

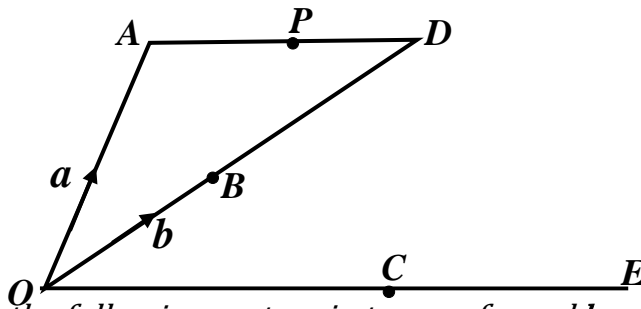
VECTOR EXERCISE PART TWO

1. In a triangle OAB , $OA = \mathbf{a}$, $OB = \mathbf{b}$, 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 $OM = hOB$, where h is a scalar.

- (a) Express the following vectors in terms of \mathbf{a} and \mathbf{b} :
- (i) OQ
 - (ii) AN
 - (iii) PN
 - (iv) NB

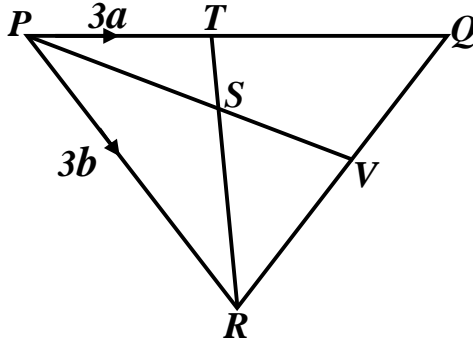
- (b) Show that the points P , N and B are collinear
 (c) Find the value of h .

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



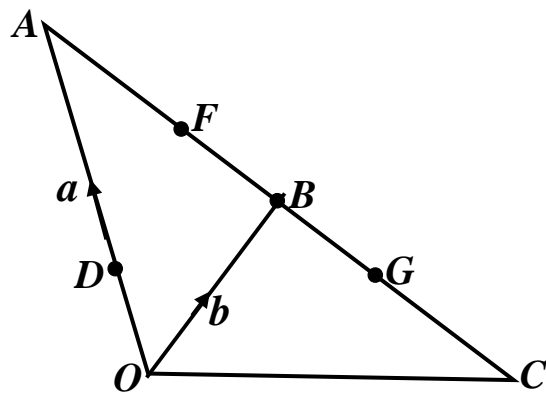
- (a) Express the following vectors in terms of \mathbf{a} and \mathbf{b} :
- (i) AD
 - (ii) BP
 - (iii) DC
- (b) Show that $AD : OE = 3 : 8$

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



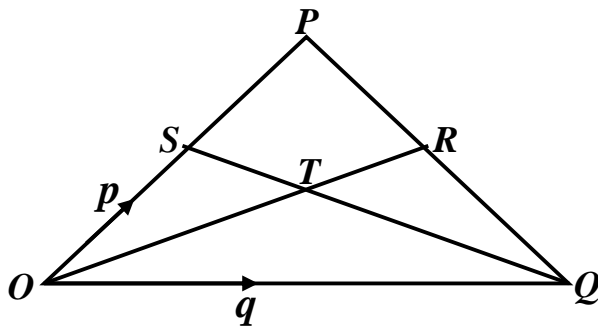
- (a) Express the following vectors in terms of \mathbf{a} and \mathbf{b} :
- (i) RS
 - (ii) PV
 - (iii) RQ
- (b) Find the ratio of RV to RQ .

4. In the figure below, $OA = \mathbf{a}$, $OB = \mathbf{b}$, 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 $OD : DA = FB : BG = 1 : 2$.



