LESSON MAKER PRO

Parabola Focus Hunt

Use equations, vertices, foci, and directrices to describe parabolas.

HIGH SCHOOL · MA.912.GR.7

MA.912.GR.7 "Apply geometric and algebraic representations of conic sections."

NAME _____ DATE _____

FOCUS FORMULA

In $(x-h)^2 = 4p(y-k)$, the vertex is (h,k), the focus is (h,k+p), and the directrix is y=k-p. Here p is the directed distance from the vertex to the focus, so divide the coefficient by 4. For a horizontal parabola, use $(y-k)^2 = 4p(x-h)$, focus (h+p,k), and directrix x=h-p.

WORKED EXAMPLE

Find the vertex, focus, and directrix of $(x-11)^2 = 28(y+13)$.

1. Compare 4p = 28, so p = 7.
2. The vertex is (11,-13).
3. The focus is (11,-13+7) = (11,-6).
4. The directrix is y = -13-7 = -20.

Answer: Vertex (11,-13), focus (11,-6), directrix y = -20.

PRACTICE 6 problems

1 Find the vertex, focus, and directrix of $(x+4)^2 = 16(y-5)$.

ANSWER _____

2 Find the vertex, focus, and directrix of $(y-9)^2 = -32(x+4)$.

ANSWER _____

3 Write the equation of the parabola with vertex (8,-4) and focus (8,5).

ANSWER _____

4 Write the equation of the parabola with vertex (-5,3) and directrix x = -9.

ANSWER _____

5 Rewrite $x^2 - 10x - 8y + 9 = 0$ in standard form. Then find the vertex, focus, and directrix.

ANSWER _____

6 A parabola has focus (3,-9) and directrix y = -15. Write its equation.

ANSWER _____

APPLY IT Show your work

1 A concert spotlight reflector has a cross section modeled by $(x-2)^2 = -16(y-9)$, where the coordinates are measured in centimeters. The bulb must be placed at the focus. Where should the bulb be placed?

WORK SPACE

ANSWER _____

2 A student robotics team makes a parabolic Wi-Fi reflector modeled by $(y+1)^2 = 16(x-4)$, where the coordinates are measured in centimeters. The receiver belongs at the focus. Where should the team place the receiver?

WORK SPACE

ANSWER _____

CHALLENGE One step up

Rewrite $y^2 - 10y + 16x + 9 = 0$ in standard form. Then find the vertex, focus, and directrix.

WORK SPACE AND ANSWER

ANSWER KEY # Parabola Focus Hunt

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the vertex, focus, and directrix of $(x+4)^2 = 16(y-5)$.	**Vertex (-4,5), focus (-4,9), directrix y = 1.**
2	Find the vertex, focus, and directrix of $(y-9)^2 = -32(x+4)$.	**Vertex (-4,9), focus (-12,9), directrix x = 4.**
3	Write the equation of the parabola with vertex (8,-4) and focus (8,5).	**$(x-8)^2 = 36(y+4)$**
4	Write the equation of the parabola with vertex (-5,3) and directrix x = -9.	**$(y-3)^2 = 16(x+5)$**
5	Rewrite $x^2 - 10x - 8y + 9 = 0$ in standard form. Then find the vertex, focus, and directrix.	**Standard form: $(x-5)^2 = 8(y+2)$. Vertex (5,-2), focus (5,0), directrix y = -4.**
6	A parabola has focus (3,-9) and directrix y = -15. Write its equation.	**$(x-3)^2 = 12(y+12)$**

PART 2 · APPLY IT

1. **(2,5)** Since 4p = -16, p = -4. The vertex is (2,9), so the focus is (2,9-4) = (2,5).
2. **(8,-1)** Since 4p = 16, p = 4. The vertex is (4,-1), so the focus is (4+4,-1) = (8,-1).

CHALLENGE

Standard form: $(y-5)^2 = -16(x-1)$. Vertex (1,5), focus (-3,5), directrix x = 5.

Accept equivalent standard-form equations and correctly expanded equivalent equations. For each parabola, accept answers with the same vertex, focus, and directrix even if the student lists them in a different order.