MITx 18.02.1x
Multivariable Calculus 1: Vectors and Derivatives

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4. Thinking in terms of time

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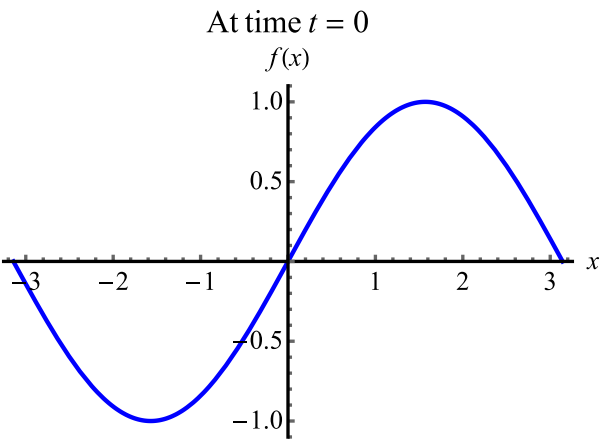
Problem Set B due Aug 4, 2021 20:30 IST   Completed

Synthesize

We continue to explore the function $f(x, t) = \sin(x - t)$.

Another way to think about this function is to think about fixing the value of t. For any fixed value of t_0, the single-variable function $f(x, t_0) = \sin(x - t_0)$ is a sine function shifted to the right by t_0.
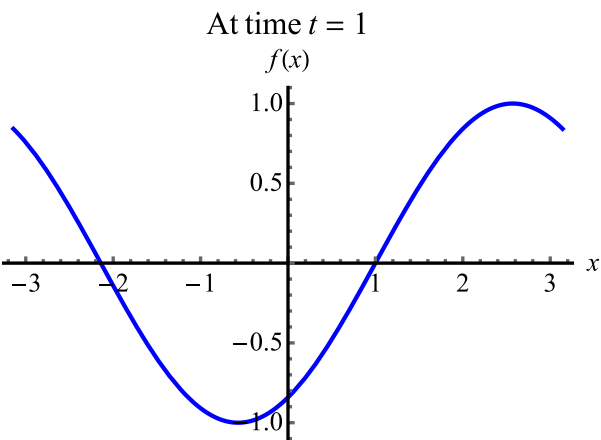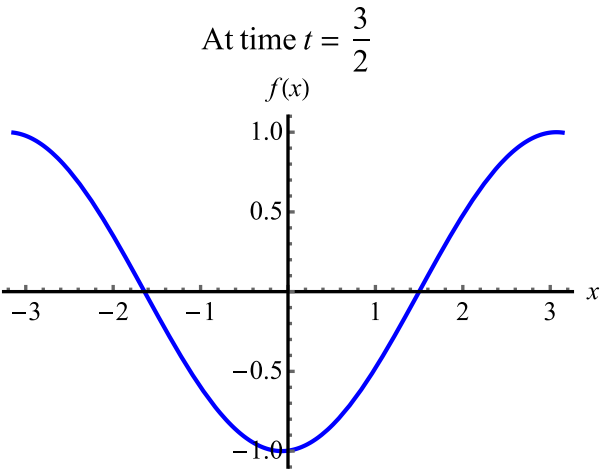
At $t = 0$, we have the function $f(x, 0) = \sin(x)$.

At time $t = 0$

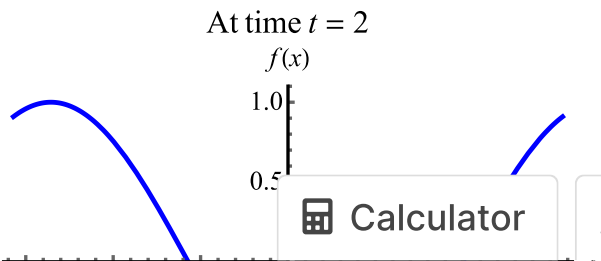At $t = 1/2$, we have the function $f(x, 1/2) = \sin(x - 1/2)$.

At time $t = \dfrac{1}{2}$
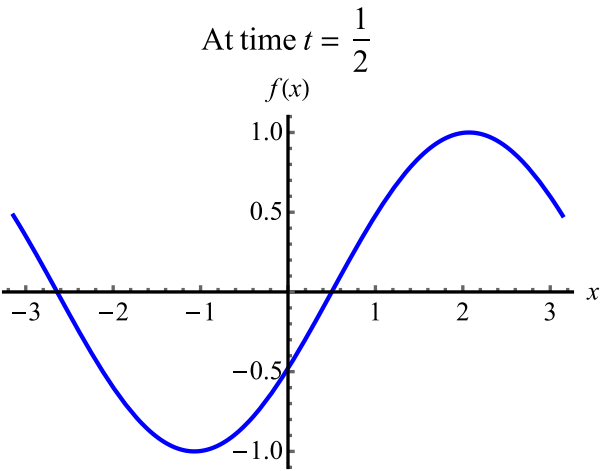
At $t = 1$, we have the function $f(x, 1) = \sin(x - 1)$.

