Cross product and determinant calculations

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. Find (1,0,1) cross (0,2,1). [2 marks]

Use $(0 \cdot 1 - 1 \cdot 2, 1 \cdot 0 - 1 \cdot 1, 1 \cdot 2 - 0 \cdot 0)$.

Check both input dot products are zero.

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

2. Find (0,2,1) cross (1,0,1). [2 marks]

Reverse the order of the previous cross product.

Negate every component.

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

3. Find $\mathbf{i} \times \mathbf{j}$ and $\mathbf{j} \times \mathbf{i}$. [2 marks]

The positive basis is right-handed.

Reversing the order negates the result.

Answer: $\mathbf{k}$ and $-\mathbf{k}$

4. Is (3,0,-1) perpendicular to (1,2,3) cross (2,-1,0)? [2 marks]

The cross product is $(3, 6, -5)$.

Its dot product with $(3, 0, -1)$ is 14.

Answer: No.

5. Find the determinant with rows (1,2,0), (0,1,3), (2,0,1). [2 marks]

Cross the last two rows: $(1, 6, -2)$.

Dot with the first: $1 + 12 = 13$.

Answer: 13

6. Find the volume spanned by (2,0,0), (0,3,0), (0,0,4). [2 marks]

The determinant is $2 \cdot 3 \cdot 4 = 24$.

Take its absolute value for volume.

Answer: 24 cubic units