Work all problems. SHOW YOUR WORK. Circle your answers. Each problem is worth 10 points max.

YOU CAN GET HELP ON CONCEPTS INVOLVED BUT NOT ON THE PROBLEMS THEMSELVES.

INSTRUCTIONS

1. Compute \( \iint_D (x^2 + y^2)^{3/2} \, dA \) where \( D \) is the region in the first quadrant bounded by lines \( y = 0 \), \( y = (\sqrt{3})x \) and the circle \( x^2 + y^2 = 9 \).
2. Compute \( \iiint_W (x^2 + y^2 + z^2) \, dV \) where \( W \) is the part of the ball of radius 2, centered in the origin, lying inside the cylinder \( x^2 + y^2 = 1 \).
3. Find the surface area of the part of the paraboloid \( z = x^2 + y^2 \) cut off by the plane \( z = 4 \).
4. Compute \( \iiint_W \frac{1}{x^2 + y^2 + z^2} \, dV \) where \( W \) is the solid bounded by spheres of radius 1 and 2, both centered at the origin.
5. Evaluate $\iint_R x^2 \, dA$ where $R$ is the square with vertices $(0, 0)$, $(1, 1)$, $(2, 0)$ and $(1, -1)$. 
6. Find the scaling factor for the change of variables \( x = 2u + 3v + 5, \ y = u - v + 3 \).
7. The surface $S$ is defined parametrically by $x = uv, y = u^2v, z = uv^2$. Find the area element $dS$ of this surface in terms of $u$ and $v$.