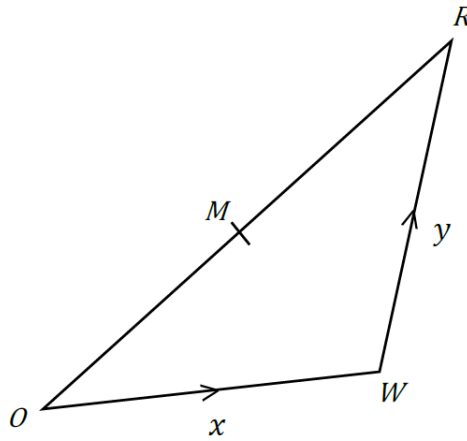


DEPARTMENT OF MATHEMATICS
S.4 MATHEMATICS—2020
REVISION QUESTIONS
VECTORS

1. Points A and B have coordinates $(0, -1)$ and $(-6, 7)$ respectively. Find:
- \mathbf{AB} ,
 - magnitude of \mathbf{AB} . *(04 marks)*
2. Two points $P(5, 2)$ and $Q(2, 4)$ are in a plane. Find the
- coordinate of M , the midpoint of \mathbf{PQ} ,
 - $|\mathbf{OM}|$, where O is the origin. *(04 marks)*
3. If $\mathbf{a} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 11 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 10 \\ 9 \end{pmatrix}$, find:
- $\frac{1}{2}(\mathbf{a} - \mathbf{c})$,
 - $|\mathbf{a} + \mathbf{b} - \mathbf{c}|$. *(05 marks)*
4. P and Q have position vectors $\begin{pmatrix} 2t \\ t+1 \end{pmatrix}$, $\begin{pmatrix} t+1 \\ -(t+2) \end{pmatrix}$ respectively. If $|\mathbf{OP}| = |\mathbf{OQ}|$, show that $3t^2 - 4t - 4 = 0$ and hence find the possible values of t . *(05 marks)*
5. In a parallelogram $OBCA$, $\mathbf{OA} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$ and $\mathbf{OB} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$, where O is the origin. Find
- \mathbf{BC} ,
 - the coordinates of C . *(04 marks)*

6. Given that $\begin{pmatrix} a \\ 3 \end{pmatrix} + \begin{pmatrix} -3 \\ b \end{pmatrix} = \begin{pmatrix} 8 \\ 5 \end{pmatrix}$, find values of a and b . (04 marks)
7. Given vectors $\mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 0 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 18 \\ 3 \end{pmatrix}$, find the values of the constants p and q such that $\mathbf{c} = p\mathbf{a} + q\mathbf{b}$. (04 marks)
8. If $\mathbf{a} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}$, find numbers m and n such that $m\mathbf{a} + n\mathbf{b} = \mathbf{c}$. (04 marks)
9. Given that $S(-2, 6)$ and $T(3, 3)$ are two points, find the coordinates of R if $\mathbf{OR} = 4\mathbf{OS} + \frac{1}{3}\mathbf{OT}$ and O is the origin. (04 marks)
10. Given that $\mathbf{OA} = \begin{pmatrix} -2 \\ 2 \end{pmatrix}$, $\mathbf{OB} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}$ and M is a point on AB such that $AM : MB = 1 : 1$; find:
- \mathbf{AM} .
 - \mathbf{OM} . (04 marks)
11. (a) Given the vectors $\mathbf{a} = \begin{pmatrix} -2 \\ 7 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 8 \\ 11 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} 4 \\ -5 \end{pmatrix}$, find:
- $\mathbf{a} + 2\mathbf{b} + \mathbf{c}$.
 - length of $\mathbf{a} + 2\mathbf{b} + \mathbf{c}$.
- (b) The position vectors of D and E are $\begin{pmatrix} 6 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} 12 \\ -11 \end{pmatrix}$ respectively. M is on DE such that $DM : DE = 2 : 3$. Find
- \mathbf{DE} ,
 - \mathbf{DM} ,
 - the position vector of M .
12. Given that $\mathbf{p} = 3\mathbf{a} - \mathbf{b}$ and $\mathbf{q} = 2\mathbf{a} - 3\mathbf{b}$, find the numbers x and y such that $x\mathbf{p} + y\mathbf{q} = \mathbf{a} + 9\mathbf{b}$. (04 marks)
13. Given that $\mathbf{p} = 2\mathbf{a} - 5\mathbf{b}$, $\mathbf{q} = \mathbf{a} + 2\mathbf{b}$ and $\mathbf{r} = \mathbf{a} - 16\mathbf{b}$, find the numbers m and n such that $m\mathbf{p} + n\mathbf{q} = \mathbf{r}$. (04 marks)

