6 min

1) Find the equation of the Hyperbola centered at (0,0) given:

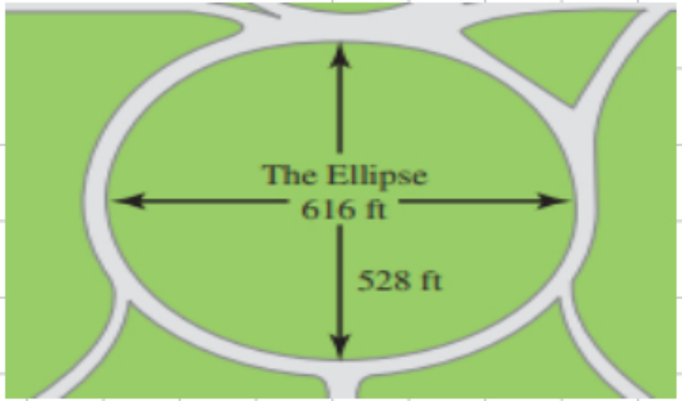
Foci (0,-4), (0,4) and vertices (0,-2), (0,2)

2) Write the equation in standard form and graph:

$$y^2 - 4x^2 = 64$$

4 min

3) **PROBLEM:** If the Ellipse at the White House is 616 ft long and 528 ft wide, what is its equation?



BitPaper
Share Knowledge

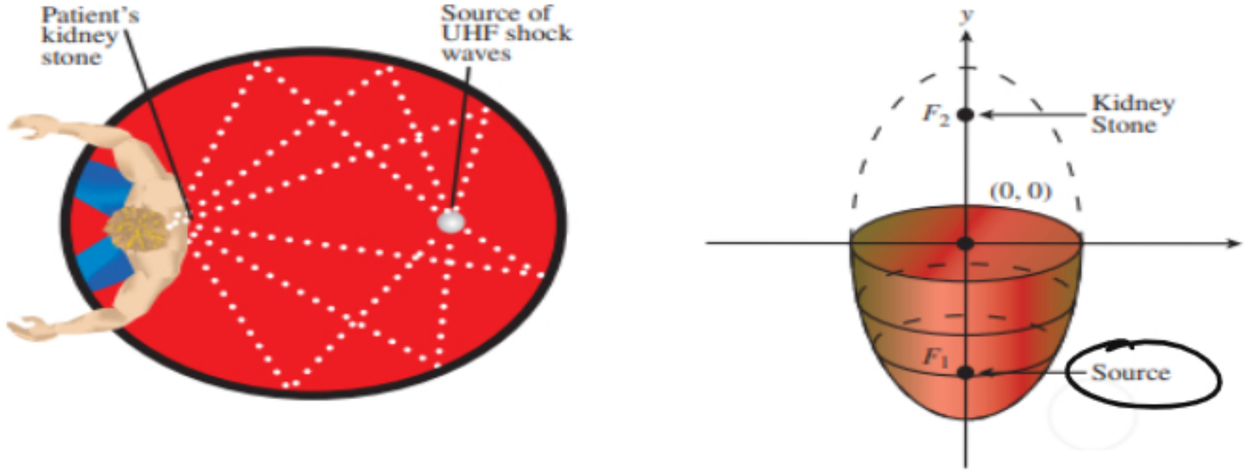


FIGURE 8.21 How a lithotripter breaks up kidney stones.

3 min

4) **Lithotripter (Refer to Figure 8.21.)** A lithotripter's shape is formed by rotating the portion of an ellipse below its minor axis about its major axis. If the length of the major axis is 26 in. and the length of the minor axis is 10 in., where should the shock-wave source and the patient be placed for maximum effect?

BitPaper
Share Knowledge

Solutions

Find the equation of the Hyperbola centered at (0,0) given:

Foci (0,-4), (0,4) and vertices (0,-2), (0,2)

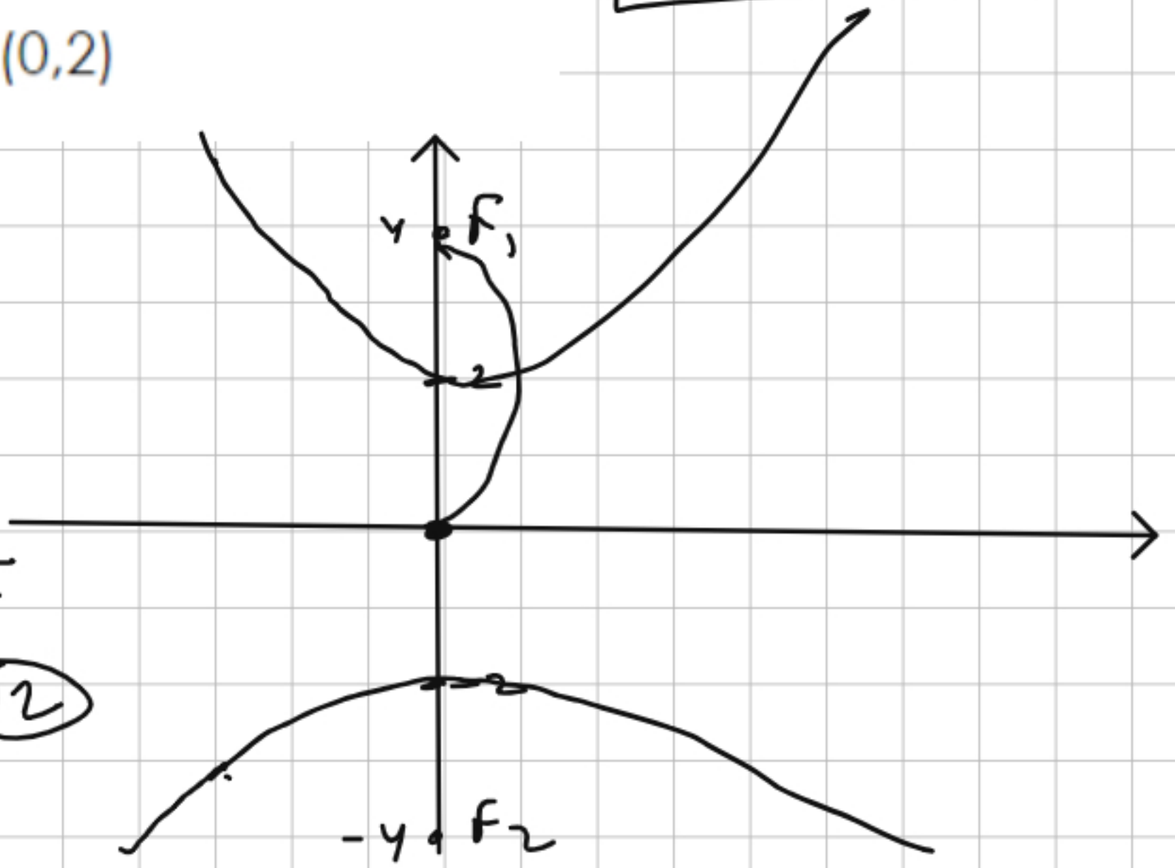
$$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$$

