1. Suppose $z = f(x, y)$ is a two-variable function and let $z_0 \in \mathbb{R}$ be a constant value in the range of the function f.

   a. What is the definition of the contour curve $C_{z_0}(f)$?

   b. What is the definition of the level curve $L_{z_0}(f)$?

   c. Describe are the similarities and differences between $L_{z_0}(f)$ and $C_{z_0}(f)$?

   d. Describe how level curves are related to contour curves?

2. Find the domain and range of the function $f(x, y) = \sqrt{80 - 5x^2 - 5y^2}$

3. Graph several level curves of the function $z = x^2 + \dfrac{y^2}{9}$.

4. Identify the trace of the surface $\dfrac{x^2}{6} + 24y^2 + \dfrac{z^2}{24} - 6 = 0$ in the plane $y = 0$.

5. Consider the function
$$z = x^2 + y^2 - 16.$$

   find a parametric equation to the tangent line of the level curve $L_0(f)$ at the point $\left(-2\sqrt{2}, -2\sqrt{2}\right)$. Then, graph this level curve and its tangent line.

6. Use a scalar projection to show that the distance from point $P(x_1, y_1)$ to line $ax + by + c = 0$ is
$$\frac{|ax_1 + by_1 + c|}{\sqrt{a^2 + b^2}}.$$

   Draw a diagram and explain your reasoning in detail using full sentences.