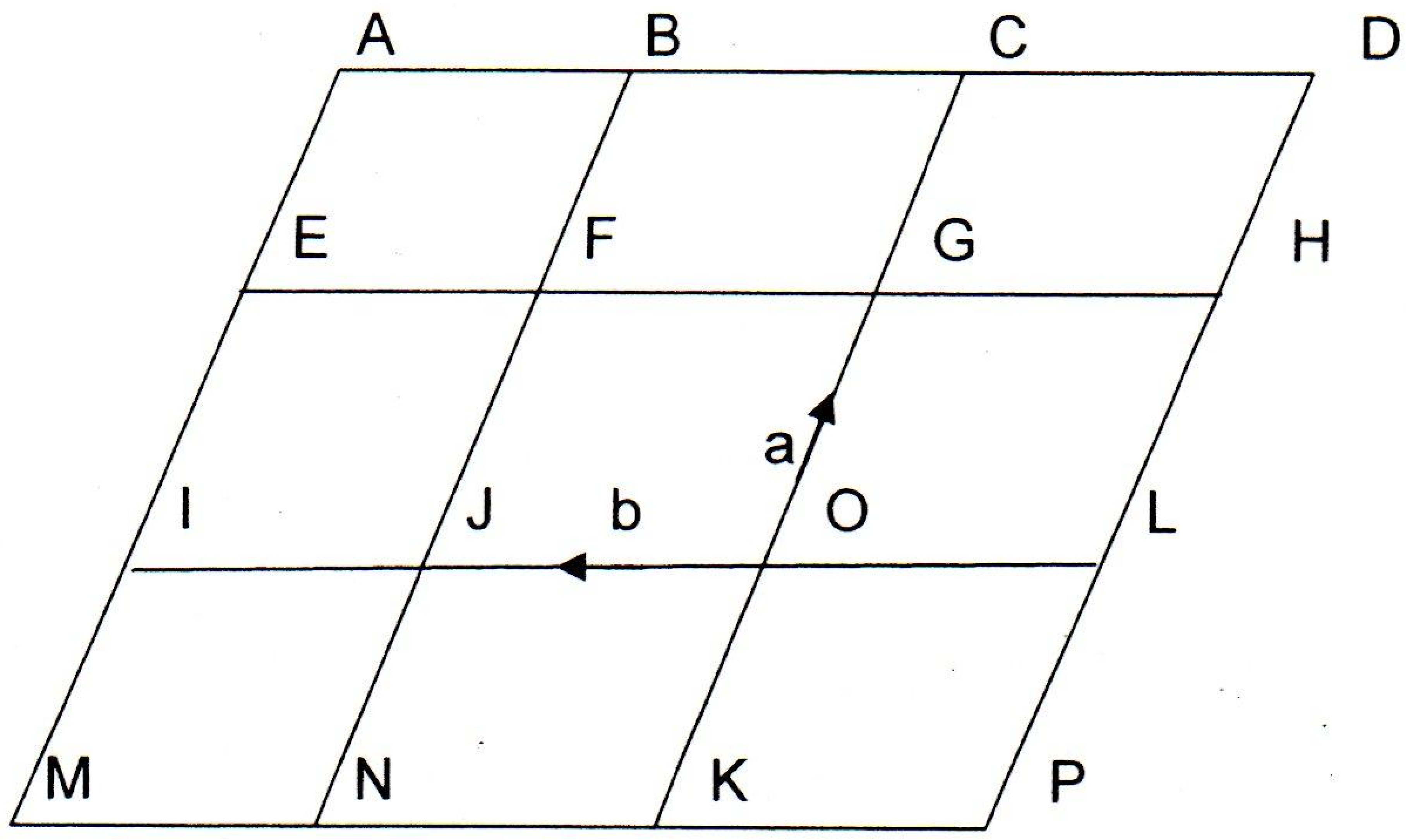
Vector



1) Here in the figure OG =a and OJ = b

Find the following vectors

AB=	NB=	OP=	FD=	PA=
AM=	NH=	OD=	FP=	PJ=
AH=	NE=	OM=	FM=	PI=

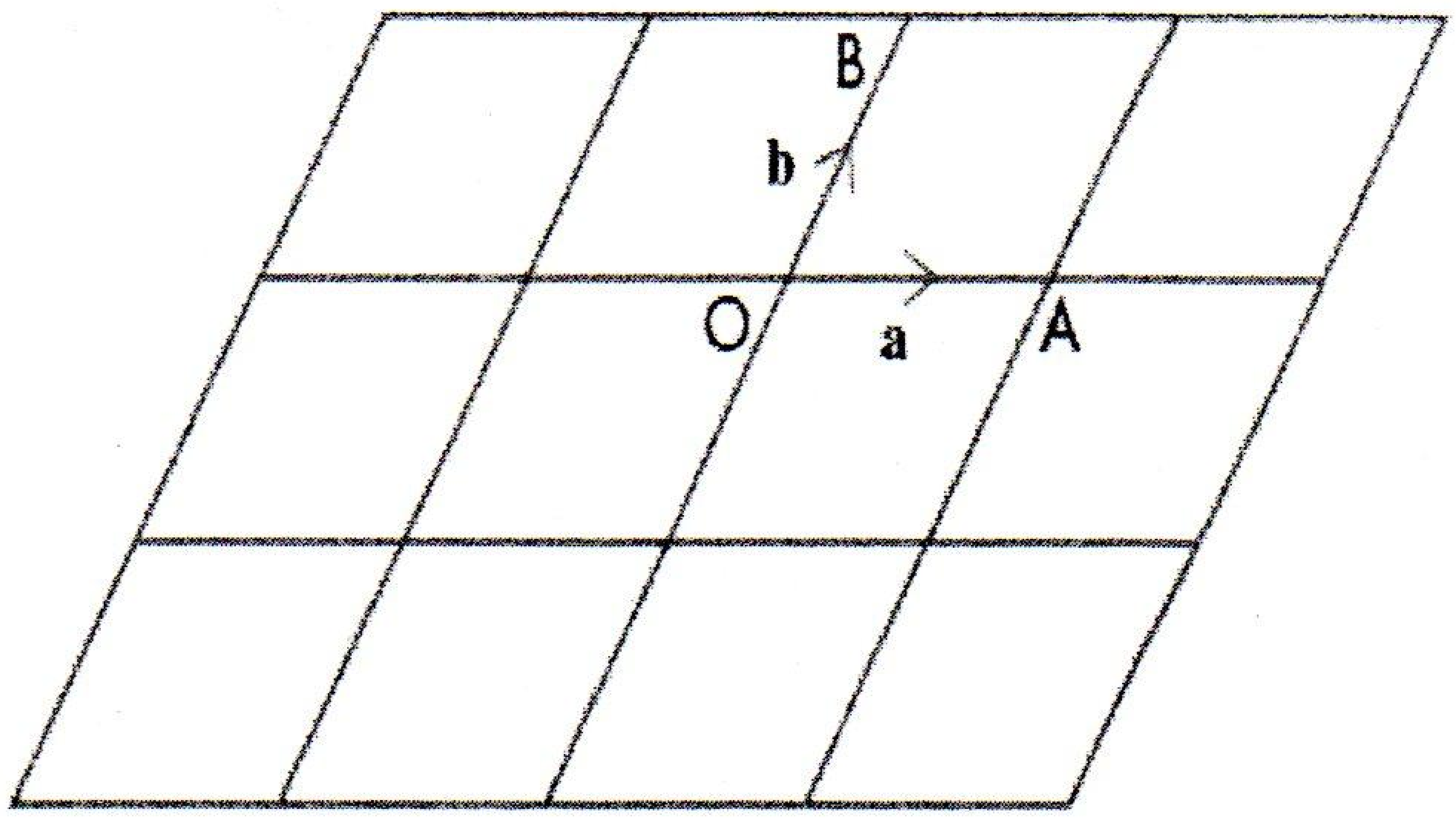
2) Find the position vector of the following vectors.

If OP = (2, 3) OQ= (5, 8) OR= (-7, 8) OS = (0,-5)
OA= (7,2) OB=(5,7) OC=(5,-9) OD = (-3,-7)