$\boxed{a=2}$ $\quad c^2 = a^2 + b^2$

$a^2 = 4$ $\quad b^2 = c^2 - a^2 =$

$= 16 - 4 = \boxed{12}$

$$\boxed{\frac{y^2}{4} - \frac{x^2}{12} = 1}$$



BitPaper
Share Knowledge

Write the equation in standard form and graph:

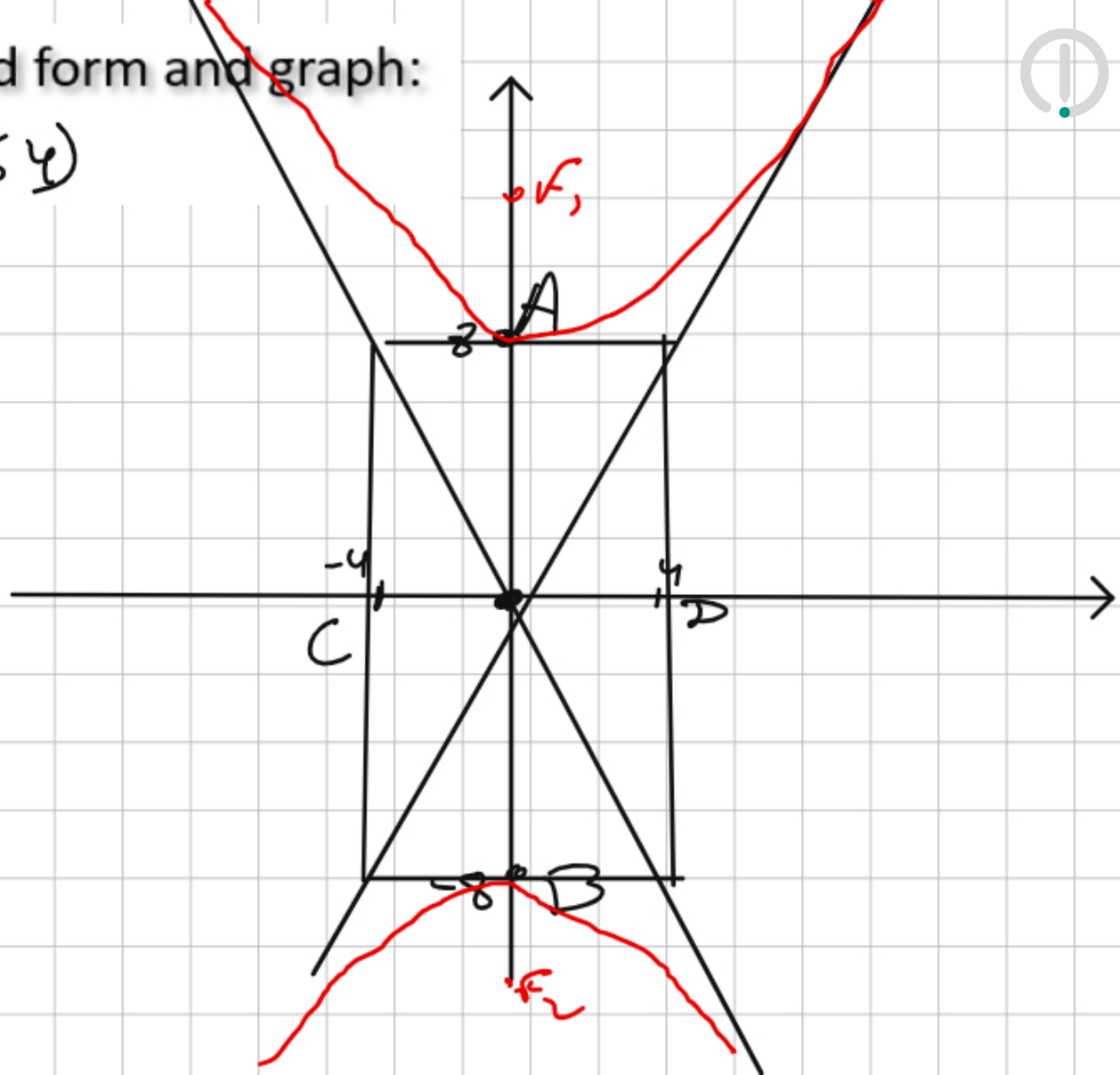
$y^2 - 4x^2 = 64$ $(\div 64)$

$\frac{y^2}{64} - \frac{x^2}{16} = 1$

$a^2 = 64$ $\quad b^2 = 16$

$\boxed{a = 8}$ $\quad \boxed{b = 4}$

$c^2 = a^2 + b^2$



BitPaper
Share Knowledge

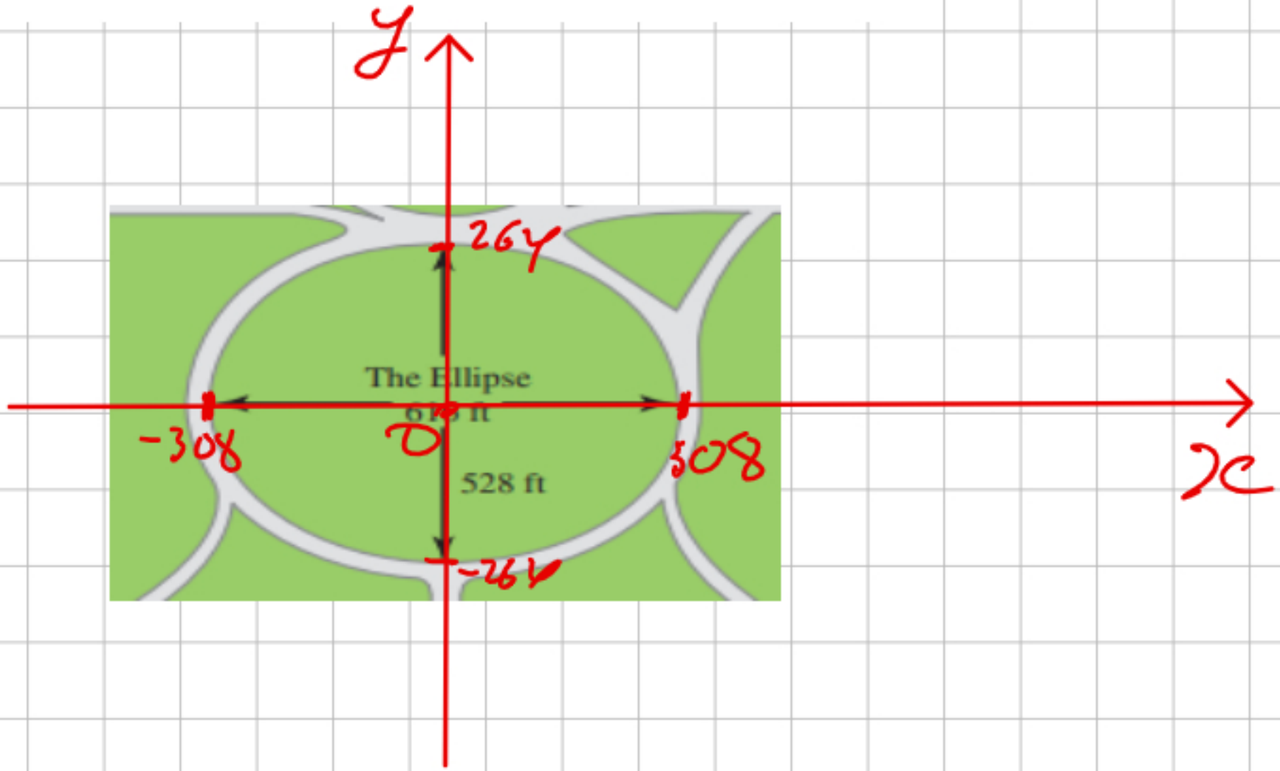
PROBLEM: If the Ellipse at the White House is 616 ft long and 528 ft wide, what is its equation?

