

Advanced Calculus Optional Project

Your Name:

Volumes With Cross-Sections

Use foam, felt, cardboard, or any other cheap and available material to build one of the solids with base and cross-section described below. You may alternatively come up with a solid of your own choosing, but please run it by me first. Decorate your solid creatively.

You will receive a maximum of 7 extra credit points if you work individually, or a maximum of 3 extra credit points if you work with a partner.

Have fun!

<u>Construction:</u>	Points
Secure and sturdy	1
Axes and graph visible and labeled	1
<u>Cross-Sections:</u>	
At least 15 sections [Your solid should be at least 50% of the model.]	1
Accurate shape	1
Completeness of the shape of the solid	1
<u>Creativity:</u>	
Craftsmanship and Presentation	1
<u>Calculus Problem:</u>	
Find the volume of your solid correctly on a separate sheet of paper.	1

A note about size of your model: I would prefer the base to be 8.5" x 11", but if you have a good reason for changing the size, we can talk.

Solid Varieties

Base is bounded by:

1. $y = x + 1$ and $y = x^2 - 1$, cross-sections are squares, perpendicular to the x-axis.
2. $y = x + 1$ and $y = x^2 - 1$, cross-sections are equilateral triangles, perpendicular to the x-axis.
3. $y = x^3$, $y = 0$, and $x = 1$, cross-sections are equilateral triangles, perpendicular to the y-axis.
4. $y = x^2$ and $x = 9$, cross-sections are squares, perpendicular to the x-axis.

5. $x = y^2$ and $x = 9$, cross-sections are quarter-circles, perpendicular to x-axis.
6. circle, $x^2 + y^2 = 4$, cross-sections are semi-circles, perpendicular to x-axis.
7. $y = x + 1$ and $y = x^2 - 1$, cross-sections are rectangles of height 1, perpendicular to x-axis.
8. $y = x^3$, $y = 0$, and $x = 1$, cross-sections are squares, perpendicular to x-axis.
9. $y = x^3$, $y = 0$, and $x = 1$, cross-sections are trapezoids for which $h = b_1 = \frac{1}{2}b_2$ where b_1 and b_2 are upper and lower bases, perpendicular to the y-axis.
10. $x = y^2$ and $x = 9$, cross-sections are rectangles of height 2, perpendicular to x-axis.
11. $x = y^2$ and $x = 9$, cross-sections are equilateral triangles, perpendicular to x-axis.
12. $x = y^2$ and $x = 9$, cross-sections are triangles with $h = \frac{1}{4}b$, perpendicular to x-axis.
13. circle, $x^2 + y^2 = 9$, cross-sections are isosceles triangles with $h = b$, perpendicular to x-axis.
14. $y = x$ and $y^2 = x$, cross-sections are semi-circles, perpendicular to x-axis.
15. one arch of $y = \cos x$, $-\frac{\pi}{2} < x < \frac{\pi}{2}$ and the x-axis, cross-sections are squares, perpendicular to x-axis.
16. $x = y^2$ and $x = 3 - 2y^2$, cross-sections are rectangles of height 2, perpendicular to x-axis.
17. $x = y^2$ and $x = 9$, cross-sections are trapezoids with lower base in xy-plane, upper base = $\frac{1}{2}$ lower base, perpendicular to x-axis.
18. $y = 4$ and $y = x^2$, cross-sections are isosceles right triangles, perpendicular to x-axis.
19. $y^2 = 4x$ and $x = 4$, cross-sections are semi-circles, perpendicular to y-axis.
20. $y = 1 - x^2$ and $y = 1 - x^4$, cross-sections are squares, perpendicular to x-axis.
21. $x = y^2$ and $x = 3 - 2y^2$, cross-sections are equilateral triangles, perpendicular to x-axis.
22. circle, $x^2 + y^2 = 9$, cross-sections are squares, perpendicular to x-axis.
23. $y = 4$ and $y = x^2$, cross-sections are squares, perpendicular to x-axis.
24. $y = x$ and $y = x^2$, cross-sections are semi-circles, perpendicular to x-axis.