VECTOR EXERCISE PART TWO

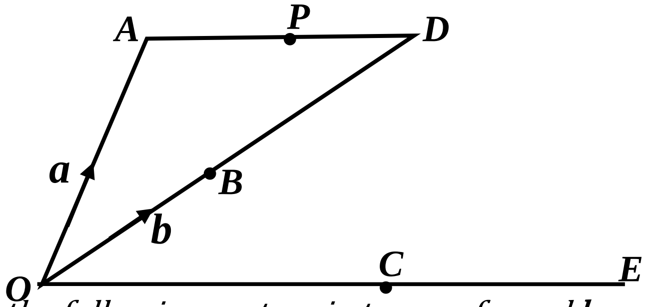
1. *In a triangle **OAB**,* $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$, *P and Q are points on **OA** and **AB** respectively such that **3OP = PA, AQ = 2QB** and **N** is the midpoint of **OQ**. **ANM** is a straight line which is such that **AN = 5NM**. Given also that* $\mathbf{OM} = h\mathbf{OB}$, *where **h** is a scalar.*

   (a) *Express the following vectors in terms of **a** and **b**:*

   (i) *OQ*
   (ii) *AN*
   (iii) *PN*
   (iv) *NB*

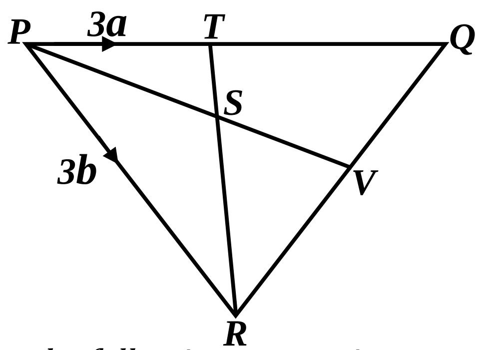
   (b) *Show that the points **P, N** and **B** are collinear*
   (c) *Find the value of **h**.*

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



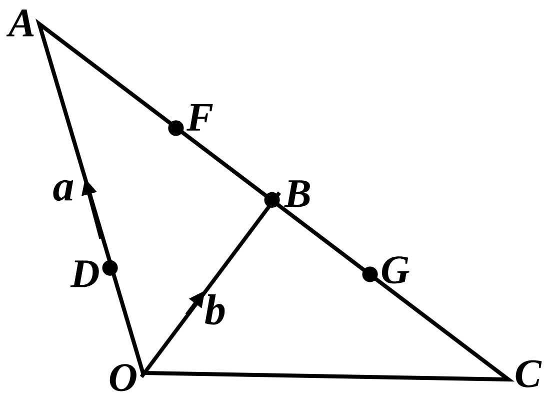
   (a) *Express the following vectors in terms of **a** and **b**:*
   (i) *AD*
   (ii) *BP*
   (iii) *DC*
   (b) *Show that **AD : OE = 3 : 8***

3. *In the figure below,* $\mathbf{PT} = 3\mathbf{a}$, $\mathbf{PR} = 3\mathbf{b}$, $\mathbf{PQ} = 4\mathbf{PT}$, $2\mathbf{PS} = \mathbf{PV}$ *and* $3\mathbf{RS} = 2\mathbf{RT}$.



   (a) *Express the following vectors in terms of **a** and **b**:*
   (i) *RS*
   (ii) *PV*
   (iii) *RQ*
   (b) *Find the ratio of **RV** to **RQ**.*

4. *In the figure below,* $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$, *F and G are points on **AC** such that **AF : AB = 3 : 4** and **AG : AC = 2 : 3**. Point **D** is on **OA** such that **OD : DA = FB : BG = 1 : 2**.*



(a) Express **AG** and **AC** in terms of **AB**. Hence find the following vectors in terms of **a** and **b**:

