Parabola Focus and Directrix Worksheet

Geometry · Common Core HSG-GPE.A.2

> Derive the equation of a parabola given a focus and directrix.

Practice

Builds the skill step by step.

1. A parabola has focus (0, 3) and directrix $y = -3$. What is its vertex?

2. The parabola with focus (0, 3) and directrix $y = -3$ has equation $y = ax^2$. What is a?

3. A parabola is the set of points that are the same distance from what?

   A. a circle and its center

   B. two points

   C. a point (the focus) and a line (the directrix)

   D. the origin and the x-axis

4. A parabola has focus (0, 1) and directrix $y = -1$, so its equation is $x^2 = 4y$. The point (4, y) is on it. What is y?

5. What is the distance from the point (2, 5) to the line $y = -1$?

6. A parabola has focus $(0, -2)$ and directrix $y = 2$. Which way does it open?

   A. down

   B. up

   C. left

   D. right

7. The parabola $x^2 = 12y$ has its focus at $(0, p)$. What is p?

8. The directrix of $x^2 = 12y$ is the line $y = c$. What is c?

9. A parabola has focus $(0, 5)$ and directrix $y = 1$. What is its vertex?

10. How far is the focus of $x^2 = 8y$ from its directrix?

ALBERT

Name _____ Date _____

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On Level

Grade-level practice.

1. A parabola has focus (2, 4) and directrix $y = 0$. Its equation is $(x - h)^2 = 4p(y - k)$. What is $4p$?

2. For the parabola with focus (2, 4) and directrix $y = 0$, what is the vertex?

3. A parabola has focus (0, 0) and directrix $y = -4$. The point (4, y) is on it. What is y?

4. Derive the equation of the parabola with focus (0, p) and directrix $y = -p$.

5. A parabola has focus (1, −3) and directrix $y = 1$. Its equation is $(x - h)^2 = 4p(y - k)$. What is $4p$?

6. Which is the equation of the parabola with focus (0, 1) and directrix $y = -1$?

   A. $x^2 = 4y$

   B. $x^2 = y$

   C. $x^2 = -4y$

   D. $y^2 = 4x$

7. The parabola $y = \frac{1}{20}x^2$ has focus (0, p). What is p?

8. A parabola has focus (0, 4) and directrix $y = -4$. The point (8, 4) is on it. What is its distance to the focus?

9. Where is the vertex of a parabola?

   A. at the focus

   B. halfway between the focus and the directrix

   C. at the origin always

   D. on the directrix

10. What is the focus of the parabola $x^2 = -16y$?

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Challenge

Multi-step and word problems that stretch it.

1. A parabola has focus $(-1, 2)$ and directrix $y = -4$. What is its y-intercept?

2. A parabola has focus $(3, 5)$ and directrix $y = 1$. In the form $y = a(x - 3)^2 + 3$, what is a?

3. Explain why the vertex of a parabola is exactly halfway between the focus and the directrix.

4. A parabola with focus $(0, p)$ and directrix $y = -p$ passes through $(6, 3)$. What is p?

5. A satellite dish has the shape $y = \frac{1}{16}x^2$. The receiver goes at the focus. How far above the vertex is it?

6. A parabola has focus $(2, -1)$ and directrix $y = -5$. It crosses the horizontal line $y = -1$ at two points. How far apart are they?

7. Is the point (4, 2) on the parabola with focus (0, 2) and directrix $y = -2$?

   A. Yes: it is 4 from the focus and 4 from the directrix.

   B. No: it is 4 from the focus and 2 from the directrix.

   C. No: it is on the focus line.

   D. Yes: because $4 = 2 \times 2$.

8. A parabola has vertex (0, 0) and focus (0, −3). Its directrix is $y = c$. What is c?

9. The parabola $x^2 - 4x - 8y + 12 = 0$ can be written $(x - 2)^2 = 8(y - 1)$. What is its focus?

10. If the focus moves farther from the directrix, what happens to the parabola?

    A. It gets wider.

    B. It gets narrower.

    C. It flips over.

    D. Nothing changes.