

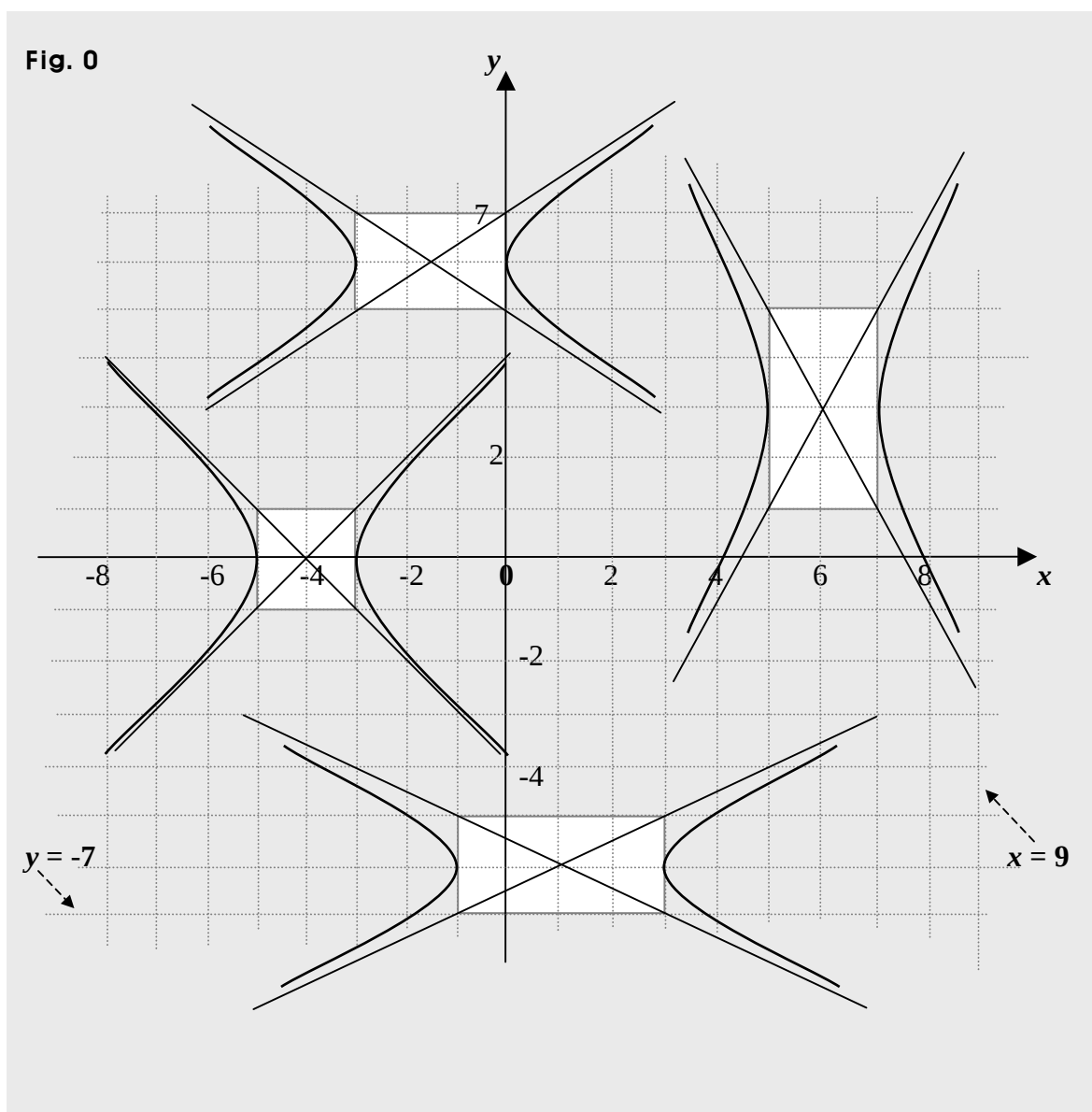
Examples 1 in Standard Forms

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Examples 1 in Standard Forms

