You may *not* use your books or notes on this exam. You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.

- **Mysterious or unsupported answers will not receive full credit**. A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.

- If you need more space, use the back of the pages; clearly indicate when you have done this.

Grade Table (for teacher use only)

Question	Points	Score
1	20	
2	20	
3	20	
4	20	
5	0	
Total:	80	

1. (20 points) Sketch the region enclosed by the given curves. Find its area.

$$y = 12 - x^2 \qquad y = x^2 - 6$$

2. (20 points) Find the volume of a cone with height H and base radius R. (*Hint: rotate an appropriate line around the y axis*)

3. (20 points) Find the volume of the solid obtained by rotating about the y-axis the region bounded by $y - 2x^2 - x^3$ and $y = 0$.

4. (20 points) Find an arc-length function for $y^2 = 4(x+4)^3$ starting at point $(0, \sqrt{32})$. Find the length of the curve from $x = 0$ to $x = 3$.

5. (20 points) Find the solution of the differential equation

$$\frac{dy}{dx} = \frac{ln(x)}{xy}$$

with initial condition $y(1) = 2$.