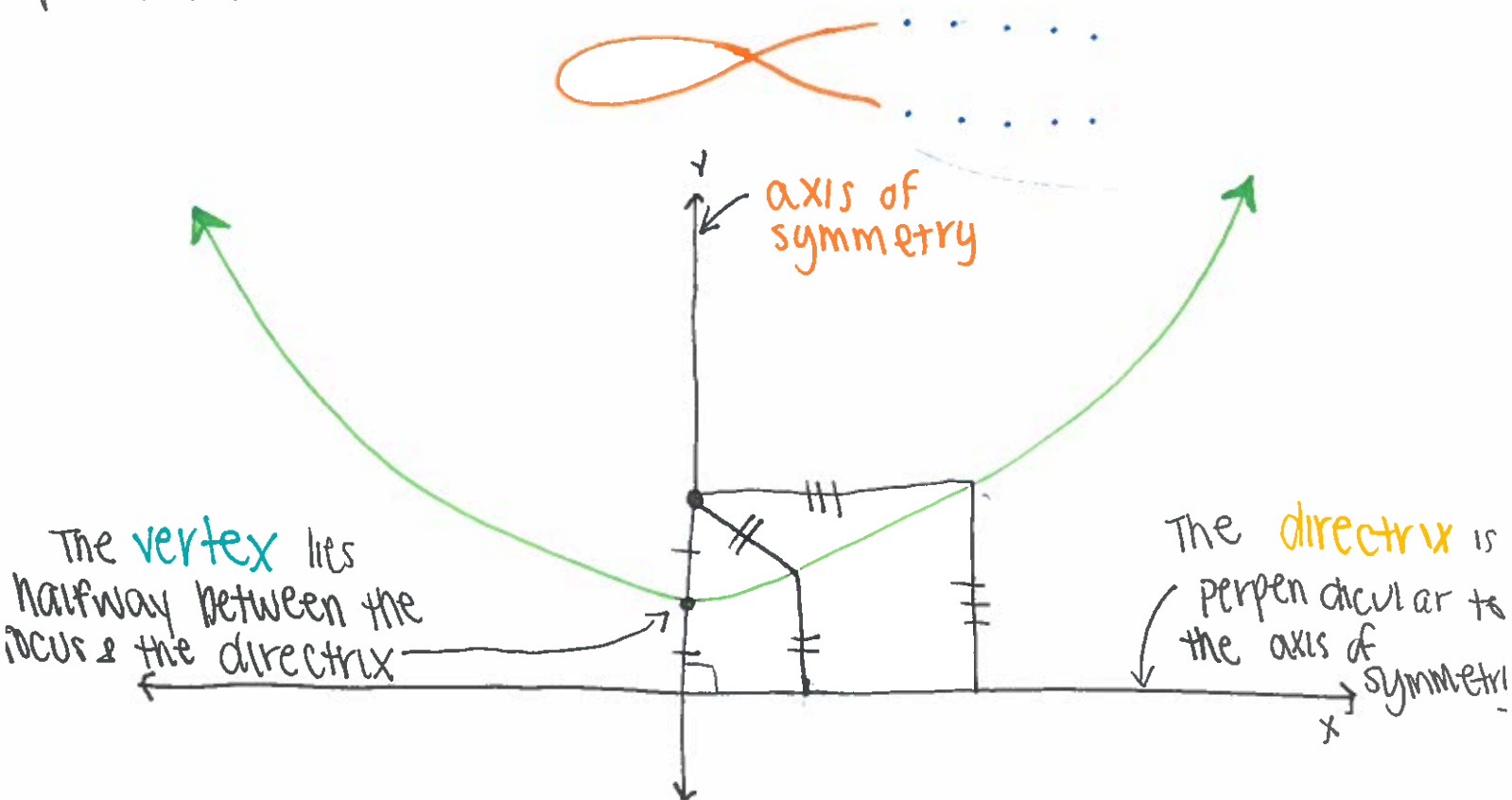


2.3 FOCUS of a PARABOLA

- A **parabola** is a set of all points in a plane which are all equal distance away from a given point & given line.
- The point is called the **focus** of the parabola & the line is called the **directrix**.
- The **focus** lies on the **axis of symmetry** of the parabola.



