Angle between vectors

6 questions | 15 marks

Equivalent correct methods earn the corresponding marks.

1. Find the angle between $(1, 0)$ and $(1, 1)$. [2 marks]

$\cos\theta = \frac{1}{\sqrt{2}}$.

Answer: 45°.

2. Find the angle between $(1, 2)$ and $(2, -1)$. [2 marks]

The dot product is $2 - 2 = 0$.

Answer: 90°.

3. Find the angle between $(3, 4)$ and $(1, 0)$ to 0.1°. [3 marks]

$\cos\theta = \frac{3}{5}$.

Take inverse cosine.

Answer: 53.1°.

4. If the angle between non-zero vectors u and v is 35°, find the angle between u and $-v$. [2 marks]

Reversing v changes cosine to its negative, giving $180^\circ - 35^\circ$.

Answer: 145°.

5. Can $\mathbf{a} \cdot \mathbf{b} = 20$ hold if $|\mathbf{a}| = 3$ and $|\mathbf{b}| = 5$? Explain. [3 marks]

It would require $\cos\theta = \frac{20}{15} > 1$.

The dot-product magnitude cannot exceed the product of the lengths.

Answer: No.

6. $A = (0, 0)$, $B = (4, 0)$, $C = (1, 3)$. Find angle BAC to 0.1°. [3 marks]

Use $AB = (4, 0)$ and $AC = (1, 3)$.

$\cos\theta = \frac{4}{4\sqrt{10}} = \frac{1}{\sqrt{10}}$.

Answer: 71.6°.