1. (8pts) Find the equation of line passing through (0, 2, 1) and (2, 7, 0).

2. (8pts) Find the projection of \( \mathbf{v} = (2, 1, -3) \) onto \( \mathbf{u} = (-1, 1, 1) \).
3. (8pts) Find an equation for the plane passing through $(0, 0, 0)$, $(2, 0, -1)$, and $(0, 4, -3)$.

4. (8pts) Express the plane $y = x$ in (a) cylindrical and (b) spherical coordinates.
5. (8pts) In $\mathbb{R}^n$, show that

$$\|x - y\| \cdot \|x + y\| \leq \|x\|^2 + \|y\|^2.$$ 

(hint: it is equivalent to prove that $\|x - y\|^2 \cdot \|x + y\|^2 \leq (\|x\|^2 + \|y\|^2)^2$.)

6. (8pts) Sketch the level curves and graphs of the function

$$f : \mathbb{R}^2 \to \mathbb{R}, \ (x, y) \mapsto x^2 + 4y^2.$$
7. (10pts) Compute the following limits, if they exist:

\[ (a) \quad \lim_{(x,y)\to(0,0)} \frac{(x+y)^2 - (x-y)^2}{xy}; \quad (b) \quad \lim_{(x,y)\to(0,0)} \sqrt{\frac{x+y}{|x-y|}}. \]

8. (8pts) Show that the unit disk \( D_1(0,0) = \{(x,y) \mid \sqrt{x^2+y^2} < 1\} \) of the plane is open.
9. (8pts) Can \( \frac{xy}{x^2 + y^2} \) be made continuous by suitably defining it at \((0, 0)\)?

10. (10pts) (a) Find the tangent plane to the hyperboloid \( x^2 + y^2 - z^2 = 1 \) at \((1, 2, 2)\).
(b) Find the tangent plane to the surface \( z = x^3 + y^2 + 2 \) at \((1, 1, 4)\).
11. (8pts) Suppose that a particle following the path, \( \mathbf{c}(t) = (e^t, e^{-t}, \cos t) \), flies off on a tangent at \( t = 1 \). Compute the position of the particle at the time \( t = 2 \).

12. (8pts) Let \( f(u, v) = (\sin(u - 1) - e^v, u^2 - v^2) \) and \( g(x, y) = (e^{x-y}, x - y) \). Calculate \( f \circ g \) and \( \mathbf{D}(f \circ g)(1, 1) \).