Module 7 Overview Document

Table 1: Timeline of Tasks in the Module

Timeline of tasks in the Module	Day 0	Homework	7.1 Introduction to the Sine Graph Desmos Task
	Day 1	20 min	7.1 Discussion Optional: Extend the Discussion: Task Design
		35 min	7.2 Launching a Technology-Mediated Math Task
		20 min	7.3 Noticing Student-Teacher Interactions
		Homework	7.4 Monitoring Student Thinking: Introduction to the Sine Function
	Day 2	15 min	7.4 Discussion
		20 min	7.5 Noticing Student Thinking about Amplitude
		40 min	7.6 Noticing Student Thinking about Period
	Day 3	40 min	7.7 Designing a Sequence of Tasks (optional project)

7.4 Facilitation Notes

The purpose of this task is to consider the importance anticipating student thinking and planning for assessing and advancing questions in monitoring small group work. Ms. Fye created a monitoring chart based on what she anticipated students' responses to the various prompts in the task. Within her monitoring chart she also included questions she might pose to assess and advance student thinking related to her anticipations. The video clip that this task is designed around shows Ms. Fye monitoring the small group interactions as they work on the Introduction to the Sine Graph Desmos task. Since this lesson occurred remotely, we have a clear view of Ms. Fye's interactions with each group and she moved from one breakout room to the next.

Ms. Fye's Task Planning Guide

Note: The monitoring chart is at the end of the task planning guide.

We recommend this task be completed outside of class and then discussed in class as the video clip is quite long (18 minutes). You might also recommend teachers watch the video on 1.5 speed. The students and teacher in the video speak slow enough that listening at this speed is not a problem. In addition, if you have access to video annotation software (e.g., GoReact, VideoAnt), you might have teachers view the video in the annotation software and tag moments they notice and wonder about prior to responding to the prompts in this task.

Depending on how much time you have and which tasks you have already completed, you might consider having teachers anticipate student thinking on this task prior to reading through Ms. Fye's plans.

Prior to completing this task, it is important that teachers are familiar with the practice of monitoring. Smith and Stein (2011) describe monitoring student responses as "paying close attention to students' mathematical thinking and solution strategies as they work on the task." (page 9). Thomas et al. (2015) describe how monitoring is connected to noticing student thinking noting that "Teachers monitor the work of the students by giving attention to and interpreting their written work, their math talk, and their interaction with manipulatives and multiple representations. These interpretations provide deeper insight into students' thinking" (p. 240). (Note: Thomas et al.'s (2015) connection between noticing and the 5 practices is discussed in Module 1.)

When teachers gather to discuss this task, for Q1 and Q2 we recommend comparing what they noticed Ms. Fye said and did compared to what she planned for in her planning guide. They will often note how similar her questions were as she moved from group to group and how planning for monitoring supported her in the moment decisions about how to respond to each group of students - including how she might use the technology to support them in their sensemaking.

When discussing Q3 we recommend first displaying the learning goals and discussing what you would be looking for and listening for to determine if students had met each goal. It is important to push on how much evidence is needed to make such a determination. For example, for the goal "Given a sine function equation, students will be able to determine the amplitude, period, and midline without graphing." Is it enough to see that students answered the prompt on page 9 correctly? If not, what else would you like to see/hear in order to decide if the learning goal was met. (If you use the language of "learning goal" vs. "performance goal" this is an example of a performance goal. It might be helpful to discuss how this is related to first goal, which is a learning goal.).

7.4 Sample Responses
Monitoring Student Thinking: Introduction to the Sine Function

Context

Ms. Fye is using the Introduction to the Sine Graph Desmos Task in a remote synchronous class session. There are eight students present for the lesson.

Ms. Fye's learning goals for the task are listed below.

- Students will recognize the connection between the structure of a sine function equation (i.e., $y = a\sin(bx) + k$) and its related graph with respect to amplitude, midline, and period. Specifically,
    - Amplitude is $|a|$
    - Midline is $y = k$
    - Period is $\frac{360}{|b|}$

Specific performance goals include:

- Given a sine function equation, students will determine the amplitude, period, and midline without graphing.
- Given the amplitude, midline, and period, students will determine the function equation.
- Given the graph of a sine function, students will determine the amplitude, period, and midline.
- Given the graph of a sine function, students will determine the function equation.

Ms. Fye's plans for implementing this task are linked here for your reference.

In the following video clip, Ms. Fye is monitoring the students as they work on the Introduction to the Sine Graph Desmos task. Ms. Fye intends for students to work collaboratively in their small groups, and to develop an understanding of amplitude, midline, and period as they do so. She moves among the breakout rooms and works to assess and advance the students' thinking about amplitude, midline, and period as they are represented in the function equation and the graph of the function.

Watch Ms. Fye Monitoring Small Group Work

As you watch the video take note of the questions Ms. Fye asks and the ways in which she and the students seem to be using the technology. (Note: Most of the students are not sharing their screens, but they do talk about what they are doing with the technology.)