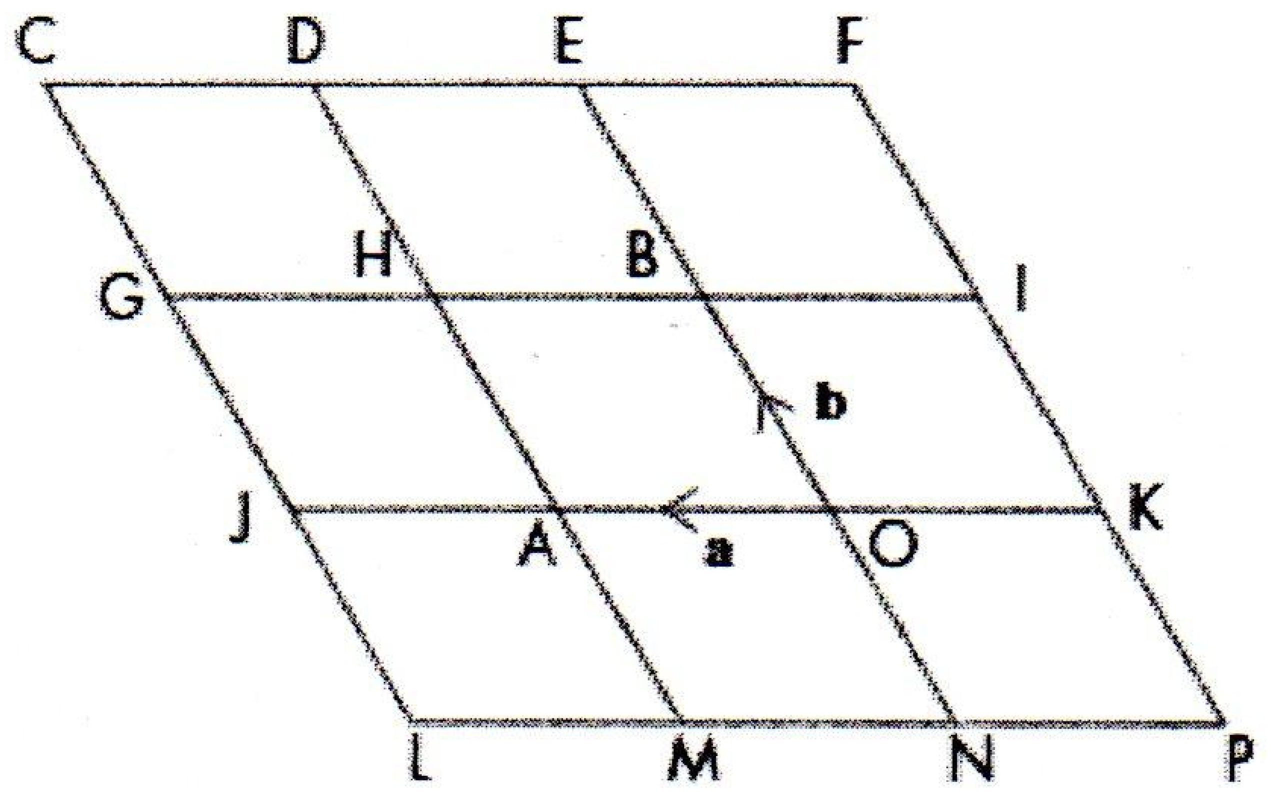
Find the following vectors.

AB=	QB=	CP=	SD=	AA=
AS=	QD=	CD=	DQ=	PO=
AR=	QA=	CR=	DP=	DO=

3) On a copy of this grid, mark on the points C to P to show the following.

a OC = 2**a** – **b**	**b** OD = 2**a** + **b**	
c OE = **a** – 2**b**	**d** OF = **b** – 2**a**	
e OG = –**a**	**f** OH = –**a** – 2**b**	
g OI = 2**a** – 2**b**	**h** OJ = –**a** + **b**	
i OK = –**a** – **b**	**j** OM = –**a** – $^3/_2$ **b**	
k ON = –$^1/_2$ **a** – 2**b**	**l** OP = $^3/_2$ **a** – $^3/_2$ **b**	

4) This grid shows the vectors
OA = **a** and OB = **b**.



a Name three vectors equivalent to **a** + **b**. ________, ________, ________

b Name three vectors equivalent to **a** – **b**. ________, ________, ________

c Name three vectors equivalent to **b** – **a**. ________, ________, ________

d Name three vectors equivalent to –**a** – **b**. ________, ________, ________

e Name three vectors equivalent to 2**a** – **b**. ________, ________, ________

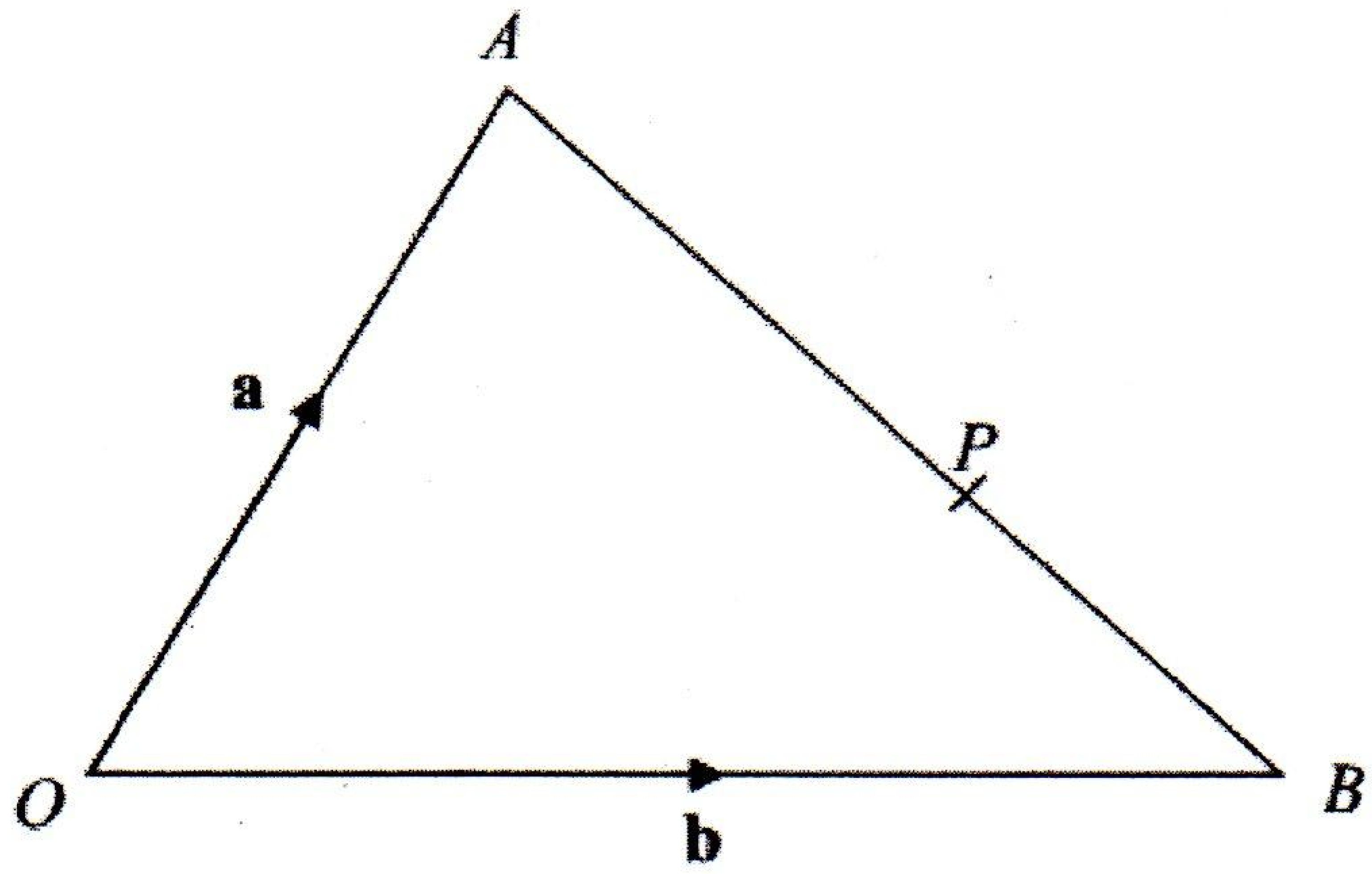
f Name three vectors equivalent to 2**b** – **a**. ________, ________, ________

g For each of these, name one equivalent vector.

i 3**a** – **b**	**ii** 2(**a** + **b**)	**iii** 3**a** – 2**b**
________	________	________
iv 3(**a** – **b**)	**v** 3(**b** – **a**)	**vi** 3(**a** + **b**)
________	________	________
vii –3(**a** + **b**)	**viii** 2**a** + **b** – 3**a** – 2**b**	**ix** 2(2**a** – **b**) – 3(**a** – **b**)
________	________	________

Vector geometry

Triangular Law of vector



Here in the figure ‘O’ is the origin, AOB is the triangle
P is the point on *AB* such that *AP* : *PB* = 3 : 2
OB vector is given by ‘b’ and BO vector = -b (Opposite direction)
OA vector given by ‘a’ and AO vector = -a (Opposite direction)
From the given ratio
2AP = 3PB

Always express the part of the side as the ration of the full side.

