LESSON MAKER PRO

Conic Clues

Find key features in equations and graphs.

HIGH SCHOOL · PC.CS.1.2

PC.CS.1.2 "Identify key features of conic sections (foci, directrix, radii, axes, asymptotes, center) graphically and algebraically."

NAME _____ **DATE** _____

READ THE FEATURES

In a conic equation, (x - h) and (y - k) show the center or vertex at (h, k). A circle's radius comes from its squared radius, while an ellipse has $c^2 = a^2 - b^2$ to locate its foci. For a horizontal hyperbola, the asymptote slopes are ±b/a; for a vertical parabola, $(x - h)^2 = 4p(y - k)$ puts the focus p units above the vertex and the directrix p units below it when p is positive.

WORKED EXAMPLE

Find the center and foci of $(x - 11)^2/169 + (y + 9)^2/144 = 1$.

1. Read the center from the shifted terms: (11, -9).
2. The larger denominator is under the x term, so the foci lie to the left and right of the center.
3. Find their distance from the center: $c^2 = 169 - 144 = 25$, so c = 5.
4. Move 5 units left and right: 11 - 5 = 6 and 11 + 5 = 16.

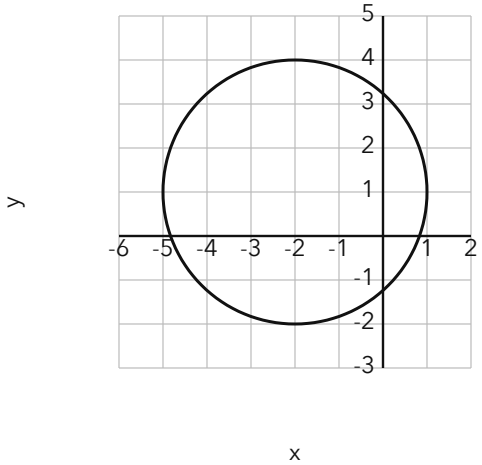
Answer: Center: (11, -9); foci: (6, -9) and (16, -9).

PRACTICE 6 problems

1 Find the center and radius of $(x - 2)^2 + (y + 1)^2 = 4$.

ANSWER _____

2 Use the graph to find the circle's center and radius.

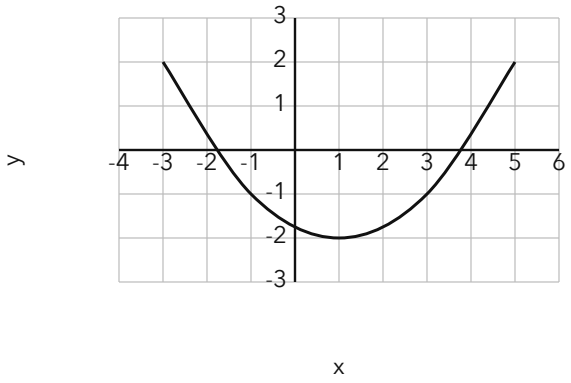


ANSWER _____

3 Find the foci and the direction of the major axis of $x^2/36 + y^2/20 = 1$.

ANSWER _____

4 Use the graph to find the parabola's vertex and axis of symmetry.



ANSWER _____

5 Find the focus and directrix of $(x - 3)^2 = 8(y + 2)$.

ANSWER _____

6 Find the center and both asymptotes of $(x + 2)^2/9 - (y - 1)^2/4 = 1$.

ANSWER _____

APPLY IT Show your work

1 An esports arena has an elliptical ceiling. A cross section is modeled by $x^2/100 + y^2/64 = 1$, with coordinates in meters. Sound sensors will be placed at the two foci. Find their coordinates.

WORK SPACE

ANSWER _____

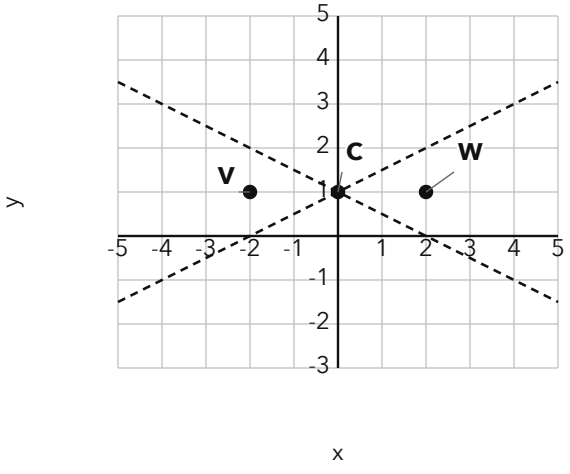
2 A student builds a parabolic reflector for a radio project. Its cross section is modeled by $x^2 = 24y$, with coordinates in centimeters. Where is the focus, and what is the equation of the directrix?

WORK SPACE

ANSWER _____

CHALLENGE One step up

The graph shows the center, vertices, and asymptotes of a horizontal hyperbola. Write its equation in standard form, and explain how the graph gives you a and b.



WORK SPACE AND ANSWER

ANSWER KEY

Conic Clues

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the center and radius of $(x - 2)^2 + (y + 1)^2 = 4$.	**Center: (2, -1); radius: 2.**
2	Use the graph to find the circle's center and radius.	**Center: (-2, 1); radius: 3.**
3	Find the foci and the direction of the major axis of $x^2/36 + y^2/20 = 1$.	**Foci: (-4, 0) and (4, 0); major axis: horizontal.**
4	Use the graph to find the parabola's vertex and axis of symmetry.	**Vertex: (1, -2); axis of symmetry: x = 1.**
5	Find the focus and directrix of $(x - 3)^2 = 8(y + 2)$.	**Focus: (3, 0); directrix: y = -4.**
6	Find the center and both asymptotes of $(x + 2)^2/9 - (y - 1)^2/4 = 1$.	**Center: (-2, 1); asymptotes: y - 1 = (2/3)(x + 2) and y - 1 = -(2/3)(x + 2).**

PART 2 · APPLY IT

1. **(-6, 0) and (6, 0), in meters.** The major axis is horizontal. Since $c^2 = 100 - 64 = 36$, each focus is 6 meters from the center.
2. **Focus: (0, 6) cm; directrix: y = -6.** Compare 24y with 4py to get p = 6. The focus is 6 cm above the vertex, and the directrix is 6 cm below it.

CHALLENGE

$x^2/4 - (y - 1)^2 = 1$. The center is (0, 1), and each vertex is 2 units from it, so a = 2. The asymptote slopes are ±1/2 = ±b/a, so b = 1.

Accept the foci in either order and equivalent equations for the asymptotes. In the challenge, accept any explanation that uses the vertex distance and asymptote slope to find a = 2 and b = 1.