You are taking "Exam (Timed, No Correctness Feedback)" as a timed exam. Show more

End My Exam 44:48:30

Previous Next

4. Equations of lines and planes

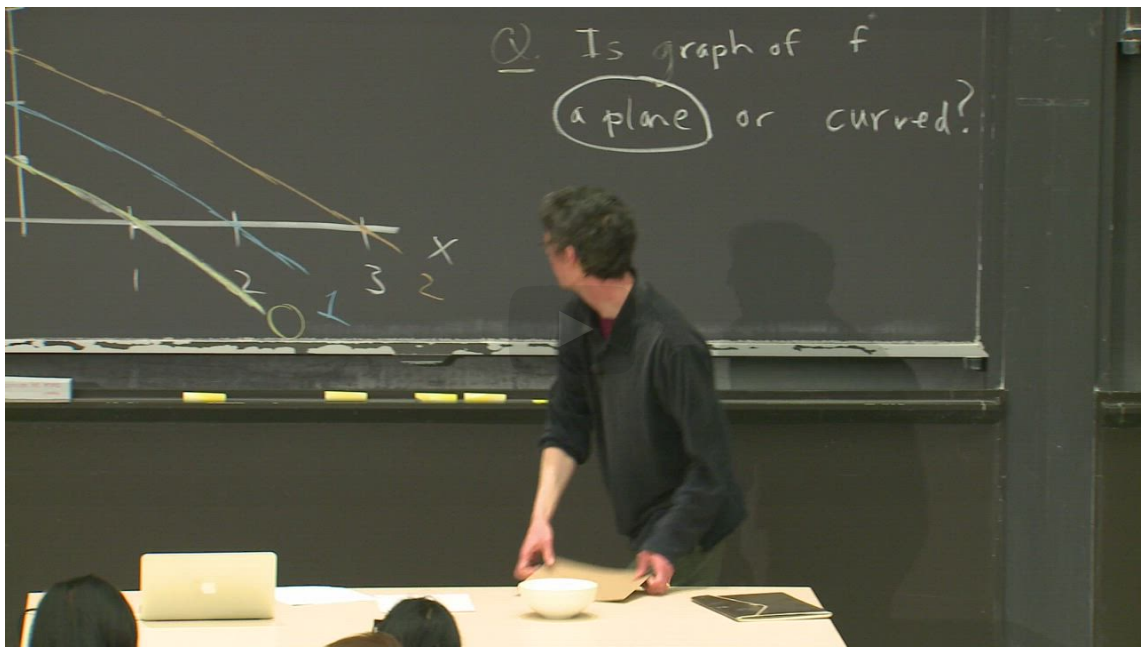
Bookmark this page

Calculator Hide Notes

Lecture due Aug 4, 2021 20:30 IST Completed

Explore

Illustration of a plane



0:00 / 0:00 2.0x

Start of transcript. Skip to the end.

PROFESSOR: And I'm going to try to illustrate it for you.

So I brought a plane with me today that we'll use sometimes.

So what does this look like?

Here we have height 0, so I'll put the cardboard

flush to the blackboard.

And over here we have height 1, and over there we

have height 2.

Video
Download video file

Transcripts
Download SubRip (.srt) file
Download Text (.txt) file

Let's explore why it makes sense for an equation of the type $z = ax + by + c$ to be a plane. To do this, we will look at the level curves, and think about what this means in terms of the geometry of the function graphed in 3 dimensions.

1 variable	$y = ax + b$	line
2 variables	$z = ax + by + c$	plane

Why is $z = ax + by + c$ the equation for a plane?

Set z to different heights and look at the level curves!

- Set $z = c$, get the line $0 = ax + by$
- Set $z = 1 + c$, get the line $1 = ax + by$
- Set $z = -1 + c$, get the line $-1 = ax + by$

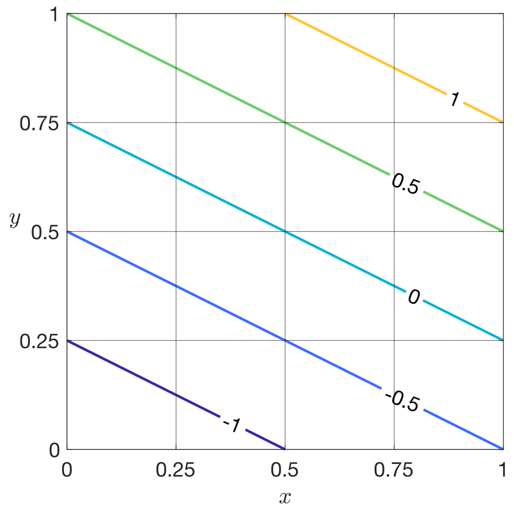
We see that the level curves of this function are parallel lines that are **equally spaced** . Thus this must be a plane.

