

SET UP THE INTEGRALS NEEDED TO SOLVE EACH OF THE PROBLEMS BELOW. INCLUDE SKETCHES OF THE REGIONS AND/OR SOLIDS.

Area Problems

1. The area of the region bounded between $y = x^2 + 2x - 3$ and $y = 4x + 45$.

2. The area of the region bounded by $y = \ln x$, the x and y axes, and $y = 3$
 - A. With respect to x .
 - B. With respect to y .

3. The area of the region in quadrant I bounded by $x^2 + y^2 = 8$, $x = \frac{1}{2}y^2$, and $y = 0$
 - A. With respect to x .
 - B. With respect to y .

Volume Problems

4. Find the volume of the solid whose base is the region in quadrant I that is bounded by $y = x^3$, $y = 0$, and $x = 2$. All cross-sections perpendicular to the x -axis are
 - A. Rectangles with height twice the width.
 - B. Semi-circles.

5. The volume of the solid generated by rotating the region bounded by $y = 3^x$, $y = 0$, between $x = 0$ and $x = 4$ around the x -axis

6. The volume of the solid generated by rotating the region in quadrant I bounded by $y = \sin x$ and $y = \cos x$ around the x -axis..

7. The volume of the solid generated by rotating the region bounded by $y = \sqrt{x+4}$, $x = 0$, and $y = 3$. the y -axis.

8. The volume of the solid generated by rotating the region in quadrant I bounded by $y = x^2 + 1$, $x = 1$ and $y = 10$ around
 - A. The line $y = 10$.
 - B. The line $x = 3$.
 - C. The line $y = -1$.

9. Estimate the volume of a lake with the given measurements.

A.

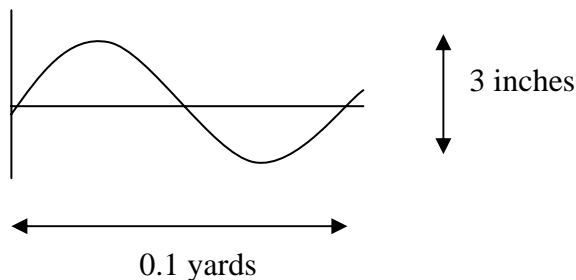
| | | | | | |
|---|----|----|----|----|----|
| Depth (measured from the surface in ft) | 0 | 10 | 20 | 30 | 40 |
| Diameter (measured in hundreds of ft) | 26 | 22 | 14 | 7 | 2 |

B.

| | | | | | |
|---|----|----|----|----|-----|
| Radius (measured from the center of the lake in ft) | 0 | 25 | 50 | 75 | 100 |
| Depth (measured in ft) | 22 | 20 | 15 | 9 | 1 |

Length Problems

10. A sheet of metal will be bent to form a corrugated wall. The wall must satisfy the specifications below. How wide should the initial sheet of metal be in order for the final product to be 5 yards wide?



11. An object travels along the curve given below. Find the total length traveled.

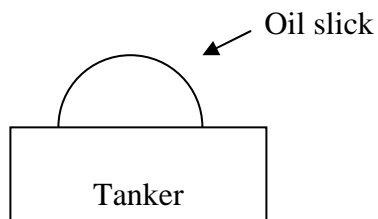
$$x = 3\cos t, \quad y = 3\sin t, \quad 0 \leq t \leq \pi$$

Miscellaneous Problems

12. Let $n(x)$ represent the number of trees per square mile in a coastal rain forest where x is the distance from the coast in miles. Assume the rain forest is rectangular and extends 130 miles inland and runs 40 miles along the coast. Find the average number of trees per square mile.

13. The velocity of blood flowing through an artery is proportional to the difference between the square of the artery's radius, R , and the square of the distance, r , of the fluid from the center of the artery. Find the total flow of blood through the artery.

14. Oil is spilling from an oil tanker as shown. The density of oil at a distance of x meters from the source is $p(x) = e^{-0.05x^2} \text{ kg/m}^2$. Find the total mass of the oil if the outer edge is 10 meters from the source.



15. Consider the triangular region bounded by the x axis, y axis, and $y = 2 - x$. If the density is $\delta(x) = 1 + x$, find the total mass of the region.