Q1. What questions and/or types of questions does Ms. Fye ask consistently as she moves from room to room?

Teacher responses typically include the following:

- She consistently asks students if they can prove it to themselves.
- She always involved both students and asks both assessing and advancing questions.

- She is asking the questions she planned on her monitoring chart (or very similar to them) - both the assessing and advancing questions.
- She always started by asking assessing questions and then moved to advancing questions. Advancing questions were usually similar to "can you prove it to yourself" or what if questions like, "so if my slider was set to 5 what would you expect your amplitude to be".

Q2. What role does the technology play in the students' work to determine the relationship between the sliders and how to determine amplitude, midline, and period?

Teacher responses typically include the following:

- It is sometimes difficult to tell because they are not sharing their screens. It is helpful when Ms. Fye shares her screen to facilitate their discussion. It is notable that when she does that, though she is driving, the students are telling her what to do. Exceptions are when she clicks on certain points so their labels show.
- The technology is where students are testing their conjectures. They test different values and see if the function attribute behaves as they expected. That is sometimes prompted by Ms. Fye making a suggestion to test and other times the students talk about what they tested unprompted.
- They use the technology to play (as Ms. Fye called it) and test their conjectures.

One of the benefits of using a Desmos task is that you have access to students' thinking through what they record in the task in real time as well. You may have noticed Ms. Fye referencing what the students had written or where they were in the task in the video clip above. She knew this because she was watching the dashboard as she moved around the class.

Q3. Here is a link to the teacher dashboard as it looked at the end of Ms. Fye's class. Given what you have seen as Ms. Fye monitored her students' as they worked and what you see in the dashboard, how confident do you think Ms. Fye is that the students have met each of her learning and performance goals? Explain.

Ms. Fye's Teacher Dashboard

Goal 1

Students will explain the connection between the structure of a sine function equation (i.e., $y = a\sin(bx) + k$) and its related graph with respect to amplitude, midline, and period. Specifically,

- Amplitude is $|a|$
- Midline is $y = k$
- Period is $\frac{360}{|b|}$

Teacher responses typically include the following:

- From the video it appears that most students have mastered this goal, especially related to amplitude and midline. More were having difficulty with period. Looking at page 8 of the dashboard it seems that most students have connected b to the period, but not all could explain how b and the period were related (how to use b to determine the period). But when I look at pages 9, 10, and 11 I see evidence that all students have figured this out.
- There is evidence from the video and dashboard that all students can explain the connection between the sliders (parameters) and the function with respect to amplitude and midline. I'm not convinced about period though.
- Yes they have met this goal. The video and dashboard prove it.

Goal 2

Given a sine function equation, students will determine the amplitude, period, and midline without graphing.
Teacher responses typically include the following:

- All of the students answered page 9 correctly so this goal has been met.
- I think so, but there is at least one student that did not explain how they found the period on page 9 so it is possible they created a graph and subtracted rather than working strictly from the equation as the prompt suggested. Jayla said "90 as period length" which makes me wonder if subtracted, but I see on page 10 that they found the period by dividing 360 by b so I'm more convinced that they all have met this goal.
- Yes, but I couldn't tell just from page 9 I had to look at 10 and 11 too.

Goal 3

Given the amplitude, midline, and period, students will determine the function equation.
Teacher responses typically include the following:

- Everyone got page 10 right which is where a question like this was asked, so yes.
- It appears that all students can do this. I actually wonder how answering this question and checking it using the graph might have helped students who might have been struggling on page 9 go back and refine their answers there.
- I couldn't really tell about this one from the video, but from the dashboard it appears as if this goal has been met but I would like to see more evidence than just one question prompt that suggest to me they can all do it (page 10).

Goal 4

Given the graph of a sine function, students will determine the amplitude, period, and midline.
Teacher responses typically include the following:

- From the video when the students were working to make sense of the definition and the relationship with the sliders it seemed as if most understood how to determine amplitude and midline from a graph. Period was more difficult, but most were getting there. From the dashboard (pages 11, 12, 13,

14) it appears all students have figured out how to determine all 3 from a graph.

- Yes, this goal has been met. I can see that on pages 11 and 13. I wish they had explained how they knew though because then I'd be even more convinced.
- The students all answered 11 and 13 correctly so yes.

Goal 5

Given the graph of a sine function, students will determine the function equation.
Teacher responses typically include the following:

- Yes, this goal has been met. We can see that on pages 12 and 14, but I don't know if they knew or did it by trial and error.
- I think this goal has been met, I see that they can determine what amplitude, midline, and period are from a graph on page 11 and 13. Some students go ahead and write the equations there as well. On page 12 and 14 I see that they can go from graph to equation. Without page 11 and 13 though I am not sure I would have enough evidence to say for sure because they might not have done it by using an understanding of the relationships between amplitude, midline, and period and the structure of the function. They might have played with numbers until they got it right.
- This is a lot harder, but I think most have met this goal from what I see on 11 - 14. I'd be more convinced if they explained to me how they found the equations on 12 and 14.