$a = 308$

$b = \frac{528}{2} = 264$

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

$$\frac{x^2}{308^2} + \frac{y^2}{264^2} = 1$$



BitPaper
Share Knowledge

. **Lithotripter (Refer to Figure 8.21.)** A lithotripter's shape is formed by rotating the portion of an ellipse below its minor axis about its major axis. If the length of the major axis is 26 in. and the length of the minor axis is 10 in., where should the shock-wave source and the patient be placed for maximum effect?

$a = 13$

$B = 5$

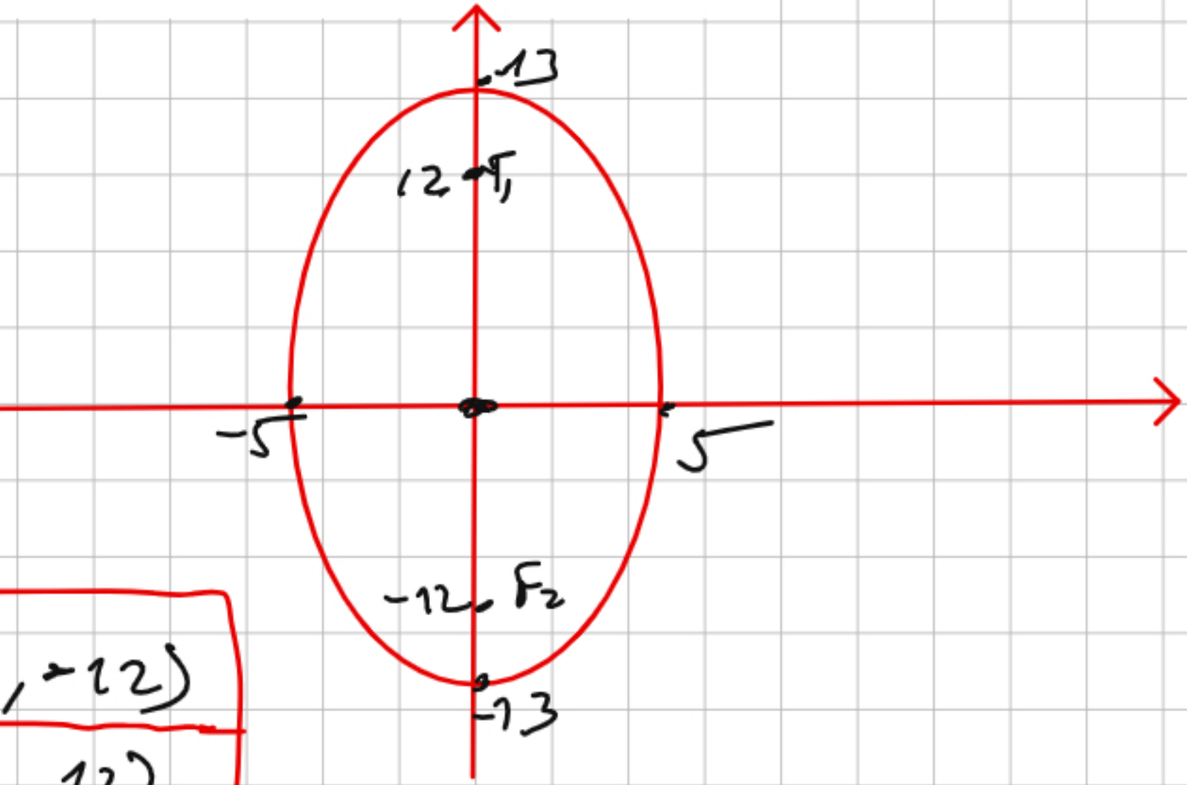
$c^2 = a^2 - B^2 = 169 - 25 =$

$= 144$

$c = 12$

Source $(0, -12)$

Patient $(0, 12)$

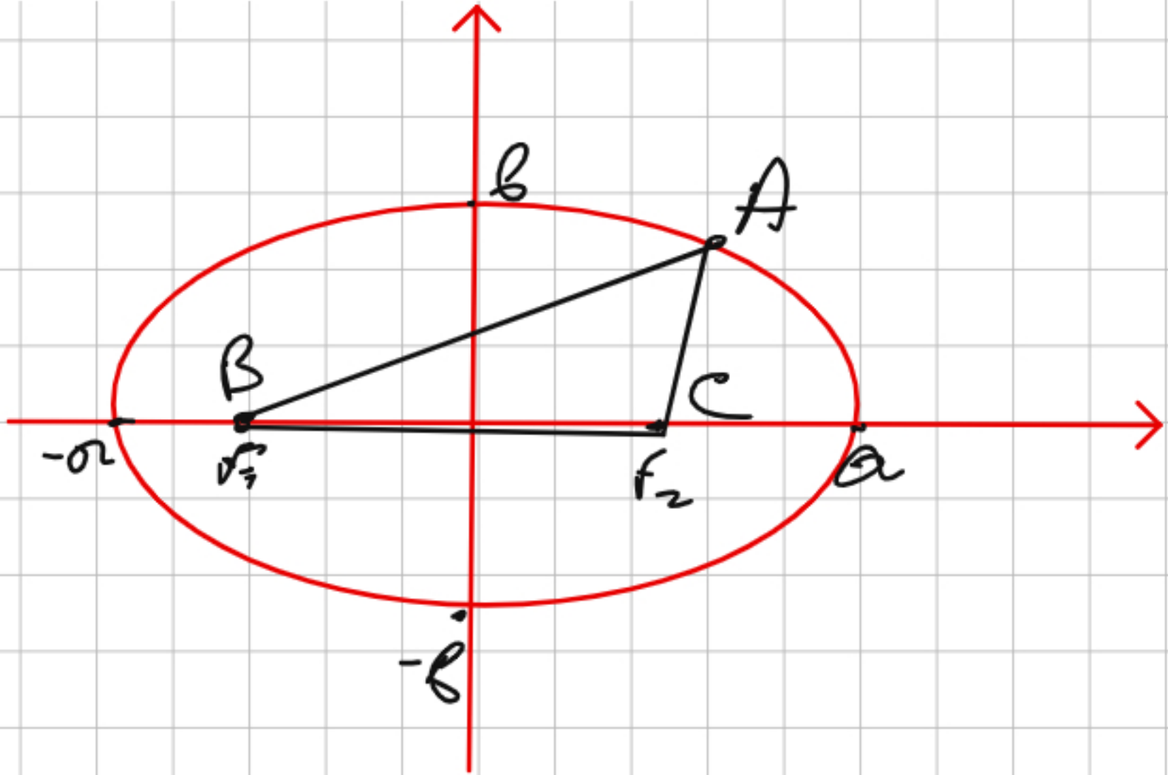


BitPaper
Share Knowledge

The perimeter of a triangle with one vertex on the ellipse $x^2/a^2 + y^2/b^2 = 1$ and the other two vertices at the foci