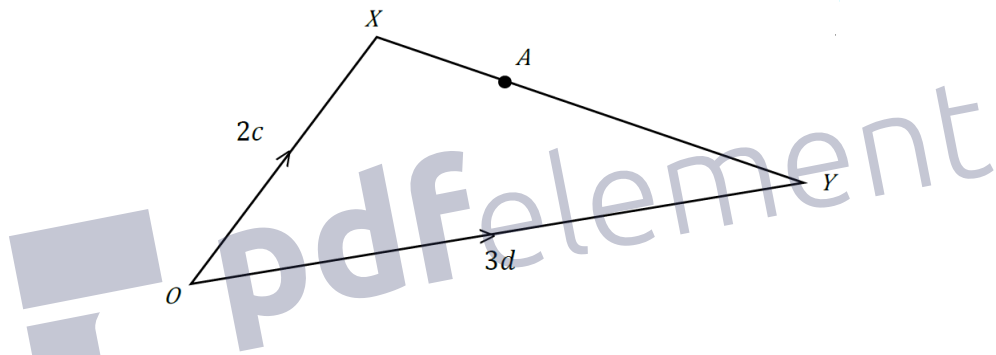
14. Show that points $A(1, 2)$, $B(2, 4)$ and $C(4, 8)$ are collinear. (04 marks)
15. Show that points $A(1, 1)$, $B(2, 3)$ and $C(5, 9)$ lie on a straight line. (04 marks)
16. If points $P(1, 1)$, $Q(2, 4)$ and $R(p, -1)$ are collinear find the value of p . (04 marks)
17. If $\mathbf{OP} = 2\mathbf{a} - 5\mathbf{b}$, $\mathbf{OQ} = 5\mathbf{a} - \mathbf{b}$ and $\mathbf{OR} = 11\mathbf{a} + 7\mathbf{b}$, show that P , Q and R are collinear and state the ratio $PQ : QR$. (04 marks)
18. The position vectors of P , Q and R are $\mathbf{a} - 2\mathbf{b}$, $2\mathbf{b}$ and $-4\mathbf{a} + k\mathbf{b}$ respectively. If P , Q and R are collinear, find the value of k . What is the ratio $PQ : QR$? (04 marks)
19. If $\mathbf{OP} = \mathbf{a} + \mathbf{b}$, $\mathbf{OQ} = k\mathbf{a}$ and $\mathbf{OR} = 7\mathbf{a} - 2\mathbf{b}$, find the value of k if Q lies on PR . (04 marks)
20. The position vectors of P , Q and R are $2\mathbf{a} - \mathbf{b}$, $t(\mathbf{a} - \mathbf{b})$ and $\mathbf{a} + \mathbf{b}$ respectively. Find the value of t if PQR is a straight line. State the ratio $PQ : QR$. (04 marks)
21. Show that the points A , B and C with position vectors $\begin{pmatrix} 4 \\ 5 \end{pmatrix}$, $\begin{pmatrix} 3 \\ 3 \end{pmatrix}$ and $\begin{pmatrix} 0 \\ -3 \end{pmatrix}$ respectively are collinear. (04 marks)
22. If the vectors $\mathbf{a} = \begin{pmatrix} m \\ -2 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 4 \\ -6 \end{pmatrix}$ are parallel, find the value of m . (04 marks)
23. The position vectors of A and B are $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$ and $\begin{pmatrix} t \\ 1 \end{pmatrix}$ respectively. Find the value of t if OAB is a straight line, where O is the origin. (04 marks)
24. P and Q divide the sides BC and AC respectively of $\triangle ABC$ in the ratio $2 : 1$. If $\mathbf{AB} = \mathbf{a}$ and $\mathbf{AC} = \mathbf{b}$, find
- \mathbf{QP} and
 - Show that \mathbf{QP} is parallel to \mathbf{AB} . (08 marks)
25. In the triangle ORW below, $\mathbf{OW} = \mathbf{x}$, $\mathbf{WR} = \mathbf{y}$. M is the midpoint of OR .



