

3. The base of a solid is the region between $y = x^2 - 2x + 1$ and $y = -x^2 + 2x + 1$. Cross-sections perpendicular to the x -axis are equilateral triangles with one side in the base. Find the volume of the solid.

4. A solid has the following cross-sections perpendicular to the y -axis: half-disks (i.e. semicircles) whose diameters run from the y -axis to the curve $x = \sqrt{4 - y^2}$. Find the volume of the solid.

5. Find the volume of the solid generated by revolving the region bounded by the following curves about the x -axis.

$$y = x, \quad y = \frac{1}{x}, \quad x = 4$$

6. Find the volume of the solid generated by revolving the region bounded by the following curves about the y -axis.

$$y = x^{2/3}, \quad \text{the } x\text{-axis}, \quad x = 8$$

7. Find the volume of the solid generated by revolving the region bounded by the following curves about the line $x = 3$.
 $y = x^2$, $y = 0$, $x = 1$, $x = 2$

8. Find the volume of the solid generated by revolving the region bounded by the following curves about the line $y = 1$.
 $x = y - y^2$, $x = 0$

9. A force of 30 lb is required to hold a spring stretched 2 ft beyond its natural length. How much work is done in stretching it from its natural length to 3 ft beyond its natural length?

10. Suppose it takes 4 J of work to stretch a spring from its natural length of 5 m to a length of 7 m.
a. Find the work it takes to compress the spring to 2 m.

b. How far beyond its natural length will a force of 40 N keep the spring stretched?

13. A tank in the shape of an inverted pyramid (tip down) with a square base holds water to a depth of 4 m. The height of the tank is 6 m, and the square base has dimensions 2 m by 2 m. How much work is required to pump the water to the top of the tank?

14. A 10-m-long trough with semicircular cross-sections is filled with water. The diameter of the semicircles is 4 m. How much work is required to pump the water to 3 meters above the top of the trough?

15. Find the average value of $f(x) = \csc^2 x$ on the interval $\left[\frac{\pi}{6}, \frac{2\pi}{3}\right]$.

16. Find the average value of $f(x) = x \ln x$ on the interval $[1, e]$.

17. Find the following integrals.

a. $\int \tan^{-1} x \, dx$

b. $\int_1^4 \sqrt{x} \ln x \, dx$

c. $\int x^2 \cos x \, dx$

d. $\int \sin^5 x \cos^4 x \, dx$

e. $\int \tan^5 x \sec x \, dx$

f. $\int \sin^2 x \cos^2 x \, dx$

g. $\int \frac{dx}{\sqrt{x^2-16}}$

h. $\int \frac{x^2}{(9-x^2)^{3/2}} dx$

i. $\int \frac{dx}{\sqrt{x^2+4x+8}}$