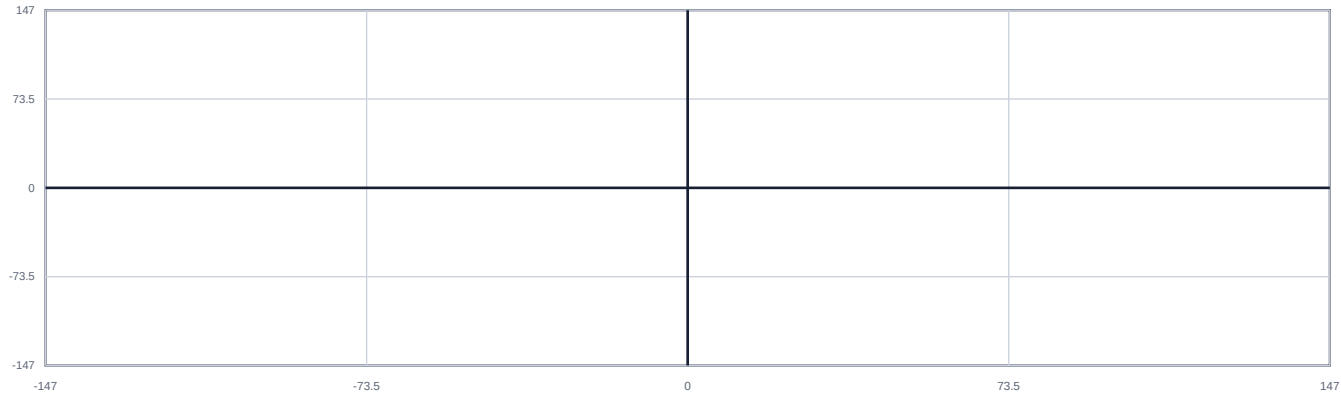


Polar Conic Sections

Normalize to  $r = ed/(1 \text{ plus or minus } e \cos(\theta) \text{ or } e \sin(\theta))$ , classify from  $e$ , and state the directrix and denominator restriction.

1. Graph  $r = 20/(1 + 2 \sin(\theta))$  on the supplied window  $-147 \leq x \leq 147$ ,  $-147 \leq y \leq 147$  from its focus-at-pole, directrix, and eccentricity features.

Assumptions: The focus is at the pole, the directrix is parallel to a coordinate axis, and denominator-zero angles are excluded rather than assigned  $r=0$ .



2. Write the polar equation for a parabola with focus at the pole,  $e=1$ , and directrix  $y = 5$ .

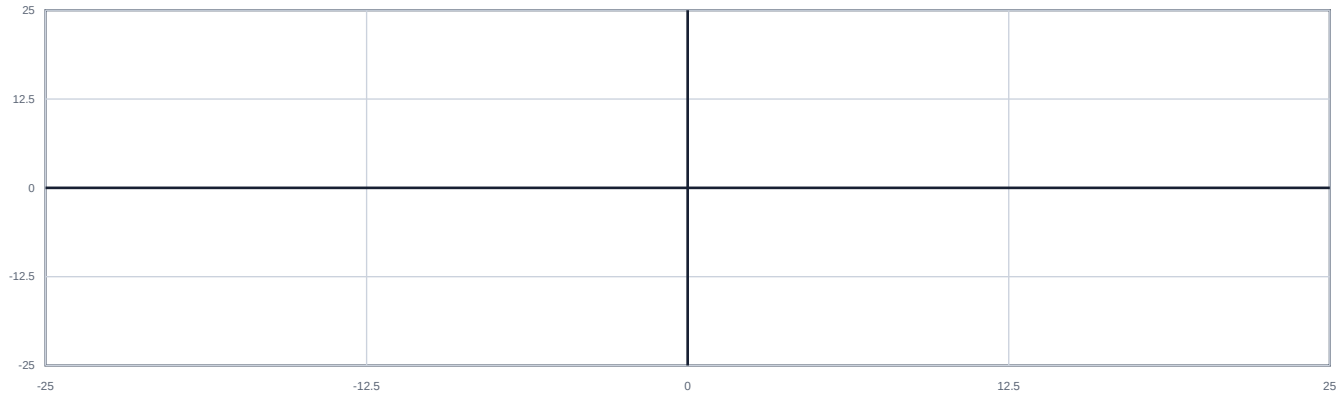
Assumptions: The focus is at the pole, the directrix is parallel to a coordinate axis, and denominator-zero angles are excluded rather than assigned  $r=0$ .

Polar Conic Sections

Normalize to  $r = ed/(1 \text{ plus or minus } e \cos(\theta) \text{ or } e \sin(\theta))$ , classify from  $e$ , and state the directrix and denominator restriction.

