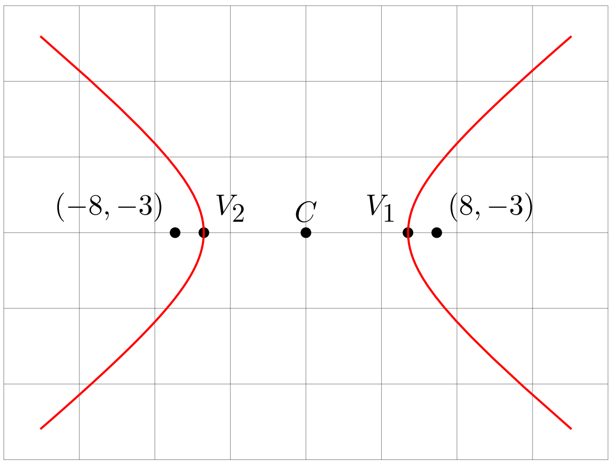
MATH137
Trigonometry with Analytic Geometry
2021 Fall Final Exam
Show-Your-Work Questions

1. (20 points) Use DeMoivre's Theorem to solve the equation $x^6 - 1 = 0$ (Hint: Express 1 as a complex number before you attempt to find all six roots.)

2. (20 points) Consider the graph of the hyperbola below. The coordinates of the two foci are indicated on the graph. The vertices, V_1 and V_2, are 12 units apart. Use this information to determine (a) the coordinates of the center C, (b) the coordinates of each vertex, V_1 and V_2, (c) the coordinates of the co-vertices, (d) the equation of both asymptotes, and (e) the equation of the hyperbola. (Hint: find a, b, c, h, and k.)



3. (25 points) Consider the following vectors: $\vec{w} = \langle 3, -5 \rangle$, $\vec{x} = \langle -2, 3 \rangle$, and $\vec{y} = \langle 4, 1 \rangle$. (a) Find the magnitude and direction of $\vec{w}$, $\vec{x}$, and $\vec{y}$, (b) perform the indicated operations and simplify: $3\vec{x} - 4\vec{w} + \frac{1}{2}\vec{y}$, (c) compute $\vec{x} \cdot \vec{y}$, (d) find a unit vector in the direction of $\vec{w}$, and (e) find the angle, α, between vectors $\vec{w}$ and $\vec{y}$.

4. (20 points) Find ALL solutions to the trigonometric equation below. Express your solution in radian measure rounded to four decimal places. Show all steps in the process for full credit!

$$6\cos^2(\beta) - 7\cos(\beta) + 2 = 0$$

5. (30 points) A robotic arm with a 0.5-meter segment and a 0.3-meter segment is attached at the origin, as shown in the figure below. The computer-controlled arm is positioned by rotating each segment through angles θ_1 and θ_2, as shown below. Given that we want to have the end of the arm at the point (0.7, 0.2), find θ_1 and θ_2 to the nearest tenth of a degree. (Hint: Laws of Cosines and Sines)