

Precalculus · Conic Sections: Parabolas, Ellipses and Hyperbolas · Worksheet

Common Core G-GPE.A.1, G-GPE.A.2, G-GPE.A.3 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

These 26 problems cover the four conic sections in order: circle equations and completing the square, parabolas from a focus and directrix, ellipses and hyperbolas from their foci, and identifying a conic from a general equation (G-GPE.A.1, G-GPE.A.2, G-GPE.A.3).

The last six are applications: a satellite dish, a whispering gallery, a sprinkler, a navigation system, a garden and a fountain. Every problem has a full worked solution in the answer key.

Precalculus Common Core: G-GPE.A.1 · G-GPE.A.2 · G-GPE.A.3

Problem 1: Write the equation of a circle

Write the equation of the circle with the given center and radius.

- a. center $(0, 0)$, radius 7
- b. center $(3, -2)$, radius 5
- c. center $(-4, 1)$, radius $\sqrt{7}$

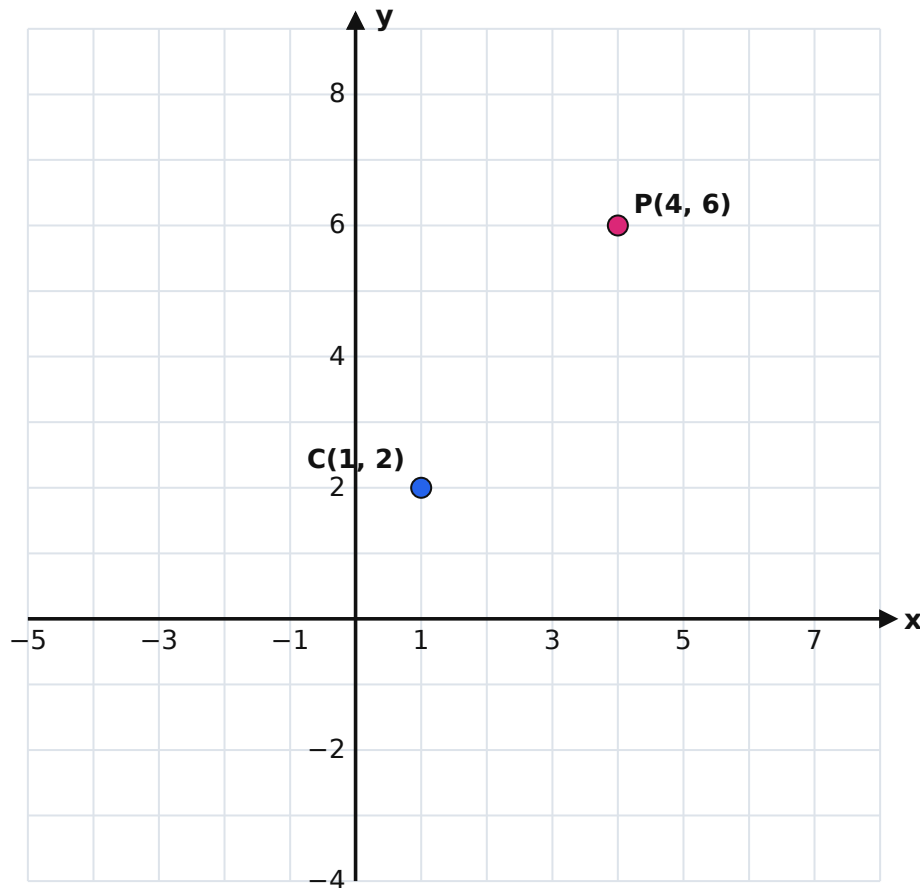
Problem 2: Center and radius from an equation

State the center and radius of each circle.

- a. $(x+4)^2 + (y-1)^2 = 49$
- b. $x^2 + (y-5)^2 = 36$
- c. $(x-2)^2 + (y+3)^2 = 20$

Problem 3: Circle through a point

A circle has its center at $C(1, 2)$ and passes through $P(4, 6)$. Find its equation.



Center and point.

Problem 4: Circle from a diameter

The segment from $A(-2, 3)$ to $B(6, 7)$ is a diameter of a circle. Write the equation of the circle.

Problem 5: Complete the square: circles

Write each equation in standard form and name the center and radius.

- a. $x^2 + y^2 - 8x + 6y + 9 = 0$
- b. $x^2 + y^2 + 10x - 4y + 13 = 0$
- c. $x^2 + y^2 + 2x - 6y - 15 = 0$

Problem 6: Parabola from focus and directrix

Find the equation of the parabola with focus $(0, 3)$ and directrix $y = -3$.

