Special Problem 2-5.12

Consider the vector field \( \mathbf{A}(\mathbf{r}) = \nabla (\rho^2 z) \), and contours \( C_a \) and \( C_b \):

Contour \( C_a \) starts at the \textit{origin} and \textit{ends} at point \( P_1 \), whereas contour \( C_b \) \textit{starts} at point \( P_1 \) and \textit{ends} at point \( P_2 \).

The location of point \( P_2 \) is denoted by the \textit{position vector}:

\[
\mathbf{r}_2 = 2 \hat{a}_y + 3 \hat{a}_z.
\]

If:

\[
\int_{C_a} \mathbf{A}(\mathbf{r}) \cdot d\mathbf{l} = 5
\]

then find the value of integral:

\[
\int_{C_b} \mathbf{A}(\mathbf{r}) \cdot d\mathbf{l}
\]