

## Answer on Question #78892 – Math – Analytic Geometry

### Question

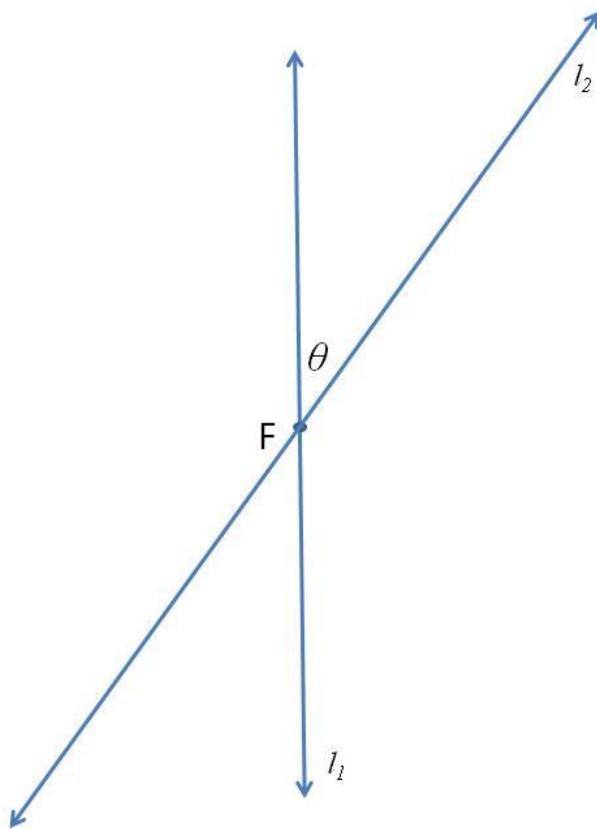
Can any conic have its focus lying on the corresponding directrix? Give reasons for your answer.

### Solution

You can define conic section as locus of a point which moves so that the ratio of its distance from a given point called focus and a given line called directrix is always constant.

In case of ellipse, this ratio  $< 1$ , in case of hyperbola, this ratio  $> 1$  and in case of parabola, this ratio  $= 1$ .

What happens when focus is on the directrix itself? Consider the following diagram, where  $F$  is focus and directrix is line  $l_1$  so that  $F$  lies on it. Consider another line  $l_2$  passing through  $F$ , so that it forms an angle of  $\theta$  with  $l_1$ .



Now consider any other point on  $l_2$ . Observe that the ratio of the distance of the point from focus  $F$  and directrix  $l_1$  will always be  $\frac{1}{\sin \theta}$ . In fact, there could be two lines as distance is scalar and independent of sign and two lines with angles  $\theta$  as well as  $(180^\circ - \theta)$  will both have the same ratio.

Hence such a conic section will be a pair of lines.

**Answer:** Yes, such a conic section will be a pair of lines.

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