$(AB + AC) + BC =$

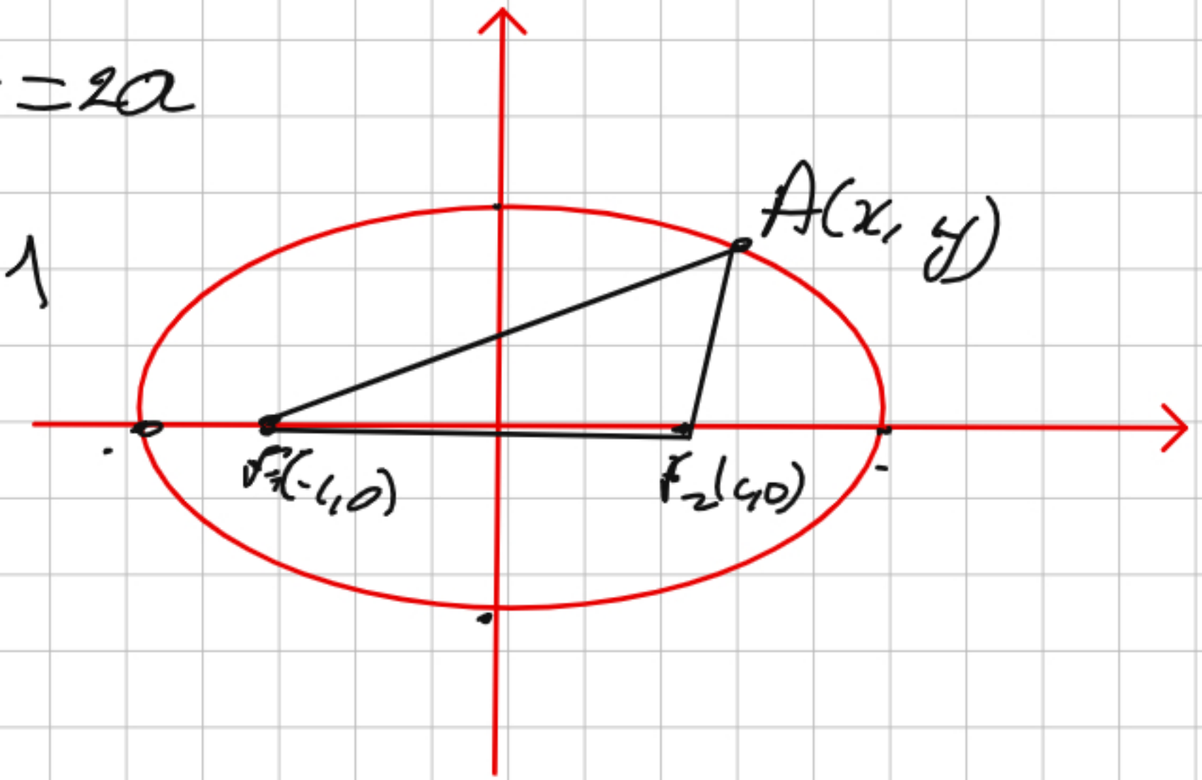
$= 2a + 2c$



BitPaper
Share Knowledge

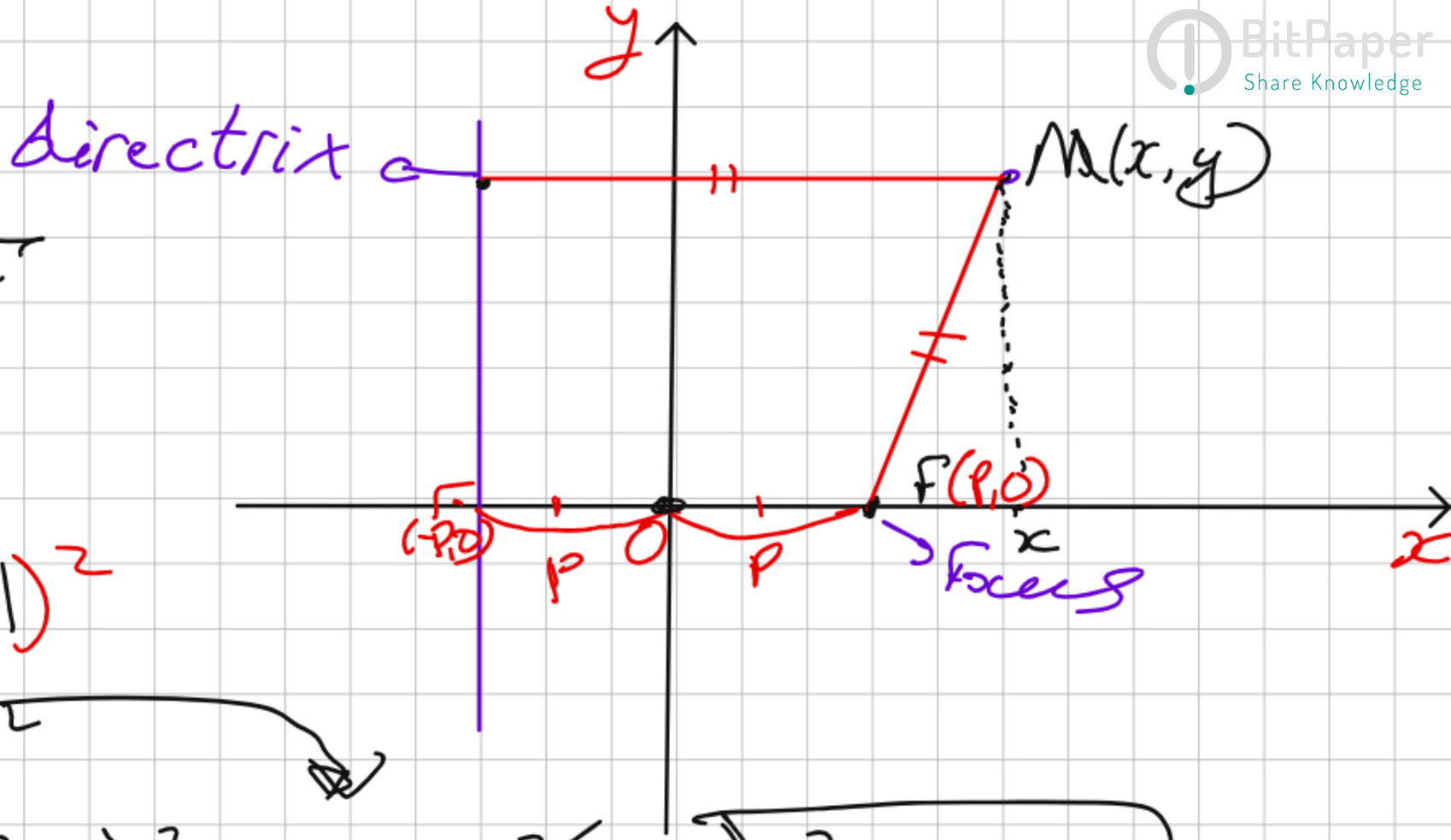
$$|AF_1| + |AF_2| = \text{const} = 2a$$

$$\frac{x^2}{a^2} + \frac{y^2}{a^2 - c^2} = 1$$



BitPaper
Share Knowledge

BitPaper
Share Knowledge



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

$$dist(M, d) = |x+p|$$

