

Vectors: worked examples

HSC Mathematics Extension 2

These examples show assessable skills, not an official HSC topic weighting or prediction. The 2024 NSW syllabuses have their first HSC examination in 2027; students sitting the 2026 HSC continue under the applicable 2017 syllabus.

Worked example 1 | 2 marks

Catalog reference: ext2_jr25_triangle_area_from_vectors | seed 41001 | mapping ext2-vectors-1

Area from two vectors

Let $\mathbf{u} = 2\text{vec}(1, 2, 3)$ and $\mathbf{v} = 2\text{vec}(2, -1, 1)$. Find the area of the triangle formed by $\mathbf{u}$, $\mathbf{v}$ and $\mathbf{u} - \mathbf{v}$.

(a) Find the exact area. [2 marks]

Answer: $((5\sqrt{3})) / 2$

Vector Magnitudes And Dot Product: $|\mathbf{u}|^2 = 14 \cdot 2^2$, $|\mathbf{v}|^2 = 6 \cdot 2^2$ and $(\mathbf{u} \cdot \mathbf{v})^2 = 9 \cdot 2^4$.

Triangle From Parallelogram: $((5\sqrt{3})) / 2$

Worked example 2 | 2 marks

Catalog reference: ext2_morris_2025_q12a_vector_angle | seed 41001 | mapping ext2-vectors-1

Angle between vectors

Find the acute angle between $\mathbf{u} = \text{vec}(3, 1, -2)$ and $\mathbf{v} = 2\text{vec}(1, 0, -3)$, to the nearest degree.

(a) Calculate the angle. [2 marks]

Answer: $(180 \cos^{-1}((9\sqrt{140}) / 140)) / \pi$

Dot Product: $\cos(\theta) = 9/\sqrt{140}$.

Inverse Cosine: $\theta \approx 40$ degrees.

Worked example 3 | 2 marks

Catalog reference: ext2_cssa25_perpendicular_vector_combination | seed 41001 | mapping ext2-vectors-1

A perpendicular vector combination

Vectors satisfy $\mathbf{a} \cdot \mathbf{c} = -12$ and $\mathbf{b} \cdot \mathbf{c} = 3$. Find k if $\mathbf{a} + k\mathbf{b}$ is perpendicular to $\mathbf{c}$.

(a) Find k . [2 marks]

Answer: 4

Dot Product Zero: $(\mathbf{a} + k\mathbf{b}) \cdot \mathbf{c} = -4 + ks = 0$.

Solve Linear Equation: 4

Source and methodology

Examples are deterministic curriq catalog generations from existing QDSL archetypes at the published fixed seed. The generator copies only student-facing prompts, mark allocations, topic mappings, display tables or options, checked answers and marking-path results into this resource.

Official syllabus source:

<https://curriculum.nsw.edu.au/learning-areas/mathematics/mathematics-extension-2-11-12-2024/overview/course>

Teacher verification note: check the mathematics, notation, permitted technology and syllabus fit for your cohort before classroom or assessment use.