Written Homework

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Problem 1 *Consider the function*

$$f(x, y, z) = \frac{4}{\sqrt{9 - x^2 - y^2 - z^2}}.$$

(a) *What is the domain of f? Describe this domain as a region in $\mathbb{R}^3$.*

(b) *What is the range of f?*

Problem 2 *Consider the function*

$$f(x) = x^2 + y^2 - 4.$$

(a) *Draw at least five level curves of f.*

(b) *Use these level curves to sketch the graph of f.*

Problem 3 *Draw the graph of the surface in $\mathbb{R}^3$ determined by the equation*

$$x = y^2/4 - z^2/9.$$

Use level curves and/or sections to justify why your drawing is correct.

Professional Problem

Problem 4 (a) *Consider the function $g : \mathbb{R}^3 \to \mathbb{R}$ given by*

$$g(x, y, z) = x^2 + y^2.$$

Draw at least three level surfaces of g, which will be surface in $\mathbb{R}^3$. What do you notice about these level surfaces?

Learning outcomes:
Author(s):

(b) *Suppose you have a function $g : \mathbb{R}^3 \to \mathbb{R}$, such that g depends on x and y, but does not depend on z. What can you say about the level surfaces of g?*

(c) *Suppose you have a function $g : \mathbb{R}^3 \to \mathbb{R}$, such that g depends on y and z, but does not depend on x. What can you say about the level surfaces of g?*

(d) *Suppose you have a function $g : \mathbb{R}^3 \to \mathbb{R}$, such that g depends on x, but does not depend on y or z. What can you say about the level surfaces of g?*