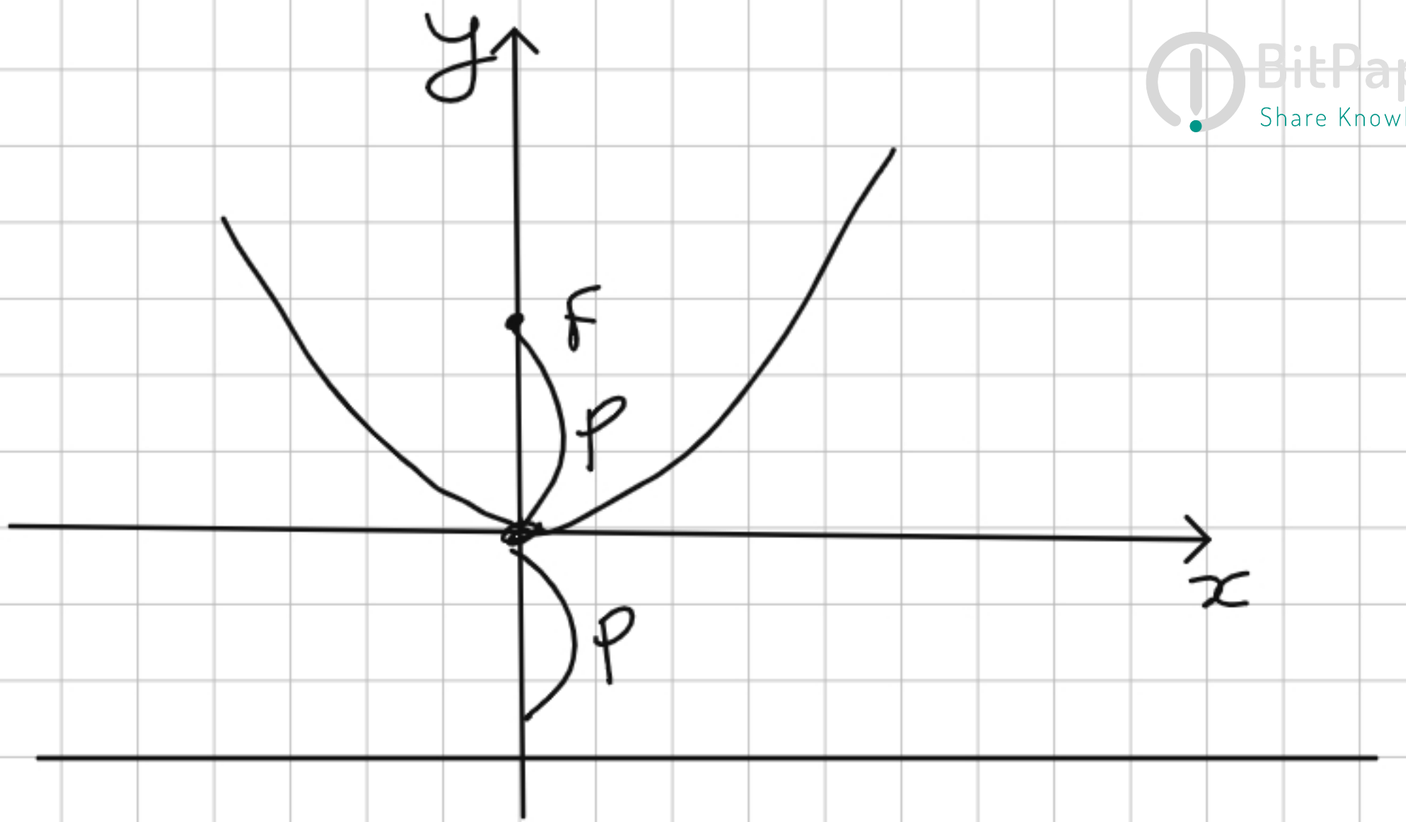
$$\left(\sqrt{(x-p)^2 + y^2}\right)^2 = (|x+p|)^2$$

$$(x-p)^2 + y^2 = (x+p)^2$$

$$x^2 - 2xp + p^2 + y^2 = x^2 + 2px + p^2$$

$$\therefore \quad \boxed{y^2 = 4px}$$

$y = 4px^2$



BitPaper
Share Knowledge

Find the coordinates of the vertex and focus, the equation of the directrix, the axis of symmetry, and the direction of opening of $2x^2 + 4x - 2y + 6 = 0$.

