

Time: 5 minutes: Closed book, notes. No calculator.

Instructions: Fill in the correct bubbles. Put your answers in the blanks.

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 $\mathbf{PQ} = \langle 1, 2, 1 \rangle$ and $\mathbf{PR} = \underline{\langle 0, 1, 3 \rangle} = \langle 1 - 1, 2 - 1, 4 - 1 \rangle$

2. Compute the cross product.

$$\mathbf{PQ} \times \mathbf{PR} = \underline{\langle 5, -3, 1 \rangle}$$

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

3. Find the area of $\triangle PQR$.

- 6
- $\sqrt{35}$
- $\sqrt{35}/2$
- 3
- none of above; correct is _____

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

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

The cross product $\mathbf{PQ} \times \mathbf{PR}$ 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: $\pm \frac{1}{\sqrt{35}} \langle 5, -3, 1 \rangle$