The distance from a point to a line is defined as the length of the perpendicular segment from the point to a line

KEY VOCAB

1) (answer key on back)

- Vertex:
- Focus:
- Directrix:

- a) point located "p" units away from vertex
 - b) line perpendicular to axis of sym. "p" units away
 - c) point where axis of sym intersects parabola
- inside the parabola on axis of sym.

Answers for page 1.

① Vertex : c

Focus : a

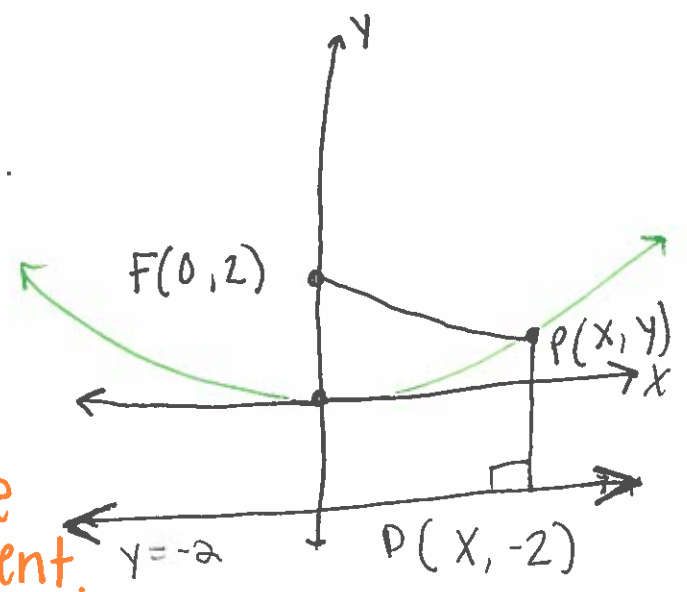
Directrix : b

+

Using the distance formula to write an equation

using \nearrow , of the parabola with a focus $F(0, 2)$ & directrix $y = -2$.

* Note: line segments drawn from point P to point D & from point F to point P. By the definition of a parabola, these line segments must be congruent.



