# 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 $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$.

**Answer:** $54.7^\circ$

**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:** $k = -\frac{1}{2}$

**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