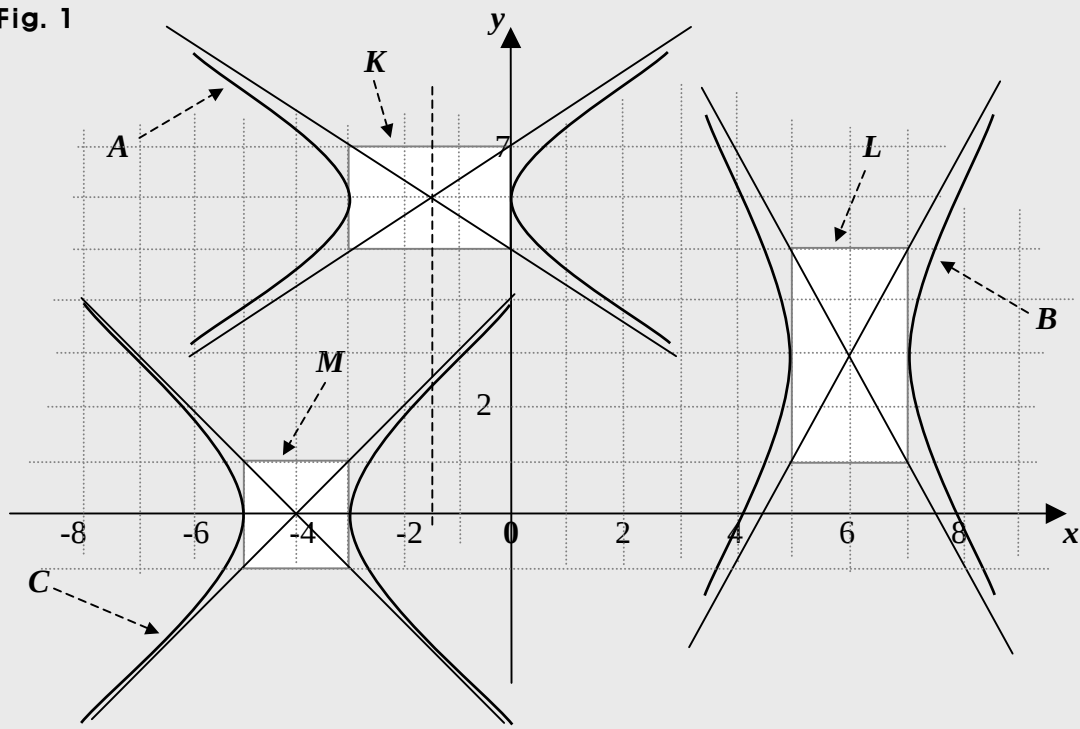
Label each hyperbola below, and then find the equation of each hyperbola.



Suggestions or Solutions To the Problems in the Examples

The hyperbolas are all horizontal, and beginning with the hyperbola **A** below, we can see first, the center is $(-\frac{3}{2}, 6)$, and the rectangle **K** is 3 by 2.

Fig. 1



The rectangle is tangent to the hyperbola at the vertices and the diagonals overlap the two asymptotes. And finding the equation of the hyperbola, we can use half the width and half the height of the rectangle. It's because of the fact below.

If a hyperbola is horizontal, the equation is $\frac{(x-u)^2}{a^2} - \frac{(y-v)^2}{b^2} = 1$, and if vertical, the equation is $\frac{(y-v)^2}{b^2} - \frac{(x-u)^2}{a^2} = 1$.

Then (u, v) is the center of the hyperbola, a is half the width (horizontal length) of the rectangle, and b is the half the height (vertical length).

And thus, beginning with the hyperbola **A**, we can see the center is $(-\frac{3}{2}, 6)$, and of the rectangle **K**, the width is 3, and the height is 2. So we get $u = -\frac{3}{2}$, $v = 6$, $a = \frac{3}{2}$, and $b = 1$.

Thus, we get $\frac{\{x - (-\frac{3}{2})\}^2}{(\frac{3}{2})^2} - \frac{(y - 6)^2}{1^2} = 1 \Rightarrow \frac{(x + \frac{3}{2})^2}{(\frac{3}{2})^2} - \frac{(y - 6)^2}{1^2} = 1$, which is the equation

of the hyperbola **A**. And we can put it this way, too, of course: $\frac{(x + \frac{3}{2})^2}{\frac{9}{4}} - (y - 6)^2 = 1$.