$$(x-h)^2 = 4p(y-k)^2$$

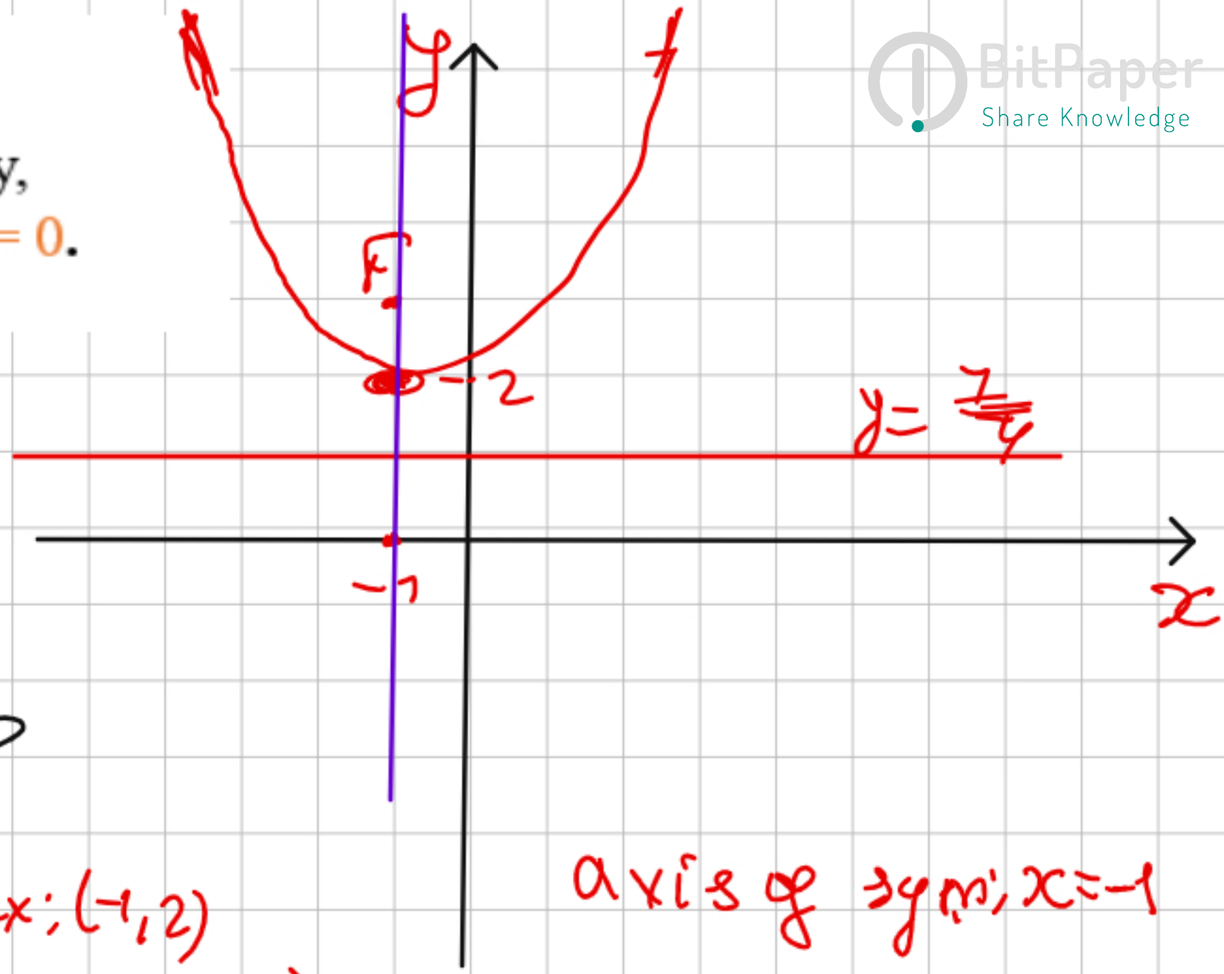
$$x^2 + 2x - y + 3 = 0$$

$$x^2 + 2x + 1 - 1 - y + 3 = 0$$

$$(x+1)^2 = y - 2$$

$$(x+1)^2 = (y-2)$$

$$p = \frac{1}{4}$$



Vertex: $(-1, 2)$

Focus: $(-1, \frac{9}{4})$

Directrix: $y = 2 - \frac{1}{4} = \frac{7}{4}$

axis of symm: $x = -1$

BitPaper
Share Knowledge

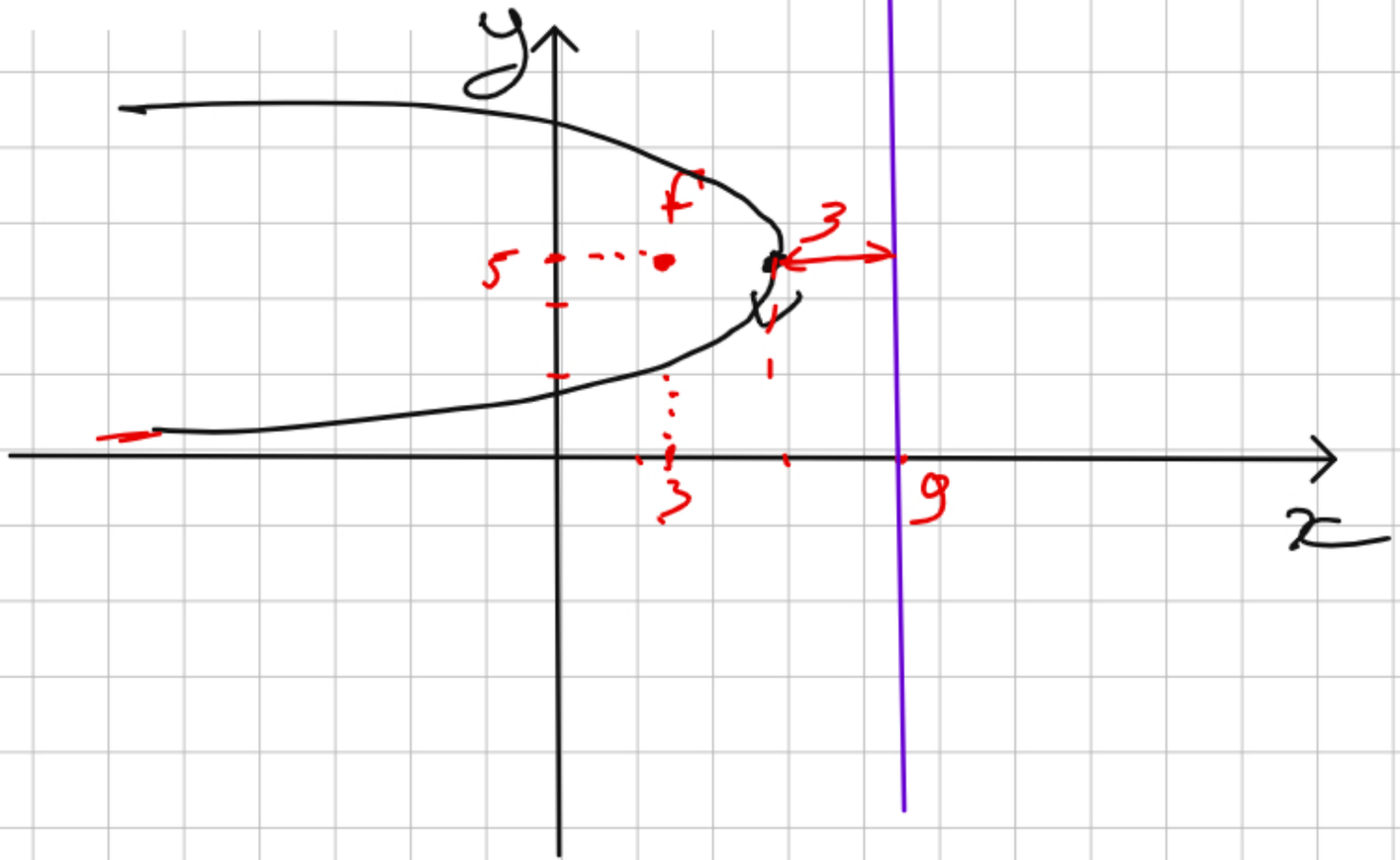
3 min

Write the equation of the parabola with a focus at (3, 5) and the directrix at $x = 9$

Vertex = (6, 5)

$(y-k)^2 = -4p(x-h)$

$(y-5)^2 = -12(x-6)$



$(y-5)^2 = -12(x-6)$

BitPaper
Share Knowledge

Practice. (8 min)

1) write the standard form of the equation of the hyperbola.

$$4x^2 - 32x - y^2 - 4y + 24 = 0$$

2) Write the equation of a hyperbola with foci at (-1 , 0) and (1 , 0) and one of its asymptotes passes through the point (1 , 3).