Find interms of \mathbf{x} and \mathbf{y}

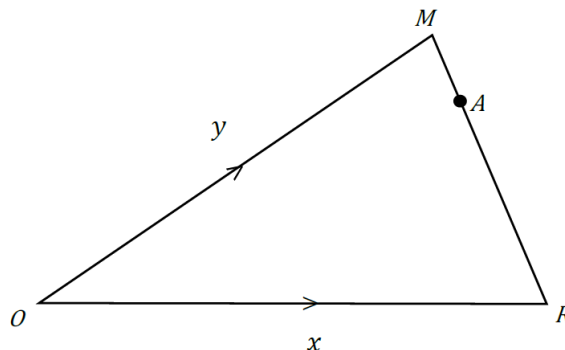
- (a) **OR.** (b) **OM.** (c) **WM.** (06 marks)

26. In the traingle OXY below, $\mathbf{OX} = 2\mathbf{c}$, $\mathbf{OY} = 3\mathbf{d}$. A is the point on XY such that $XA : AY = 2 : 3$



- (a) Find \mathbf{XY} interms of \mathbf{c} and \mathbf{d}
 (b) Show that \mathbf{OA} is parallel to the vector $\mathbf{c} + \mathbf{d}$. (04 marks)

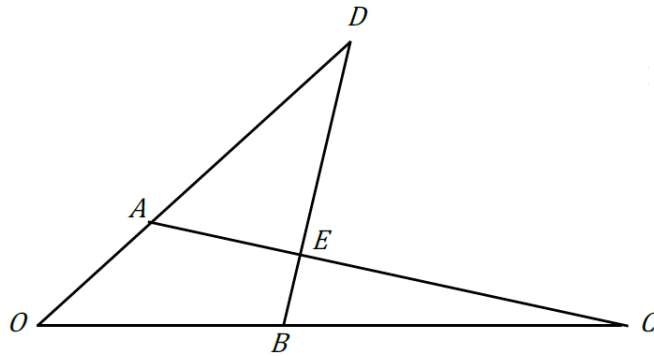
27. In the traingle OMR below, $\mathbf{OR} = \mathbf{x}$, $\mathbf{OM} = \mathbf{y}$. A is the point on MR such that $MA : AR = 3 : 1$



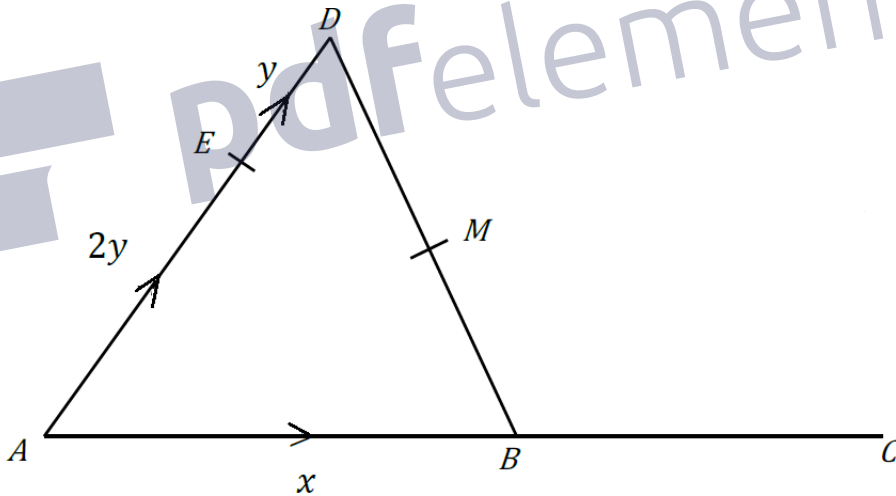
Find interms of \mathbf{x} and \mathbf{y}

- (a) **RM.** (b) **OA.** (06 marks)

