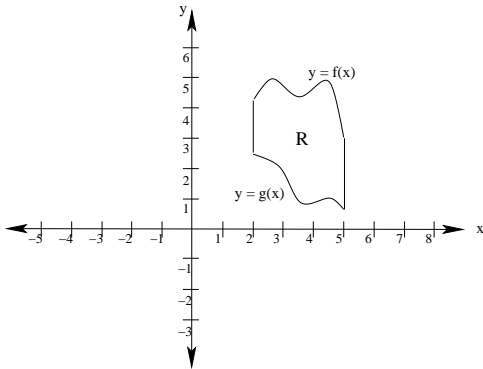


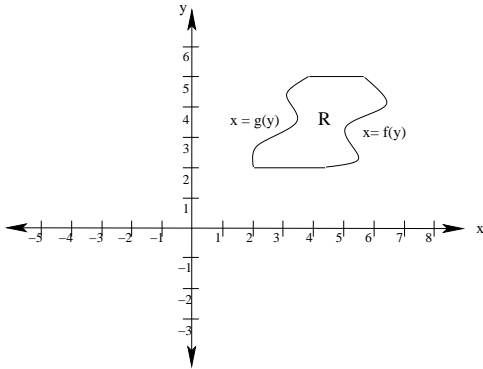
1. Let R be the region bounded by the graphs of $y = f(x)$, $y = g(x)$, $x = 2$, and $x = 5$ (see graph below).



Set up an integral (you do **not** need to evaluate it) that can be used to find each of the following:

- The area of R
- The volume of the solid generated if R is revolved about the x -axis.
- The volume of the solid generated if R is revolved about the y -axis.
- The volume of the solid generated if R is revolved about $x = 9$.
- The volume of the solid generated if R is revolved about $x = -4$.
- The volume of the solid generated if R is revolved about $y = 8$.
- The volume of the solid generated if R is revolved about $y = -2$.

2. Let R be the region bounded by the graphs of $x = f(y)$, $x = g(y)$, $y = 2$, and $y = 5$ (see graph below).



Set up an integral (you do **not** need to evaluate it) that can be used to find each of the following:

- (a) The area of R

- (b) The volume of the solid generated if R is revolved about the x -axis.

- (c) The volume of the solid generated if R is revolved about the y -axis.

- (d) The volume of the solid generated if R is revolved about $x = 9$.

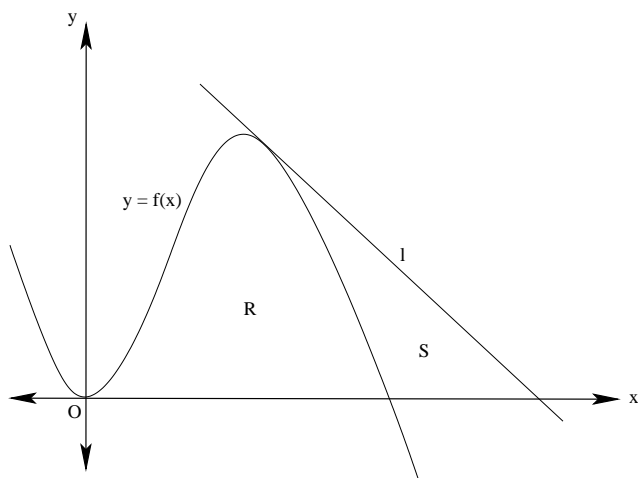
- (e) The volume of the solid generated if R is revolved about $x = -4$.

- (f) The volume of the solid generated if R is revolved about $y = 8$.

- (g) The volume of the solid generated if R is revolved about $y = -2$.

3. A doughnut-shaped solid is called a **torus**. Use the washer method to calculate the volume of the torus obtained by rotating the region inside the circle with equation $(x - a)^2 + y^2 = b^2$ around the y -axis (assume that $a > b$). Hint: Evaluate the integral by interpreting it as the area of a circle.

4. Let R be the region bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. Show that the solid obtained by rotating R about the y -axis (called an **ellipsoid**) has volume $\frac{4}{3}\pi a^2 b$.



5. (From the 200? AP Calculus AB exam.) 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 above. Find the volume of the solid generated when R is revolved about the x -axis.

6. (From the 200? AP Calculus AB exam.) Let R be the region enclosed by the graph of $y = \sqrt{x-1}$, the vertical line $x = 10$, and the x -axis.

(a) Find the area of R .

(b) Find the volume of the solid generated when R is revolved about the horizontal line $y = 3$.

(c) Find the volume of the solid generated when R is revolved about the vertical line $x = 10$.