3) Write the equation of the hyperbola centered at (2, 5) with a vertex at (2, 8) and asymptote $y = \frac{3}{2}x + 2$.

BitPaper
Share Knowledge

write the standard form of the equation of the hyperbola.

$$4x^2 - 32x - y^2 - 4y + 24 = 0$$

$4(x^2 - 8x + 16 - 16) - (y^2 + 4y + 4 - 4) + 24 = 0$

$4(x-4)^2 - 64 - (y+2)^2 + 4 + 24 = 0$

$4(x-4)^2 - (y+2)^2 = 36 \qquad (\div 36)$

$$\frac{(x-4)^2}{9} - \frac{(y+2)^2}{36} = 1$$

BitPaper
Share Knowledge

Write the equation of a hyperbola with foci at (-1 , 0) and (1 , 0) and one of its asymptotes passes through the point (1 , 3).

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

$$y = \pm \frac{b}{a} x$$

$$3 = \frac{b}{a} \cdot 1$$

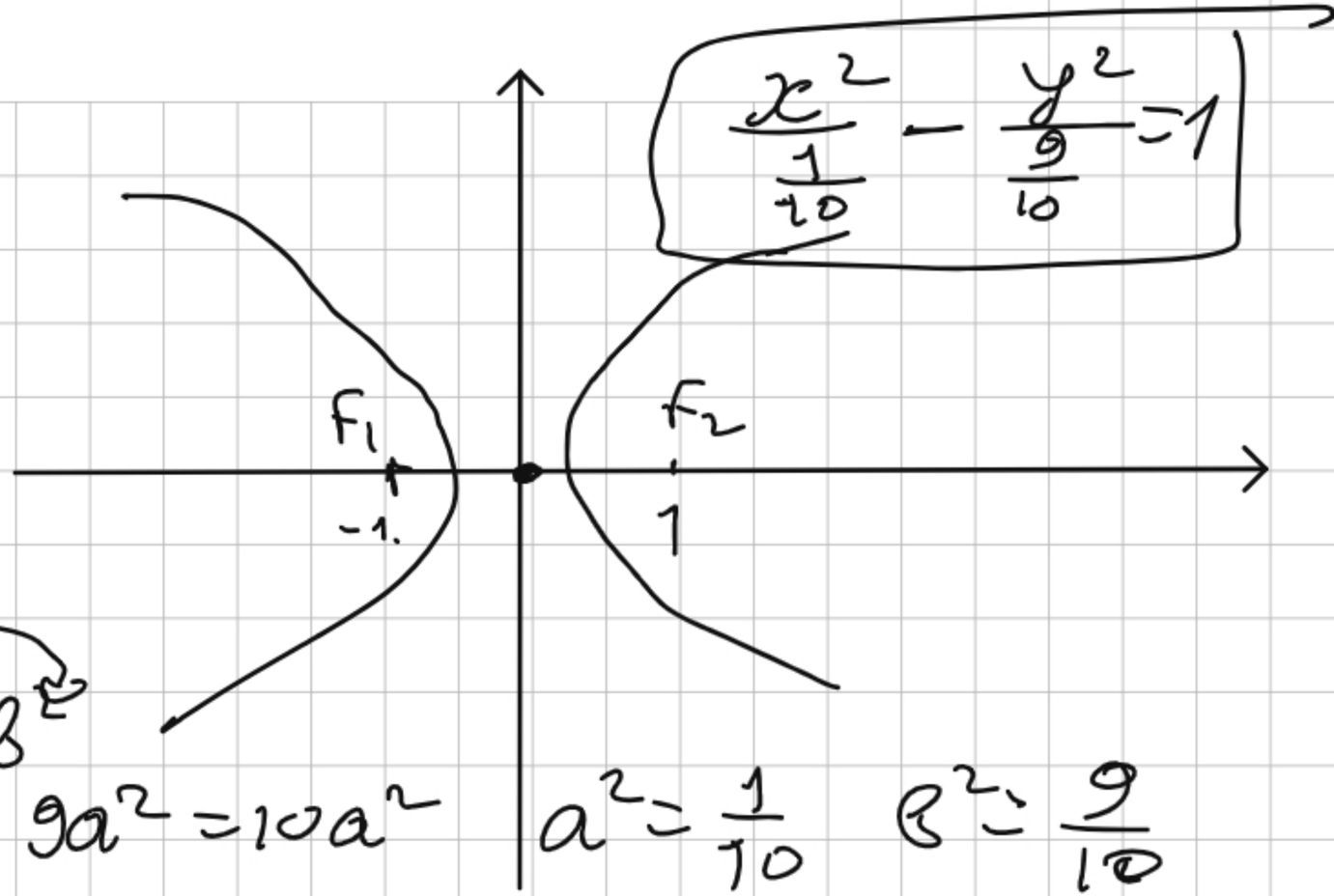
$$\boxed{b = 3a}$$

$c = 1$

$$c^2 = a^2 + b^2$$

$$1 = a^2 + 9a^2 = 10a^2$$

$$a^2 = \frac{1}{10} \qquad b^2 = \frac{9}{10}$$



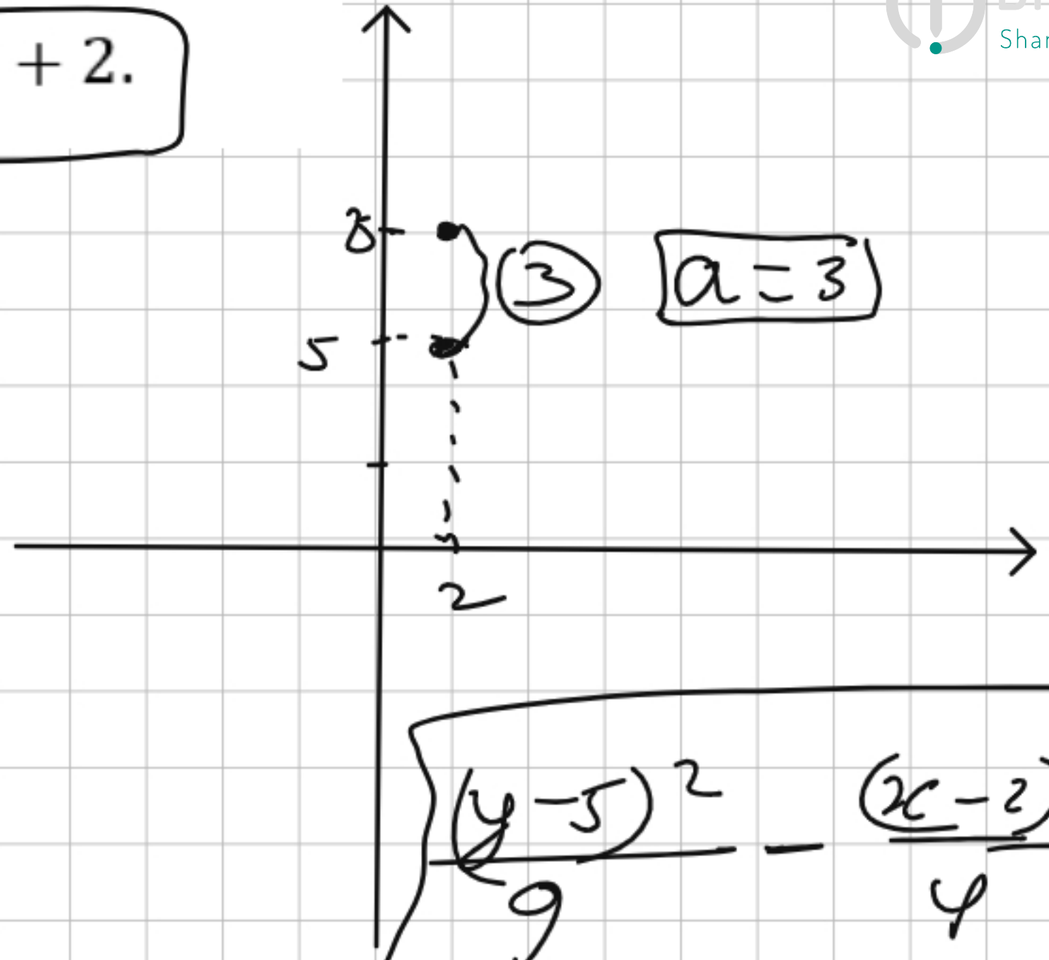
Write the equation of the hyperbola centered at (2, 5) with a vertex at (2, 8) and asymptote $y = \frac{3}{2}x + 2$.

$$\frac{(y-5)^2}{a^2} - \frac{(x-2)^2}{b^2} = 1$$

$$y - 5 = \pm \frac{a}{b}(x-2)$$