$$PD = PF$$

$$\sqrt{(x-x_1)^2 + (y-y_1)^2} = \sqrt{(x-x_2)^2 + (y-y_2)^2}$$

$$\sqrt{(x-x)^2 + (y-(-2))^2} = \sqrt{(x-0)^2 + (y-2)^2}$$

$$\sqrt{(y+2)^2} = \sqrt{x^2 + (y-2)^2}$$

$$y^2 + 4y + 4 = x^2 + y^2 - 4y + 4$$

$$8y = x^2$$

$$y = \frac{1}{8} x^2$$

2. 10. 1944

10. 10. 1944

10. 10. 1944

10. 10. 1944

10. 10. 1944

10. 10. 1944

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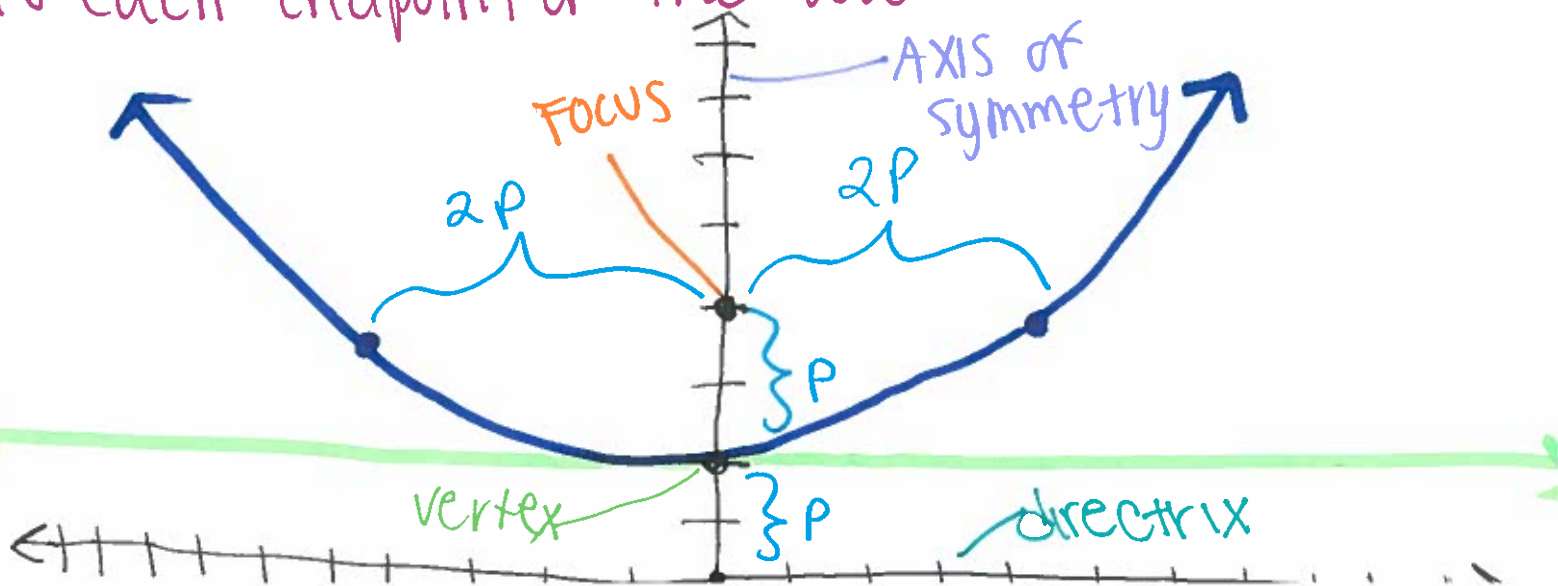
10. 10. 1944

10. 10. 1944

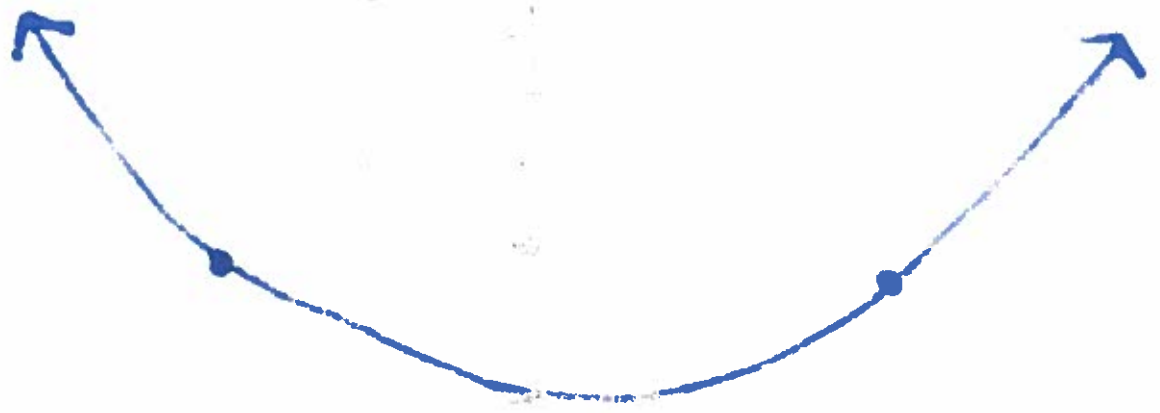
Graphing a Parabola in Vertex Form

3

1. Locate the vertex (h, k) on your graph.
2. Decide whether the parabola opens up, down, left, or right.
3. To locate the axis of symmetry, draw a line through the vertex going in whatever direction the parabola opens.
4. To locate the **FOCUS**, count " p " units from the vertex on the axis of symmetry in whatever direction the parabola opens.
5. To locate the directrix, count " p " units from the vertex on the axis of symmetry the opposite direction of the focus.
6. Pick two points located $2p$ units from the **FOCUS** in a direction that is parallel to the directrix.
7. To draw the parabola start at the vertex & draw to each endpoint of the width.



The function $f(x) = x^2 - 4x + 4$ is a parabola opening upwards. The vertex is at $(2, 0)$. The x-intercepts are at $x = 0$ and $x = 4$. The y-intercept is at $(0, 4)$. The graph is symmetric about the line $x = 2$.



