To receive full credits, write down all steps. No aide besides a scientific calculator is allowed.

1. (1 point) Rewrite the equation \((x - 1)^2 + y^2 = 1\) in polar coordinates.

\[
\begin{align*}
\rho^2 - 2\rho \cos \theta + 1 + y^2 &= 1 \\
\rho^2 - 2\rho \cos \theta &= 0 \\
\rho \left(\rho - 2\cos \theta\right) &= 0 \\
\rho &= 0 \quad \text{or} \\
\rho - 2\cos \theta &= 0.
\end{align*}
\]

2. (4 points). Evaluate the integral \(\int_1^1 \int_0^{\sqrt{1-x^2}} 4(x^2 + y^2) \, dy \, dx\) using polar coordinates.

\[
\begin{align*}
0 \leq y &\leq \sqrt{1-x^2} \\
y^2 &\leq 1-x^2 \\
x^2 + y^2 &\leq 1 \\
0 \leq \theta &\leq \pi
\end{align*}
\]

\[
\int_0^1 \int_0^{\sqrt{1-x^2}} 4(x^2 + y^2) \, dy \, dx = \pi \cdot 4^2 \int_0^1 = \pi.
\]

3. (5 points). Evaluate \(\int \int_R \sin(x^2 + y^2) \, dA\), where \(R\) is the region between circle \(x^2 + y^2 = 4\) and circle \(x^2 + y^2 = 9\) in the upper half plane \(y \geq 0\). (Hint: use polar coordinates.)

\[
\begin{align*}
\int \int_R \sin(x^2 + y^2) \, dA
&= \int_0^\pi \int_2^3 \sin(r^2) \cdot r \, dr \, d\theta \\
&= \int_0^\pi \int_2^3 \sin r^2 \cdot \frac{1}{2} \, dr \, d\theta \\
&= \pi \left[ \frac{1}{2} \cos r^2 \right]_2^3 \\
&= \frac{\pi}{2} (-\cos 9 + \cos 4)
\end{align*}
\]