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: (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.

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.

Name:

- 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.