$$y = \pm \frac{a}{b}(x-2) + 5$$

$$\begin{cases} y = \pm \frac{3}{b}(x-2) + 5 \\ y = \frac{3}{2}x + 2 \end{cases} \Rightarrow b = 2$$



$$\frac{(y-5)^2}{9} - \frac{(x-2)^2}{4} = 1$$

BitPaper
Share Knowledge

2 min

Halley's Comet The orbit of Halley's comet is 36.18 AU long and 9.12 AU wide. What is its eccentricity?

0,968...

$a = \frac{36.18}{2} = 18.09$

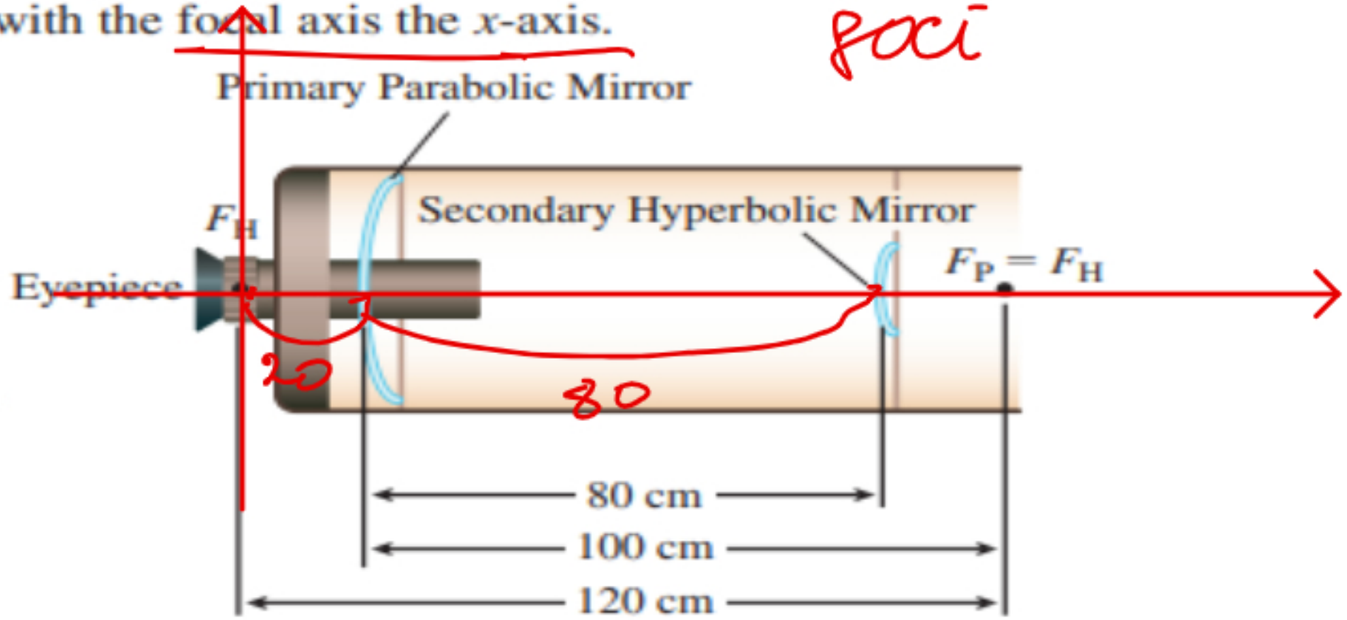
$B = \frac{9.12}{2} = 4.56$

$c = \sqrt{a^2 - B^2} = \sqrt{327.1481 - 20.7936} = \sqrt{306.3545} \simeq 17,51$

$e = \frac{c}{a} = \frac{17,51}{18,09} = 0.9677 \simeq 0,97$

Cassegrain Telescope A Cassegrain telescope as described in the section has the dimensions shown in the figure. Find the standard form for the equation of the hyperbola centered at the origin with the focal axis the x-axis.

foci



$$\frac{x^2}{10{,}000} - \frac{y^2}{6400} = 1$$

$$\frac{x^2}{2500} - \frac{y^2}{1100} = 1$$

$a = 100$ $\quad \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

$c = 120$

$b^2 : c^2 - a^2 = 120^2 - 100^2 = (120-100)(120+100) = 200 \cdot 220 = 4400$

$$\frac{x^2}{10{,}000} - \frac{y^2}{4400} = 1$$