Draw all defined regions without the use of a calculator. Then use the calculator to find intersections and evaluate the volumes.

1. Let R be the region bounded by $f(x) = x + 1$ and $g(x) = \frac{1}{2}x^2 + 1$. Find the volume when R is revolved around the following.

    (a) x-axis   (b) y-axis   (c) line $y = 1$ (d) line $x = 3$

2. Let S be the region bounded by the graphs $y = 5 - x, y = \ln x,$ and the x-axis. Find the volume when S is revolved around the following.

    (b) line $y = -1$ (b) y-axis   (c) x-axis   (d) line $x = 5$

3. Let A be the region bounded by the graphs $y = x + 2$ and $y = e^{2x}$. Find the volume when S is revolved around the following.

    (c) line $y = 6$ (b) line x=4   (c) x-axis   (d) line $x = -6$

4. Region T is bounded by the graphs of $y = x^2, y = 0,$ and $x = 4$.

    (a) Find the value of a such that the line $x = a$ divides T into two equal areas.

    (b) If T is rotated about the x-axis, find the value of b such that the line $x = b$ divides the solid into two equal volumes.

    (c) If T is rotated about the line $x = -1$, find the value of c such that the line $y = c$ divides that solid into two equal volumes. Set up but don't solve.

5. Let f be the function given by $f(x) = 4x^2 - x^3$, and let l be the line $y = 18 - 3x$, where l is tangent to the graph of f. Let R be the region bounded by the graph of f and the x-axis, and let S be the region bounded by the graph of f, the line l, and the x-axis as shown below.

(a) Show that l is tangent to the graph of $y = f(x)$ at the point $x = 3$.

(b) Find the area of S.

(c) Find the volume of the solid generated when R is revolved about the x-axis.

(d) Find the volume of the solid generated when R is revolved about the line $y = 12$.