

Directions:

1. Section: Math251-007
2. Write your name with one character in each box below.
3. Show all work. No credit for answers without work.

1. **[3 points]** Let $P(2, -1, -2)$, $Q(3, 0, 3)$ and $R(1, 2, -1)$ be points in \mathbb{R}^3 . Find the angle formed by the triangle PQR at the vertex Q . Leave your answer in terms of inverse trig functions.

2. **[2 parts, 3 points each]** Let $\mathbf{a} = \langle 1, -1, 3 \rangle$ and $\mathbf{b} = \langle 5, 1, -2 \rangle$.
 - (a) Find $\mathbf{a} \times \mathbf{b}$.

 - (b) Find the area of the triangle formed by placing the tails of the vectors \mathbf{a} and \mathbf{b} at the origin.

3. **[1 point]** Let $\mathbf{a}, \mathbf{b} \in \mathbb{R}^n$ and let T be the triangle with vertices $\mathbf{0}, \mathbf{a}, \mathbf{b}$. The cross product is defined only in 3-dimensions, so it cannot be used to compute the area of T . Use the dot product theorem and the formula $\sin \theta = \sqrt{1 - \cos^2 \theta}$ for $0 \leq \theta \leq \pi$ to find a formula for the area of T in terms of the magnitudes of \mathbf{a} and \mathbf{b} and the dot product $\mathbf{a} \cdot \mathbf{b}$.