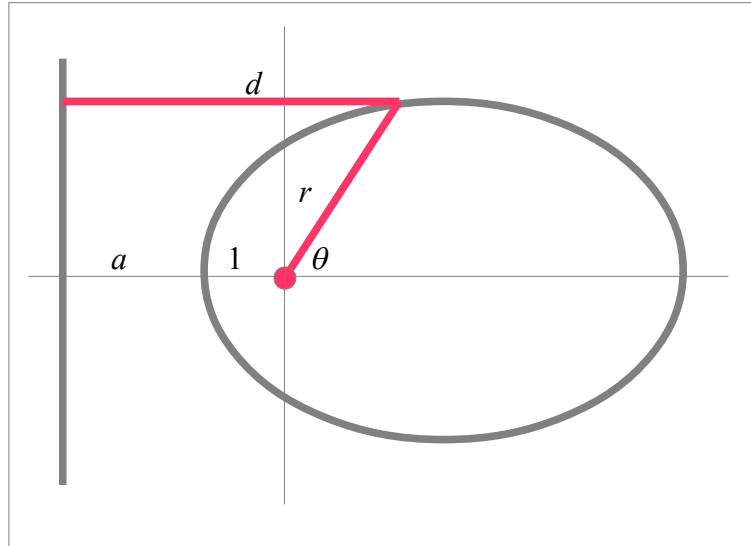


## Conic Sections in Polar Coordinates

Conic sections (ie the circle, ellipse, parabola and hyperbola) have the following property – the distance between any point on the curve and a straight line ( $d$ ) is a fixed multiple ( $a$ ) of the distance between the point and the focus of the curve ( $r$ ).



Suppose that the straight line is the line  $x = -(a + 1)$  and the focus of the curve is at the origin. (This will mean that all the curves pass through the point  $(-1,0)$ ) Then:

$$d = ar = a + 1 + r \cos \theta$$

from which we deduce that

$$r = \frac{a + 1}{a - \cos \theta}$$

This generates all the conic sections as follows:

$a = 0$	straight line
$0 < a < 1$	hyperbola
$a = 1$	parabola
$1 < a < \infty$	ellipse
$a = \infty$	circle

(Negative values of  $a$  generate similar curves.)