

**Time Limit:** 5 minutes**Instructions:** Open book. Closed notes. No calculator allowed.Instructions for all quizzes: Do not discuss any aspect of this quiz with other midshipmen until after 6th period.

Print your last name above. Also, fill in the bubble for your section.

Fill the bubble for the correct answer. Write your answers in any blanks provided.

Your work will not be graded unless requested.

Throughout this quiz we consider the three points

$$P = (1, 1, 1), \quad Q = (2, 3, 2), \quad R = (1, 2, 4).$$

1. We have  $\overrightarrow{PQ} = \langle 1, 2, 1 \rangle$  and  $\overrightarrow{PR} = \underline{\langle 0, 1, 3 \rangle} = \langle 1 - 1, 2 - 1, 4 - 1 \rangle$

2. Compute the cross product  $\overrightarrow{PQ} \times \overrightarrow{PR}$ . **Answer:**  $\overrightarrow{PQ} \times \overrightarrow{PR} = \underline{\langle 5, -3, 1 \rangle}$

$$\overrightarrow{PQ} \times \overrightarrow{PR} = \det \begin{bmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 1 & 2 & 1 \\ 0 & 1 & 3 \end{bmatrix} = \mathbf{i}(6 - 1) - \mathbf{j}(3 - 0) + \mathbf{k}(1 - 0) = \langle 5, -3, 1 \rangle$$

3. Find the area of  $\triangle PQR$ . 6  $\sqrt{35}$   $\sqrt{35}/2$  3 none of above; correct is \_\_\_\_\_

$$\text{Area of triangle} = \frac{1}{2} |\overrightarrow{PQ} \times \overrightarrow{PR}| = \frac{1}{2} |\langle 5, -3, 1 \rangle| = \frac{1}{2} \sqrt{5^2 + (-3)^2 + 1^2} = \sqrt{35}/2$$

4. Find all unit vectors orthogonal to the plane through  $P$ ,  $Q$ , and  $R$ .

PUT YOUR ANSWER ON THE LINE AND SHOW YOUR WORK BELOW.

The cross product  $\overrightarrow{PQ} \times \overrightarrow{PR}$  is orthogonal to the plane.

We need to “unitize” this cross product by dividing by its length.

We should also take the negative of this unitized vector.

**Answer:**  $\pm \frac{1}{\sqrt{35}} \langle 5, -3, 1 \rangle$