1. Let $R = \{(x, y) \mid 1 \leq x \leq 4, 0 \leq y \leq 2\}$, and let

$$f(x, y) = \begin{cases} 
2 & \text{if } 1 \leq x < 3, 0 \leq y \leq 2 \\
3 & \text{if } 3 \leq x \leq 4, 0 \leq y \leq 2.
\end{cases}$$

Find $\int \int_R f(x, y)\,dA$.

2. Find $\int_0^{\pi/2} \int_0^1 x\sin(xy)\,dy\,dx$.

3. Find $\int_0^{\ln 3} \int_0^1 xy e^{xy^2} \,dx\,dy$.

4. Find the volume of the solid in the first octant bounded by $9z = 36 - 9x^2 - 4y^2$ and the coordinate planes.

5. Let $R = \{(x, y) \mid 1 \leq x^2 + y^2 \leq 4\}$. Find $\int \int_R x^2\,dA$.

6. Find $\int \int_R e^{x^2+y^2}\,dA$, where $R$ is the region enclosed by $x^2 + y^2 = 4$.

7. Find $\int_0^1 \int_0^{\sqrt{1-x^2}} (4-x^2-y^2)^{-1/2}\,dy\,dx$.

8. Find the volume of the solid in the first octant bounded by $y = 2x^2$ and $y + 4z = 8$.

9. Find the volume of the solid bounded by the $xy$ plane and $z = 9 - x^2 - y^2$.

10. Find the volume of the solid whose lower bound is $x^2 + y^2 = z$ and whose upper bound is $x^2 + y^2 + z^2 = 12$.  