Lesson 2, Parabola Unit
Instructor Notes

Preparation:
- If you plan to do Activity 1 (see Item 1 of the Lesson below), then bring the toolbox from Lesson 1 and make it available to groups as they work and print copies of Activity 1.
- Print copies of Activity 2 to distribute to groups.

Lesson

1. **Activity 1: Review & Extend (Optional)**

- The goal of this activity is to allow groups a chance to solidify a solution to the Construct-a-Parabola Task from Lesson 1. This is a challenging task and often takes math majors more than one class period to find a satisfying approach. If a group did reach a method during the Lesson 1 class, then they can explore a second method.
- Whether or not you use this activity depends upon how far groups got on the Construct-a-Parabola Task in Lesson 1) and whether or not you assigned Homework 1.
- Distribute the Activity 1 worksheets to class members.
- You can set up the activity by using Slide 3 of the class Powerpoint.
- Circulate and identify any new approaches or ideas that you'd like to highlight for the whole class. For those instances, ask groups to select a presenter from the group. Ask presenters to justify each step of their presentation by explaining their thinking behind each action.

2. **Activity 2: Discussing the Videos of Sasha and Keoni**

- The goal of this activity is to introduce pre-service teachers to the thinking of high school students on the Construct-a-Parabola Task. There are opportunities for pre-service teachers to practice analyzing student thinking and to see that high school students are capable of persisting and solving challenging math problems.
- Distribute the Activity 2 worksheets to class members.
- Follow Slides 6 – 26 of the Class PowerPoint. Note the following:

  o **Slide 11.** The video should start as soon as you advance the slide. If the video does not work for some reason, it can be viewed from the Project MathTalk website ([www.mathtalk.org)](www.mathtalk.org); see top of slide for the Lesson

Number, Episode Number, and time stamps). On the website, you can also select whether you want to view the video with captions or without. The PowerPoint slides use the captioned versions.

- **Slide 12.** Sample responses:

  - They started off with just a focus and 2 points, and no directrix
  - Didn't follow the definition initially
  - Once they had to include the directrix, they weren't sure what to do
  - They may have interpreted the phrase "set of points" in the definition as "a pair of points."
  - They may be thinking of the directrix as the line of symmetry

- **Slide 13.** Sample responses:

  - At the end they concluded that it wasn't a parabola. If you connect their 2 points that fit the definition it would be a line
  - Keoni seemed to realize that the focus doesn't need to be on the directrix; hopefully that will lead to him understanding that it CAN'T be on the directrix

- **Slide 14.** The goal of this slide is to summarize another conceptual challenge faced by the students in the video, namely how to measure the distance from a point to a line. This may be a challenge that your pre-service teachers faced in Lesson 1 when they worked on the Construct-a-Parabola Task.

- **Slide 17.** Sample responses:

  - They were able to place the focus away the directrix
  - They then placed the midpoint between the focus and the directrix.
  - The midpoint worked! It fit the definition. The midpoint is the same distance to the focus as it is to the directrix.

- **Slide 20.** Sample responses:

  - Keoni didn't understand that you need to measure the shortest distance from a point to line
  - Keoni was trying to justify that the second point he drew was the same distance to the directrix as it was to the focus

- He also seemed to still be making sense of the meaning of the definition

o **Slide 21.** Sample responses:

- He might have realized that you need to measure the shortest distance from a point to the directrix
- He seemed to figure out that the points are symmetric – what you have on the right is mirrored to what you have on the left
- Keoni seems to now have a better understanding of the definition of a parabola. He talks clearly about the distance from a point to the focus being 3 inches and the distance from that point to the directrix is also 3 inches.

o **Slide 24.** Sample response:

First, Sasha and Keoni drew a line parallel to the directrix that was also 2 inches away from the directrix. That means every point on the new line is 2 inches from the directrix. Then Sasha put one end of her ruler on the focus and swung it around until it was 2 inches from the focus and placed her point at the intersection with the dashed line. That gave her a point that was 2 inches from the focus but also 2 inches from the directrix.

o **Slide 25.** Responses will vary depending on how your class members solved the Construct-a-Parabola Task. If the idea of using a compass to create circles of a particular radius has not emerged yet, you can ask, "Can anyone think of a tool we can use instead of swinging a ruler from the focus—Is there another tool besides the ruler that allows you to find all the points that are 2 inches from the focus?"

o **Slide 26.** Sample responses:

- Perseverance
- They let each other make mistakes
- Keoni tested Sasha's idea
- Built off each other's ideas – collaborated

3. **Homework 2**

- The goal of Homework 2 is to provide the opportunity for every class member to present a viable solution to the Construct-a-Parabola Task in a way that is polished and accessible for high school students to read and follow.
- You may want to highlight the specific requirements in Homework 2 by using Slides 27-29 of the class PowerPoint.