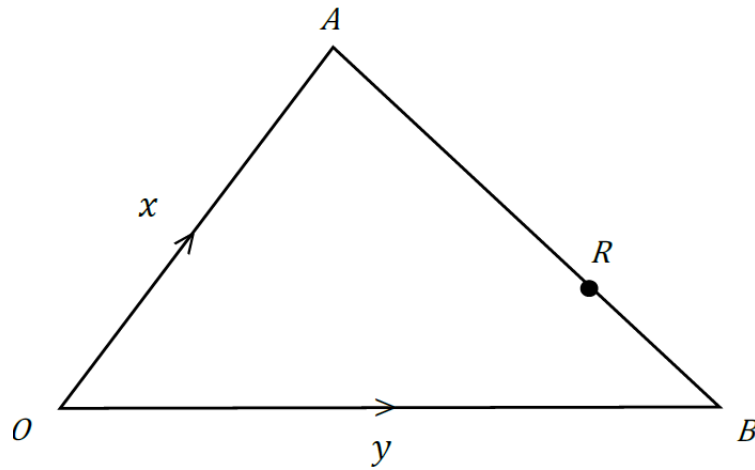
28. In the below, $\mathbf{OA} = 4\mathbf{x}$, $\mathbf{OB} = 4\mathbf{y}$. OAD , OBC and BED are all straight lines. $AD = 2OA$ and $BE : ED = 1 : 3$.



- (a) Find, in terms of \mathbf{x} and \mathbf{y} , the vectors which represent:
- (i) \mathbf{BD} . (ii) \mathbf{AE} .
- (b) Given that $\mathbf{BC} = 8\mathbf{y}$. Show that points A , E and C lie on a straight line. (06 marks)
29. In the triangle ABD , $\mathbf{AB} = \mathbf{x}$, $\mathbf{AE} = 2\mathbf{y}$ and $\mathbf{ED} = \mathbf{y}$. E is a point on AD , B is the midpoint of AC and M is the midpoint of DB .



- (a) Find, in terms of \mathbf{x} and \mathbf{y} , the vectors which represent:
- (i) \mathbf{DA} . (ii) \mathbf{DB} . (iii) \mathbf{AM} .
- (b) Show that points E , M and C lie on a straight line. (08 marks)
30. In the triangle OAB below, $\mathbf{OA} = \mathbf{x}$, $\mathbf{OB} = \mathbf{y}$. R is the point on AB such that $AR : RB = 3 : 2$

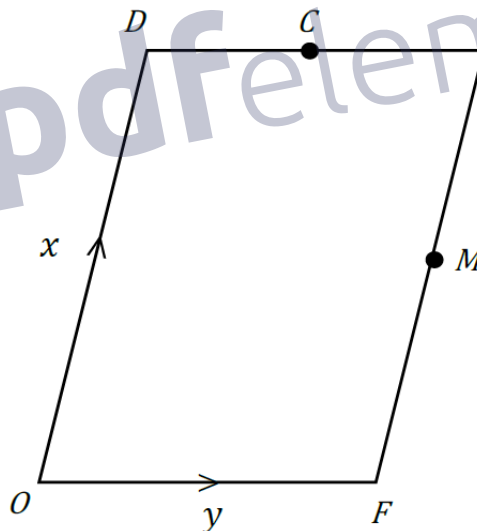


Find in terms of \mathbf{x} and \mathbf{y}

(a) \mathbf{AB} .

(b) Show that $\mathbf{OR} = \frac{1}{5}(2\mathbf{x} + 3\mathbf{y})$. (06 marks)

31. In the parallelogram $ODEF$ below, $\mathbf{OD} = \mathbf{x}$, $\mathbf{OF} = \mathbf{y}$. M is the midpoint of FE . C is the midpoint of DE .



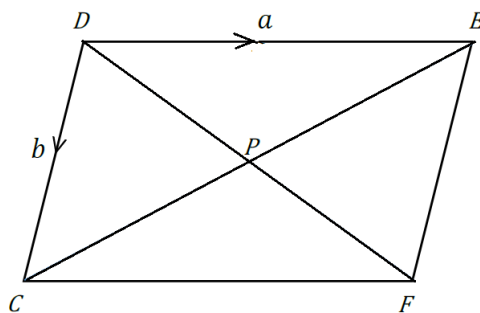
(a) Express, in terms of \mathbf{x} and/or \mathbf{y} , the vectors:

(i) \mathbf{ME} .

(ii) \mathbf{MC} .