(i) **AB**

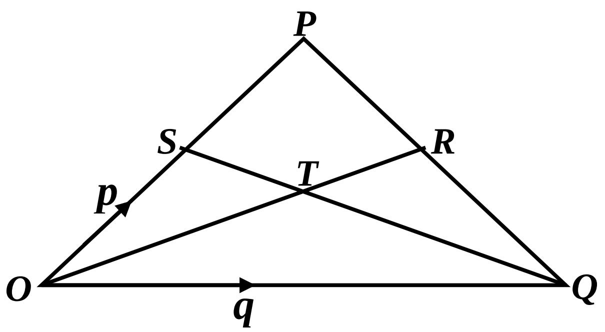
(ii) **AC**

(iii) **DG**

(iv) **OF**

(b) Find the ratio **DG : OC**

5. In the figure below, $\mathbf{OP} = \mathbf{p}$, $\mathbf{OQ} = \mathbf{q}$, $\mathbf{OS} = \frac{3}{4}\mathbf{OP}$ and **PR : RQ = 2 : 1**



(a) Express the following vectors in terms of **p** and **q**:

(i) **PQ**

(ii) **OR**

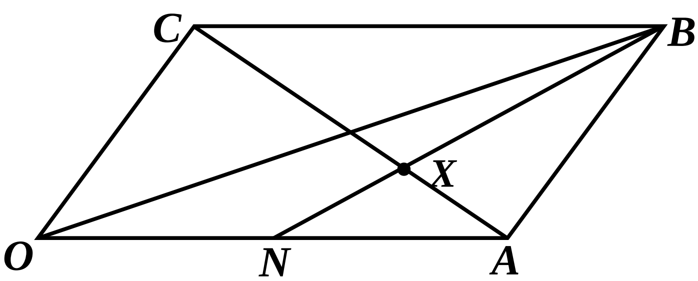
(iii) **SQ**

(b) Line **OR** and **SQ** meet at point **T** such that **OT = hOR** and **ST = kSQ**.

(i) By expressing **OT** in two different ways, find the values of **h** and **k**

(ii) Determine the ratio in which **T** divides **SQ**

6. In the figure below, **OABC** is a parallelogram where **OA = a** and **AB = b**. Point **N** is on **OA** such that **ON:NA = 1:2.**



(a) Express the following vectors in terms of **a** and **b**:

(i) **AC**

(ii) **BN**

(b) Line **AC** and **BN** meet at point **X** such that **AX = hAC** and **BX = kBN**

(i) By expressing **OX** in two different ways, find the values of **h** and **k**

(ii) Determine the ratio in which **X** divides **AC**

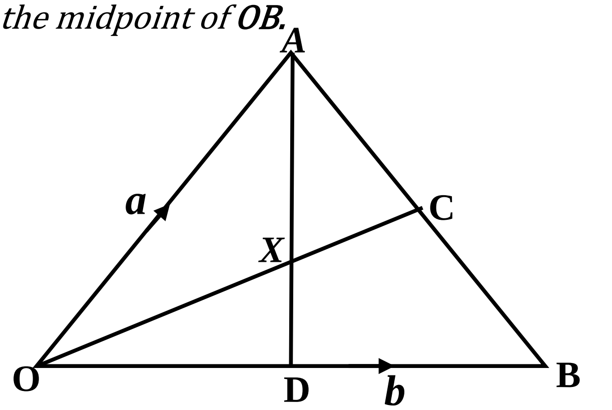
7. *In a triangle **OAB**,* $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$, ***N** and **M** are points of **AB** and **OB** respectively. Line **ON** and **AM** meet at point **T** such that **AT = TM** and* $\mathbf{OT} = \frac{3}{4}\mathbf{ON}$. *Given that **OM = xOB** and **AN = yAB**, Express the vectors:*
   (i) ***AM** and **OT** in terms of **a**, **b** and **x**.*
   (ii) ***ON** and **OT** in terms of **a**, **b** and **y**, hence find the values of **x** and **y**.*