AP + PB = AB
AP = 3/5 AB and PB =2/5 AB

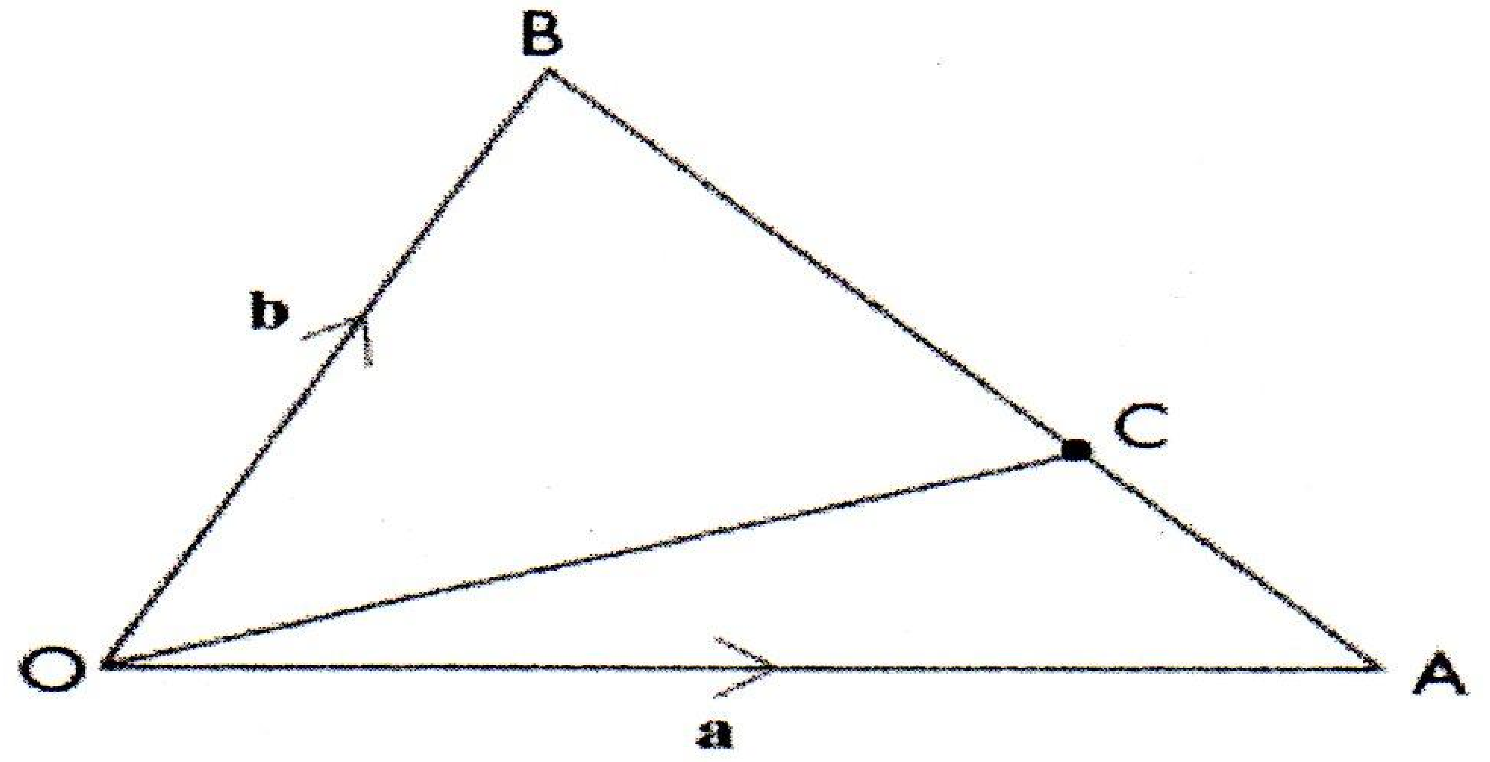
BP+ PA = BA
BP = 2/5 BA and PA = 3/5BA

AB = AO + OB = -a + b OP= OA + AP = a+ 3/5 AB = a + 3/5 (-a+b) = 5a/5 + 3/5 (-a + b) = 1/5(5a – 3a + 3b) = 1/5(2a + 3b)	BA = BO + OA = -b + a OP = OB + BP = b + 2/5BA = b + 2/5(-b +a) = 5b/5 + 2/5(-b +a) = 1/5(5b -2b + 2a) = 1/5(2a +3b)

If P is the midpoint , then the ratio *AP* : *PB* = 1 : 1
AP = ½(AB)

Similarly OP = ½(a + b)

1) The diagram shows the vectors
OA = **a** and OB = **b**.



The point C divides the line AB in the ratio 1: 3 (i.e. AC is 1/4 the distance from A to B).

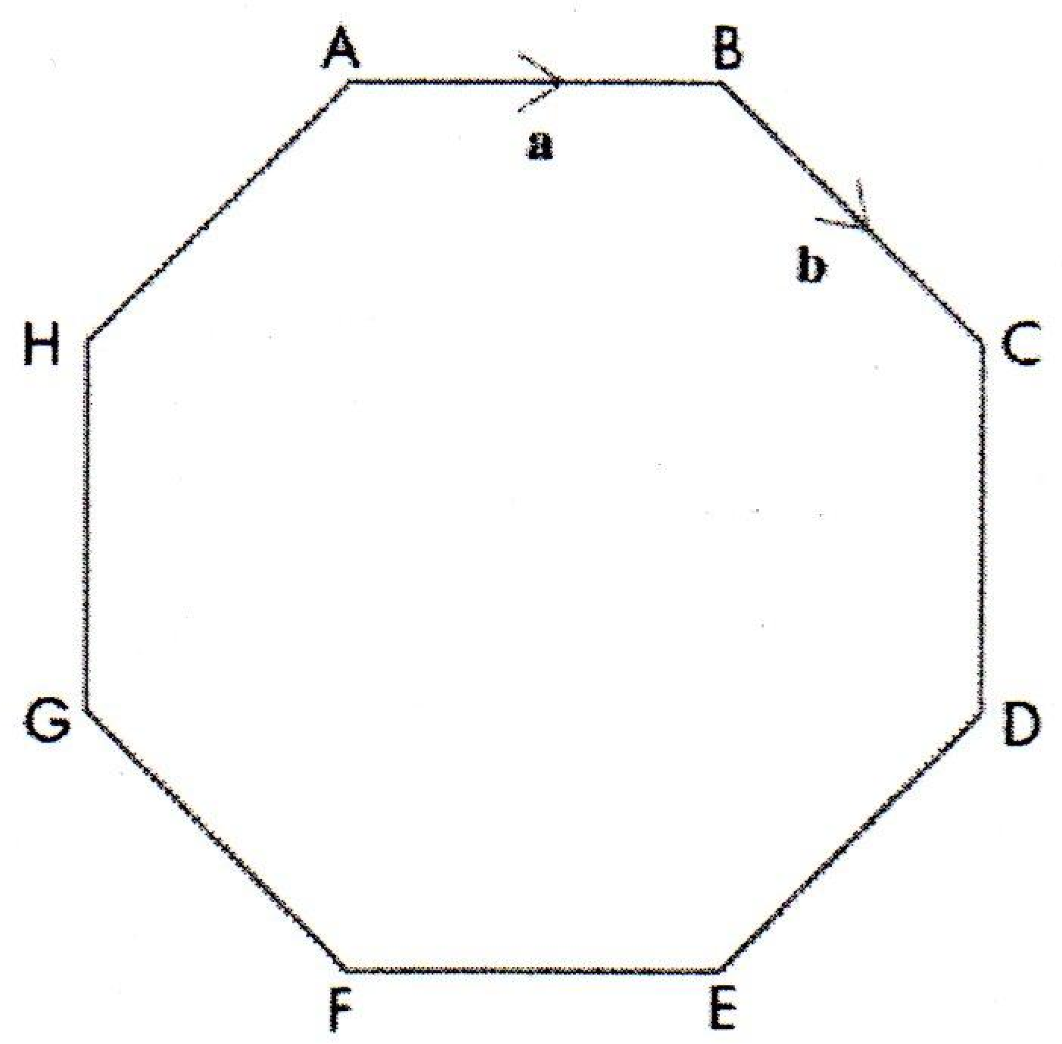
a i Work out the vector AB.

ii Work out the vector AC.

iii Work out the vector OC in terms of **a** and **b**.

b If C now divides the line AB in the ratio 2: 3 (i.e. AC is 2/5 the distance from A to B), write down
the vector that represents OC.

2) ABCDEFGH is a regular octagon. AB is represented by the vector **a**, and BC by the vector **b**.



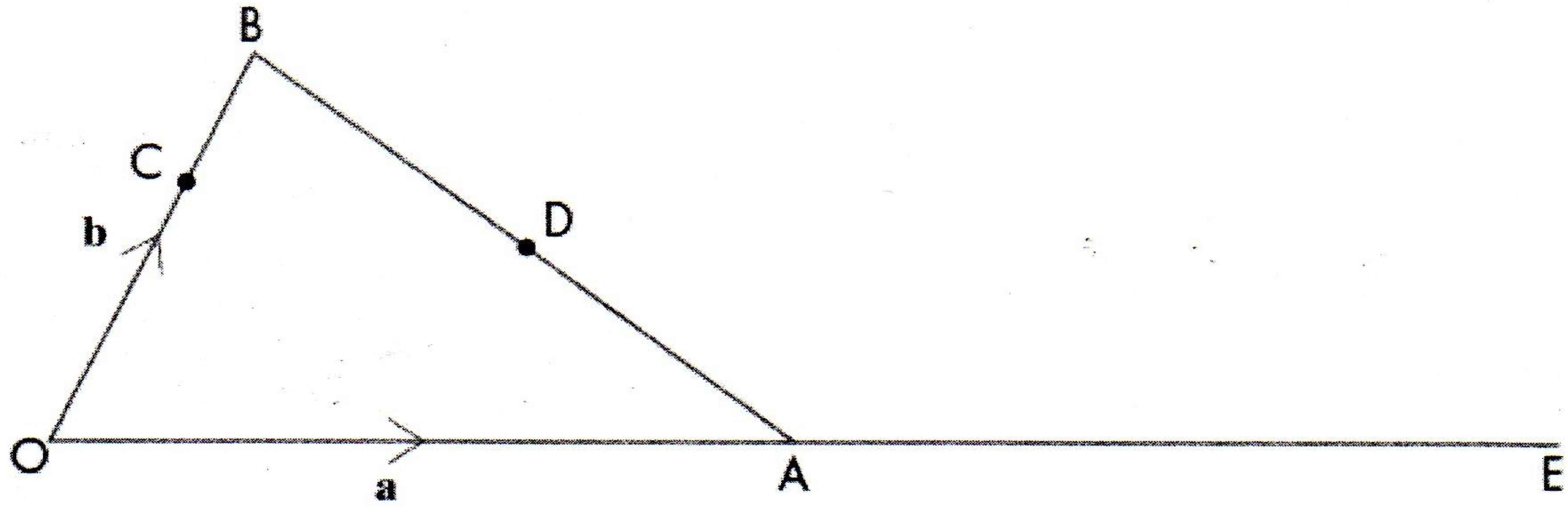
a By means of a diagram, or otherwise, explain why CD = √2**b** – **a**.

