

The equation for hyperbola when the two focal points are $(0, k)$, $(0, -k)$ and the difference in length is given by $2b$

두 초점이 $(0, k)$, $(0, -k)$ 이고 길이의 차이가 $2b$ 로 주어졌을 때 쌍곡선의 방정식

(The equation for hyperbola when the two focal points are $(0, k)$, $(0, -k)$ and the difference in length is given by $2b$)

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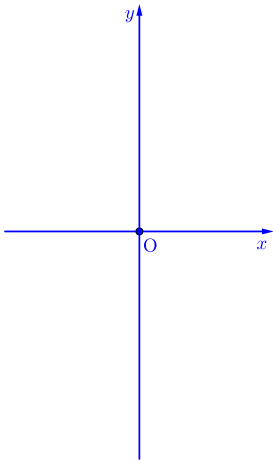
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The equation for hyperbola when the two focal points are $(0, k)$, $(0, -k)$ and the difference in length is given by $2b$

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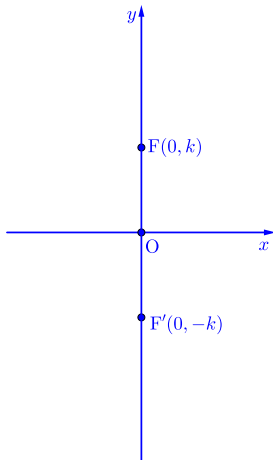
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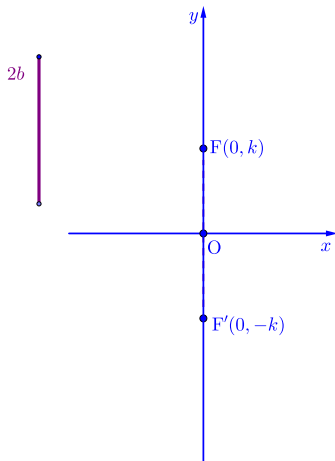
