

VECTORS (Q 2, PAPER 2)

LESSON NO. 3: DOT PRODUCT

2006

2 (b) $\vec{p} = -5\vec{i} + 2\vec{j}$, $\vec{q} = \vec{i} - 6\vec{j}$ and $\vec{r} = -\vec{i} + 5\vec{j}$.

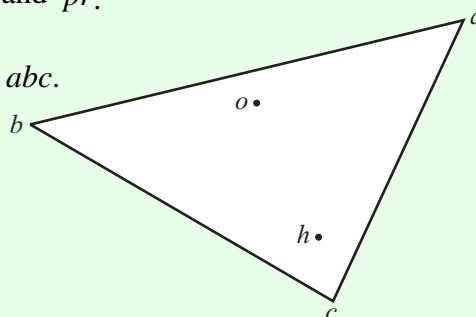
(i) Express \vec{pq} and \vec{pr} in terms of \vec{i} and \vec{j} .

(ii) Given that $10\vec{s} = |\vec{pr}|\vec{pq} + |\vec{pq}|\vec{pr}$, express \vec{s} in terms of \vec{i} and \vec{j} .

(iii) Find the measure of the angle between \vec{s} and \vec{pr} .

2 (c) The origin o is the circumcentre of the triangle abc .

If $\vec{h} = \vec{a} + \vec{b} + \vec{c}$, show that $\vec{ah} \perp \vec{bc}$.



2005

2 (c) $\vec{u} = \vec{i} + 5\vec{j}$ and $\vec{v} = 4\vec{i} + 4\vec{j}$.

(i) Find $\cos \angle uov$, where o is the origin.

(ii) $\vec{r} = (1-k)\vec{u} + k\vec{v}$, where $k \in \mathbf{R}$ and $k \neq 0$. Find the value of k for which

$$|\angle uov| = |\angle vor|.$$

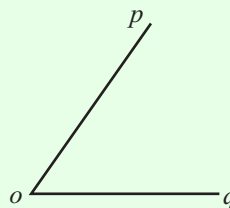
2004

2 (c) p and q are points and o is the origin. p , q and o

are not collinear and $|\vec{p}| = |\vec{q}|$.

(i) Prove that \vec{pq} is perpendicular to $(\vec{p} + \vec{q})$.

(ii) Prove that $\vec{po} \cdot \vec{pq} = \frac{1}{2}|\vec{pq}|^2$.



2003

2 (b) $\vec{p} = 2\vec{i} + \vec{j}$, $\vec{q} = 3\vec{i} + k\vec{j}$, $\vec{r} = 3\vec{i} + t\vec{j}$ where $k, t \in \mathbf{R}$ and o is the origin.

(i) Given that $\vec{p} \perp \vec{q}$, calculate the value of k .

(ii) Given that $|\angle por| = 45^\circ$, calculate the two possible values of t .

2002

2 (c) $\vec{k} = \vec{i} + 3\vec{j}$, $\vec{n} = 4\vec{i} - 2\vec{j}$, $\vec{u} = 2\vec{i} + \vec{j}$ and $\vec{v} = x\vec{i} + y\vec{j}$ where $x, y \in \mathbf{R}$.

(i) Express the value of $\overrightarrow{kn} \cdot \overrightarrow{kv}$ in the form $ax + by + c$ where $a, b, c \in \mathbf{R}$.

(ii) Prove that if $\overrightarrow{kn} \cdot \overrightarrow{kv} = \overrightarrow{kn} \cdot \overrightarrow{ku}$, and $\vec{u} \neq \vec{v}$, then $\overrightarrow{kn} \perp \overrightarrow{uv}$.

2001

2 (c) rst is a triangle where $\vec{r} = -\vec{i} + 2\vec{j}$, $\vec{s} = -4\vec{i} - 2\vec{j}$ and $\vec{t} = 3\vec{i} - \vec{j}$.

(i) Express \overrightarrow{rs} , \overrightarrow{st} and \overrightarrow{tr} in terms of \vec{i} and \vec{j} .

(ii) Show that the triangle rst is right-angled at r .

(iii) Find the measure of $\angle rst$.

ANSWERS

2006 2 (b) (i) $\overrightarrow{pq} = 6\vec{i} - 8\vec{j}$, $\overrightarrow{pr} = 4\vec{i} + 3\vec{j}$ (ii) $\vec{s} = 7\vec{i} - \vec{j}$ (iii) 45°

2005 2 (c) (i) $\frac{3}{\sqrt{13}}$ (ii) $k = 3$

2003 2 (b) (i) $k = -6$ (ii) $t = -1, 9$

2002 2 (c) (ii) $3x - 5y + 12$

2001 2 (c) (i) $\overrightarrow{rs} = -3\vec{i} - 4\vec{j}$, $\overrightarrow{st} = 7\vec{i} + \vec{j}$, $\overrightarrow{tr} = -4\vec{i} + 3\vec{j}$ (iii) 45°