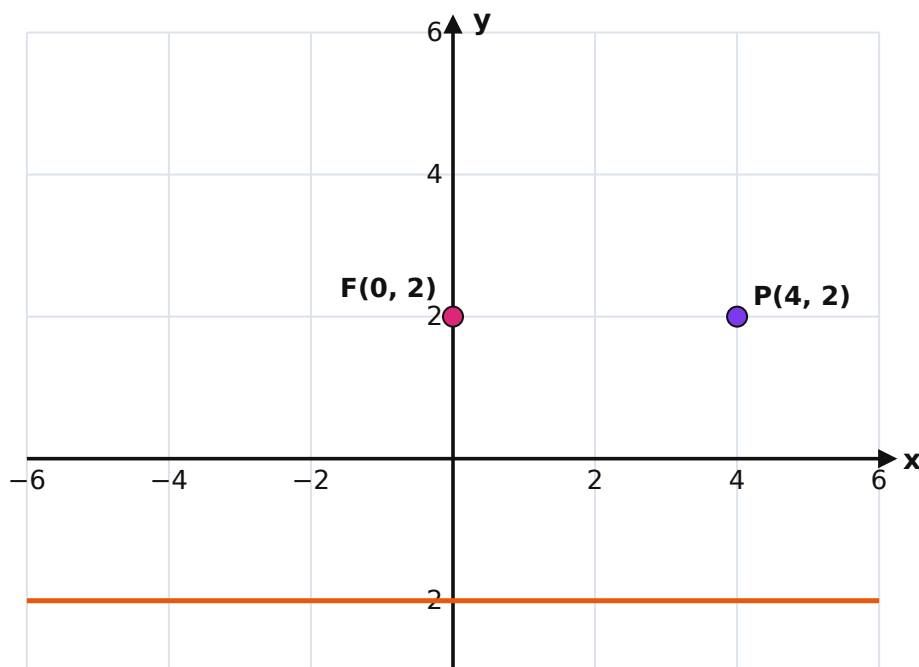
Problem 7: Focus and directrix from an equation

For each parabola, find p , the focus and the directrix.

- a. $y^2 = 16x$
b. $x^2 = -20y$

Problem 8: Equal distances

Show that $P(4, 2)$ lies on the parabola with focus $F(0, 2)$ and directrix $y = -2$ by comparing two distances.



Point, focus and directrix.

Problem 9: Parabola with a shifted vertex

A parabola has vertex $(2, 1)$ and focus $(2, 4)$. Write its equation and its directrix.

Problem 10: Parabola opening left

Find the equation of the parabola with focus $(-3, 0)$ and directrix $x = 3$.

Problem 11: Ellipse features

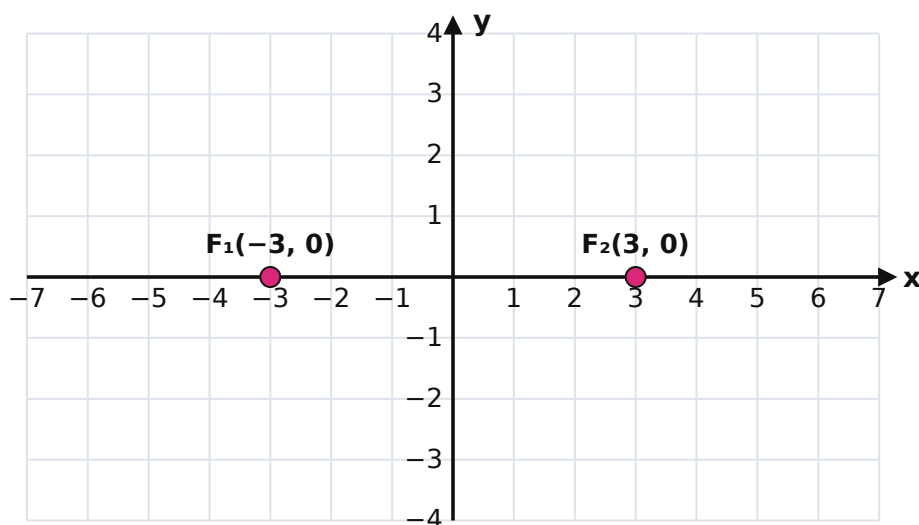
For $\frac{x^2}{25} + \frac{y^2}{9} = 1$, find a , b , c , the vertices, the co-vertices and the foci.

Problem 12: A vertical ellipse

For $\frac{x^2}{16} + \frac{y^2}{25} = 1$, find the vertices and the foci. Which axis is the major axis?

Problem 13: Ellipse from its foci

An ellipse has foci $(\pm 3, 0)$. The sum of the distances from any point on it to the foci is 10. Write its equation.



The foci of the ellipse.

Problem 14: A shifted ellipse

For $\frac{(x-2)^2}{36} + \frac{(y+1)^2}{20} = 1$, find the center, vertices, foci, and the sum of the distances from a point on the ellipse to the foci.

Problem 15: Hyperbola features

For $\frac{x^2}{16} - \frac{y^2}{9} = 1$, find the vertices, foci and asymptotes.