Graph of $f(x) = x^2 - 4x + 4$

PROBLEMS

$$y = \frac{1}{8}(x-2)^2 - 1$$

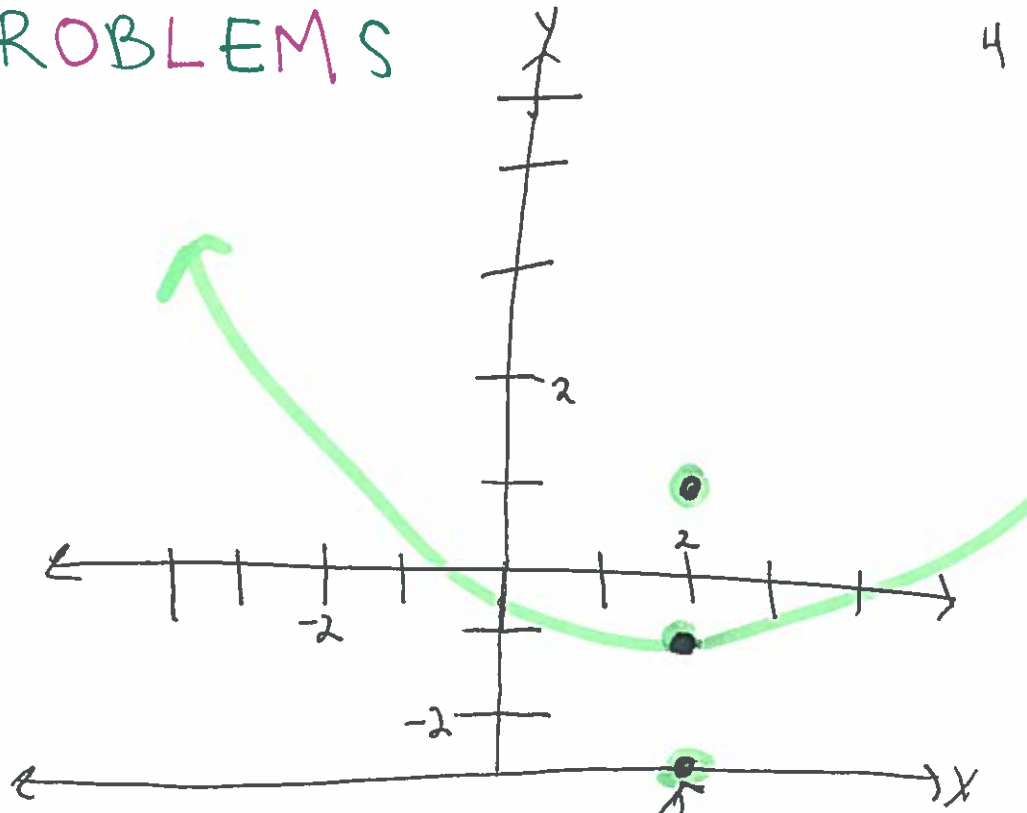
opening: up

$$p: \frac{1}{8} = \frac{1}{4p} \rightarrow p = 2$$

vertex: (2, -1)

focus: (2, 1)