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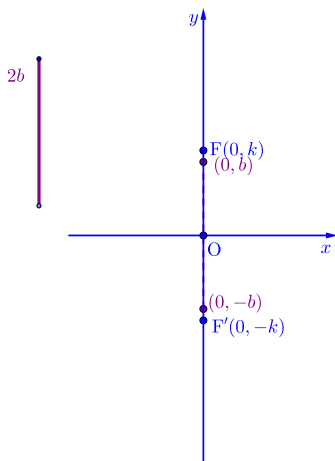
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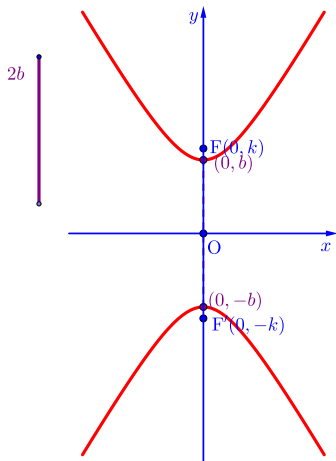
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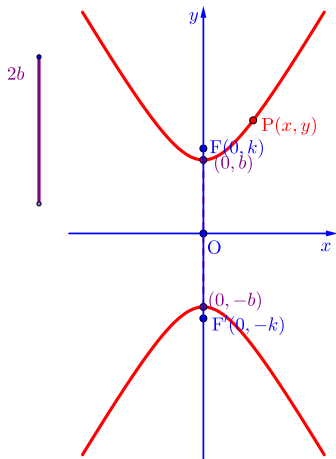
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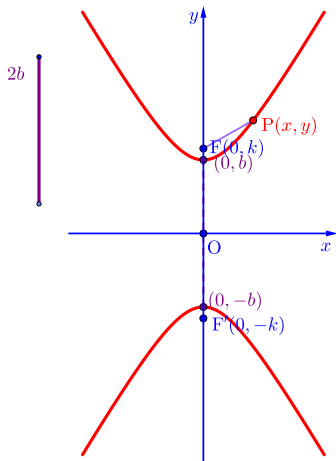
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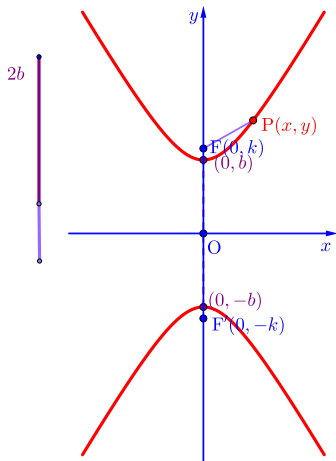
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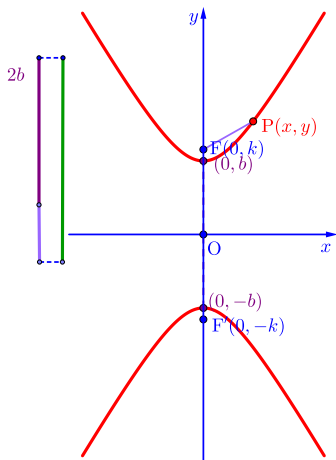
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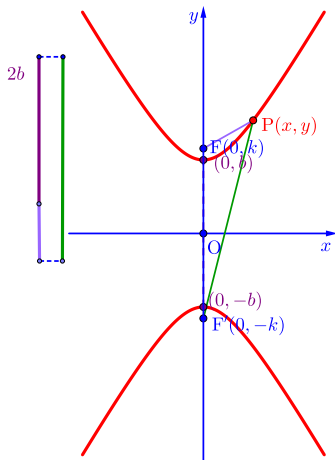
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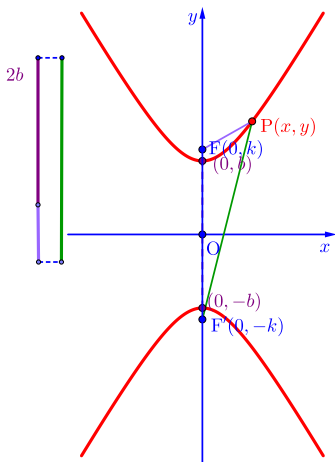
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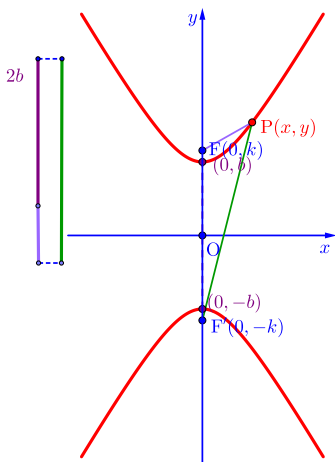