8. ***ABCD** is a parallelogram with* $\mathbf{CB} = \begin{pmatrix} -6 \\ 6 \end{pmatrix}$, $\mathbf{CD} = \begin{pmatrix} 5 \\ 10 \end{pmatrix}$ *and point **C** is **(–5, 2)**. Find the:*
   (a) *coordinates of:*
   (i) ***B*** *(ii)* ***D*** *(iii)* ***A***
   (b) *length of the diagonal **AC***
   (c) *point of intersection of the diagonal **AC** and **BD***

9. *The vectors* $\mathbf{OP} = \begin{pmatrix} -1 \\ -15 \end{pmatrix}$, $\mathbf{OQ} = \begin{pmatrix} 7 \\ -11 \end{pmatrix}$ *and* $\mathbf{PN} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$.
   (a) *Find the:*
   (i) *position vector of **N***
   (ii) *length of **ON***
   (iii) *coordinates of point **E**, where **E** divides **PQ** in the ratio **1:3**.*
   (b) *Use the vector method to show that **N** lies on **PQ**. Hence state the ratio **PN : PQ**.*

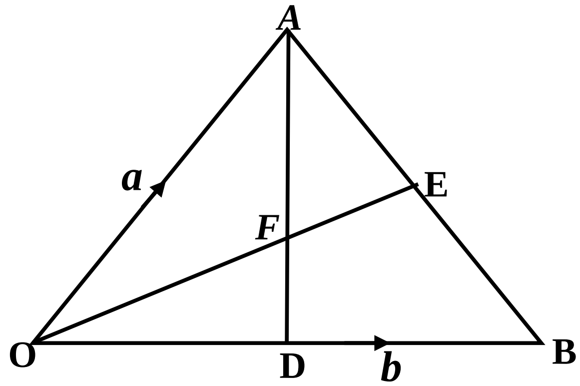
10. *Given that **OA = a**, **OB = b** and **C** is the midpoint of **AB**,*
   (a) *Draw a vector diagram showing vector **AB**.*
   (b) *Express in terms of **a** and **b** the vectors:*
   (i) ***AB***
   (ii) ***OC***

11. *In the triangle **OAB**,* $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$, ***C** is a point on **AB** such that **AC:AB = 1:3** and **D** is the midpoint of **OB**.*



   (a) *Express the following vectors in terms of **a** and **b**:*
   (i) ***AB*** *(ii)* ***OC*** *(iii)* ***AD***
   (b) ***X** is a point on **AD** such that **AX : AD = 1 : 2**. Find in terms of **a** and **b** the vectors:*
   (i) ***AX***
   (ii) ***OX***
   (c) *Find in simplest form the ratio **OX : OC**.*

12. *In the triangle **OAB**,* $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$, ***D** is a point on **OB** such that **OD:OB = 2:5** and **E** is the midpoint of **AB**.*

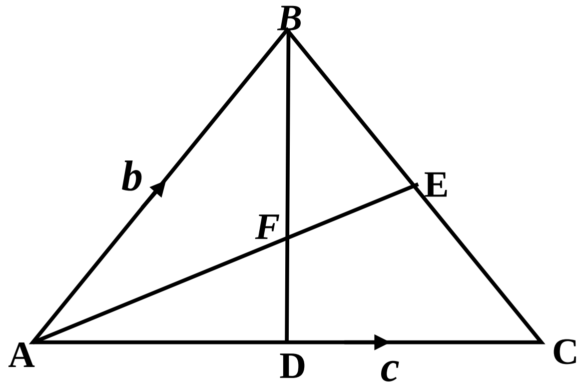


(a) *Express the following vectors in terms of **a** and **b**:*
   (i) *OE* (ii) *AD*

(b) *Given that **AF = tAD** and **OF = hOE**, find the values of **t** and **h***

(c) *Show that the points **O, F** and **E** are collinear*

13. *In the triangle **ABC**,* $\mathbf{AB} = \mathbf{b}$, $\mathbf{AC} = \mathbf{c}$, ***D** is a point on **AC** such that **AD:DC = 3:2** and **E** is the midpoint of **BC**.*