(b) Show that \mathbf{FD} is parallel to \mathbf{MC} . (06 marks)

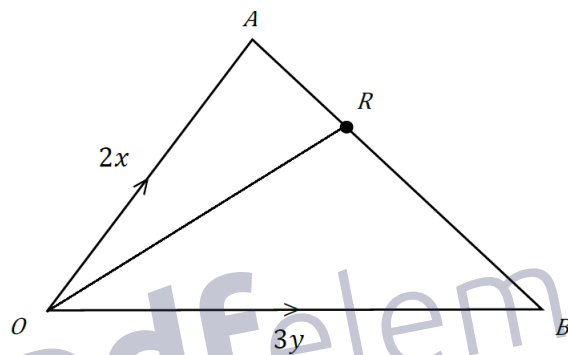
32. In the parallelogram $CDEF$ below, $\mathbf{DE} = \mathbf{a}$, $\mathbf{DC} = \mathbf{b}$. DF and EC are diagonals of parallelogram $DEFC$ and they intersect at point P .



Express, in terms of \mathbf{a} and \mathbf{b} , the vectors:

- (a) \mathbf{DF} . (b) \mathbf{EC} . (c) \mathbf{DP} . (06 marks)

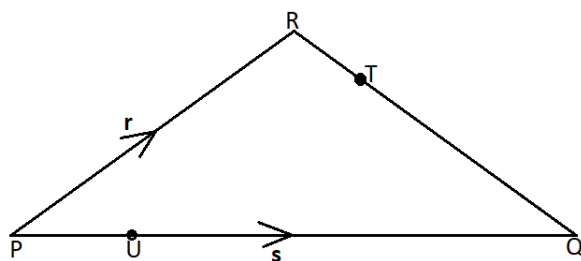
33. In the triangle OAB below, $\mathbf{OA} = 2\mathbf{x}$, $\mathbf{OB} = 3\mathbf{y}$. R is the point on AB such that $AR : RB = 2 : 3$



Find in terms of \mathbf{x} and \mathbf{y}

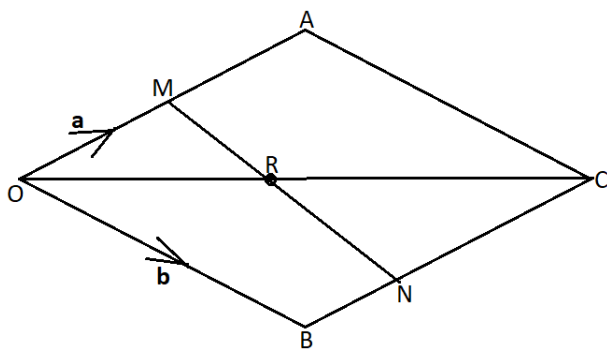
- (a) \mathbf{AB} .
 (b) Show that \mathbf{OR} is parallel to the vector $\mathbf{x} + \mathbf{y}$. (07 marks)

34. In the figure below, vector, $\mathbf{PQ} = \mathbf{s}$, $\mathbf{PR} = \mathbf{r}$, $2QT = 3TR$ and $PU : UQ = 2 : 3$.



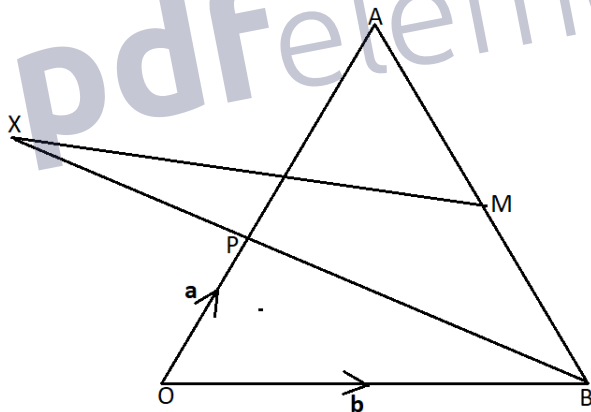
- (a) Find in terms of \mathbf{r} and \mathbf{s} , vectors
 (i) \mathbf{QR} , (ii) \mathbf{QT} , (iii) \mathbf{PT}
 (b) Show that \mathbf{PT} is parallel to \mathbf{PR} . (12 marks)

35. The diagram below shows a parallelogram $OACB$. The position vectors of A and B are \mathbf{a} and \mathbf{b} respectively.

