Problem 1 (40%). Consider the surface \( S \): \( z^2 + 2y = 3 \) with \( 0 \leq x \leq 1 \). Calculate \( \iint_{S}(x^2 + y^2) \, dy \, dz \).

**Answer:** \( S \) is perpendicular to the yz-plane. Therefore, \( \iint_{S}(x^2 + y^2) \, dy \, dz = 0 \).

Problem 2 (60%). Let \( C \) be the curve that is the intersection of the following two surfaces:

\[
\begin{align*}
x^2 + y^2 + z^2 &= 9 \\
z &= 0.
\end{align*}
\]

Orient \( C \) so that it passes points \((3, 0, 0), (0, 3, 0), (-3, 0, 0)\) in this order. Calculate \( \int_{C} 2y \, dx + 3x \, dy - z^2 \, dz \). (Hint: apply Stokes’ Theorem on a properly chosen surface.)

**Answer:** Let \( S \) be the circle enclosed by \( C \), oriented with its upper side taken. Introduce

\[
\begin{align*}
f_1 &= 2y \\
f_2 &= 3x \\
f_3 &= -z^2.
\end{align*}
\]

Hence:

\[
\begin{align*}
\frac{\partial f_3}{\partial y} - \frac{\partial f_2}{\partial z} &= 0 \\
\frac{\partial f_1}{\partial z} - \frac{\partial f_3}{\partial x} &= 0 \\
\frac{\partial f_2}{\partial x} - \frac{\partial f_1}{\partial y} &= 1
\end{align*}
\]

By Stokes Theorem, we have:

\[
\int_{C} 2y \, dx + 3x \, dy - z^2 \, dz = \iint_{S} 1 \, dx \, dy = 9\pi.
\]