

WANYANGE GIRLS SECONDARY SCHOOL

S.3 AND S.4 VECTORS UNIT TEST

VECTORS

1. Given that  $\mathbf{OA} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$ ,  $\mathbf{OB} = \begin{pmatrix} x \\ 5 \end{pmatrix}$ , and  $\mathbf{AB} = \begin{pmatrix} 7 \\ y \end{pmatrix}$ . Find (i)  $x$  and  $y$  (ii)  $|\mathbf{AB}|$ .

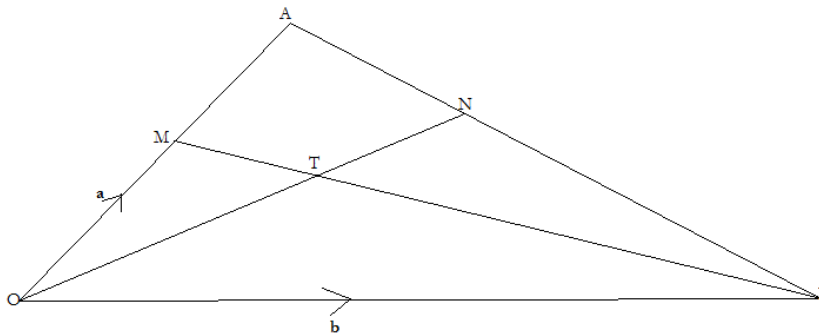
2. Given that A is  $(-2,4)$  and B  $(4,10)$ . Find the column vector for  $\mathbf{AB}$ .

If  $\mathbf{OK} = \begin{pmatrix} 2 \\ 8 \end{pmatrix}$ , find  $\mathbf{AK}$  and hence show that A, K and B lie on the straight line.

3. Given that  $\mathbf{p} = \begin{pmatrix} 6 \\ 12 \end{pmatrix}$ ,  $\mathbf{q} = \begin{pmatrix} -4 \\ 2 \end{pmatrix}$  and  $\mathbf{r} = \begin{pmatrix} 26 \\ 32 \end{pmatrix}$ . Find the scalar  $k$  for which  $3\mathbf{p} + k\mathbf{q} = \mathbf{r}$ .

4. In the diagram below,  $\mathbf{a}$  and  $\mathbf{b}$  are the position vectors of A and B respectively.

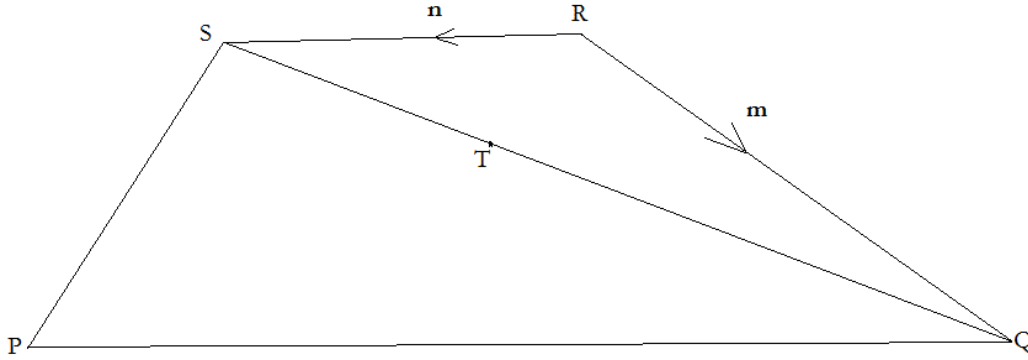
M is the mid – point of OA and AN: NB = 1: 2



(i) Find  $\mathbf{BM}$  and  $\mathbf{MN}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$

(ii) Given that  $\mathbf{OT} = \gamma\mathbf{ON}$  and  $\mathbf{OT} = \mathbf{OM} + \mu\mathbf{MB}$ , find the values of  $\gamma$  and  $\mu$ . Hence determine  $\mathbf{OT}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

5.



The diagram shows a trapezium PQRS in which  $QP = 2RS$ , T is a point on QS such that  $QT:TS = 2:1$ . Also  $RS = \mathbf{n}$ ,  $PQ = \mathbf{m}$ .

(a) Express in terms of  $\mathbf{n}$  and  $\mathbf{m}$ .

- (i)  $\mathbf{QP}$
- (ii)  $\mathbf{BS}$
- (iii)  $\mathbf{RT}$
- (iv)  $\mathbf{TP}$

(b) Hence show that the point R, T, P are collinear.

6. Three points A, B and C lie in the same plane. The position vectors of A, B and C with respect to the origin O are  $\mathbf{a}$ ,  $\mathbf{b}$  and  $\mathbf{c}$  respectively. P is a point on the mid-point of AB and R is a point on BC such that  $BR:RC = 1:1$ . Also Q is a point on AC such that  $2QC = AQ$ .

