1. (12 pts) Sketch the region bounded between the curves \( y = x^2 - 5x - 3 \) and \( y = -2x + 7 \). Find the area of that region.

2. Let \( R \) be the region, in the first quadrant, bounded by the curves \( y = 3x^2 \), \( y = -x + 14 \) and by the y-axis. Set up, but do not evaluate, an integral to compute the volume of the solid of revolution generated by revolving the region \( R \) about the indicated axis of rotation:
   a. (10 pts) the y-axis
   b. (10 pts) the line \( y = -3 \)

3. (12 pts) The polar curves \( r^2 = 4 \sin \theta \) and \( r = \sqrt{2} \) have four distinct intersection points. Find polar coordinates for two of the intersections points.

4. (12 pts) Consider the four-petal rose given by \( r = 5 \sin \theta \). Find the area in one of the petals. It may help to know the following:
   \[
   \int \cos^2 u \, du = \frac{1}{2} u + \frac{1}{4} \sin 2u + c \\
   \int \sin^2 u \, du = \frac{1}{2} u - \frac{1}{4} \sin 2u + c
   \]

5. (12 pts) Setup, but do not evaluate, an integral to find the length of the curve \( y = \sqrt{x + 1} \) from \( x = 0 \) to \( x = 3 \).

6. (12 pts) Setup, but do not evaluate, an integral to find the surface area generated by revolving the curve \( y = \sqrt{x} + \frac{1}{x} \) from \( x = 1 \) to \( x = 4 \) about the x-axis.

7. (12 pts) Consider a vertical plate in tank filled with water (density \( \rho = 62.4 \)) – see figure to the right. Calculate the fluid force against the face of the vertical plate.

8. (12 pts) Find the y-coordinate of the centroid of the planar region in the first quadrant bounded by the curves \( y = 1 + 3x \) and \( y = -3x + 7 \) and the y-axis.