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3. Multivariable functions of time

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Problem Set B due Aug 4, 2021 20:30 IST Completed



Explore

Let us consider a new multivariable function $f(x, t) = \sin(x - t)$.

Like the functions $f(x, y)$, this is a function of two variables. The only difference here is that we are now thinking of the function as being a function of a position x and a time t .

We can still think about the level curves of this function.

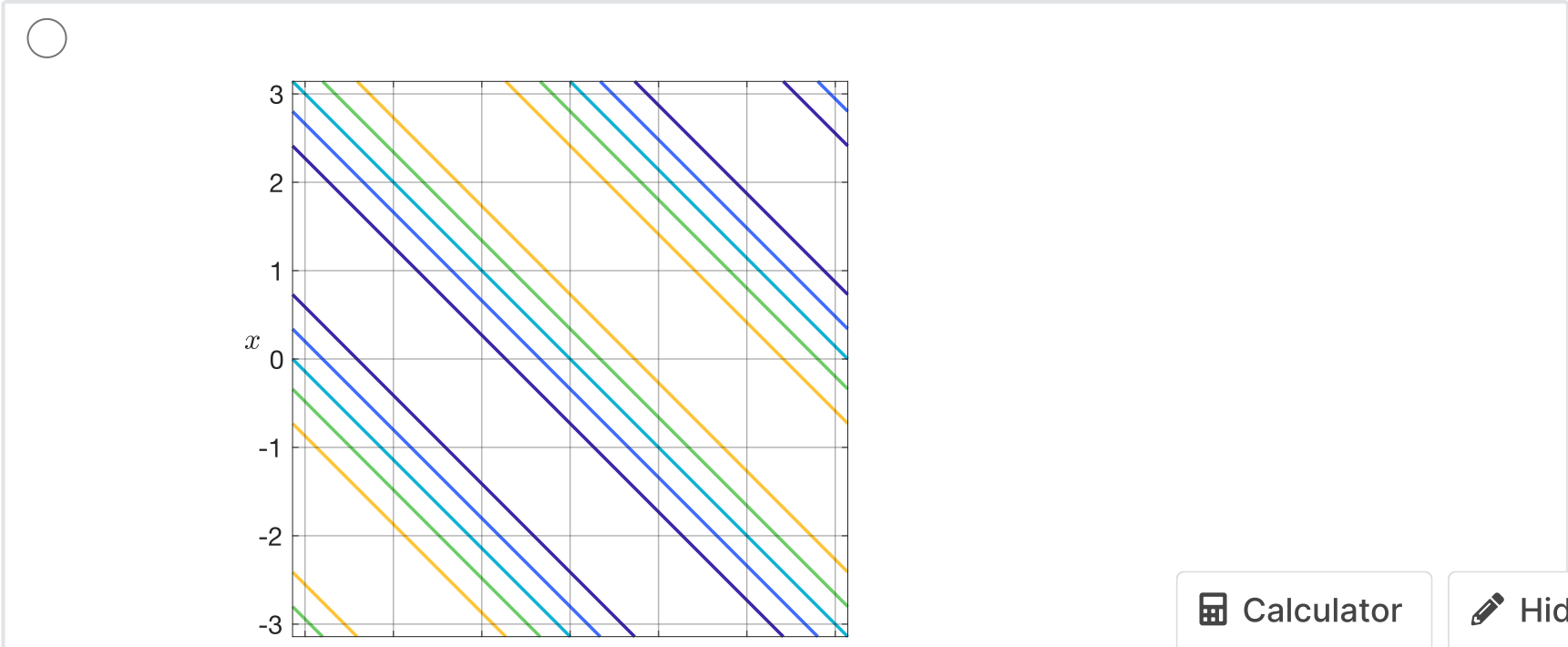
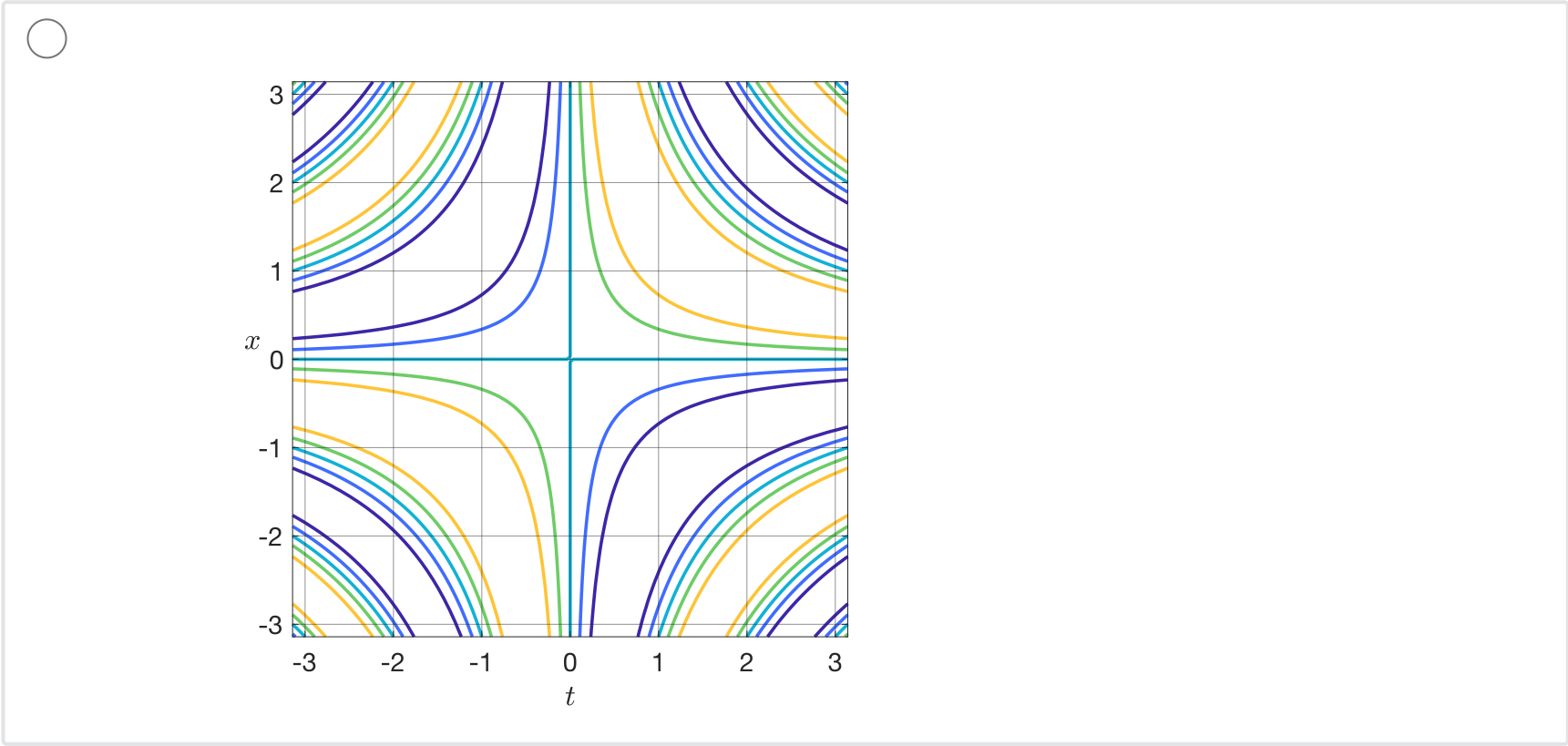
But how should we interpret this function as a function of time? And how is this time perspective related to level curves?

