A hyperbola locus problem

Let the left and right vertices of the hyperbola $H: \frac{x^2}{3} - y^2 = 1$ be A_1, A_2.

Let $P(x_1, y_1)$, $Q(x_1, -y_1)$ be two different movable points on the given hyperbola.

Let the intersection of A_1P and A_2Q be M. Find the equation E of the locus of M.