Vector operations

6 questions | 12 marks

Equivalent correct methods earn the corresponding marks.

1. For $a = (2, -1, 3)$, $b = (-1, 4, 2)$, find $a + b$ and $3a - 2b$. [2 marks]

Add components.

For the second result subtract $(-2, 8, 4)$ from $(6, -3, 9)$.

Answer: $(1, 3, 5)$ and $(8, -11, 5)$

2. Find the midpoint of $(2, 4, -2)$ and $(6, -2, 8)$. [2 marks]

Add coordinates to get $(8, 2, 6)$.

Divide by 2.

Answer: $(4, 1, 3)$

3. Find P one quarter of the way from $(0, 1, 2)$ to $(8, 5, -2)$. [2 marks]

One quarter of displacement $(8, 4, -4)$ is $(2, 1, -1)$.

Add this to the first point.

Answer: $(2, 2, 1)$

4. Are $A(1,1,0)$, $B(3,5,2)$, $C(4,7,3)$ collinear? [2 marks]

$\overrightarrow{AB} = (2,4,2) = 2(1,2,1)$.

$\overrightarrow{AC} = 3(1,2,1)$, so the displacements are parallel.

Answer: Yes.

5. Solve $2\mathbf{p} + (1,-1,3) = (7,5,-1)$. [2 marks]

Subtract the fixed vector to obtain $2\mathbf{p} = (6,6,-4)$.

Divide by 2.

Answer: $\mathbf{p} = (3,3,-2)$

6. For parallelogram $ABCD$ in order, $A(1,0,1)$, $B(3,2,0)$, $C(6,1,4)$, find D. [2 marks]

$\overrightarrow{AD} = \overrightarrow{BC}$, so $\mathbf{d} = \mathbf{a} + \mathbf{c} - \mathbf{b}$.

Substitute and combine components.

Answer: $(4,-1,5)$