1. Find the minimum and maximum values of the function
   \[ f = (x - 1)^2 + (y - 1)^2 \]
on the unit disc \( x^2 + y^2 \leq 1 \).

2. Calculate \( \int_0^1 \int_{x^{2/3}}^1 x \cos(y^4) dy \, dx \).

3. Calculate \( \int_0^1 \int_0^{\sqrt{1-y^2}} (x^2 + y^2)^{2003} \, dx \, dy \).

4. Find the area of the region enclosed by the curve
   \[ x^2 + xy + y^2 = 1 \]
   Hint: use the substitution
   \[ x = u + v\sqrt{3}, \quad y = u - v\sqrt{3} \]

5. Let \( C \) be a plane curve starting at \((0,0)\) and ending at \((1,1)\). Let
   \[ \mathbf{F} = \langle x^2 + y, y^2 + x \rangle \].
   (a) Show that \( \int_C \mathbf{F} \cdot d\mathbf{r} \) has the same value for every \( C \) as above.
   (b) Compute \( \int_C \mathbf{F} \cdot d\mathbf{r} \) for a curve \( C \) as above.

6. Calculate \( \int_C \mathbf{F} \cdot d\mathbf{r} \), where \( C \) is the unit circle oriented counterclockwise, and \( \mathbf{F} \) is the following vector field in the plane:
   \[ \mathbf{F} = \langle -y^3 + \sin(\sin x), x^3 + \sin(\sin y) \rangle \].