Perpendicularity

6 questions | 14 marks

Equivalent correct methods earn the corresponding marks.

1. Are $(2, 3)$ and $(6, -4)$ perpendicular? [2 marks]

Their dot product is $12 - 12 = 0$.

Answer: Yes.

2. Find k if $(k, 5)$ is perpendicular to $(2, -6)$. [2 marks]

$2k - 30 = 0$.

Answer: $k = 15$.

3. Find a unit vector perpendicular to $(3, 4)$. [2 marks]

Rotate to $(-4, 3)$ and divide by its length five.

Answer: For example $(-\frac{4}{5}, \frac{3}{5})$.

4. $A = (0, 0)$, $B = (2, 1)$, $C = (1, 3)$. Decide whether angle ABC is a right angle. [3 marks]

$BA = (-2, -1)$; $BC = (-1, 2)$.

Their dot product is zero.

Answer: Yes.

5. For $u = (t, 2)$, $v = (3, t)$, find all real t making u perpendicular to v. [3 marks]

$u \cdot v = 3t + 2t = 5t$.

Set it equal to zero; the resulting vectors are both non-zero.

Answer: $t = 0$.

6. Explain why $\mathbf{0} \cdot (1, 2) = 0$ does not show a right angle. [2 marks]

The geometric perpendicularity conclusion requires both vectors to be non-zero.

Answer: The zero vector has no direction, so it forms no defined angle.