directrix: $y = -3$



this is the...?
● focus
✓ directrix
○ vertex

$$x = \frac{1}{12}y^2 + 2$$

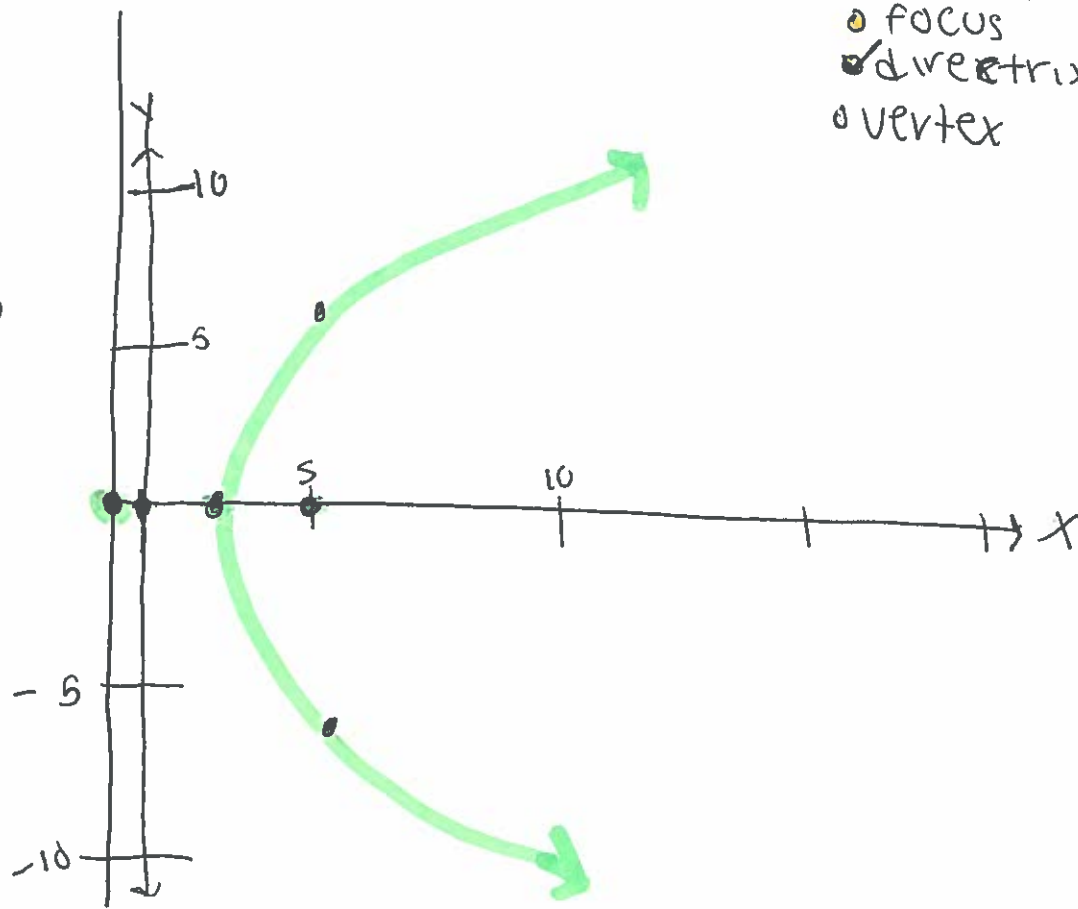
opening: right

$$p: \frac{1}{12} = \frac{1}{4p} \rightarrow p = 3$$

vertex: (2, 0)

focus: (5, 0)

directrix: $x = -1$



9, ME 110, 99

1000000000

1000000000

1000000000

1000000000

1000000000

1000000000

SUMMARY...

5

A ① is the ② of all points
③ from a fixed ④ & a
fixed ⑤.

The fixed ⑥ is the parabolas ⑦.

The fixed ⑧ is the parabolas ⑨.

WORD BANK
(words can be used twice!)

DIRECTRIX

collection

FOCUS

line

POINT

Equidistant

(answer key
on back)

Answer key:

1) Parabola

2) Collection

3) Equidistant

4) point

5) line

6) point

7) focus

8) line

9) directrix

EXERCISES

1) Write an equation of the parabola with the given characteristics.

a) Focus: $(3, 0)$

Directrix: $x = -3$

b) Directrix: $x = -10$

Vertex: $(0, 0)$

c) Focus: $(0, \frac{6}{7})$

Vertex: $(0, 0)$

2) Identify the focus, directrix, & axis of symmetry of the parabola.

a) $y = \frac{1}{8}x^2$



b) $y = -\frac{1}{12}x^2$



c) $x = -\frac{1}{20}y^2$



ANSWERS

①

a) $X = \frac{1}{12} Y^2$

b) $X = \frac{1}{40} Y^2$

c) $Y = \frac{7}{24} X^2$

②

a) FOCUS: $(0, 2)$

DIRECTRIX: $Y = -2$

AXIS OF SYMM: Y axis

b) FOCUS: $(0, -3)$

DIRECTRIX: $Y = 3$

AXIS OF SYMM: Y axis

c) FOCUS: $(-5, 0)$

DIRECTRIX: $X = 5$

AXIS OF SYMM: X axis