b By means of a diagram, or otherwise, explain why DE = **b** – √2**a**.

c Express the following vectors in terms of **a** and **b**.

iEF	**ii**FG	**iii**GH	**iv**HA
vHC	**vi**AD	**vii**BE	**viii**BF

3) The diagram shows the vectors



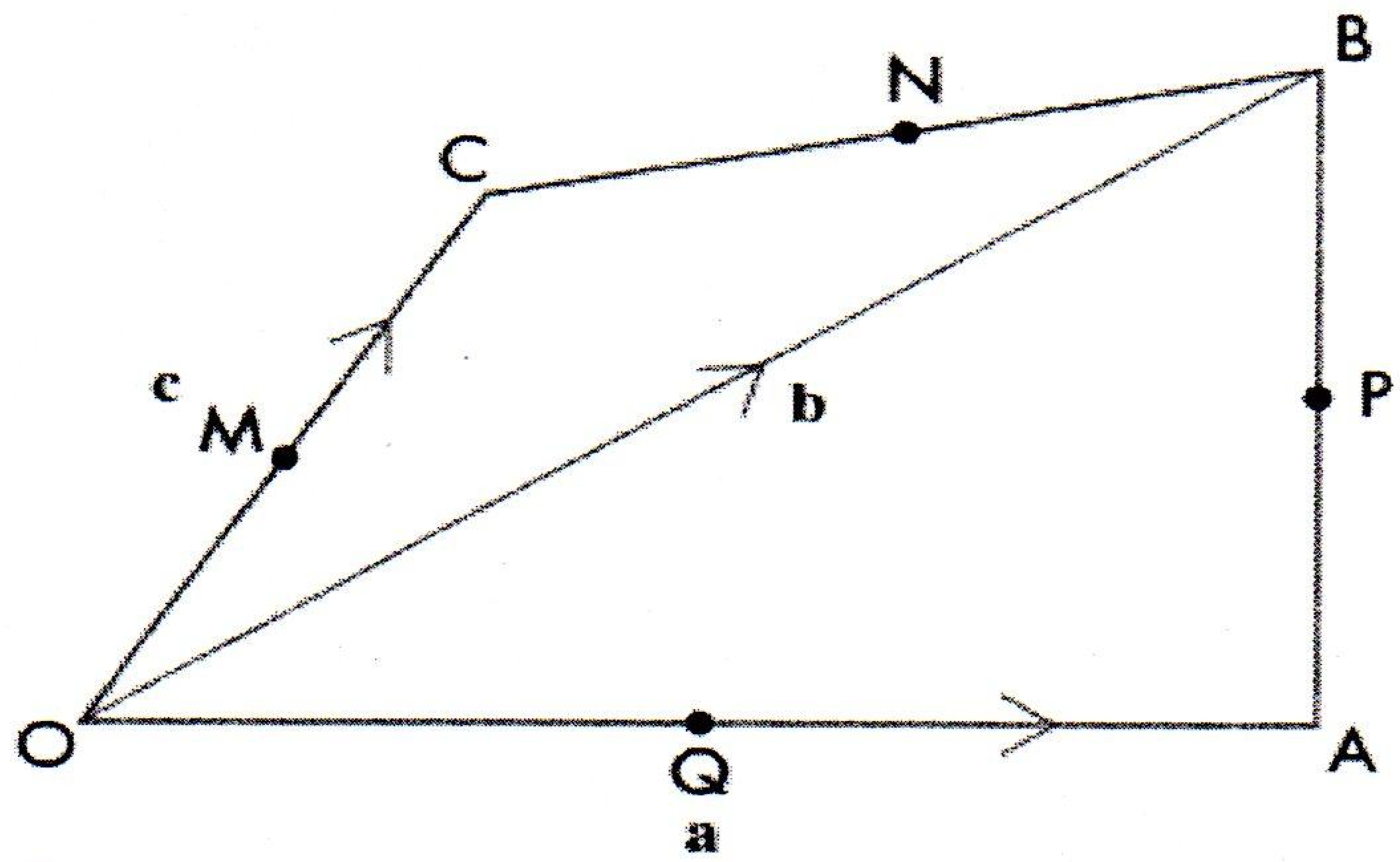
OA = **a** and OB = **b**.
The point C divides OB in the ratio 2 :1 (i.e. OC is 2/3 the distance from O to B).
The point E is such that OE = 2 OA. D is the midpoint of AB.
a Write down (or work out) these vectors in terms of **a** and **b**.
i OC **ii**OD **iii**CO

b The vector CD can be written asCD =CO +OD.
Use this fact to work outCD in terms of **a**and **b**.

c Write down a similar rule to that in part **b** for the vector DE.
Use this rule to work out DE in terms of **a** and **b**.

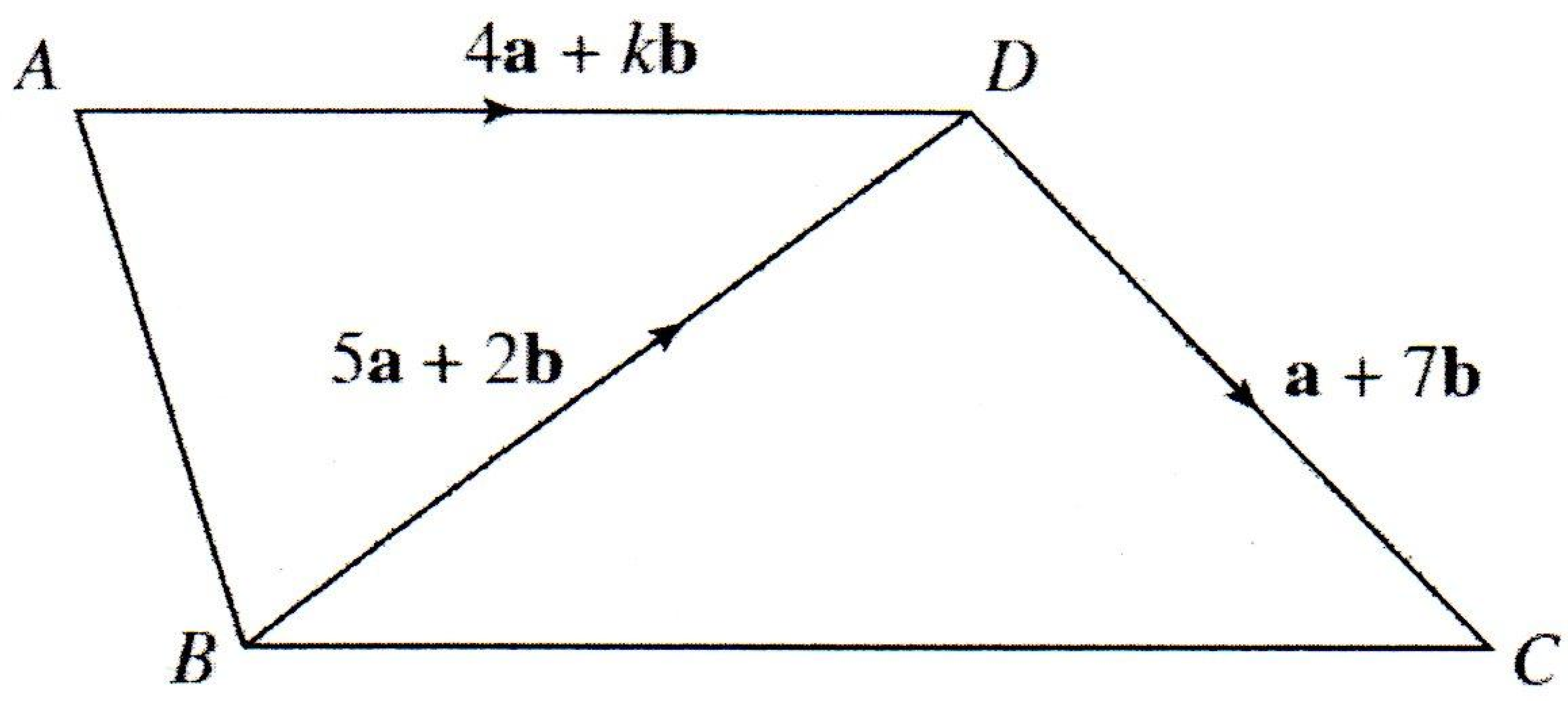
d Explain why C, D and E lie on the same straight line.

4) In the quadrilateral OABC, M, N, P and Q are the midpoints of the sides as shown. OA is represented by the vector **a**, and OC by the vector **c**. The diagonal OB is represented by the vector **b**.