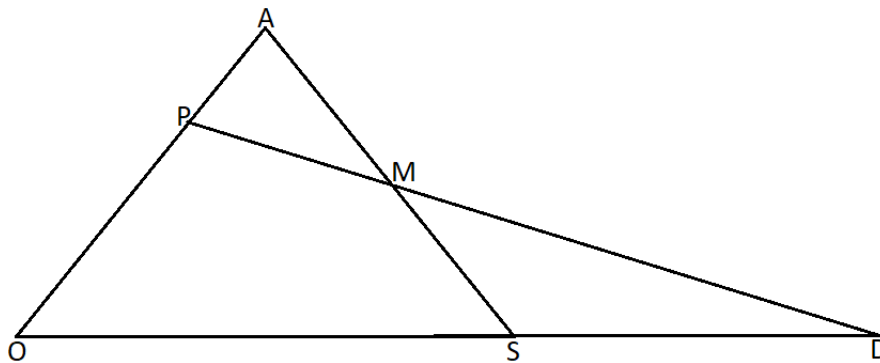


- (a) If $OM = MA$ and $NC = 2BN$, find in terms of \mathbf{a} and \mathbf{b}
- (i) \mathbf{NC} . (ii) \mathbf{NA} . (iii) \mathbf{MN} .
- (b) Given that $\mathbf{OR} = \lambda\mathbf{OC}$ and $\mathbf{MR} = \mu\mathbf{MN}$, find the value of λ and μ .
Hence show that $\mathbf{AR} = \frac{1}{7}(3\mathbf{b} - 4\mathbf{a})$. (12 marks)

36. In the below, $\mathbf{OP} = \mathbf{a}$, $\mathbf{OA} = 3\mathbf{a}$ and $\mathbf{OB} = \mathbf{b}$. M is the midpoint of AB .



- (a) Find, in terms of \mathbf{a} and \mathbf{b}
- (i) \mathbf{BP} . (ii) \mathbf{AB} . (iii) \mathbf{MB} .
- (b) If X lies on BP produced such that $\mathbf{BX} = k\mathbf{BP}$, express \mathbf{MX} in terms of \mathbf{a} , \mathbf{b} and k .
- (c) Find the value of k if \mathbf{MX} is parallel to \mathbf{BO} . (12 marks)
37. In the below, $\mathbf{OA} = \mathbf{a}$, $\mathbf{OS} = \mathbf{b}$ and M is the midpoint of AB . The point P divides OA in the ratio $2 : 1$, and PM produced meets OS produced at D .



- (a) Find, in terms of \mathbf{a} and \mathbf{b}
- (i) \mathbf{AS} . (ii) \mathbf{PA} . (iii) \mathbf{PM} .

- (b) Given that $\mathbf{PD} = k\mathbf{PM}$ and $\mathbf{OD} = t\mathbf{OS}$, find the value of k and t .
(12 marks)

38. The position vectors of the points A and B are \mathbf{a} and \mathbf{b} respectively. The point P lies on OA produced such that $OP = 3OA$. Point Q lies on OB such that $OQ = \frac{1}{3}OB$. The lines AB and PQ meet at C

- (a) (i) Express \mathbf{PQ} in terms of vectors \mathbf{a} and \mathbf{b} .
(ii) If also $\mathbf{PC} = \mu\mathbf{PQ}$, express \mathbf{OC} in terms of μ , \mathbf{a} and \mathbf{b} .
(iii) If also $\mathbf{AC} = \lambda\mathbf{AB}$, express \mathbf{OC} in terms of λ , \mathbf{a} and \mathbf{b} . Hence find the value of λ and μ .

- (b) Show that \mathbf{AQ} is parallel to \mathbf{PB} . (12 marks)

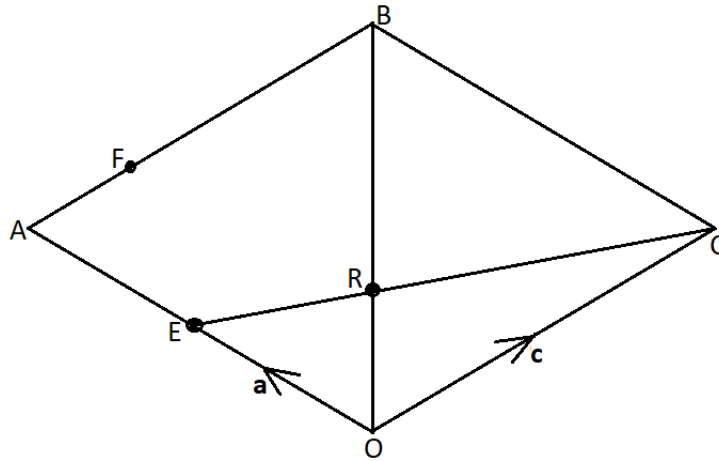
39. In a triangle ABC , M and D are mid-points of AC and CN respectively. N is a point on AB such that $AN = 3NB$.

