

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 $g : \mathbb{R}^3 \rightarrow \mathbb{R}$ 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):

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