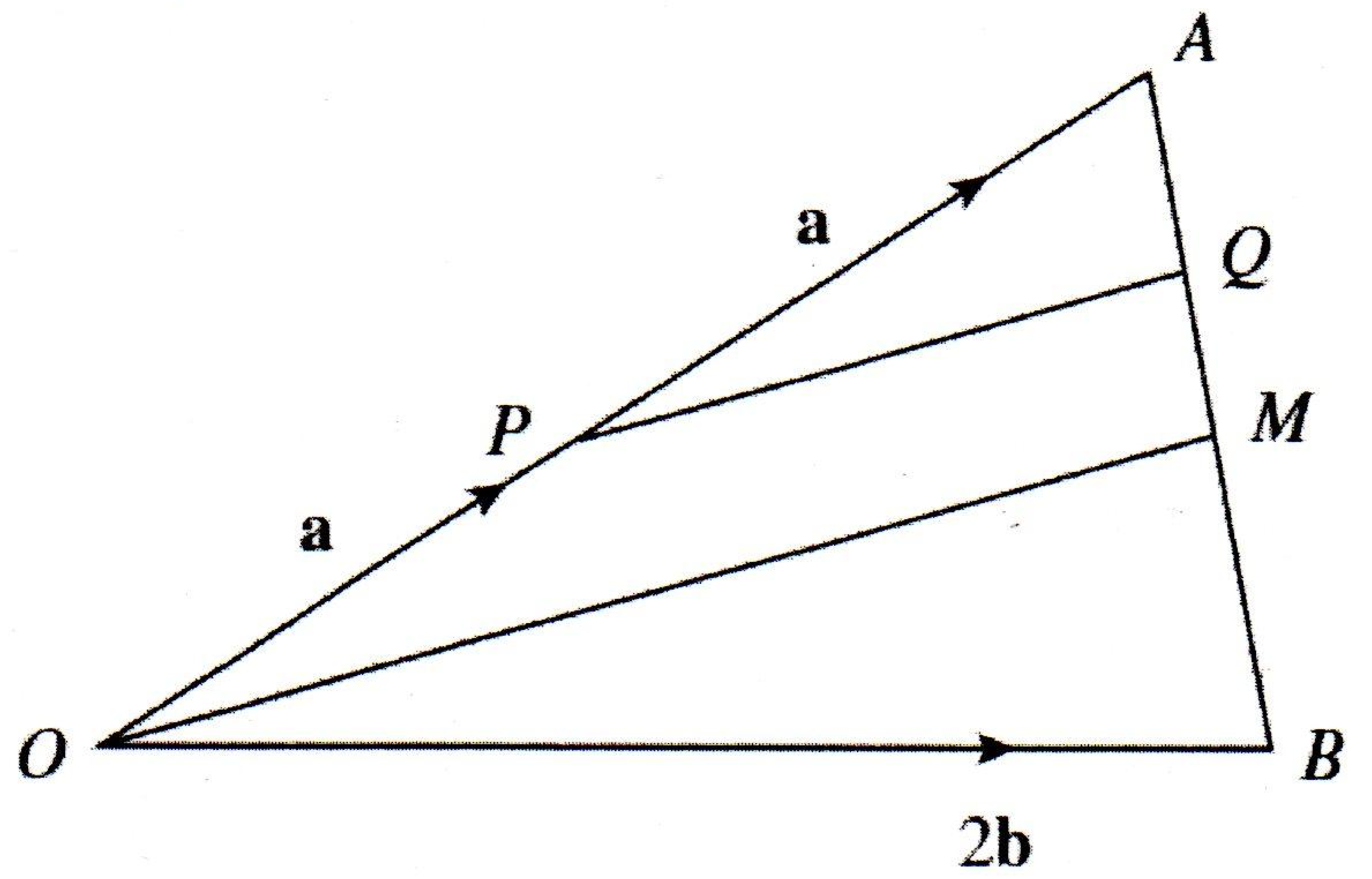
a Express these vectors in terms of **a**, **b** and **c**.
i AB **ii**AP **iii**OP
Give your answers as simply as possible.
b i Express the vector ON in terms of **b** and **c**.
ii Hence express the vector PN in terms of **a** and **c**.
c i Express the vector QM in terms of **a** and **c**.
ii What relationship is there between PN and QM?
iii What sort of quadrilateral is PNMQ?
d Prove that AC = 2 QM.

1) *ABCD* is a trapezium. *BC* is parallel to *AD*.
BD = 5**a** + 2**b**, *DC* = **a** + 7**b** and *AD* = 4**a** + *k***b**, where *k* is a number to be determined.



Find the value of *k*.
You **must** show your working.

2) *OAB* is a triangle with *P* the mid-point of *OA* and *M* the mid-point of *AB*.
OP = **a**, *PA* = **a** and *OB* = 2**b**



(a) Write down an expression for *AB* in terms of **a** and **b**.

....

Q lies on *AB* such that *AQ* = ¼ *AB*
Show that *PQ* = ½ **a** +1/2 **b**

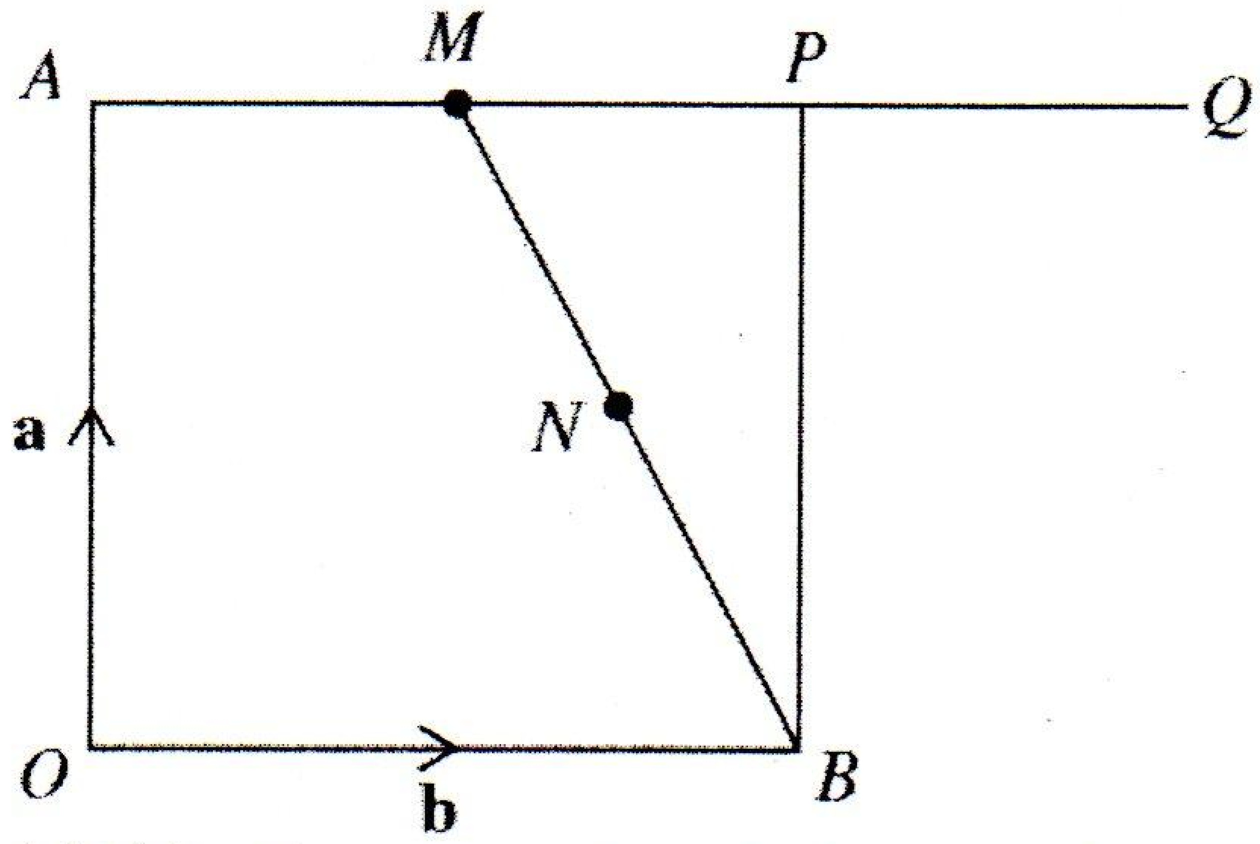
Explain your answer.

....

(c) Write down, and simplify, an expression for *OM* in terms of **a** and **b**.

(d) Explain why the answers for part (b) and part (c) show that *OPQM* is a trapezium.