And this way, as well: $\frac{4(x + \frac{3}{2})^2}{9} - (y - 6)^2 = 1$ or $4(x + \frac{3}{2})^2 - 9(y - 6)^2 = 9$.

Next, moving on to the hyperbola **B**, we can see the center is $(6, 3)$, and of the rectangle **L**, the width is 2, and the height is 4. So we get $u = 6$, $v = 3$, $a = 1$, and $b = 2$.

Thus, we get $\frac{(x - 6)^2}{1^2} - \frac{(y - 3)^2}{2^2} = 1$, which is the equation of the hyperbola **B**.

And we can put it this way, too: $(x - 6)^2 - \frac{(y - 3)^2}{4} = 1$ or $4(x - 6)^2 - (y - 3)^2 = 4$.

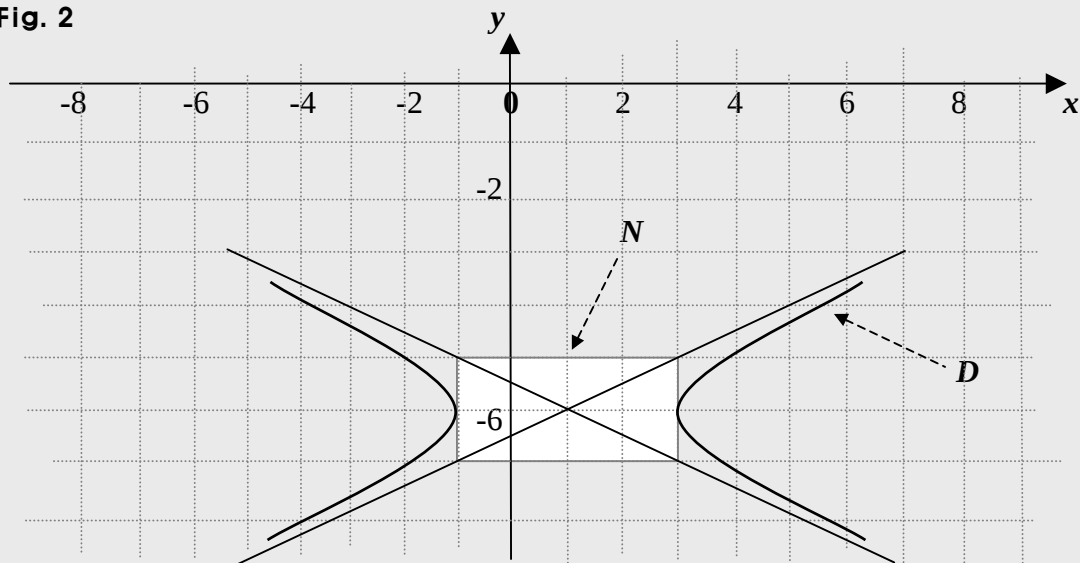
Moving next, on to the hyperbola **C**, we can see the center is $(-4, 0)$, and of the rectangle **M**, the width is 2, and the height is 2. So we get $u = -4$, $v = 0$, $a = 1$, and $b = 1$.

Thus, we get $\frac{\{x - (-4)\}^2}{1^2} - \frac{(y - 0)^2}{1^2} = 1 \Rightarrow \frac{(x + 4)^2}{1^2} - \frac{y^2}{1^2} = 1$, which is the equation of the hyperbola **C**.

And of course, we can put it this way, too: $(x + 4)^2 - y^2 = 4$.

And next, moving on to the other hyperbola, we have

Fig. 2



Then, we can see the center of hyperbola **D** is (1, -6), and of the rectangle **N**, the width is 4, and the height is 2. So we get $u = 1$, $v = -6$, $a = 2$, and $b = 1$.

Thus, we get $\frac{(x-1)^2}{2^2} - \frac{(y+6)^2}{1^2} = 1$, which is the equation of the hyperbola **D**.

And we can put it this way, too: $\frac{(x-1)^2}{4} - (y+6)^2 = 1$ or $(x-1)^2 - 4(y+6)^2 = 4$.