- (i) Find in terms of vectors  $\mathbf{a}$ ,  $\mathbf{b}$  and/or  $\mathbf{c}$  vectors  $\mathbf{AB}$ ,  $\mathbf{OP}$ ,  $\mathbf{AR}$  and  $\mathbf{QR}$ .
- (ii) Show that PR is parallel to AC.

7. OAB is a triangle, N is a point on OB such that  $ON:NB = 1:1$ , M is a point on OA such that  $OM = \frac{2}{3}OB$ , X is a point of intersection of the lines BM and AN. Given that  $\mathbf{OA} = \mathbf{a}$ ,  $\mathbf{OB} = \mathbf{b}$  and that  $\mathbf{XM} = l\mathbf{MB}$  also  $\mathbf{NX} = k\mathbf{NA}$ .

(a) Express the following vectors in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

- (i)  $\mathbf{NA}$
- (ii)  $\mathbf{MB}$ .

(b) Express  $\mathbf{OX}$  in terms of;

- (i)  $\mathbf{a}$ ,  $\mathbf{b}$  and  $l$
- (ii)  $\mathbf{a}$ ,  $\mathbf{b}$  and  $k$ .

(c) use your results in (b) above to find the values of  $k$  and  $l$

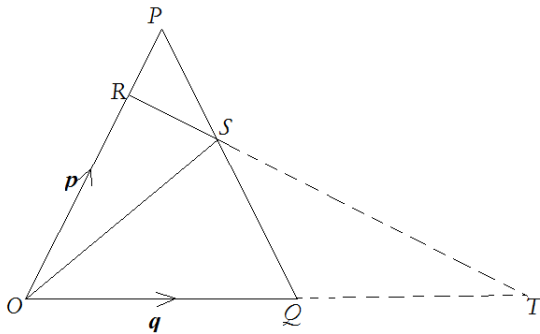
8. A quadrilateral  $OABC$  has points  $P, Q$  and  $R$  on  $OA, OB$  and  $OC$  respectively.  $OA = 3OP$ ,  $OB = 5OQ$  and  $OC = 2OR$ .  $OP = p$ ,  $OQ = q$  and  $OR = r$ .

(a) Express the following vectors in terms of  $p, q$  and  $r$  :

- (i)  $PQ$
- (ii)  $AB$
- (iii)  $BC$
- (iv)  $CA$

(b) Given that  $OABC$  is a parallelogram, show that  $3p - 5q + 2r = 0$

9. In the figure below,  $OP = p$ ,  $OQ = q$ ,  $2\overline{OP} = 5\overline{OR}$ , and  $4\overline{PQ} = 5\overline{PS}$ . When  $RS$  and  $OQ$  are produced, they meet at  $T$ .

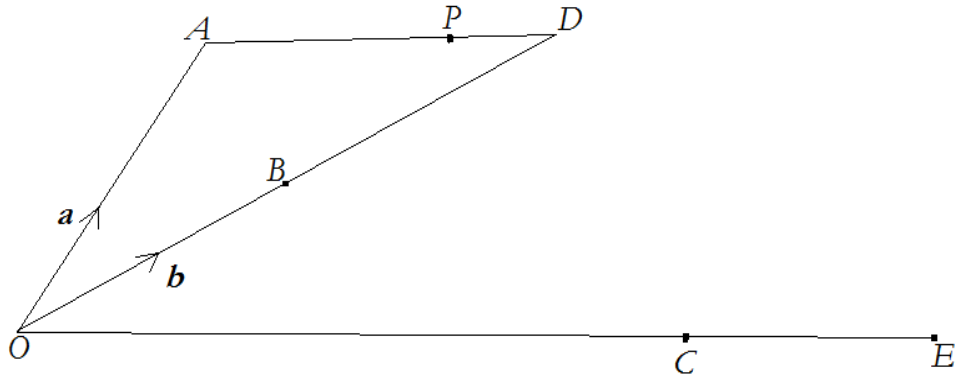


(a) Express in terms  $p$  and  $q$  the vectors

- (i)  $OR$
- (ii)  $OS$
- (iii)  $RS$

(b) Given that  $\overline{OT} = n\overline{OQ}$  and  $\overline{RT} = m\overline{RS}$ , find the values of  $m$  and  $n$

10. In the figure below,  $OA = a$  and  $OB = b$ .  $3OB = 2BD$ . P is a point on  $\overline{AD}$  such that  $\overline{PD} : \overline{AP} = 1 : 2$ .  $OC = 3CE = 3AP$ .



(a) Express the following vectors in terms of vectors  $\mathbf{a}$  and  $\mathbf{b}$  :

(i)  $\vec{AD}$

(ii)  $\vec{AP}$

(b) Show that  $\overline{AD} : \overline{OE} = 3:8$

*Stay safe. We shall overcome.*