Find the exact area bounded by the functions *f* and *g*. Include a sketch of the graphs with the region shaded. Use algebra to find any intersections of graphs.

1. $f(x) = x^2 - 4x$ and $g(x) = 0$.

2. $f(x) = 4\sin(4x)$ and $g(x) = 0$.

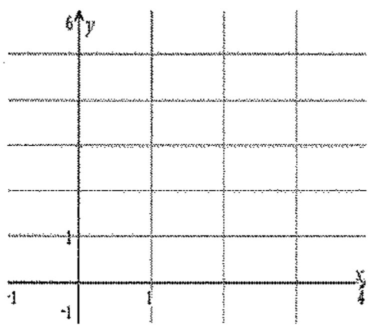
3. $f(x) = x^2 + 2x + 1$ and $g(x) = x + 1$.

4. $f(x) = -x^2 + 4x + 2$ and $g(x) = x + 2$.

Volume by Cross Sectional Areas

For each problem, sketch the region bounded by the graphs of the functions and find the area of the region. <u>Be sure to draw in the representative rectangle</u>. Do not use a calculator for any problem.

1.) Find the volume of the solid whose base is the region bounded between the curve $y = x^2$ and the x-axis from $x = 0$ to $x = 2$ and whose cross sections taken perpendicular to the x-axis are depicted by each of the following shapes.



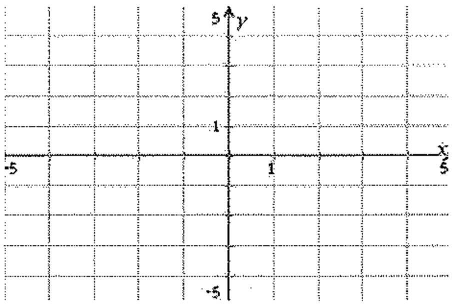
a.) squares

b.) semicircles

c.) rectangles whose heights are 3 times the base width

d.) equilateral triangles

e.) isosceles right triangles where the base is the hypotenuse

2.) Find the volume of the solid whose base is bounded by the circle whose center is the origin, whose radius is 9 and whose cross sections taken perpendicular to the x-axis are depicted by each of the following shapes.	
	**a.)** squares
b.) semicircles	**c.)** rectangles whose heights are twice the base width
d.) equilateral triangles	**e.)** isosceles right triangles where the base is the hypotenuse

5.2 Turn Up the Volume!

SKETCH THE REGION R BOUNDED BY THE GIVEN CURVES AND LINES. THEN FIND THE VOLUME OF THE SOLID GENERATED BY REVOLVING R AROUND THE GIVEN AXIS.

1132. $y = -2/x,\ y = 1,\ y = 2,\ x = 0$; axis: $x = 0$

1133. $y = x^2,\ y = 2 - x^2$; axis: y-axis

1134. $y = \cos x,\ y = \sin x,\ x = 0,\ x = \pi/4$; axis: x-axis

1135. $y = x^2,\ y = 0,\ x = 2$; axis: y-axis

1136. $y = 1/x^2,\ x = e,\ x = e^3,\ y = 0$; axis: x-axis

1137. $y = 1/x^2,\ x = e,\ x = e^3,\ y = 0$; axis: y-axis

1138. $y = 3 - x^2,\ y = -1$; axis: $y = -1$

1139. $x = 1 - y^2,\ x = -3$; axis: $x = -3$

1140. $y = 16x - 4x^2,\ y = 0$; axis: $y = -20$

1141. $y = (x + 3)^3,\ y = 0,\ x = 2$; axis: $y = -1$

SET UP THE INTEGRALS THAT REPRESENT THE VOLUME OF THE SOLID DESCRIBED IN THE FOLLOWING PROBLEMS. THEN USE YOUR CALCULATOR TO EVALUATE THE INTEGRALS.

1142. The region R is bounded by the curve $y = -\frac{1}{2}x^3$ and the lines $y = 4$ and $x = 1$. Find the volume of the solid generated by revolving R about the axis

a) $x = 2$ b) $y = 5$ c) $x = -3$ d) $y = -\frac{3}{2}$

1143. The region R is bounded by the curve $y = \sin x \cos x$ and the x-axis from $x = 0$ to $x = \pi/2$. Find the volume of the solid generated by revolving R about the x-axis.

1144. The region R is bounded by the curve $y = \ln x$ and the lines $y = 0$ and $x = e^3$. Find the volume of the solid generated by revolving R about the y-axis.

1145. The region R is bounded by the curve $y = e^x$ and the lines $y = 2$ and $x = -1$. Find the volume of the solid generated by revolving R about the line $y = e$.

1146. The region R is bounded by the curve $16y^2 + 9x^2 = 144$ and the line $4y = 3x + 12$ in Quadrant II. Find the volume of the solid generated by revolving R about the x-axis.

1147. The arch $y = \sin x,\ 0 \le x \le \pi$, is revolved about the line $y = c$, for $0 \le c \le 1$, to generate a solid. Find the value of c that minimizes the volume of the solid. What is the minimum volume? What value of c in $[0, 1]$ maximizes the volume of the solid?

In the index to the six hundred odd pages of Arnold Toynbee's *A Study of History*, abridged version, the names of Copernicus, Galileo, Descartes and Newton do not occur yet their cosmic quest destroyed the medieval vision of an immutable social order in a walled-in universe and transformed the European landscape, society, culture, habits and general outlook, as thoroughly as if a new species had arisen on this planet. —*Arthur Koestler*