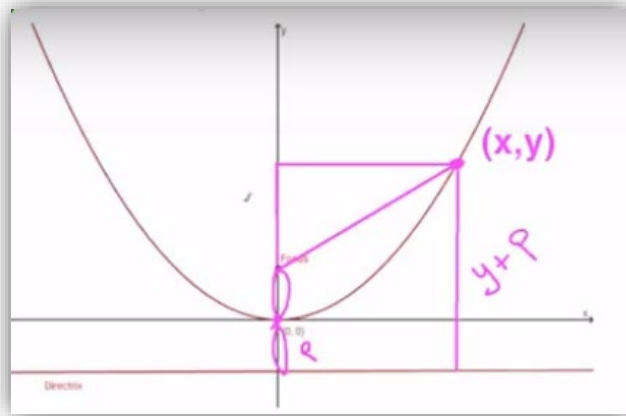
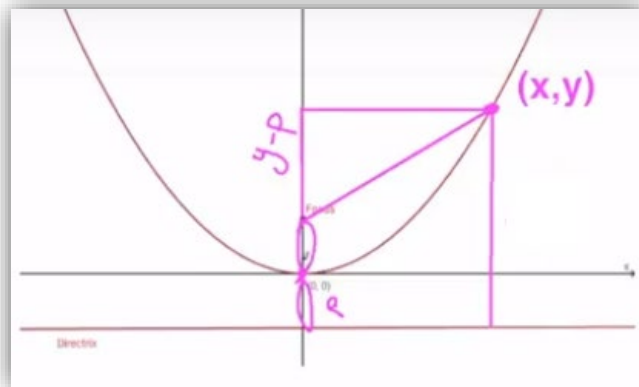


## Homework 4

1. For this question, you will need to view a MathTalk video:
- Go to [www.mathtalk.org](http://www.mathtalk.org)
  - Select Students. Select Parabolas. Select Lesson 5.
  - **Optional:** Select Episode 5 and watch them make a prediction that the equation for a general parabola with vertex at the origin will be  $y = \frac{x^2}{4p}$ .
  - **Required:** Select Episode 6. Watch all of Episode 6, which is an 8 minute video. Then answer all parts of Questions 1 below.
- a. When Sasha writes  $y + p$  (as shown below), describe the distances that are represented by:
- $y$
  - $p$
  - $y + p$  (as a whole or entity)



- b. Similarly for  $y - p$  (as shown below), describe the distances that are represented by
- $y$
  - $p$
  - $y - p$  (as a whole or entity)



## Homework 4

- c. Why do you think Sasha and Keoni were able to write these (correct) algebraic expressions so quickly (which is not easy for students, since they are working only with algebraic letters and no numbers)? You may want to think back to the videos you viewed for Homework 3 and in class.
- d. What does  $y = \frac{x^2}{4p}$  represent?
- e. If  $p = 5$ :
- What will the focus of the parabola be?
  - What will the directrix be?
  - What are two points on the parabola and how do you know?

### 2-3. Sasha and Keoni Explain a Relationship between $p$ and the Shape of the Parabola

For Questions 2 and 3 below, you will need to view additional MathTalk videos.

- Go to [www.mathtalk.org](http://www.mathtalk.org)
- Select Students. Select Parabolas. Select Lesson 7.
- For the episodes to watch, see the table below.

Sasha and Keoni created three different explanations for why, as they put it, “As  $p$  increases the parabola gets wider; as  $p$  decreases the parabola gets skinnier.” The first explanation uses points on the parabolas with the same  $x$ -value. The second explanation relies on points with the same  $y$ -value. The last explanation relies on what they call “special points,” which are the points horizontally aligned with the focus. You will be watching the videos related to their first and third explanations. For each of their explanations, Sasha and Keoni refer to a set points that they discovered in a previous video. For this assignment, we’ll just view their explanations from Lesson 7 (but optionally, you are most welcome to watch any part of the videos from Project MathTalk’s Lesson 6).

Sasha & Keoni’s Explanations	View these Episodes	Then Answer:
Relies on points with the same $x$ -value	Lesson 7, Episodes 2 & 3 (about 9 minutes long)	Questions 2a and 2b
Relies on “special points,” which are points horizontally aligned with the focus	Lesson 7, Episodes 5 & 6 (about 12 minutes long)	Questions 3a and 3b

## Homework 4

- 2a. In your own words, **explain why** as  $p$  increases the parabola gets wider, by building on Sasha and Keoni's argument from Lesson 7, Episode 2. You will need to **include a graph** with 3 parabolas and the points labeled on each for some fixed  $x$ -value. You can use Sasha and Keoni's parabolas and points or choose other ones. Provide a 1-paragraph argument that connects with your graph; be sure to refer to particular points on the graph in your argument.

*Note: All of the arguments for 2a, 2b, 3a, and 3b should build on Sasha and Keoni's ideas but be better elaborated and articulated.*

- 2b. In your own words, **explain why** as  $p$  increases the parabola gets wider, by building on Sasha and Keoni's argument from Lesson 7, Episode 3. This explanation uses the equation  $y = \frac{x^2}{4p}$  and the fixed  $x$ -value from Question 2a.
- 3a. In your own words, **explain why** as  $p$  increases the parabola gets wider, by relying on Sasha and Keoni's argument from Lesson 7, Episode 5. You will need to **include a graph** with 3 parabolas and the "special points" labeled on each parabola. You can use Sasha and Keoni's parabolas and points or choose other ones. Provide a 1-paragraph explanation that connects with your graph.
- 3b. In your own words, **explain why** as  $p$  increases the parabola gets wider, by relying on Sasha and Keoni's arguments from Lesson 7, Episode 6. First explain why a "special point" can be represented by  $(2p, p)$ . **Include a graphical representation**. Then use this representation in your explanation.

**NOTE:** For Questions 2a and 3a, you can draw your own graphs by hand, use a program like Desmos to create graphs, or print the graphs (with points labeled) that Sasha and Keoni worked with. These can be found by clicking on the button "Download Math Task," which appears beneath the video window of the episode you viewed.