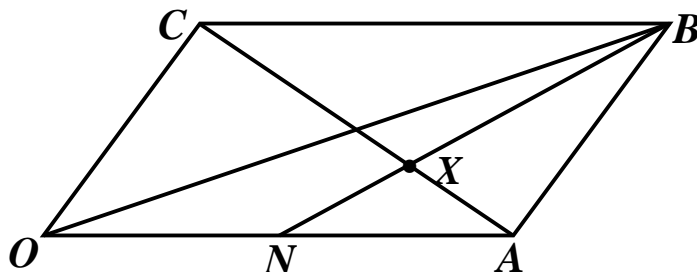
- (a) Express AG and AC in terms of AB . Hence find the following vectors in terms of a and b :
- AB
 - AC
 - DG
 - OF
- (b) Find the ratio $DG : OC$

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



- (a) Express the following vectors in terms of p and q :
- PQ
 - OR
 - SQ
- (b) Line OR and SQ meet at point T such that $OT = hOR$ and $ST = kSQ$.
- By expressing OT in two different ways, find the values of h and k
 - 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 :
- AC
 - BN
- (b) Line AC and BN meet at point X such that $AX = hAC$ and $BX = kBN$
- By expressing OX in two different ways, find the values of h and k
 - Determine the ratio in which X divides AC

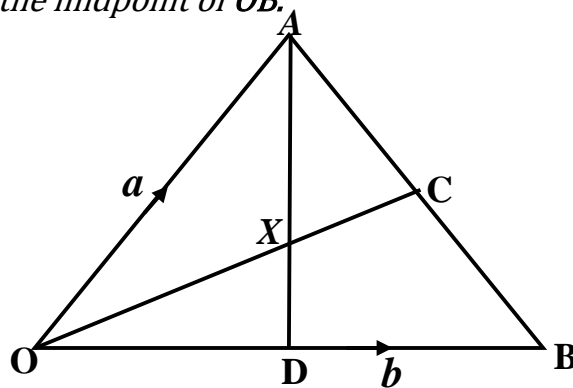
7. In a triangle OAB , $OA = \mathbf{a}$, $OB = \mathbf{b}$, N and M are points of AB and OB respectively. Line ON and AM meet at point T such that $AT = TM$ and $OT = \frac{3}{4}ON$. Given that $OM = xOB$ and $AN = yAB$, Express the vectors:
- AM and OT in terms of \mathbf{a} , \mathbf{b} and x .
 -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

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

9. The vectors $OP = \begin{pmatrix} -1 \\ -15 \end{pmatrix}$, $OQ = \begin{pmatrix} 7 \\ -11 \end{pmatrix}$ and $PN = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$.

- Find the:
 - position vector of N
 - length of ON
 - coordinates of point E , where E divides PQ in the ratio $1:3$.
 - Use the vector method to show that N lies on PQ . Hence state the ratio $PN : PQ$.
10. Given that $OA = \mathbf{a}$, $OB = \mathbf{b}$ and C is the midpoint of AB ,
- Draw a vector diagram showing vector AB .
 - Express in terms of \mathbf{a} and \mathbf{b} the vectors:
 - AB
 - OC

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



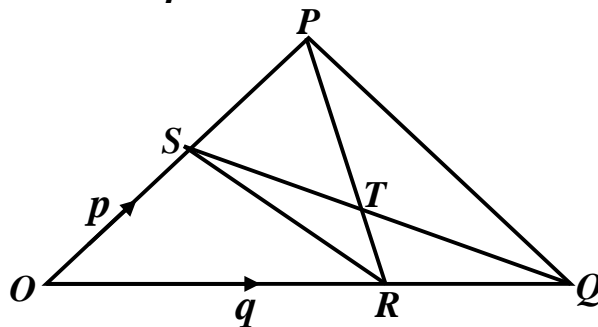
- Express the following vectors in terms of \mathbf{a} and \mathbf{b} :
 - AB
 - OC
 - AD
- X is a point on AD such that $AX:AD = 1:2$. Find in terms of \mathbf{a} and \mathbf{b} the vectors:
 - AX
 - OX
- Find in simplest form the ratio $OX : OC$.

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

(i) \mathbf{BT} (ii) \mathbf{OR} (iii) \mathbf{AT}

(b) Given that $\mathbf{AD} = k\mathbf{AT}$ and $\mathbf{RD} = h\mathbf{RO}$, find the values of k and h . Hence express vector \mathbf{AD} in terms of \mathbf{a} and \mathbf{b}

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



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

(i) \mathbf{SR} (ii) \mathbf{QS} (iii) \mathbf{PT}

(iv) \mathbf{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.