Position and Displacement Vectors

Starter

1. **(Review of last lesson)** Given that $\mathbf{a} = 2\mathbf{i} + 5\mathbf{j}$ and $\mathbf{b} = 3\mathbf{i} - \mathbf{j}$, find:
   (a) λ if $\mathbf{a} + \lambda\mathbf{b}$ is parallel to the vector $\mathbf{i}$
   (b) μ if $\mu\mathbf{a} + \mathbf{b}$ is parallel to the vector $\mathbf{j}$.

Working: (a) $\mathbf{a} + \lambda\mathbf{b} = 2\mathbf{i} + 5\mathbf{j} + \lambda(3\mathbf{i} - \mathbf{j}) = (2 + 3\lambda)\mathbf{i} + (5 - \lambda)\mathbf{j}$
To be parallel to the vector $\mathbf{i}$, the $\mathbf{j}$ component must be 0.
So $5 - \lambda = 0 \Rightarrow \lambda = 5$

(b) $\mu\mathbf{a} + \mathbf{b} = \mu(2\mathbf{i} + 5\mathbf{j}) + 3\mathbf{i} - \mathbf{j} = (2\mu + 3)\mathbf{i} + (5\mu - 1)\mathbf{j}$
To be parallel to the vector $\mathbf{j}$, the $\mathbf{i}$ component must be 0.
So $2\mu + 3 = 0 \Rightarrow \mu = -\frac{3}{2}$

E.g. 1 Find the displacement vector from the point $A(1, 5)$ to $B(4, 3)$.

Working: $\overrightarrow{AB} = \begin{pmatrix} 4 \\ 3 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \end{pmatrix} = \begin{pmatrix} 3 \\ -2 \end{pmatrix}$

E.g. 2 Find the distance between the points $P(6, 2)$ and $Q(1, -10)$.

Working: $\overrightarrow{PQ} = \begin{pmatrix} 1 \\ -10 \end{pmatrix} - \begin{pmatrix} 6 \\ 2 \end{pmatrix} = \begin{pmatrix} -5 \\ -12 \end{pmatrix}$

$\text{Distance} = |\overrightarrow{PQ}| = \left| \begin{pmatrix} -5 \\ -12 \end{pmatrix} \right| = \sqrt{(-5)^2 + (-12)^2} = 13$

Video: Position vectors
Video: Vector notation

Solutions to Starter and E.g.s

Exercise
p236 12C Qu 2i, 4i, 5-6