

Given the points $P(1, -1, 2)$, $Q(2, 3, 4)$, $B(0, 1, -1)$, find:

1. **(3 points)** the equation of the sphere for which PQ is a diameter;
2. **(3 points)** the vectors \overrightarrow{PB} , \overrightarrow{PQ} and $\overrightarrow{PB} \times \overrightarrow{PQ}$;
3. **(3 points)** the direction cosines for \overrightarrow{PB} .
4. **(3 points)** the degree measure of the acute angle \widehat{BPQ} ;
5. **(3 points)** the area of the triangle BPQ ;
6. **(3 points)** the height of the triangle BPQ when PQ is the base;
7. **(3 points)** a decomposition of the vector \overrightarrow{PB} into two vectors, one in the direction of \overrightarrow{PQ} and the other orthogonal to it.
8. **(3 points)** parametric equations of the line that passes through P and Q ;
9. **(2 points)** all points C on the line through P and Q such that the triangle PBC has a right angle;
10. **(3 points)** the distance between the point B and the line through P and Q ;