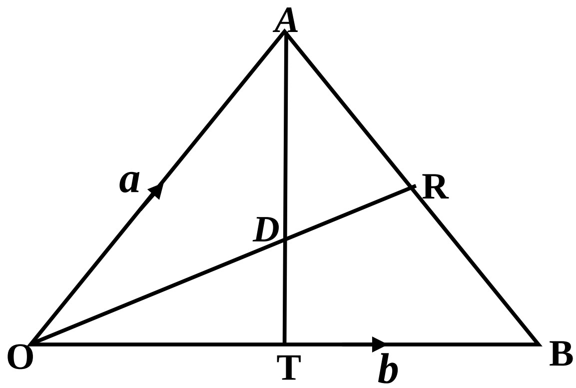


(a) *Express the following vectors in terms of **a** and **b**:*
   (i) *BD* (ii) *AE*

(b) *Given that **BF = tBD** and **AF = nAE**, find the values of **t** and **n***

(c) *State the ratio of **BD** to **BF***

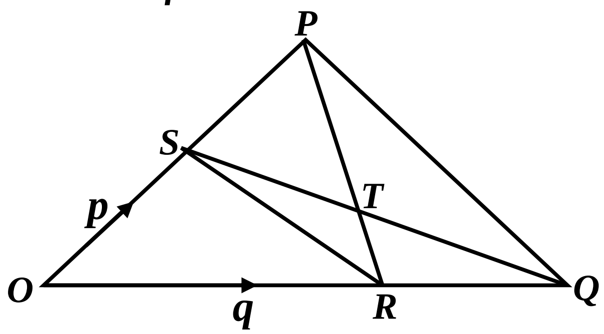
14. *In the triangle **OAB**,* $\mathbf{OA} = \mathbf{a}$, $\mathbf{OB} = \mathbf{b}$, *Point **R** divides **AB** in the ratio **2:5** and point **T** divides **OB** in the ratio **1:3**.*



(a) *Express the following vectors in terms of **a** and **b**:*
(i) *BT* (ii) *OR* (iii) *AT*

(b) *Given that **AD = kAT** and **RD = hRO**, find the values of **k** and **h**. Hence express vector **AD** in terms of **a** and **b***

15. *In the triangle **OPQ**,* $\mathbf{OP} = \mathbf{p}$, $\mathbf{OQ} = \mathbf{q}$, $\mathbf{OS} = \frac{1}{3}\mathbf{OP}$, $\mathbf{OR} = \frac{1}{3}\mathbf{OQ}$ *and point **T** is on **QS** such that* $\mathbf{QT} = \frac{3}{4}\mathbf{QS}$



(a) *Express the following vectors in terms of **p** and **q**:*
(i) *SR* (ii) *QS* (iii) *PT* (iv) *TR*

(b) *Show that the points **P, T** and **R** are collinear.*

16. 2019 P2 No. 8, 11
17. 2018 P2 No. 10, 16
18. 2017 P2 No. 10, 15
19. 2016 P2 No. 8, 16
20. 2015 P2 No. 4, 13
21. 2014 P2 No. 10, 14
22. 2013 P2 No. 3, 16
23. 2012 P2 No. 2, 13
24. 2011 P2 No. 9, 15
25. 2010 P1 No. 17 P2. No. 7
26. 2009 P2 No. 6, 9, 16
27. 2008 P1 No. 14 P2 No. 4
28. 2007 P1 No. 13.
29. 2006 P2 No. 15
30. 2005 P1 No. 5. P2 No. 16
31. 2004 P2 No. 16.
32. 2003 P2 No. 14.
33. 2002 P1 No. 7. P2 No. 4, 12
34. 2001 P1 No. 8. P2 No. 14
35. 2000 P1 No. 7. P2 No. 13.

The end.
Practice makes perfect