A first example

1/1 point (graded)
Identify the level curves of the function

$$f(x, t) = \sin(x - t)$$

Use the convention that the x axis is the vertical axis, and the t axis is the horizontal axis.

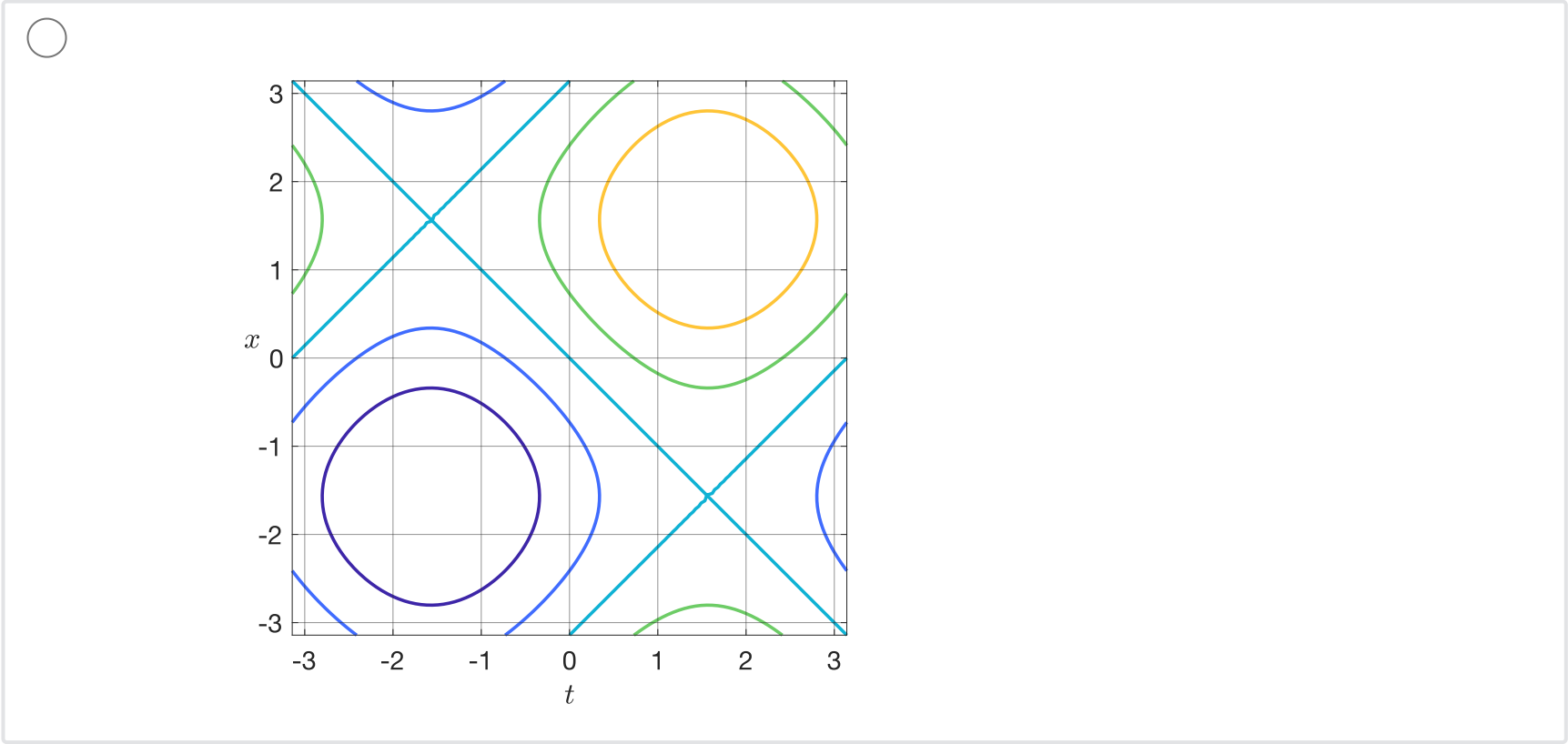
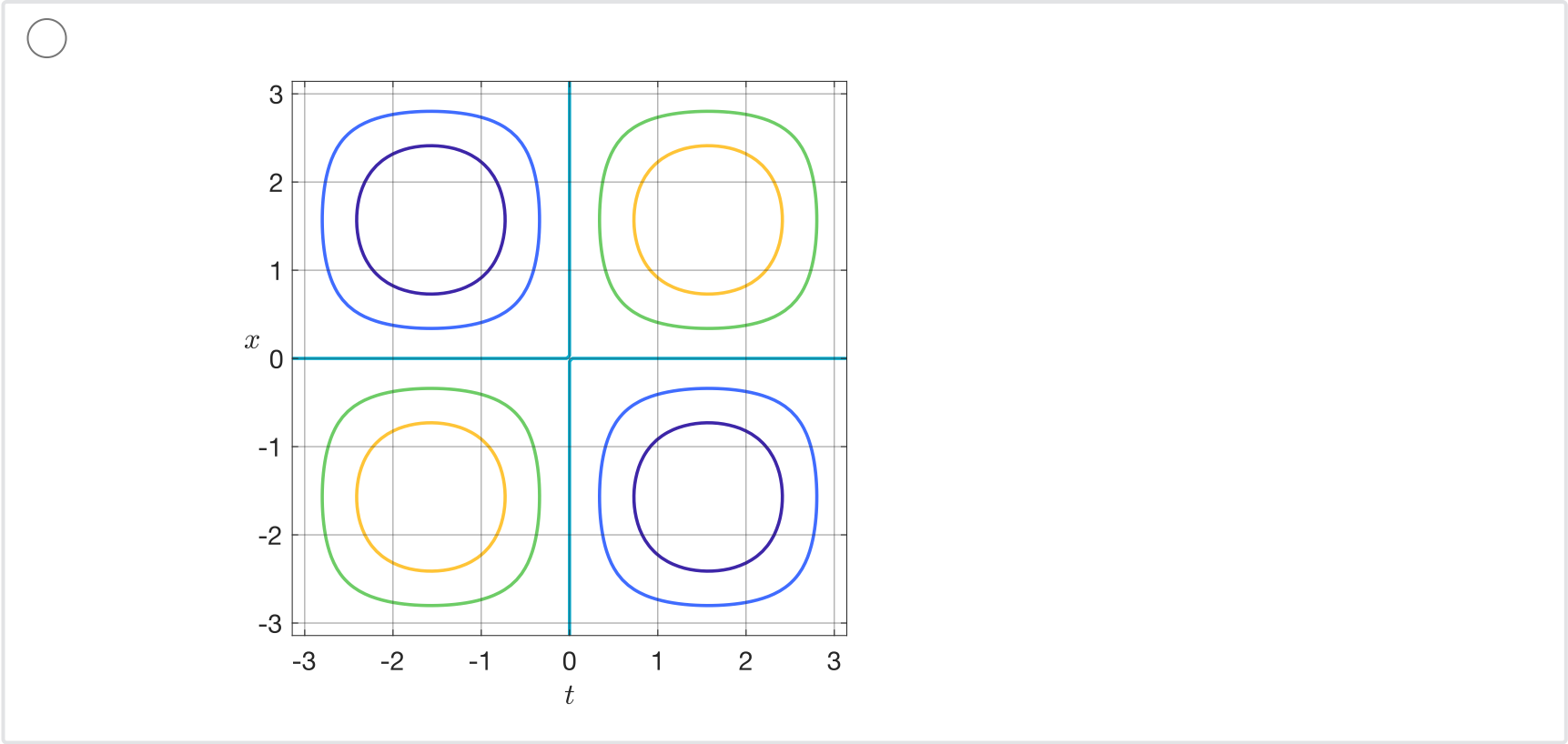
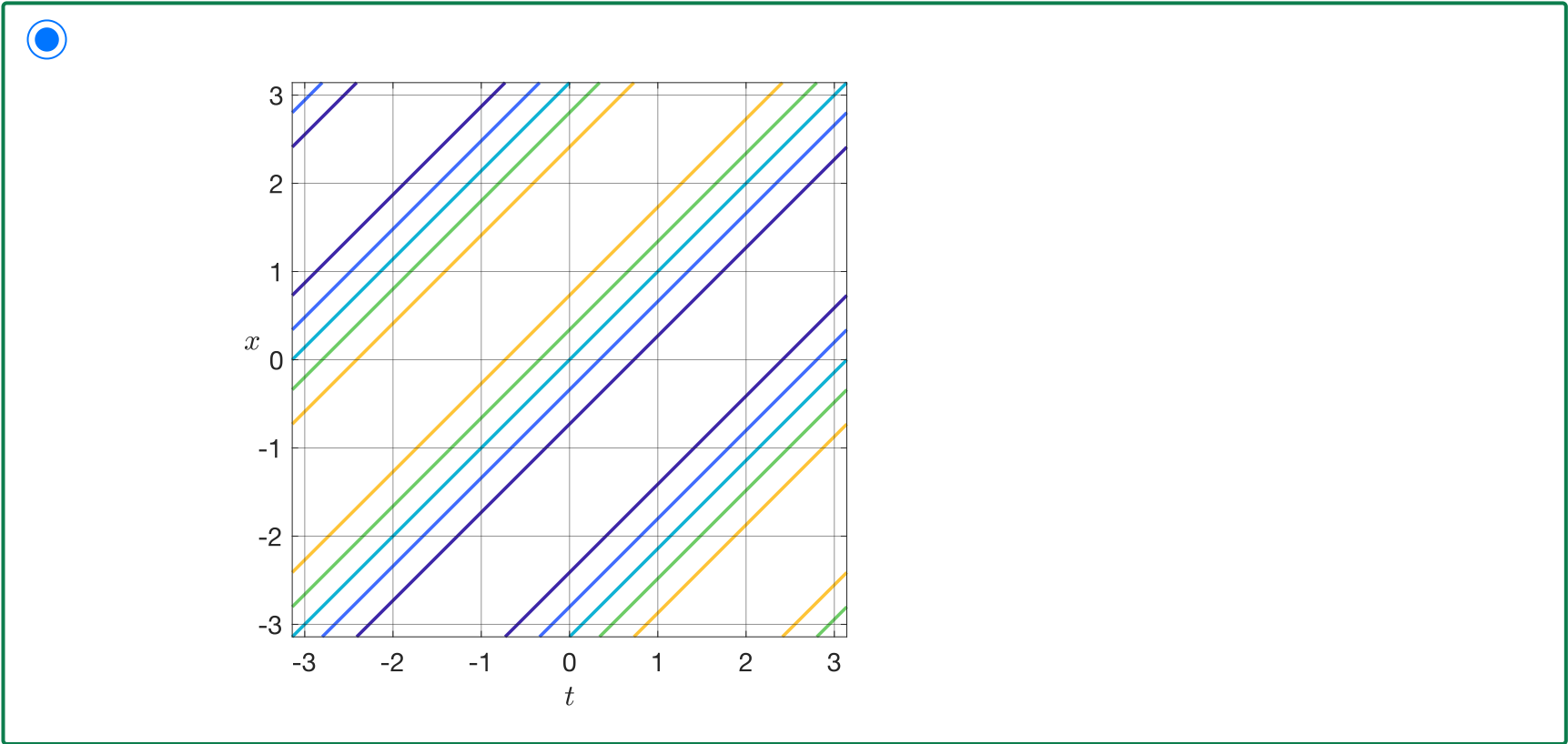