Problem 16: A vertical hyperbola

For $\frac{y^2}{9} - \frac{x^2}{16} = 1$, find the vertices, foci and asymptotes.

Problem 17: Hyperbola from its foci

A hyperbola has foci $(\pm 5, 0)$. The absolute difference of the distances from any point on it to the foci is 8. Write its equation.

Problem 18: Identify an ellipse

Complete the square to write $4x^2 + 9y^2 - 16x + 18y - 11 = 0$ in standard form. Name the conic, its center, and its foci.

Problem 19: Identify a hyperbola

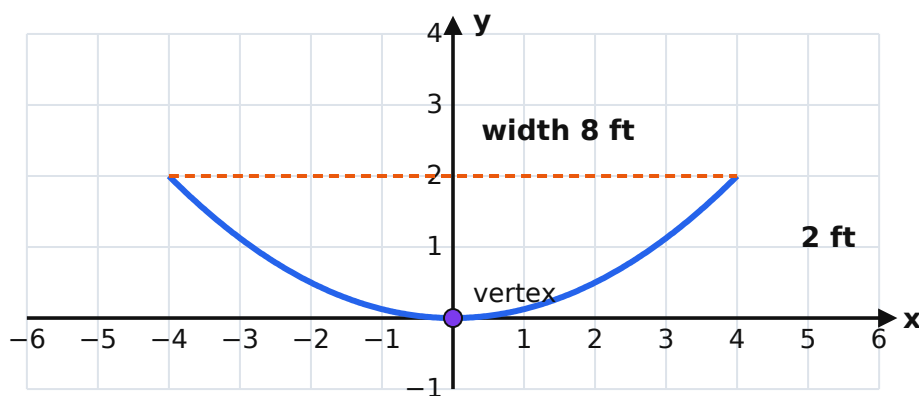
Complete the square to write $x^2 - 4y^2 + 6x + 16y - 23 = 0$ in standard form. Name the conic, its center, and its asymptotes.

Problem 20: Identify a parabola

Complete the square to write $y^2 - 6y - 8x + 25 = 0$ in standard form. Find the vertex, focus and directrix.

Problem 21: Satellite dish

A satellite dish has a parabolic cross-section 8 feet wide and 2 feet deep. Place the vertex at the origin with the dish opening upward. Write an equation for the cross-section and find how far above the vertex the receiver should sit (at the focus).



Cross-section of the dish.

Problem 22: Whispering gallery

A whispering gallery is an ellipse-shaped hall 100 feet long and 60 feet wide. Write its equation with the center at the origin and the long axis along the x -axis. Then find how far apart the two focus points are.

Problem 23: Sprinkler coverage

A sprinkler at $(20, 30)$ waters a circular region of radius 15 feet (coordinates in feet). Write the equation of the boundary. Is the flower at $(24, 38)$ watered? Is the bench at $(35, 45)$ watered?

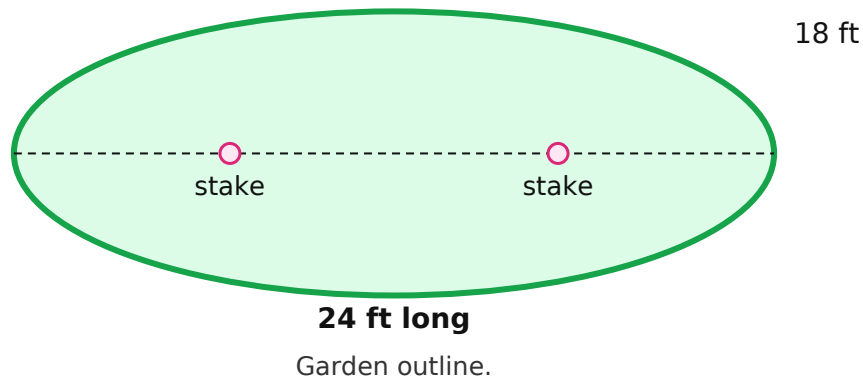
Problem 24: Navigation stations

Two radio stations at $(-5, 0)$ and $(5, 0)$, measured in miles, send signals. A ship is exactly 6 miles closer to one station than to the other, so it lies on a hyperbola with these foci. Write the

equation of the hyperbola, then find the y -coordinate of the ship when $x=6$ and $y>0$.

Problem 25: Elliptical garden

Priya outlines an elliptical garden 24 feet long and 18 feet wide by looping a string around two stakes and keeping it taut with a pencil. How far apart should the stakes be, and how long must the loop be around the stakes? Give the stake distance to the nearest hundredth.



Problem 26: Circular fountain

The edge of a circular fountain is modeled by $x^2+y^2-12x-16y+75=0$, in feet, with the entrance at the origin. Find the center and radius, then find the shortest distance from the entrance to the edge of the fountain.