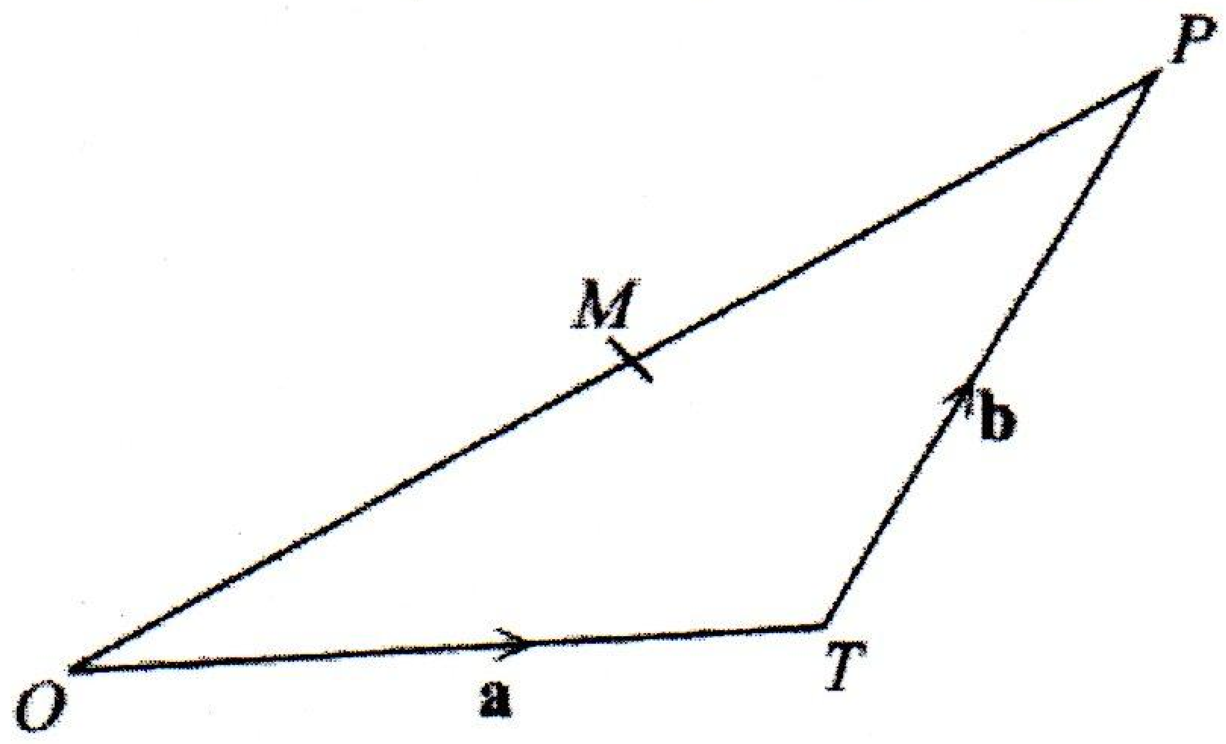
3) The diagram shows a square *OAPB*.
M is the mid-point of *AP*.   *N* is the mid-point of *BM*.
AP is extended to *Q* where *AQ* = 2 *AP*
OA = **a** and *OB* = **b**



a) Write these vectors in terms of **a** and **b**. Give your answers in their simplest form.
(i) *OQ*   (ii) *BM*   (iii) *BN*   (iv) *ON*

(b) What can you deduce about points *O*, *N* and *Q*?
Give a reason for your answer.

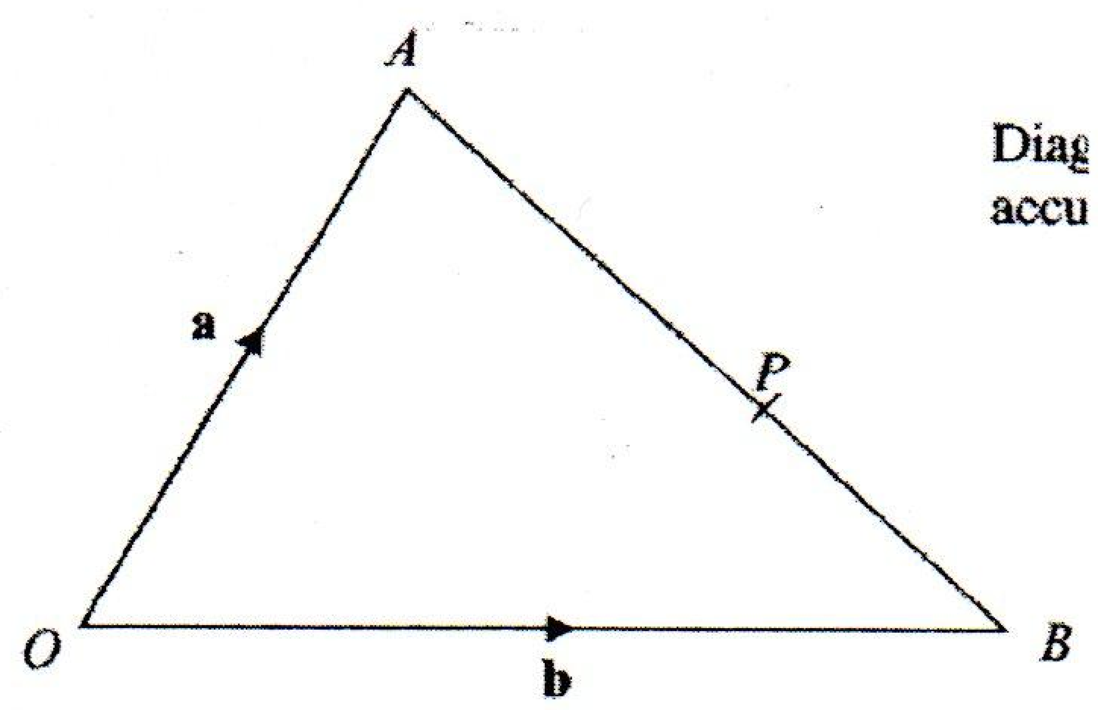
4) OPT is a triangle.
M is the midpoint of *OP*. *OT* = **a**, *TP* = **b**



(a) Express *OM* in terms of **a** and **b**.   *OM* =..........................

(b) Express *TM* in terms of **a** and **b**.
Give your answer in its simplest form.   *TM* =..........................

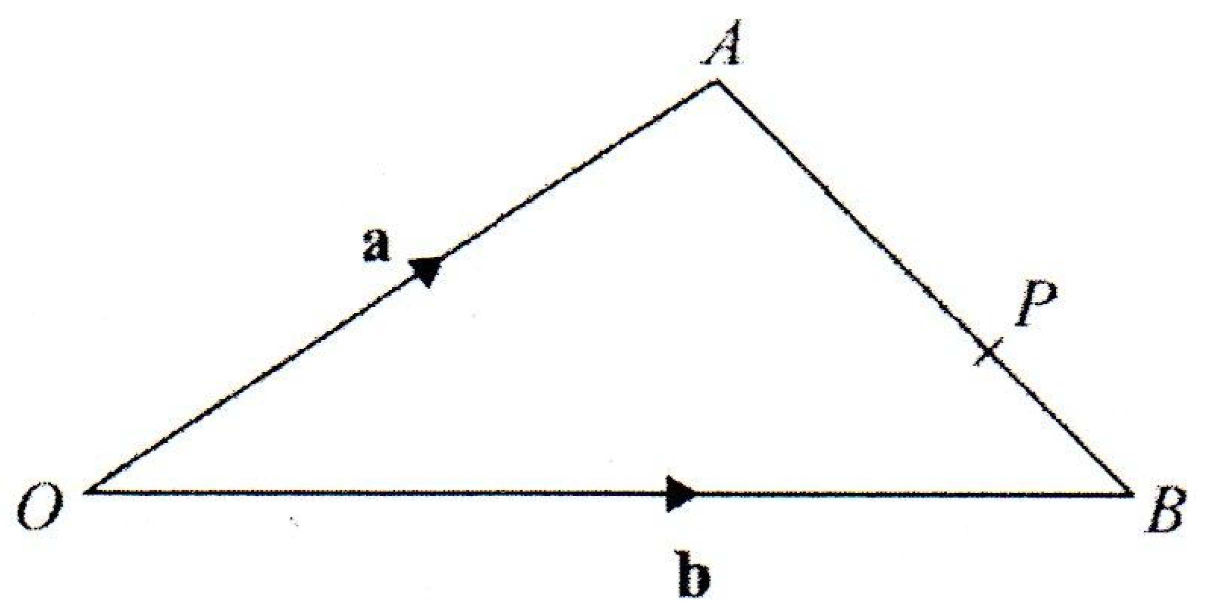
5) Here *OAB* is a triangle. *OA* = **a** *OB* = **b**



(a) Find the vector *AB* in terms of **a** and **b**.   *AB* = ...

P is the point on *AB* such that *AP* : *PB* = 3 : 2
(b) Show that *OP* = 1/5 (2**a** + 3**b**)

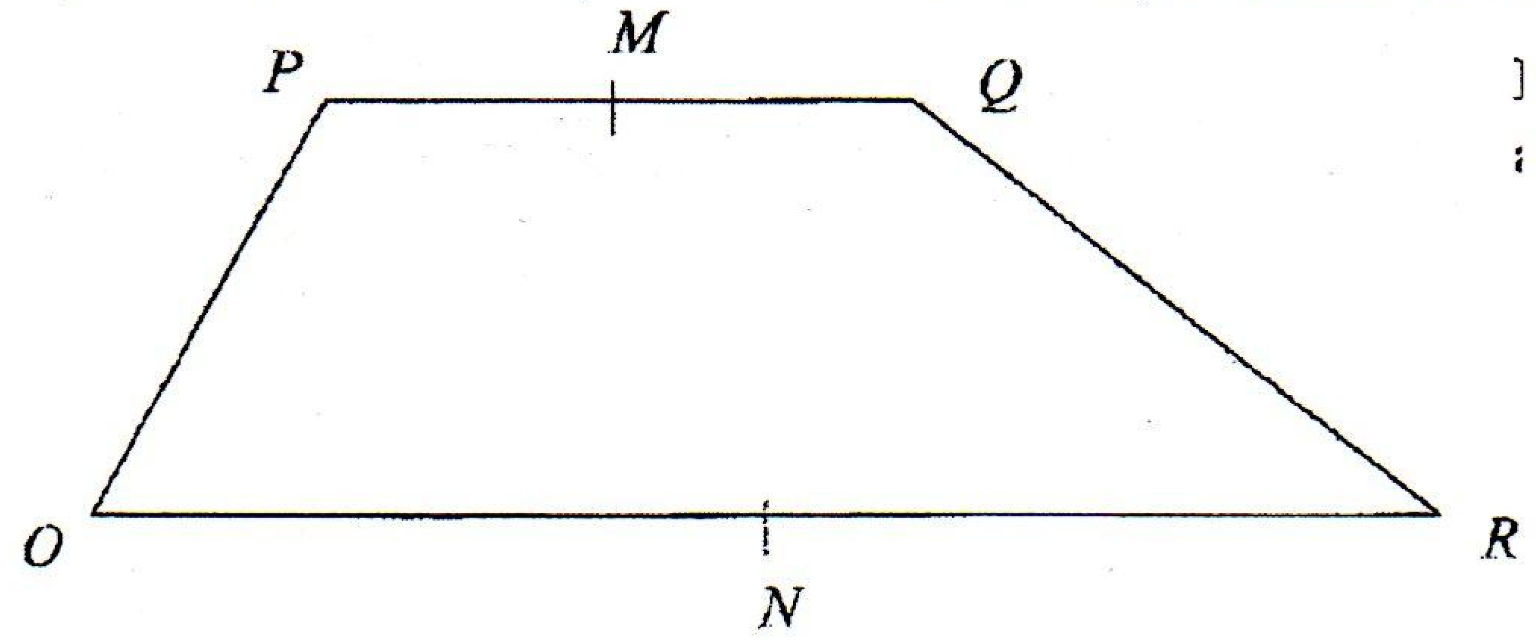
6) OAB is a triangle. *OA* = **a**, *OB* = **b**



