LESSON MAKER PRO

Conic Equation Lab

Turn key features into equations.

HIGH SCHOOL · PC.CS.1.4

PC.CS.1.4 "Write the equation of a conic section given its key features."

NAME _____ DATE _____

CHOOSE THE FORM

For a circle, use $(x-h)^2+(y-k)^2=r^2$. For a parabola with vertex (h,k), use $(x-h)^2=4p(y-k)$ if its axis is vertical, or $(y-k)^2=4p(x-h)$ if its axis is horizontal; p is the signed distance from the vertex to the focus. For an ellipse, add the squared coordinate terms over the squared semiaxis lengths; for a hyperbola, subtract them and place the positive term in the direction of the vertices.

WORKED EXAMPLE

Write the equation of a parabola with vertex (-7,9) and focus (-7,12).

1. The focus is directly above the vertex, so use $(x-h)^2=4p(y-k)$.
2. The signed vertex-to-focus distance is $p=12-9=3$.
3. Substitute $h=-7$, $k=9$, and $4p=12$.

Answer: $(x+7)^2=12(y-9)$

PRACTICE 6 problems

1 Write the equation of a circle with center (-1,4) and radius 3.

ANSWER _____

2 Write the equation of a circle with center (5,-2) that passes through (5,4).

ANSWER _____

3 Write the equation of a parabola with vertex (0,0) and focus (0,2).

ANSWER _____

4 Write the equation of a parabola with vertex (4,1) and focus (2,1).

ANSWER _____

5 Write the equation of an ellipse centered at (-2,1), with vertices (-6,1) and (2,1) and co-vertices (-2,3) and (-2,-1).

ANSWER _____

6 Write the equation of a hyperbola centered at (1,-1), with vertices (1,3) and (1,-5) and conjugate-axis endpoints (3,-1) and (-1,-1).

ANSWER _____

APPLY IT Show your work

1 A student maps a Wi-Fi signal on a coordinate grid measured in meters. The router is at (6,4), and the signal reaches 5 meters in every direction. Write an equation for the boundary of the coverage area.

WORK SPACE

ANSWER _____

2 In a skateboarding video game, a jump follows a parabolic path. Its highest point is (3,6), and the path passes through (5,4). Write an equation for the path.

WORK SPACE

ANSWER _____

CHALLENGE One step up

An ellipse is centered at (0,0). Its vertices are (0,6) and (0,-6), and its foci are (0,4) and (0,-4). Use $c^2=a^2-b^2$ to write its equation. State how you found b^2.

WORK SPACE AND ANSWER

ANSWER KEY # Conic Equation Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Write the equation of a circle with center (-1,4) and radius 3.	$(x+1)^2+(y-4)^2=9$
2	Write the equation of a circle with center (5,-2) that passes through (5,4).	$(x-5)^2+(y+2)^2=36$
3	Write the equation of a parabola with vertex (0,0) and focus (0,2).	$x^2=8y$
4	Write the equation of a parabola with vertex (4,1) and focus (2,1).	$(y-1)^2=-8(x-4)$
5	Write the equation of an ellipse centered at (-2,1), with vertices (-6,1) and (2,1) and co-vertices (-2,3) and (-2,-1).	$(x+2)^2/16+(y-1)^2/4=1$
6	Write the equation of a hyperbola centered at (1,-1), with vertices (1,3) and (1,-5) and conjugate-axis endpoints (3,-1) and (-1,-1).	$(y+1)^2/16-(x-1)^2/4=1$

PART 2 · APPLY IT

1. **$(x-6)^2+(y-4)^2=25$** Use the router's location as the center and 5 as the radius. Square the radius to get 25.
2. **$y=-1/2(x-3)^2+6$** Start with $y=a(x-3)^2+6$. Substitute (5,4): $4=4a+6$, so $a=-1/2$.

CHALLENGE

$y^2/36+x^2/20=1$; $b^2=6^2-4^2=20$.

Accept algebraically equivalent equations, including cleared-denominator forms. For the challenge, the explanation must identify 36 as a^2 and 16 as c^2.