8.4 Directing Our Focus

A Develop Understanding Task

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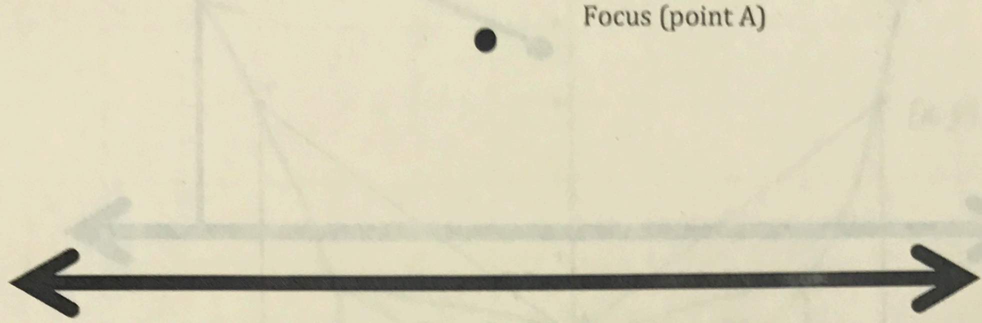
On a board in your classroom, your teacher has set up a point and a line like this:



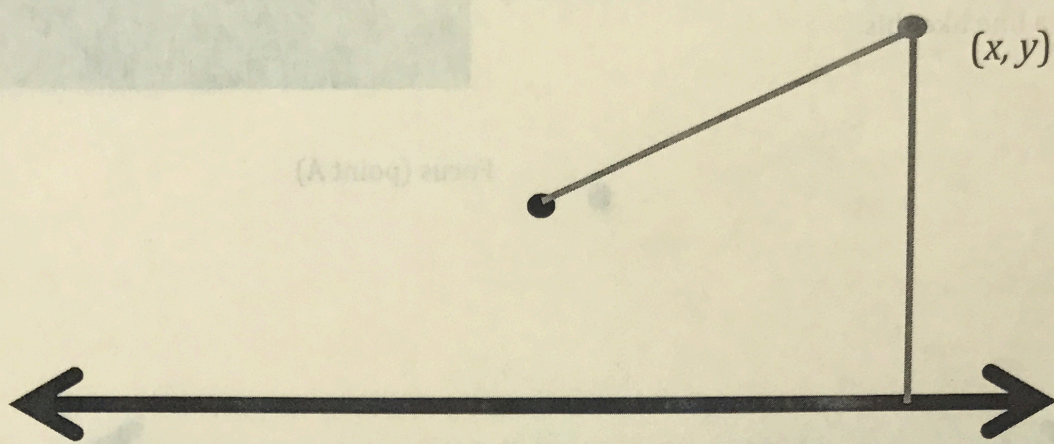
We're going to call the line a directrix and the point a focus. They've been labeled on the drawing.

Similar to the circles task, the class is going to construct a geometric figure using the focus (point A) and directrix (line *l*).

1. Cut two pieces of string with the same length.

2. Mark the midpoint of each piece of string with a marker.

3. Position the string on the board so that the midpoint is equidistant from the focus (point A) and the directrix (line l), which means that it must be perpendicular to the directrix. While holding the string in this position, put a pin through the midpoint. Depending on the size of your string, it will look something like this:



4. Using your second string, use the same procedure to post a pin on the other side of the focus.

5. As your classmates post their strings, what geometric figure do you predict will be made by the tacks (the collection of all points like (x, y) show in the figure above)? Why?

Write your prediction and why.

6. Where is the vertex of the figure located? How do you know?

Directly under the Focus, halfway between the focus and directrix.