(a) Find the vector *AB* in terms of **a** and **b**. *AB* = ...

P is the point on *AB* so that *AP* : *PB* = 2 : 1
(b) Find the vector *OP* in terms of **a** and **b**.
Give your answer in its simplest form. *OP* = ...

7) OPQR is a trapezium with PQ parallel to OR

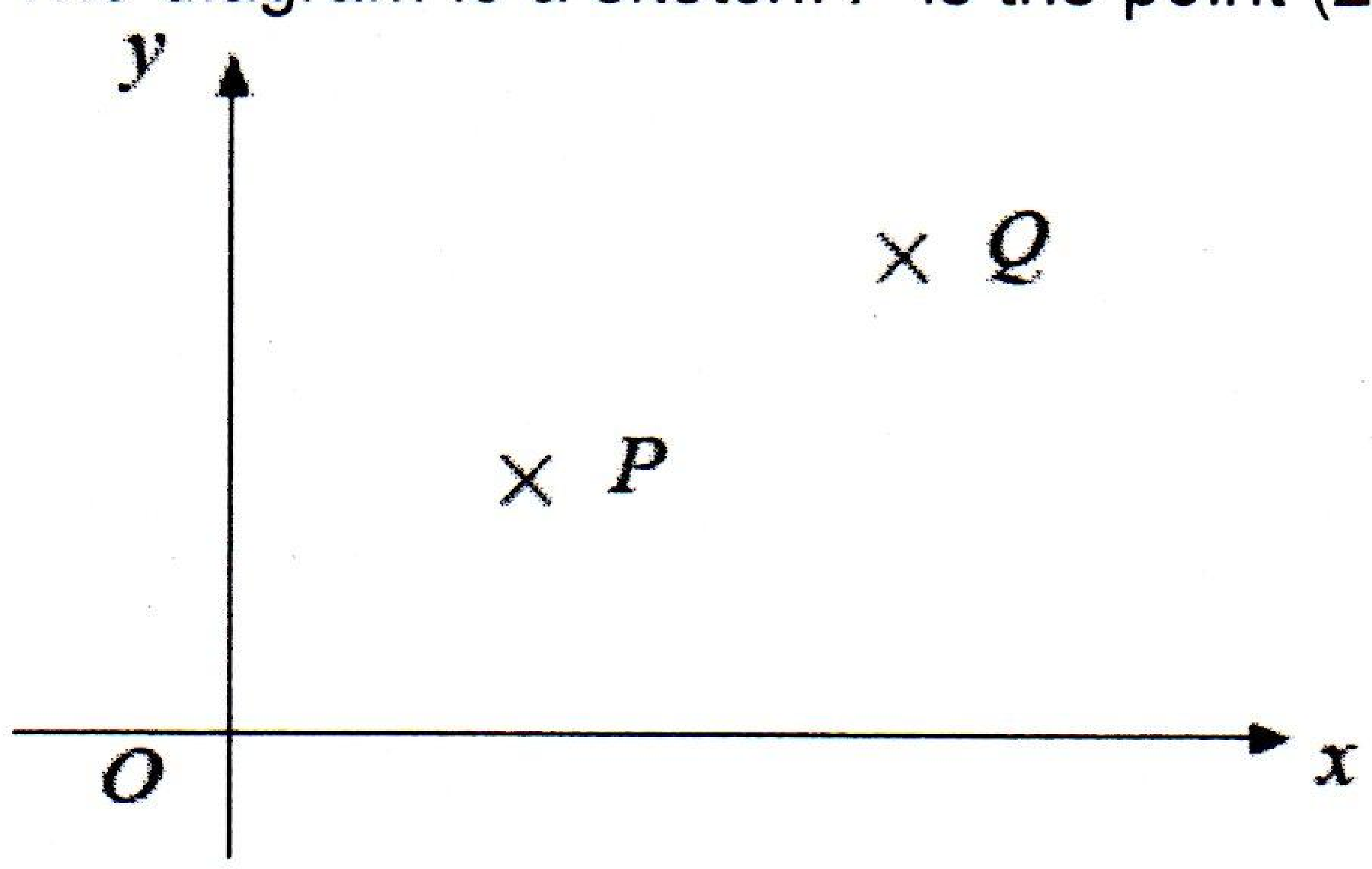


OP = 2b PQ= 2a OR= 6a
M is the midpoint of PQ and N is the midpoint of OR.
a) Find the vector MN in terms of a and b.

X is the midpoint of MN and Y is the midpoint of QR.

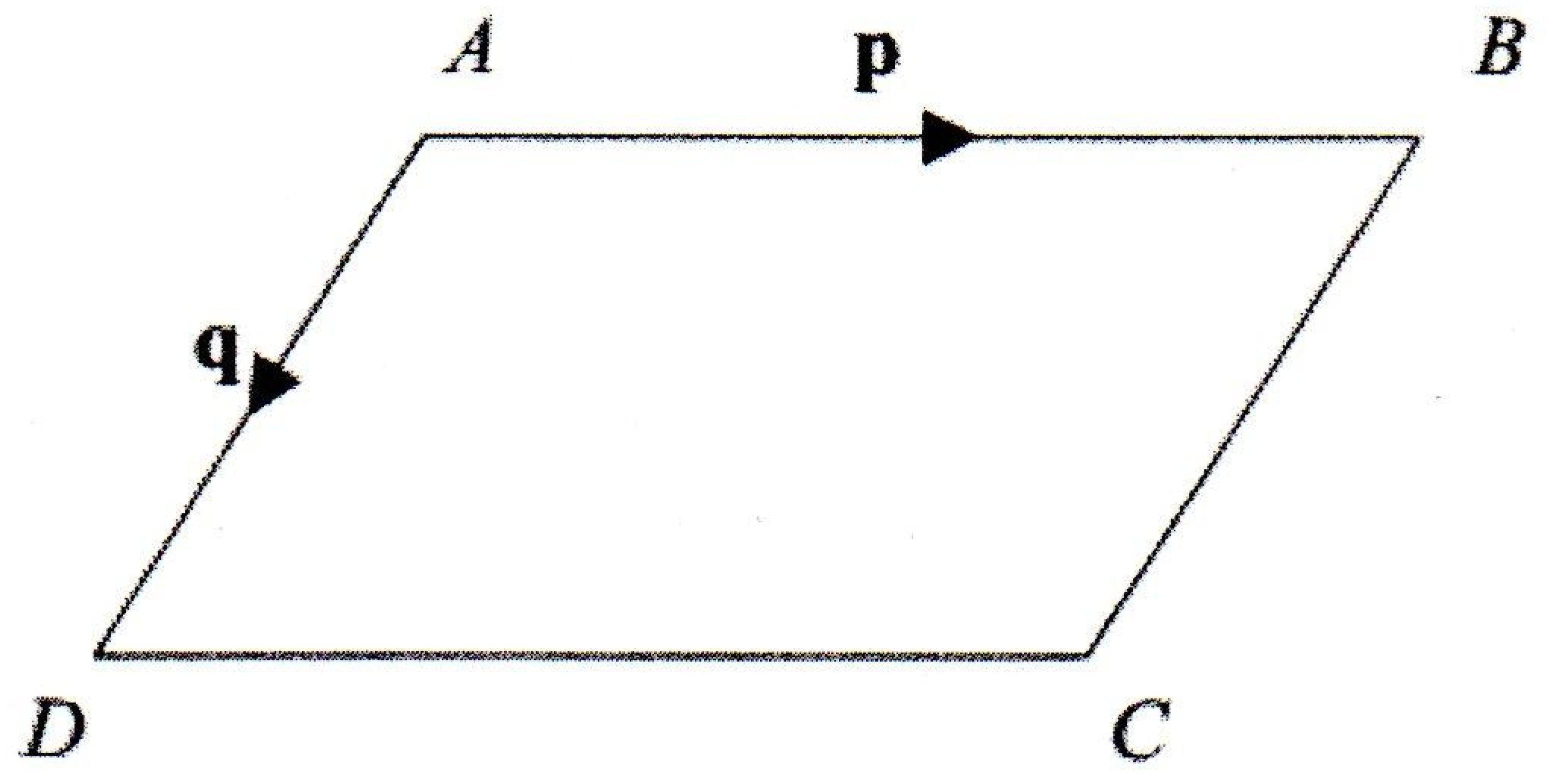
b) Prove that XY is parallel to OR.

