**Activity 5.7.1a Exploring the Parabola as a Locus of Points**

Materials Needed: A piece of parchment paper, Pencil, Ruler

1. Use your ruler to draw a long segment that appears to be parallel to the bottom edge of your parchment paper. Place this segment at most 2 inches away from the bottom of the paper. (Don’t worry if this segment isn’t “perfectly parallel” to the bottom edge of the paper.)
2. Plot and label the left-most endpoint of your segment as *A*. Plot and label the right-most endpoint of your segment as *X*.
3. Fold point *A* on top of point *X*. (This will create a vertical crease that serves as the perpendicular bisector of $\overbar{AX}$.) Label the midpoint of $\overbar{AX}$ as *M*. (See figure.)



1. Plot and label a point *F* somewhere along the vertical crease created in step (3) but less than 3 inches from *M*.
2. Fold point *M* onto point *F* and crease sharply creating a horizontal crease parallel to $\overbar{AX}$. Label the intersection of this horizontal crease and the vertical crease formed in step (3) as *V*. (See figure.)



1. This is the most important step here, so please read carefully!
2. Plot any point (leave it unnamed) on $\overbar{AX}$ that lies either to the left or right side of *M*. Fold point *A* directly on top of this point. Crease sharply. This should create a vertical crease on your paper (on the left side of *M*).
3. Plot and label a point *D* at the intersection of $\overbar{AX}$ and vertical crease you just formed.
4. Fold point *D* onto point *F*. Crease sharply. This will create a diagonal crease somewhere on your paper.
5. Plot and label a point *P* at the intersection of this diagonal crease and the vertical crease formed in step (a). (See figure.)



1. Take your ruler and measure the lengths *FP* and *PD* (on the left side of *M*.) What do you notice?
2. Why is your observation in step (7) above true? Can you think of a previously learned theorem that helps support your observation?
3. Repeat the **entire steps (6) and (7)** at least 15 more times. Pick the unnamed points on $\overbar{AX}$ on both the left and right side of *M*. The more folds you make, the easier it will be to observe a pattern.
4. Draw a smooth curve through the set of points labeled *P* that you plotted by completing step (6) numerous times. If the shape of this curve is familiar, what do you call it?
5. Now even though $\overbar{AX}$ was a segment, we could keep generating more points (all with the label *P*) if our paper were large enough. So, as we complete this formal definition below, consider the segment with endpoints *A* and *X* to be a *line* instead.

After class discussion:

1. Use your observation to help complete the following definition:

A is the locus of points in a plane that are from a fixed (called the ) and a given line (called the ).