1. (a) (1.5 point) Give the implicit cartesian equation of a hyperbola in the $xy$-plane, having its two vertices on the $x$-axis. Make a sketch.
(b) (1.5 point) Give a parametric cartesian equation of the above hyperbola.

2. (2 points) In this problem all vectors are functions of $t$.
   (a) Is the following statement true or false? (No justification needed)
   \[ \frac{d(\vec{r} \times \vec{v})}{dt} = \vec{r} \times \frac{d\vec{v}}{dt} \]
   where $\vec{v} = \frac{d\vec{r}}{dt}$
   (b) Complete the identity (No proof needed)
   \[ \frac{d}{dt}[(\vec{a} \times \vec{b}) \cdot \vec{c}] = \]
3. (5 points) Consider the equation \( \frac{d\vec{r}}{dt} = \vec{\omega} \times \vec{r} \), where \( \vec{\omega} \) is a constant vector, but \( \vec{r} \) depends on \( t \).

(a) Prove that \( \vec{r} \) has constant magnitude. Show all steps.
(b) Show that \( \vec{\omega} \cdot \vec{r} \) is constant.
(c) Show that \( \theta \), the angle between \( \vec{\omega} \) and \( \vec{r} \), is also constant.
(d) Conclude that \( \vec{v} = \frac{d\vec{r}}{dt} \) has constant magnitude.