

Ellipse Mission

Read graphs, find features, and model real situations.

HIGH SCHOOL • MA.912.GR.7.7

MA.912.GR.7.7 "Graph and solve mathematical and real-world problems that are modeled with an equation of an ellipse. Determine and interpret key features in terms of the context."

NAME _____

DATE _____

ELLIPSE FEATURES

In $(x-h)^2/a^2 + (y-k)^2/b^2 = 1$, the center is (h, k) . The larger denominator shows the direction of the major axis, and its square root is the distance from the center to each vertex.

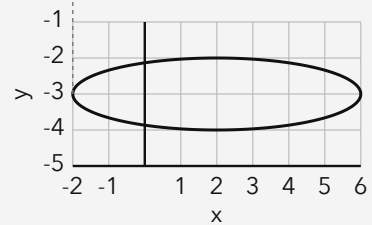
WORKED EXAMPLE

Use the graph of the ellipse to identify its center, vertices, and covertices.

1. Read the midpoint of the ellipse: $(2, -3)$.
2. The horizontal distance from the center to an endpoint is 4.
3. The vertical distance from the center to an endpoint is 1.
4. Move 4 left and right, then 1 up and down, from the center.

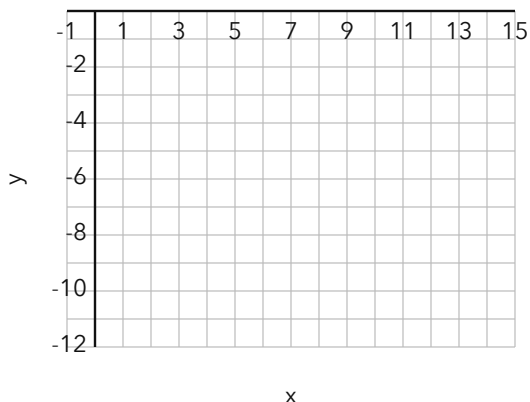
Answer: Center: $(2, -3)$. Vertices: $(-2, -3)$ and $(6, -3)$. Covertices: $(2, -4)$ and $(2, -2)$.

$$(x - 2)^2/16 + (y + 3)^2 = 1$$



PRACTICE 6 problems

- 1** Graph $(x - 7)^2/49 + (y + 6)^2/25 = 1$ on the grid. State the center and whether the major axis is horizontal or vertical.



ANSWER _____

- 3** Solve for y : $(x - 6)^2/36 + (y + 4)^2/64 = 1$ when $x = 6$.

ANSWER _____

- 5** An ellipse has center $(8, -5)$, vertical vertices $(8, 4)$ and $(8, -14)$, and covertices $(2, -5)$ and $(14, -5)$. Write its equation in standard form.

ANSWER _____

- 2** Find the vertices and covertices of $(x + 8)^2/36 + (y - 9)^2/81 = 1$.

ANSWER _____

- 4** Find the foci of $x^2/49 + (y - 7)^2/24 = 1$.

ANSWER _____

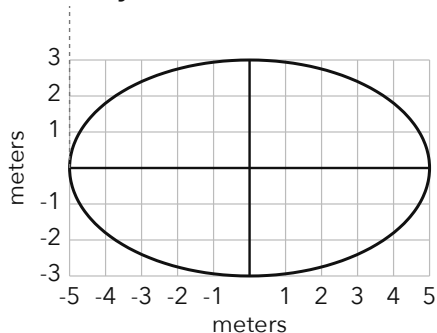
- 6** The point $(-6, 6)$ is tested in $(x + 9)^2/81 + (y - 2)^2/36 = 1$. Is the point inside, on, or outside the ellipse?

ANSWER _____

APPLY IT Show your work

- 1** A game designer uses the elliptical boundary shown for a virtual competition arena. One grid unit represents 1 meter. Write an equation for the boundary, then give the arena's total width and total height.

Arena boundary



ANSWER _____

- 2** A robotics club marks an elliptical safety zone centered at (3, -2). Its horizontal semimajor axis is 10 meters, and its vertical semiminor axis is 6 meters. Write an equation for the zone. Is the robot at (11, 2) inside the safety zone, on its boundary, or outside it?

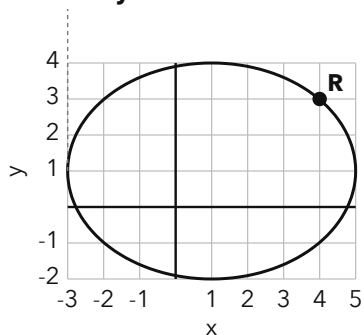
WORK SPACE

ANSWER _____

CHALLENGE One step up

The concert stage boundary is shown. Write its equation in standard form. Then use substitution to explain whether point R is inside, on, or outside the boundary.

Stage boundary



WORK SPACE AND ANSWER

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Graph $(x - 7)^2/49 + (y + 6)^2/25 = 1$ on the grid. State the center and whether the major axis is horizontal or vertical.	Ellipse centered at (7,-6), with horizontal major axis. Vertices: (0,-6) and (14,-6); covertices: (7,-11) and (7,-1).
2	Find the vertices and covertices of $(x + 8)^2/36 + (y - 9)^2/81 = 1$.	Vertices: (-8, 0) and (-8, 18). Covertices: (-14, 9) and (-2, 9).
3	Solve for y: $(x - 6)^2/36 + (y + 4)^2/64 = 1$ when $x = 6$.	$y = 4$ or $y = -12$.
4	Find the foci of $x^2/49 + (y - 7)^2/24 = 1$.	(-5, 7) and (5, 7)
5	An ellipse has center (8, -5), vertical vertices (8, 4) and (8, -14), and covertices (2, -5) and (14, -5). Write its equation in standard form.	$(x - 8)^2/36 + (y + 5)^2/81 = 1$
6	The point (-6, 6) is tested in $(x + 9)^2/81 + (y - 2)^2/36 = 1$. Is the point inside, on, or outside the ellipse?	Inside the ellipse.

PART 2 · APPLY IT

- $x^2/25 + y^2/9 = 1$; width: 10 meters; height: 6 meters.** The center is (0, 0), with horizontal semiaxis 5 and vertical semiaxis 3. Double each semiaxis to find the total width and height.
- $(x - 3)^2/100 + (y + 2)^2/36 = 1$; the robot is outside the safety zone.** Substitute (11, 2): $8^2/100 + 4^2/36 = 16/25 + 4/9 = 244/225$. Since this is greater than 1, the point is outside.

CHALLENGE

$(x - 1)^2/16 + (y - 1)^2/9 = 1$. Point R is outside because $(4 - 1)^2/16 + (3 - 1)^2/9 = 145/144$, which is greater than 1.

Accept equivalent standard-form equations with terms reversed. For point-location questions, accept a correct comparison of the substituted value to 1, along with the matching interpretation.