Dot product and projection

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. Calculate $(2, -1, 3) \cdot (4, 2, -2)$. [2 marks]

Multiply matching components.

$8 - 2 - 6 = 0$.

Answer: 0

2. Find the angle between (1,0,0) and (1,1,1), to one decimal degree. [2 marks]

The dot product is 1 and the magnitudes are 1 and $\sqrt{3}$.

Take $\cos^{-1}(1/\sqrt{3})$.

Answer: 54.7°

3. Project (3,4,0) along (1,0,0). [2 marks]

The target is a unit direction.

Keep the x component and set the perpendicular components to zero.

Answer: $(3, 0, 0)$

4. Find the component of (2,-1,2) perpendicular to (1,0,0). [2 marks]

Its parallel component is $(2, 0, 0)$.

Subtract that component.

Answer: $(0, -1, 2)$

5. Find k for perpendicular vectors (1,k,2) and (3,2,-1). [2 marks]

Their dot product is $3 + 2k - 2$.

Set it to zero and solve.

Answer: $k = -1/2$

6. Force (6,2,-1) N acts through displacement (3,-1,2) m. Find the work. [2 marks]

Work equals the dot product.

$18 - 2 - 2 = 14$.

Answer: 14 J