

Section 9.3

Solutions and Hints

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for the book:

Precalculus, Mathematics for Calculus 4th Edition
by James Stewart, Lothar Redlin and Saleem Watson.

- 32. Find an equation for the hyperbola that satisfies the conditions:**
Vertices (0, -6) and (0, 6)
Asymptotes $y = -(1/3)x$ and $y = (1/3)x$

With vertices on (0, -6) and (0, 6) we know the transverse axis is vertical, or rather the curves open up and down. So the general form of the hyperbola is:

$$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1, \quad \text{with } a > 0 \text{ and } b > 0$$

Knowing the vertices are at (0, -6) and (0,6) also tells us $a = 6$.

And by definition the asymptotes occur at $y = -(a/b)*x$ and $y = (a/b)*x$.

And we were given they occur at $y = -(1/3)*x$ and $(1/3)*x$. Looking at the positive, if we put $a = 6$ into the general equation we get $y = (6 / b)*x$.

Setting this equal to the positive given we get:

$$\begin{aligned} (6 / b)*x &= (1 / 3)*x && \rightarrow (6 / b) = (1 / 3) \\ &&& \rightarrow 6 = (1 / 3)*b \\ &&& \rightarrow 18 = b \end{aligned}$$

So putting a and b into the general form we arrive at the answer:

The equation for the hyperbola is: $\frac{y^2}{36} - \frac{x^2}{324} = 1$