[Module 1 Overview Document]

Table 1: Timeline of Tasks in the Module

Timeline of tasks in the Module	Day 1	75 Minutes	1.1 Comparing and Contrasting Tasks and Technology with a Focus on Digital Equity Read: McCulloch, A. W., Lovett, J. N., Dick, L. K., & Cayton, C. (2021). Positioning each and every student as a mathematical explorer with technology. *Mathematics Teacher: Learning and Teaching PK-12: Special Issue on Digital Equity and the Digital Divide, 114*(10), 738–749.
		Homework	1.2 Noticing Student Thinking: Quadratic Functions - Making Sense of "h"
	Day 2	30 Minutes	1.3 Introduction to Noticing Students' Mathematical Thinking in a Technology-Mediated Learning Environment
		Homework	Read: Dick, L. K., McCulloch, A. W., & Lovett, J. N. (2021). When students use technology tools, what are you noticing? *Mathematics Teacher: Learning and Teaching PK-12, 114*(4), 272–283.

1.1 Facilitation Notes

Create a class code for the Desmos Tasks and provide the link to your teachers. We recommend asking teachers to log in so that the task will appear in their history, and they can revisit it at any time. In addition, they must be logged in to receive any feedback you provide.

[Task 1: Introduction to Vertical Asymptotes]

[Task 2: Introduction to Vertical Asymptotes]

The purpose of this task is to clearly layout both the types of technologies and technology-mediated learning environments that are the focus of our collection of modules, but also to situate this work in the context of digital equity. Specifically, we focus on the ways teachers can select and implement tasks that use mathematics action technologies to either position students as powerful doers of mathematics (as described by McCulloch et al., 2021), or in ways that perpetuate the existing inequities that exist in many mathematics classrooms (e.g., only using technology to practice

procedures, or as remediation). This task should be completed prior to reading McCulloch et al. (2021) Positioning Students to Explore Math with Technology.

McCulloch et al. (2021) Positioning Students to Explore Math with Technology

This task is intended to be a first experience in a course – or unit within a course – on teaching with technology. By comparing and contrasting technology enhanced tasks the hope is to not only start a discussion about equity, but also to support teachers who have not had prior experiences with technology develop a vision of high-quality instruction and task selection when using mathematics specific technologies.

Before launching this task we recommend an introductory discussion. Ask teachers what they think is important to consider when deciding whether or not to include a technology-enhanced task in a lesson and what they might look for when selecting a technology-enhanced task for a lesson. Record these ideas publicly so they can be revisited later.

Teachers can complete this task either independently or in pairs, but we recommend that you do not stop and discuss until after they have had a chance to engage with both tasks and have considered their similarities and differences.

After they have completed the first two questions on 1.1 Comparing and Contrasting Tasks + Technology with a Focus on Digital Equity, as a whole class discuss the similarities and differences between the two tasks as a whole class. Highlight that while they are focused on the same content, the ways they support students in developing understanding is different. Both tasks provide a definition of vertical asymptote and ask students to make sense of where they occur and why. For Task 1, teachers often notice that the task is not that different from reading a textbook and answering prompts along the way. In contrast, teachers should notice that Task 2 provides opportunities for students to explore the structure of the rational function using sliders and make conjectures about how the structure relates to the graph and any asymptotes. While Task 1 has some “cool/interactive” aspects (i.e., a card sort, drawing on a graph), none are related to actually interacting with the mathematical object. The whole class discussion should set the stage nicely for the need to think critically about the types of technology-enhanced tasks we select. At this point, we suggest collecting ideas regarding the two tasks, so you can revisit them later in the discussion.

After the whole class discussion on Q1 and Q2, we recommend teachers read and discuss McCulloch et al. (2021) Positioning Students to Explore Math with Technology (we suggest you unpack the videos with respect to the ways the authors suggest math action technologies can support all students as mathematical explorers). When discussing the article, you might pose the following questions:

- How are Math Action technologies different from conveyance technologies?
- This article was part of a special issue on Digital Equity. What aspect of digital equity are the authors of this article focused on?

- In the instructional triangle (Figure 1), what do the sides of the triangle represent? Why does technology not have its own vertex?
- In the section with examples you might want to focus on the first and third example as they align best with these Modules (but all three are great). The first is the same task teachers engaged in for 1.1 Comparing and Contrasting Tasks and Technology with a Focus on Digital Equity. The third example emphasizes the ways that students can use the technology to support their communication with each other and teachers as the students in the video do not speak the same language.

Note: The video clips in the article have been included in this Module so you can access them easily with your teachers.

Video 1

Video 2

Video 3

After reading and discussing the article, return to 1.1 Comparing and Contrasting Tasks and Technology with a Focus on Digital Equity and complete Q3 either in small groups or as a class.

1.1 Sample Responses
Comparing and Contrasting Tasks and Technology

Q1. Compare and contrast the two tasks and note at least 3 ways the tasks are the same.

- Both tasks focus on students learning about vertical asymptotes of rational functions
- Both tasks use Desmos for students to learn about vertical asymptotes.
- Both tasks provide a definition of vertical asymptotes.
- Both tasks ask students what they notice or to make a conjecture about the location of vertical asymptotes in rational functions.
- Both tasks ask students to look at multiple examples with zero, one, or two vertical asymptotes.

Q2. Compare and contrast the two tasks and note at least 3 ways the tasks are different.

- Task 2 allows students to move sliders and create their own examples. Task 1 has specific examples for students to explore.
- Task 1 has students sketch the vertical asymptotes. Task 2 has them already drawn.
- Task 1 has a card sort to allow students to demonstrate their understanding of vertical asymptotes.
- Task 2 begins with building off of previous knowledge of domain, but Task 1 does not. It just begins by providing a definition.
- Task 2 focuses more on the different number of vertical asymptotes for various rational functions and specifically focuses students' attention on this to ask why.

Q3. Reflect on the tasks with respect to the prompts in the chart below.

Table 2: Task Reflection Table

	Task 1	Task 2
In what ways does the task allow all students to access the problem?	A definition is provided, but then students have to understand it to answer the questions. So if they don't understand, access is limited.	There is a way for every student to explore and get started.
In what ways does the task support communication?	Students have to explain their answers. If they are working with a partner they can talk about how they determined the answers.	Students have to explain their answers and if they are working with a partner they can show each other what they notice when they explore using the sliders.
In what ways does the task support students in developing informal and powerful mathematical ideas?	I'm not sure, it seems to jump to expect pretty formal understanding.	Students can explore and test their ideas using the sliders so when they are unsure they can still move forward and continue to revise their thinking as they do.