8) The diagram is a sketch. *P* is the point (2, 3) *Q* is the point (6, 6)



The diagram is a sketch. *P* is the point (2, 3) *Q* is the point (6, 6)
a) Write down the vector PQ.
Write your answer as a column vector.
PQRS is a parallelogram. And PR = $\begin{pmatrix}4\\7\end{pmatrix}$
Find the vector QS

9) ABCD is a parallelogram. *AB* is parallel to *DC*. *AD* is parallel to *BC*.

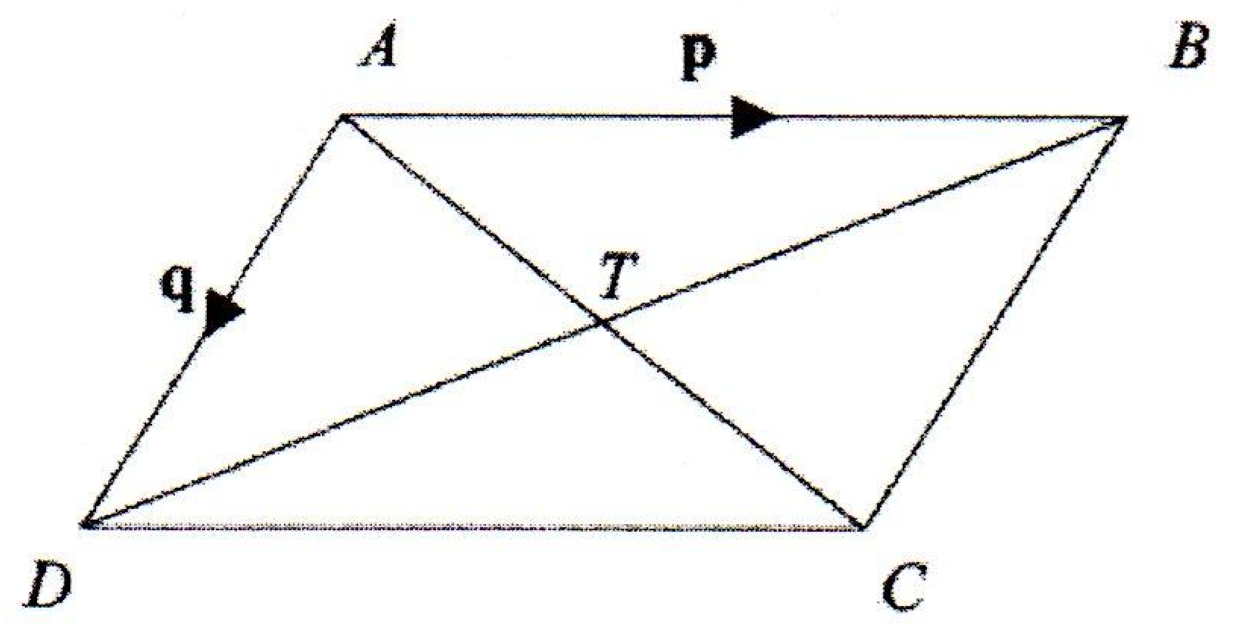


AB Vector = **p** and AD vector = **q**.
a) Express following vectors, in terms of **p** and **q**

i) AC

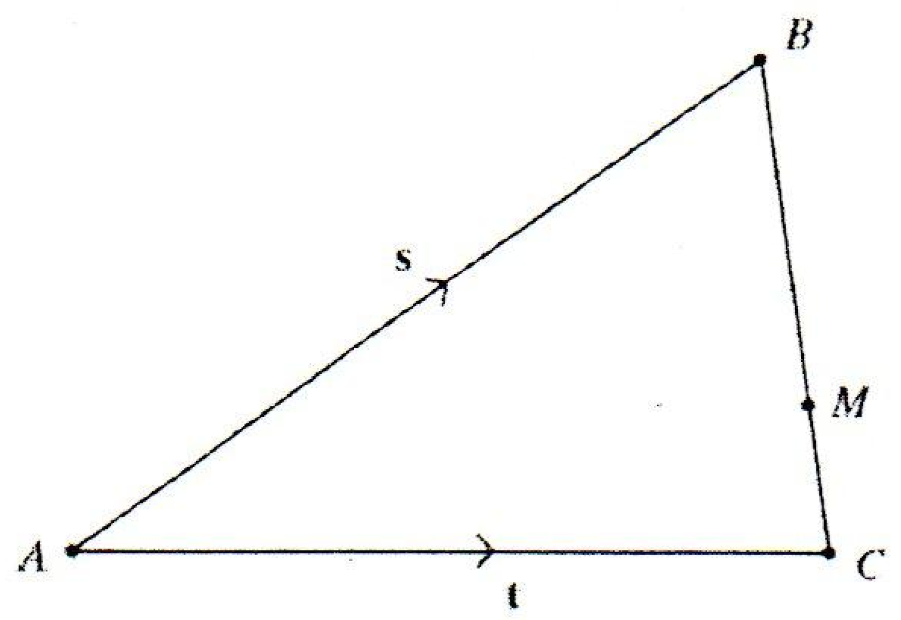
ii) BD

10) AC and BD are diagonals of parallelogram ABCD
AC and BD intersect at T



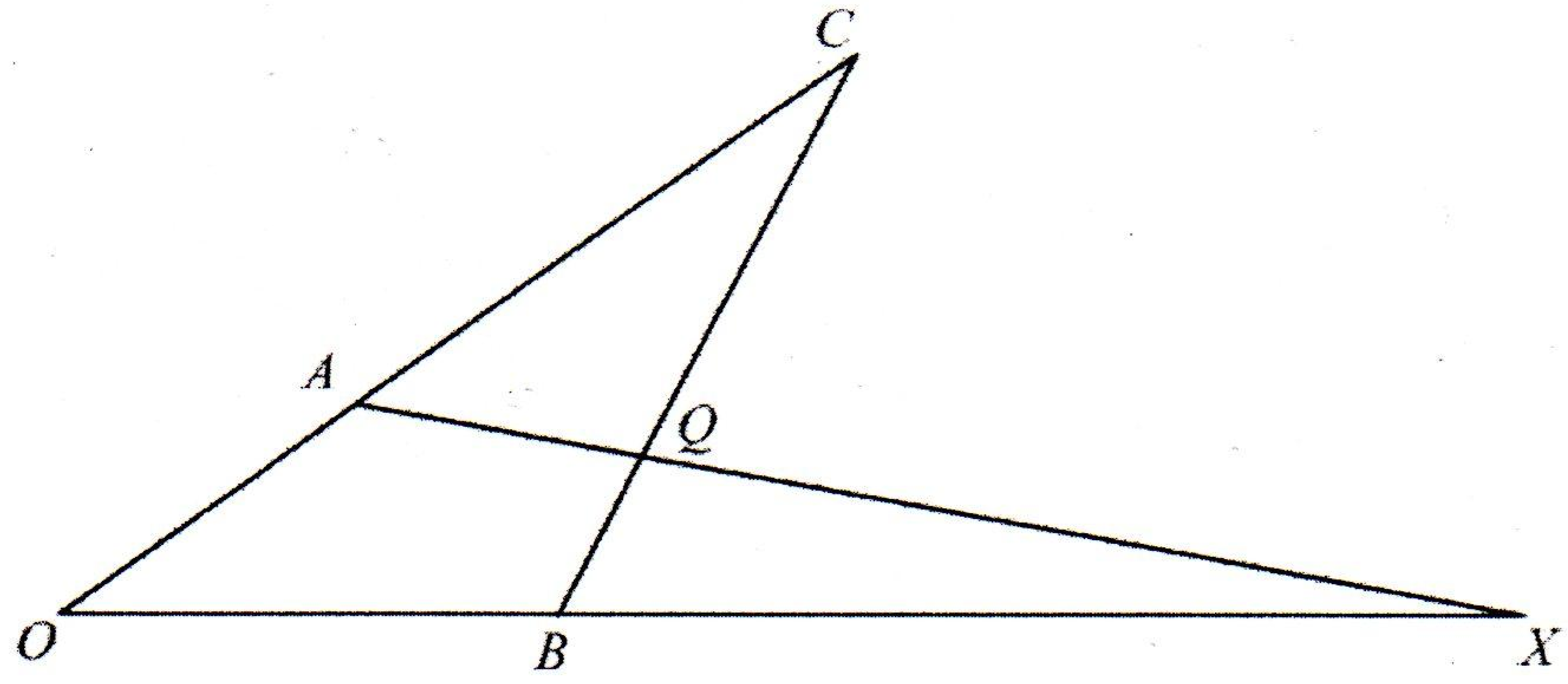
Express AT in terms of **p** and **q.**

11) In triangle ABC , M lies on BC such that BM = ¾ BC
AB = s and AC = t



Find **AM** in terms of **s** and **t**.
Give your answer in its simplest form

12) In the diagram, OA=4a and OB=4



OAC, OBX and *BQC* are all straight lines
AC = 2*OA* and *BQ*: *QC* = 1:3

(a) Find, in terms of **a** and **b**, the vectors which represent

(i) BC

(ii) AQ

Given that BX = 8b

(b) Show that AQX is a straight line.