- (a) If $\mathbf{AB} = \mathbf{p}$ and $\mathbf{AC} = \mathbf{q}$, express the following vectors in terms of vectors \mathbf{p} and \mathbf{q} ;

- (i) \mathbf{AM} . (ii) \mathbf{AN} . (iii) \mathbf{ND} .

- (b) Show that \mathbf{MD} is parallel to \mathbf{AB} and that $MD : AB = 3 : 8$. (12 marks)

40. In the diagram below, $OABC$ is a parallelogram. $\mathbf{OA} = \mathbf{a}$, $\mathbf{OC} = \mathbf{c}$ and E is the midpoint of OA .



If $OR : RB = 1 : 2$ and $AF : FB = 1 : 5$,

- (a) in terms of vectors \mathbf{a} and \mathbf{c} the vectors

(i) \mathbf{FC} .

(ii) \mathbf{FR} .

- (b) determine the ratio of $ER : RC$. (12 marks)

41. In a parallelogram $ABCD$, $\mathbf{AB} = 2\mathbf{a}$ and $\mathbf{AD} = \mathbf{b}$. A point E is such that $\mathbf{AE} = 2\mathbf{b}$. Lines AC and BD intersect at F . Lines CD and BE intersect at G . $\mathbf{DC} = 2\mathbf{DG}$. Find in terms of vectors \mathbf{a} and \mathbf{b}

(a) \mathbf{EC} ,

(c) \mathbf{BG} ,

(b) \mathbf{AG} ,

(d) \mathbf{FG} .

(12 marks)

42. In a triangle ABC , E divides OA in the ratio $6 : 1$. D divides \mathbf{AB} in the ratio $1 : 2$. Point C is on OB produced such that $OC : OB = 3 : 2$. Given that $\mathbf{OA} = \mathbf{a}$ and $\mathbf{OB} = \mathbf{b}$,

- (a) find in terms of vectors \mathbf{a} and \mathbf{b} ;

(i) \mathbf{OD} ,

(iii) \mathbf{ED} ,

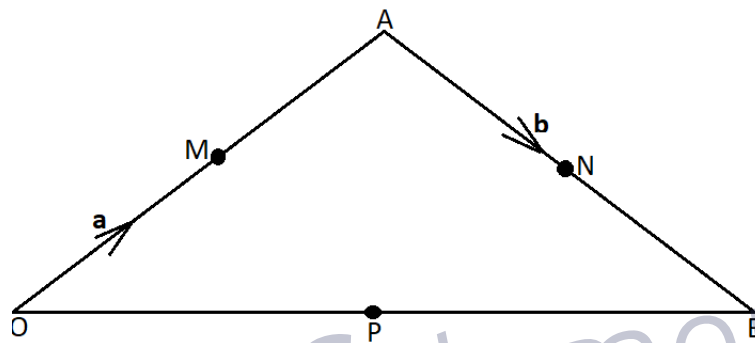
(ii) \mathbf{AC} ,

(iv) \mathbf{DC} .

- (b) determine the ratio $ED : DC$. What can you conclude about the points E , D and C . (12 marks)

43. The points P and Q have position vectors \mathbf{p} and \mathbf{q} respectively. The point R divides PQ externally in the ratio $3 : 1$. S is a point on a straight line with R such that $3RS = 2PQ$. Find the
- position vectors of R and S
 - vectors \mathbf{QS} and \mathbf{PS} in terms of \mathbf{p} and \mathbf{q} .
 - ratio $PS : RS$.
- (12 marks)

44. The vectors \mathbf{OA} , \mathbf{AB} and \mathbf{BO} form a triangle OAB with O the origin. If $\mathbf{OA} = \mathbf{a}$, $\mathbf{AB} = \mathbf{b}$, and the points M , N and P are midpoints of OA , AB and OB respectively.



- Determine in terms of vectors \mathbf{a} and \mathbf{b}
 - \mathbf{AP} ,
 - \mathbf{NP} ,
 - \mathbf{MB} .
 - Show that \mathbf{MN} is parallel to \mathbf{OB} .
 - determine the ratio of $MN : OB$.
- (12 marks)

—END—