

Polar Equations of Conics:

$$r = \frac{ed}{1 \pm e \cos \theta} \quad \text{or} \quad r = \frac{ed}{1 \pm e \sin \theta}$$

where e (eccentricity) > 0 and

$|d|$ = distance between the focus at the pole and directrix.

Note: Focus is at the pole.

Classification of Conics by Eccentricity

Let e = eccentricity.

- The conic is a ellipse for $0 < e < 1$.
 - The conic is a parabola for $e = 1$.
 - The conic is a hyperbola for $e > 1$.
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Four types of equations based on location and type of directrix:

1) Horizontal directrix above the pole: $r = \frac{ed}{1 + e \sin \theta}$

2) Horizontal directrix below the pole: $r = \frac{ed}{1 - e \sin \theta}$

3) Vertical directrix to the right of the pole: $r = \frac{ed}{1 + e \cos \theta}$

4) Vertical directrix to the left of the pole: $r = \frac{ed}{1 - e \cos \theta}$