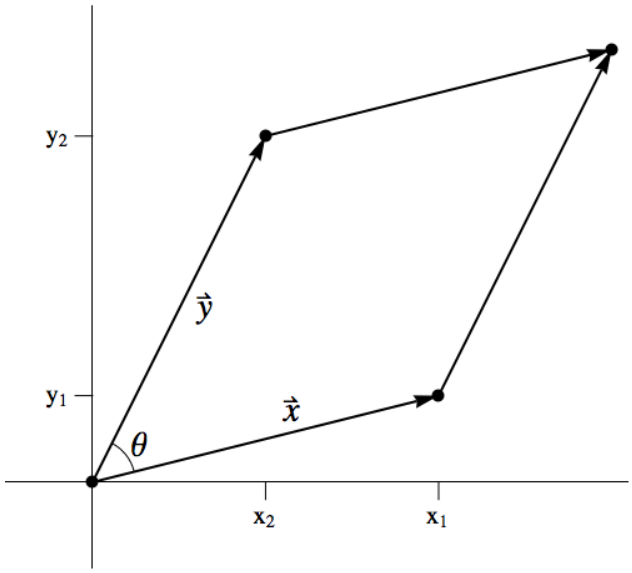
Name : ________________ Math 1C, Lesson 4: In-Class Problems **Class Number**: _____

---

1. Let $\mathbf{x} = \langle x_1, y_1 \rangle$ and $\mathbf{y} = \langle x_2, y_2 \rangle$ be given vectors.

   a. Find the area of the Parallelogram below using only the components of vectors $\mathbf{x}$ and $\mathbf{y}$.



   b. Explain how the component form of the cross product is related to part a above

   c. Find the area of the parallelogram as a function of θ and the two norms of vectors $\mathbf{x}$ and $\mathbf{y}$.

   d. Derive the sine formula for the cross product from the component form of the cross product.

---

2. T F For any vectors $\mathbf{u}, \mathbf{v} \in \mathbb{R}^3$, $(\mathbf{u} \times \mathbf{v}) \cdot \mathbf{u} = 0$.

---

3. T F Let $\mathbf{u}, \mathbf{v} \in \mathbb{R}^3$. Then $(\mathbf{u} - \mathbf{v}) \times (\mathbf{u} + \mathbf{v}) = 2\,\mathbf{u} \times \mathbf{v}$

---

4. Suppose $\mathbf{u}, \mathbf{v} \in \mathbb{R}^3$ are orthogonal vectors. Find the magnitude of $\mathbf{u} \times \mathbf{v}$.

---

5. Find a vector normal to $\langle 8, 0, 3 \rangle$ and $\langle -7, 1, 2 \rangle$.

---

6. Find the area of the triangle with vertices at the points $(0, 0, 0)$, $(1, 0, -1)$ and $(1, -1, 2)$.

7. Consider the diagram below. Suppose we want to project vector **y** onto the direction of **x**. Use this information to derive the formula for the projection of **y** onto **x**.