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t



Solution:

To understand the level curves, it is helpful to look at specific levels and understand what is happening.

First let us consider the level curve $\sin(x - t) = 0$ Note that this happens when $x - t$ is an integer multiple of π . Therefore the level curves for $\sin(x - t) = 0$ is a collection of lines

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$$\{t = -\pi k + x | k \text{ an integer}\}$$

Note that these lines are all parallel to each other, with intercepts along the t axis differing by integer values of π .

If instead we consider the level curves $\sin(x - t) = 1$, we find that $x - t = \pi/2 + 2\pi k$, where k is an integer. Therefore the level curves are

$$\{t = -\pi/2 - 2\pi k + x | k \text{ an integer}\}$$

The level curves $\sin(x - t) = -1$, we find that $x - t = -\pi/2 + 2\pi k$, where k is an integer. Therefore the level curves are

$$\{t = \pi/2 - 2\pi k + x | k \text{ an integer}\}$$

Extrapolating to any level curve, we see that the level curves are all lines of slope **1** thus the correct choice is the third option.

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You have used 1 of 3 attempts

i Answers are displayed within the problem

3. Multivariable functions of time

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Topic: Unit 1: Functions of two variables / 3. Multivariable functions of time

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Notes on method and solution (mostly restating).	1
axis typo? The directions say that x should be the vertical axis, but the diagram seems to have it as the horizontal axis.	3
a new multivariable function of time The presentation on dimensions makes me wonder about this new function. The argument of sine is supposed to be a pure number....	3
Wave equation	1

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