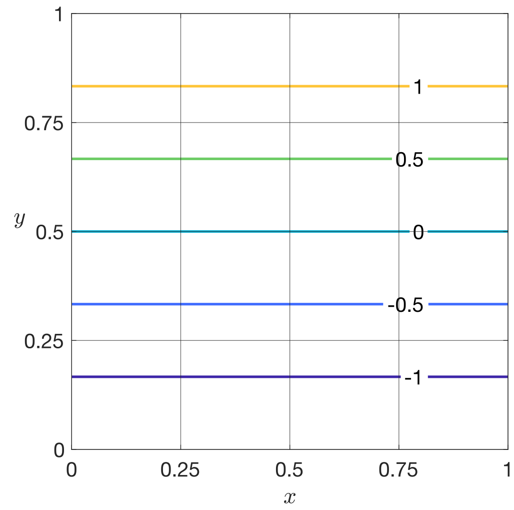
Observations

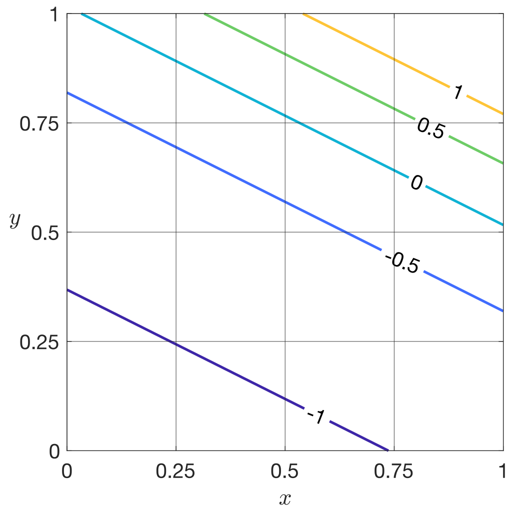
2/2 points (graded)
The following images of level curves depict a level curve of heights -1, -0.5, 0, 0.5, [illegible] the level curves of a plane?

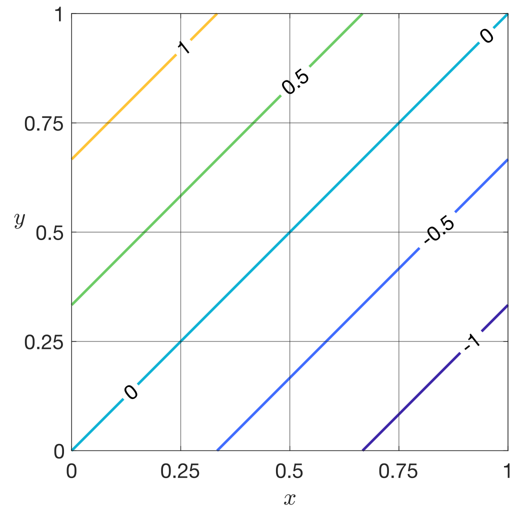
Calculator Hide Notes

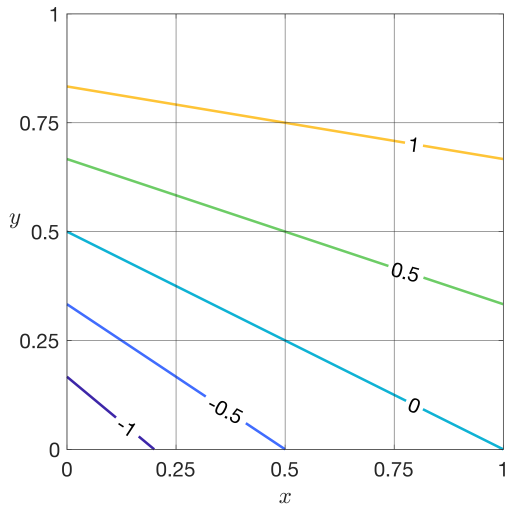
(Choose all that apply, each column is graded separately.)

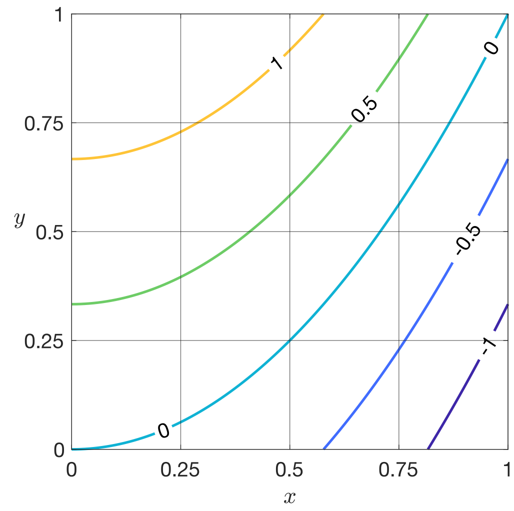
- [x] 

- [x] 

- [ ] 

- [x] 

- [ ] 

- [ ] 

✔ ✔

Solution:

A level curve for a plane $z = ax + by + c$ of height h satisfies the equation

$$h - c = ax + by,$$

which is the equation for a line with slope $-a/b$. Thus in particular, the level curves must all be lines, and they must all be lines of the same slope. This eliminates the options whose level curves are not lines, or are lines that do not have the same slope.

Note that horizontal lines are possible (set $a = 0$ in the equation for the plane); vertical lines are possible (set $b = 0$).

The y-intercept is given by $(h - c)/b$. Therefore if you look at level curves at height 0, 1, and 2, the y-intercepts are $-c/b$, $-c/b + 1/b$, and $-c/b + 2/b$. Thus the y-intercepts must also be equidistant. This eliminates all of the choices where the level curves have equidistant heights, but the level curves do not have equidistant y-intercepts.

Calculator Hide Notes

Submit You have used 3 of 5 attempts

Answers are displayed within the problem

4. Equations of lines and planes

Topic: Unit 1: Functions of two variables / 4. Equations of lines and planes

Hide Discussion

Add a Post

Show all posts by recent activity

? Why parallel, equally spaced level lines imply a plane? 3
So, I was thinking about how to justify formally the above assertion. The idea is that only in a planar surface you can have parallel, e...

STAFF 2
The following images of level curves depict a level curve of height -1,0,1,2 The heights in the text do not match the figures which act...

possible small typo... 2
I think the slope for the plane's level curve should be -a/b, as opposed to a/b

? STAFF -- z values for the level curves 2

Previous Next

Calculator Hide Notes

Sitemap

Connect

Blog
Contact Us
Help Center
Media Kit
Donate

GET IT ON Google play
Download on the App Store

Calculator
Hide Notes