int_0^1 \pi \left(\sqrt{x}\right)^2 \, dx + \int_1^2 \pi \, (2-x)^2 \, dx \\
&= \pi \int_0^1 x \, dx + \pi \int_1^2 (x-2)^2 \, dx \\
&= \left(\tfrac{1}{2}\pi x^2\right)\Big|_0^1 + \left(\tfrac{1}{3}\pi \, (x-2)^3\right)\Big|_1^2 \\
&= \left(\tfrac{1}{2}\pi - 0\right) + \left(0 - \left(-\tfrac{1}{3}\pi\right)\right) \\
&= \tfrac{5}{6}\pi \approx 2.62 \text{ cm}^3
\end{aligned}$$