1. Give a definition of the vector space.

2. Consider the vector space $V \simeq \mathbb{R}^n$.

   Dual vector space V^* to V is defined as the space of all linear functions $f : V \to \mathbb{R}$.

   - Prove that V^* is a vector space,
   - Find dimension of V^*.

3. Give a definition of

   - differential 1-form
   - differential of a scalar field

4. Consider the following differential forms:

$$dx + dy, \quad x\,dy + dx, \quad \frac{x}{y^2}dy - \frac{dx}{y} \tag{1}$$

   - Which of these forms are differentials of a scalar field?
   - Find the corresponding scalar field (if it exists)
   - Integrate all three forms along a) a straight line from $\{x, y\} = \{0, 0\}$ to $\{x, y\} = \{1, 1\}$ b) a path consisting of two straight lines that connect points $\{x, y\} = \{0, 0\}$, $\{x, y\} = \{1, 0\}$, $\{x, y\} = \{1, 1\}$.