1. Consider the linear transformation

\[ T(x) = (2x_1 - 3x_2, x_1 - x_2) \]

(a) Find the matrix \( A \) of this transformation. If it is invertible find the inverse matrix \( A^{-1} \).

(b) Draw the image of the parallelogram with vertices \((1,1), (1,2), (3,2), (3,3)\) under the linear transformation \( T \) and find the area of the image. Explain.

2. Find the symmetric matrix that represents the quadratic form

\[ q(x) = x^2 + 4y^2 + 9z^2 - 2xy - 2xz \]

and determine if this quadratic form is positive definite, negative definite, indefinite or none of these.
3. (a) Find the domain of the following function and make a sketch of it

\[ f(x, y) = \left( \frac{2xy}{x^4 - y^2}, \sqrt{\ln(x^2 + y^2)} \right) \]

(c) Is this function continuous at points of its domain? Explain.

4. Use the Chain Rule to find the derivative of \( g \circ f \) at the point \( a = (1, 1) \)

\[ g = (\sin(xy), x^2y), \quad f = (x + y, x - y) \]
5. Suppose that the pressure in space is given by the function
\[ P(x, y, z) = e^{x+y+z^2} \]
and let \( \mathbf{x}(t) = (t^2 - t, t - 1, t^3 - 1) \) be a parametrization for a path. Find the rate of change in pressure along the path when \( t = 1 \)
\[ \frac{d}{dt} P(\mathbf{x}(t)) = \]