1. Suppose I give you the linear transformations

\[ S(x, y) = (x + y, y, 2x - y) \]
\[ T(x, y) = (x + y, 2x - 3y) \]

(a) Write both \( S \) and \( T \) in matrix form.

(b) Compute \( S \circ T \).

(c) Compute \( T \circ S \).

(d) Compute \( T^{-1} \).

(e) Compute \( T \circ T^{-1} \) and \( T^{-1} \circ T \). Try and explain your answer.
2. Sketch the level curves of the function for \( c = -2, -1, 0, 1, 2 \)

\[
f(x, y) = x^2 - 2y^2 \quad \quad \quad f(x, y) = -x^2 - y^2
\]

Identify each contour plot.

(a) \( c(x, y) = x^2 + y^2 \)

(b) \( f(x, y) = \sqrt{x^2 + y^2} \)

(c) \( g(x, y) = -x^2 - y^2 \)

(d) \( h(x, y) = 5x^2 + y^2 \)