At time $t = 1$

At $t = 3/2$, we have the function $f(x, 3/2) = \sin(x - 3/2)$.

At time $t = \dfrac{3}{2}$

At $t = 2$, we have the function $f(x, 2) = \sin(x - 2)$.

At time $t = 2$

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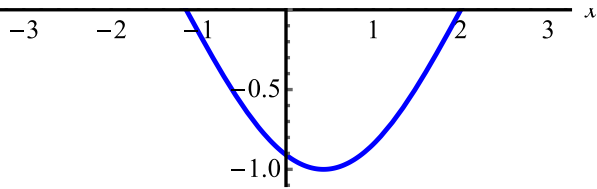
To understand this function as both a function of x and t, we need one snapshot of the function $f(x, t)$ for each time t. Putting these in order, what we end up with is a function that changes in time, or an animation of a function over time.

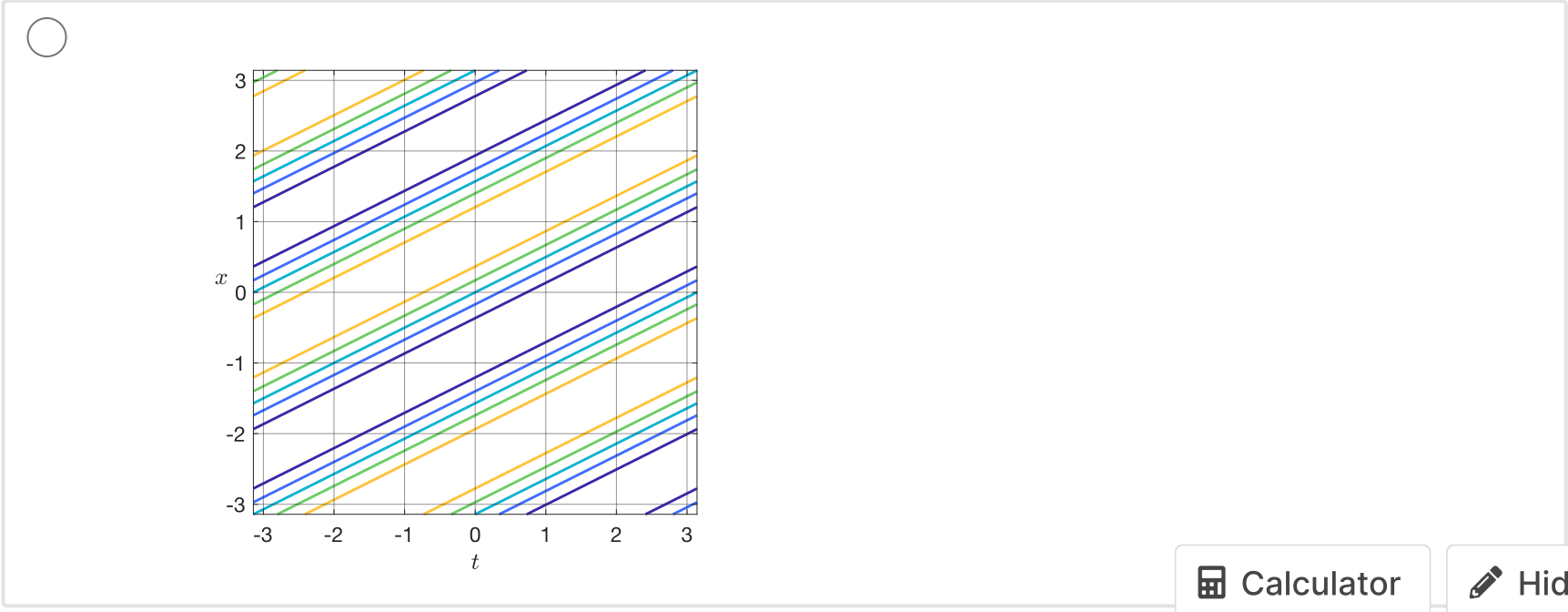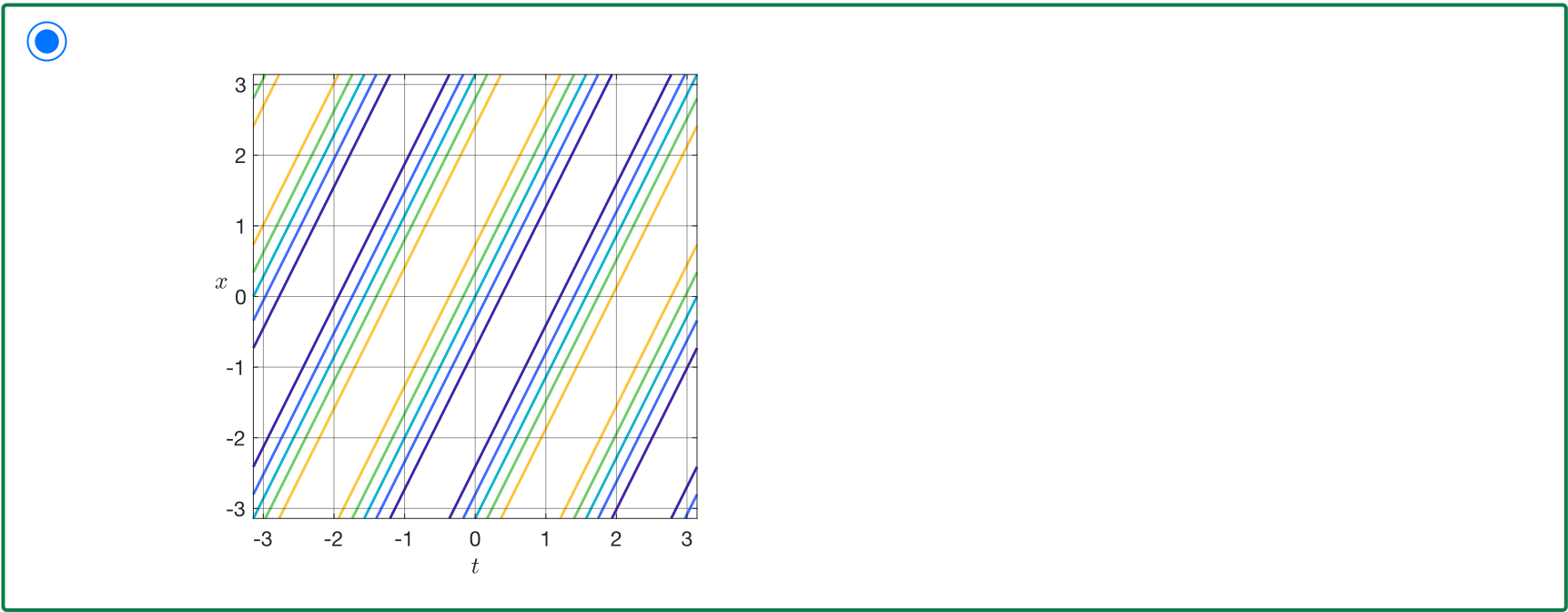In this case, we observe a sine function that appears to travel to the right over time.
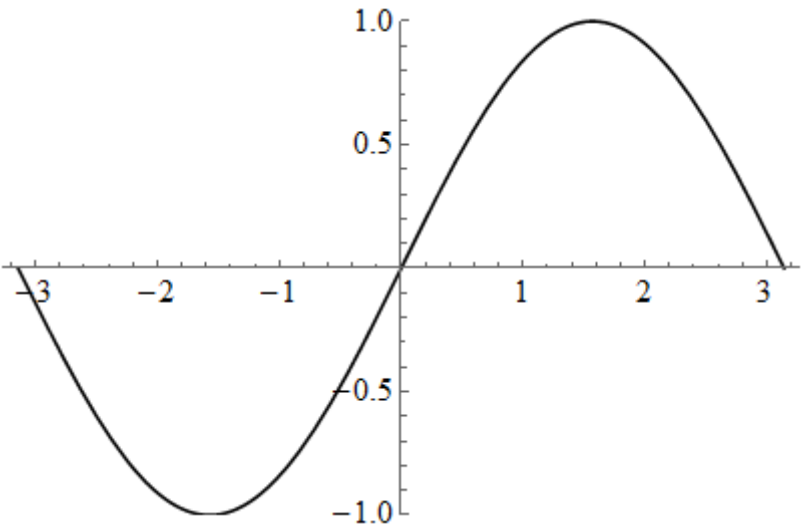
Definition 4.1 A function of the form $\sin(ax - bt)$ is called a **traveling wave**.

Connection to level curves

1/1 point (graded)
The following two graphics are level curves of traveling waves. Which of the traveling waves is traveling faster?

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✔

Solution:

The faster a traveling wave is moving, the further it will move in the x direction over a similar time t. The slope of a level curves gives the change in x over the change in time t. So a level curve with the greater slope corresponds to a traveling wave that is moving faster.

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ⓘ Answers are displayed within the problem

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4. Thinking in terms of time

Topic: Unit 1: Functions of two variables / 4. Thinking in terms of time

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| ? | Distance between level curves as measure of speed. | 2 |
| | The solution says that the slope of the level curve corresponds to the speed of the travelling wave. Why is this the solution instead o… | |

| 💬 | Another typo? | 2 |

| ? | [staff] typos | 4 |

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