3. Graph  $r = 3/(1 + 1 \cos(\theta))$  on the supplied window  $-25 \leq x \leq 25$ ,  $-25 \leq y \leq 25$  from its focus-at-pole, directrix, and eccentricity features.

Assumptions: The focus is at the pole, the directrix is parallel to a coordinate axis, and denominator-zero angles are excluded rather than assigned  $r=0$ .



4. Write the polar equation for a hyperbola with focus at the pole,  $e=5/2$ , and directrix  $y = 8$ .

Assumptions: The focus is at the pole, the directrix is parallel to a coordinate axis, and denominator-zero angles are excluded rather than assigned  $r=0$ .

Polar Conic Sections

Normalize to  $r = ed/(1 \text{ plus or minus } e \cos(\theta) \text{ or } e \sin(\theta))$ , classify from  $e$ , and state the directrix and denominator restriction.

5. Write the polar equation for a parabola with focus at the pole,  $e=1$ , and directrix  $x = 10$ .

Assumptions: The focus is at the pole, the directrix is parallel to a coordinate axis, and denominator-zero angles are excluded rather than assigned  $r=0$ .

6. Write the polar equation for a ellipse with focus at the pole,  $e=3/4$ , and directrix  $y = -4$ .

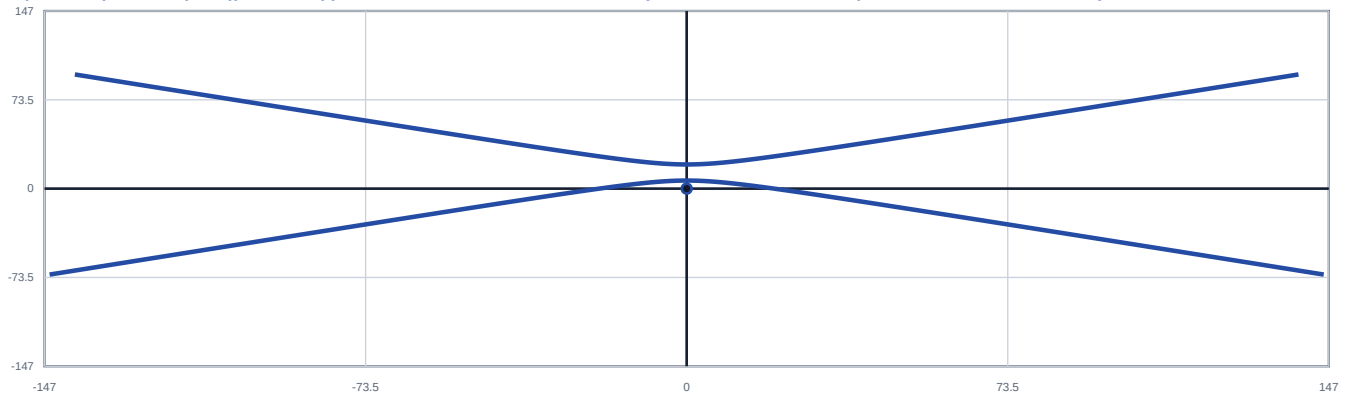
Assumptions: The focus is at the pole, the directrix is parallel to a coordinate axis, and denominator-zero angles are excluded rather than assigned  $r=0$ .

## Polar Conic Sections

## Worked Answer Key

Normalize to  $r = ed/(1 \text{ plus or minus } e \cos(\theta) \text{ or } e \sin(\theta))$ , classify from  $e$ , and state the directrix and denominator restriction.

1. Graph  $r = 20/(1 + 2 \sin(\theta))$  on the supplied window  $-147 \leq x \leq 147$ ,  $-147 \leq y \leq 147$  from its focus-at-pole, directrix, and eccentricity features.



**Answer:**  $r = 20/(1 + 2 \sin(\theta))$ ; hyperbola;  $e=2$ ; directrix  $y = 10$

1. Compare  $e=2$  with 1:  $e<1$  ellipse,  $e=1$  parabola,  $e>1$  hyperbola.
2. A positive-axis directrix produces the displayed plus sign in the denominator.
3. Restriction:  $1 + 2 \sin(\theta) \neq 0$ .