7. Where is the line of symmetry located? How do you know?

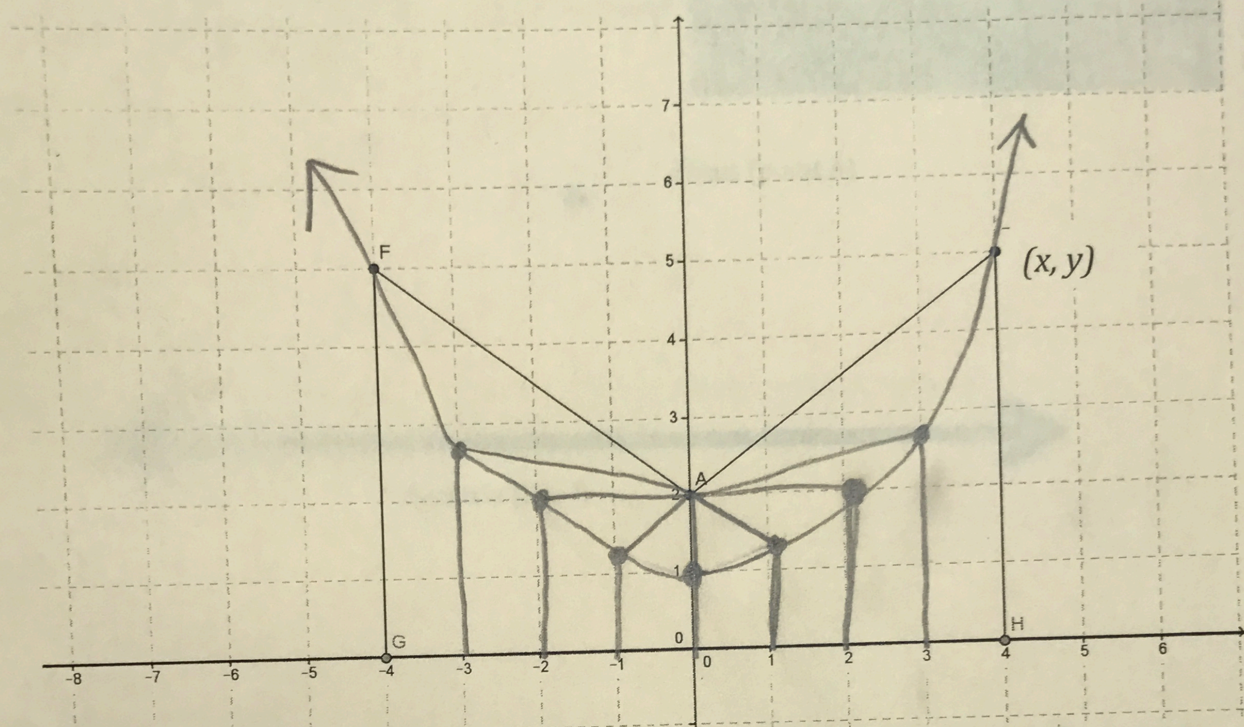
Perpendicular to the directrix, through the focus point.

$(x-h)^2=4p(y-k)$

(h,k): vertex point

p: distance from vertex to Focus/directrix

8. Consider the following construction with focus point A and the x axis as the directrix. Use a ruler to complete the construction of the parabola in the same way that the class constructed the parabola with string.



9. You have just constructed a parabola based upon the definition: A parabola is the set of all points *(x, y)* equidistant from a line *l* (the directrix) and a point not on the line (the focus). Use this definition to write the equation of the parabola above, using the point *(x, y)* to represent any point on the parabola.

vertex: $(0,1)$

$p=1$

$(x-0)^2 = 4(1)(y-1)$

$\frac{x^2}{4} = \frac{4(y-1)}{4}$

$\frac{1}{4}x^2 = y-1$

$+1 \quad +1$

$y=\frac{1}{4}x^2+1$

10. How would the parabola change if the focus was moved up, away from the directrix?

vertex would move up, parabola gets wider/compresse

11. How would the parabola change if the focus was moved down, toward the directrix?

vertex would move down, parabola gets stretched up

12. How would the parabola change if the focus was moved down, below the directrix?

parabola flips upside down