1. [20] Find the area of the region enclosed by the curve \( r = \sqrt{\sin \theta} \).
2. [20] Let $D$ be the region in the $uv$ plane bounded by $u = v^2$ and $u = v + 2$. Let $S$ be the surface parameterized by $\mathbf{r}(u,v) = (u + v)\mathbf{i} + (u - v)\mathbf{j} + 2v\mathbf{k}$ for $(u,v)$ in $D$. Find the surface area of $S$. 
3. [40] Let $D$ be the region in the first octant inside the sphere $x^2 + y^2 + z^2 = 16$ and outside the cylinder $x^2 + y^2 = 4$. Suppose $D$ has mass density $\delta(x, y, z) = (x + 2y)z$. Write down, but do not evaluate, integrals giving the total mass of $D$
   a) in rectangular coordinates.
   b) in cylindrical coordinates.
   c) in spherical coordinates.
4. [20] Let \( R \) be the region bounded by the lines \( 2x - y = 1, 2x - y = 2, x = 2y, \) and \( \frac{x - 2y}{2x - y} = \pi/2. \) Find
\[
\int \int_R (2x - y) \sin \left( \frac{x - 2y}{2x - y} \right) dA
\]