$$\left| \sqrt{x^2 + (y - k)^2} - \sqrt{x^2 + (y + k)^2} \right| = 2b$$

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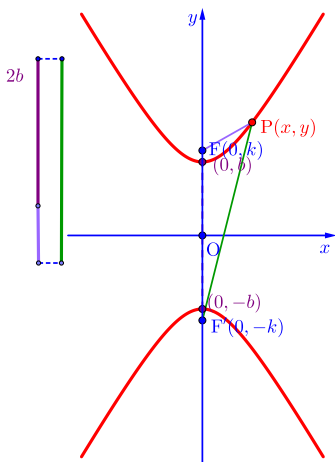


$$\left| \sqrt{x^2 + (y - k)^2} - \sqrt{x^2 + (y + k)^2} \right| = 2b$$
$$\sqrt{x^2 + (y - k)^2} - \sqrt{x^2 + (y + k)^2} = \pm 2b$$

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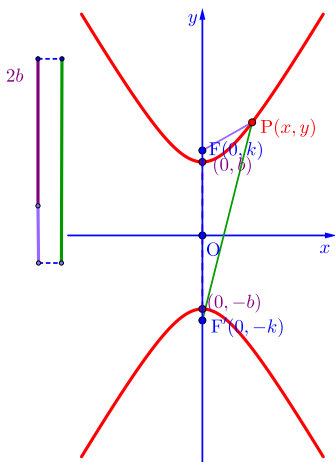


$$\left| \sqrt{x^2 + (y - k)^2} - \sqrt{x^2 + (y + k)^2} \right| = 2b$$
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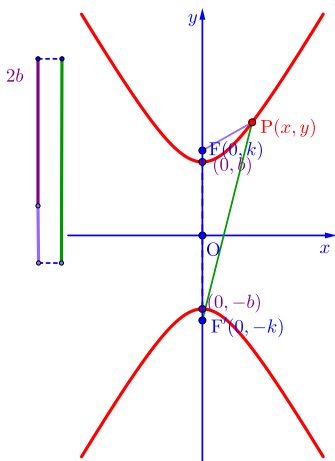
$$\sqrt{x^2 + (y - k)^2} = \sqrt{x^2 + (y + k)^2} \pm 2b$$

$$x^2 + (y - k)^2 = x^2 + (y + k)^2 \pm 4b\sqrt{x^2 + (y + k)^2} + 4b^2$$

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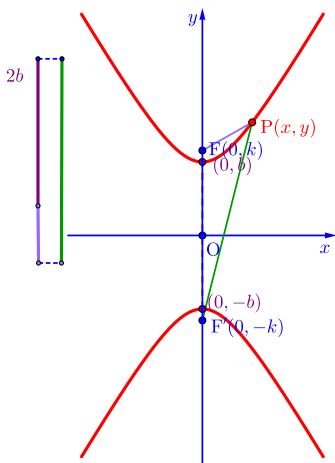
$$x^2 + (y - k)^2 = x^2 + (y + k)^2 \pm 4b\sqrt{x^2 + (y + k)^2} + 4b^2$$

$$-4ky - 4b^2 = \pm 4b\sqrt{x^2 + (y + k)^2}$$

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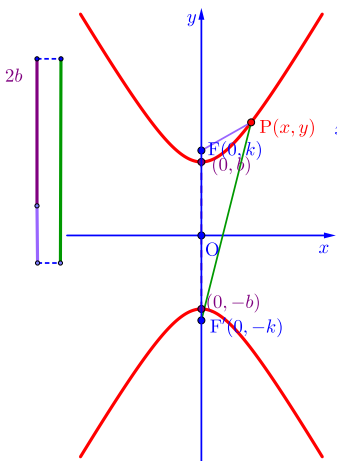
$$-4ky - 4b^2 = \pm 4b\sqrt{x^2 + (y + k)^2}$$

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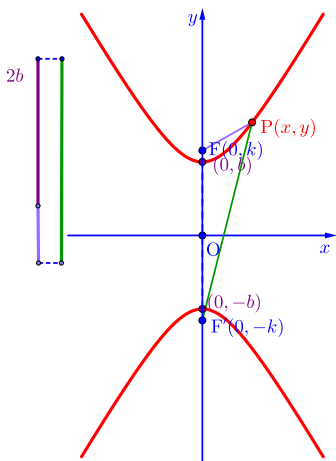


$$\begin{aligned} \left| \sqrt{x^2 + (y - k)^2} - \sqrt{x^2 + (y + k)^2} \right| &= 2b \\ \sqrt{x^2 + (y - k)^2} - \sqrt{x^2 + (y + k)^2} &= \pm 2b \\ \sqrt{x^2 + (y - k)^2} &= \sqrt{x^2 + (y + k)^2} \pm 2b \\ x^2 + (y - k)^2 &= x^2 + (y + k)^2 \pm 4b\sqrt{x^2 + (y + k)^2} + 4b^2 \\ -4ky - 4b^2 &= \pm 4b\sqrt{x^2 + (y + k)^2} \\ -ky - b^2 &= \pm b\sqrt{x^2 + (y + k)^2} \\ k^2y^2 + 2b^2ky + b^4 &= b^2x^2 + b^2y^2 + 2b^2ky + b^2k^2 \\ -b^2x^2 + (k^2 - b^2)y^2 &= b^2(k^2 - b^2) \end{aligned}$$

