1. (2pts) Evaluate the given integral by changing to polar coordinates.
\[ \int \int_{R} ye^{x} dA \]
where \( R \) is the region in the first quadrant enclosed by the circle \( x^2 + y^2 = 25 \).

2. (3pts) Use the polar coordinates to find the volume of the solid bounded by the paraboloid \( z = 10 - 3x^2 - 3y^2 \) and the plane \( z = 4 \).

3. (3pts) Evaluate the iterated integral by converting to polar coordinates.
\[ \int_{0}^{2} \int_{0}^{\sqrt{2x-x^2}} \int_{0}^{\sqrt{y^2 + y^2}} dy \ dx \]

4. (3pts) Describe the region whose area is given by the integral
\[ \int_{0}^{\pi/2} \int_{0}^{\sin 2\theta} r dr d\theta \]
and calculate its area.

5. (4pts) Use polar coordinates to combine the sum
\[ \int_{1/\sqrt{2}}^{x} x y dy dx + \int_{1}^{\sqrt{2}} x y dy dx + \int_{0}^{2} \int_{0}^{\sqrt{1-x^2}} x y dy dx \]
into one double integral. The evaluate the double integral.

6. (2pts) Use the fact that \( \int_{-\infty}^{\infty} e^{-x^2} dx = \sqrt{\pi} \) to evaluate \( \int_{0}^{\infty} x^2 e^{-x^2} dx \).

7. (5pts) Find the (a) center of mass, (b) moments of inertia \( I_x, I_y, \) and \( I_0 \) of a lamina which occupies the part of the disk \( x^2 + y^2 \leq 1 \) in the first quadrant, and the density at any point is proportional to the square of its distance from origin.
\[ [\frac{8}{5\pi}, \frac{8}{5\pi}, \frac{\pi k}{24}, \frac{\pi k}{24}, \frac{\pi k}{12}] \]

8. (Bonus! 3pts) An agricultural sprinkler distributes water in a circular pattern of radius 100 ft. It supplies water to a depth of \( e^{-r} \) feet per hour at a distance of \( r \) feet from the sprinkler. What is the total amount of water supplied per hour to the region inside the the circle of radius \( R \) centered at the sprinkler.
\[ [2\pi(1 - Re^{-R} - e^{-R}) ft^3] \]