2. Write the polar equation for a parabola with focus at the pole,  $e=1$ , and directrix  $y = 5$ .

**Answer:**  $r = 5/(1 + \sin(\theta))$ ; parabola;  $e=1$ ; directrix  $y = 5$

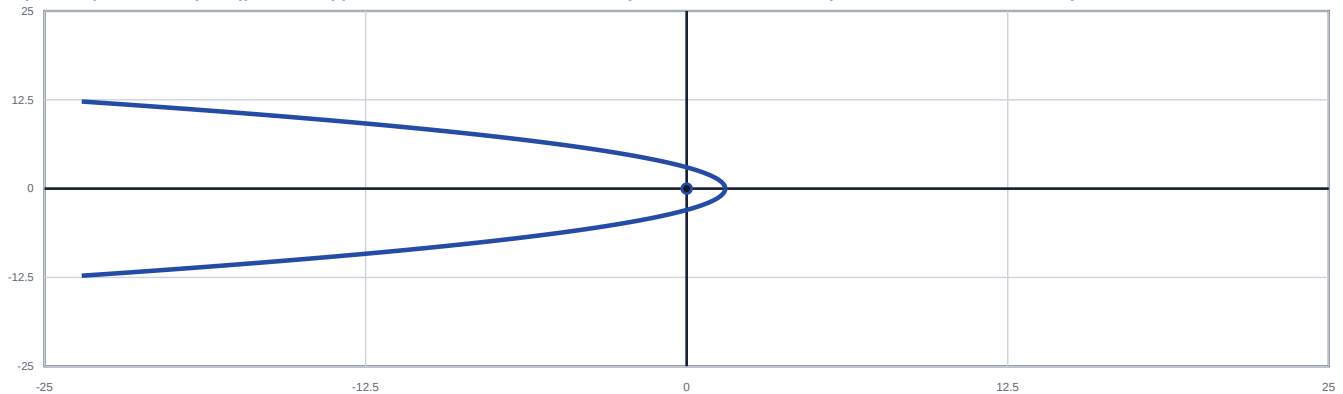
1. Compare  $e=1$  with 1:  $e<1$  ellipse,  $e=1$  parabola,  $e>1$  hyperbola.
2. A positive-axis directrix produces the displayed plus sign in the denominator.
3. Restriction:  $1 + \sin(\theta) \neq 0$ .

## Polar Conic Sections

## Worked Answer Key

Normalize to  $r = ed/(1 \text{ plus or minus } e \cos(\theta) \text{ or } e \sin(\theta))$ , classify from  $e$ , and state the directrix and denominator restriction.

3. Graph  $r = 3/(1 + 1 \cos(\theta))$  on the supplied window  $-25 \leq x \leq 25$ ,  $-25 \leq y \leq 25$  from its focus-at-pole, directrix, and eccentricity features.



**Answer:**  $r = 3/(1 + 1 \cos(\theta))$ ; parabola;  $e=1$ ; directrix  $x = -3$

1. Compare  $e=1$  with 1:  $e < 1$  ellipse,  $e=1$  parabola,  $e > 1$  hyperbola.
2. A positive-axis directrix produces the displayed plus sign in the denominator.
3. Restriction:  $1 + 1 \cos(\theta) \neq 0$ .

4. Write the polar equation for a hyperbola with focus at the pole,  $e=5/2$ , and directrix  $y = 8$ .

**Answer:**  $r = 20/(1 + 5/2 \sin(\theta))$ ; hyperbola;  $e=5/2$ ; directrix  $y = 8$

1. Compare  $e=5/2$  with 1:  $e < 1$  ellipse,  $e=1$  parabola,  $e > 1$  hyperbola.
2. A positive-axis directrix produces the displayed plus sign in the denominator.
3. Restriction:  $1 + 5/2 \sin(\theta) \neq 0$ .

# Math Sheet

Name \_\_\_\_\_ Score \_\_\_\_\_ Teacher \_\_\_\_\_ Date \_\_\_\_\_

## Polar Conic Sections

### Worked Answer Key

Normalize to  $r = ed/(1 \text{ plus or minus } e \cos(\theta) \text{ or } e \sin(\theta))$ , classify from  $e$ , and state the directrix and denominator restriction.

5. Write the polar equation for a parabola with focus at the pole,  $e=1$ , and directrix  $x = 10$ .

**Answer:  $r = 10/(1 + 1 \cos(\theta))$ ; parabola;  $e=1$ ; directrix  $x = 10$**

1. Compare  $e=1$  with 1:  $e<1$  ellipse,  $e=1$  parabola,  $e>1$  hyperbola.
2. A positive-axis directrix produces the displayed plus sign in the denominator.
3. Restriction:  $1 + 1 \cos(\theta) \neq 0$ .

6. Write the polar equation for an ellipse with focus at the pole,  $e=3/4$ , and directrix  $y = -4$ .

**Answer:  $r = 3/(1 - 3/4 \sin(\theta))$ ; ellipse;  $e=3/4$ ; directrix  $y = -4$**

1. Compare  $e=3/4$  with 1:  $e<1$  ellipse,  $e=1$  parabola,  $e>1$  hyperbola.
2. A negative-axis directrix produces the displayed minus sign in the denominator.
3. Restriction:  $1 - 3/4 \sin(\theta) \neq 0$ .