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

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$$-4ky - 4b^2 = \pm 4b\sqrt{x^2 + (y + k)^2}$$

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$$k^2y^2 + 2b^2ky + b^4 = b^2x^2 + b^2y^2 + 2b^2ky + b^2k^2$$

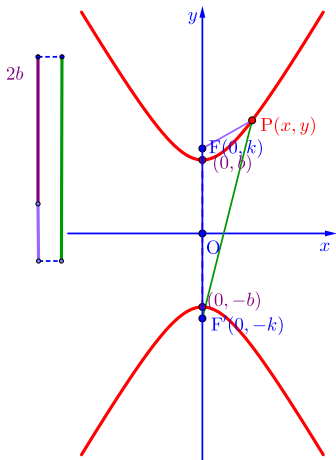
$$-b^2x^2 + (k^2 - b^2)y^2 = b^2(k^2 - b^2)$$

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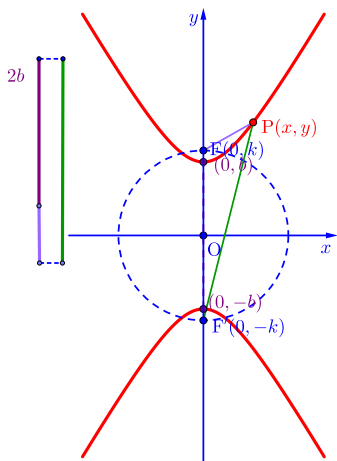


$$\begin{aligned}
 \left| \sqrt{x^2 + (y - k)^2} - \sqrt{x^2 + (y + k)^2} \right| &= 2b \\
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 -b^2x^2 + (k^2 - b^2)y^2 &= b^2(k^2 - b^2) \\
 b^2x^2 - (k^2 - b^2)y^2 &= -b^2(k^2 - b^2) \\
 \text{Let } a^2 &= k^2 - b^2
 \end{aligned}$$

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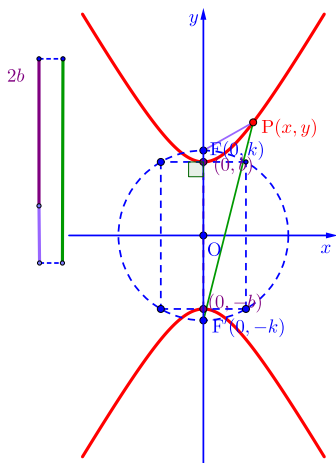
$$\text{Let } a^2 = k^2 - b^2$$

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

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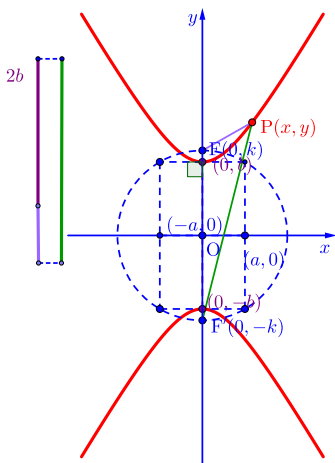
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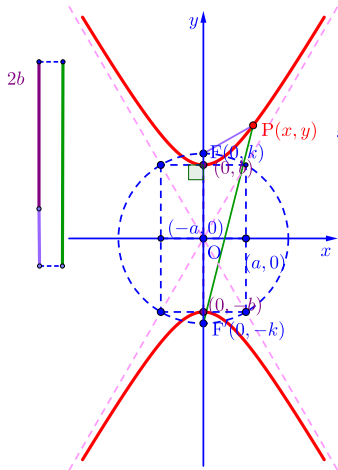
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Github:

<https://min7014.github.io/math20200610001.html>

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and you can see a picture moving.