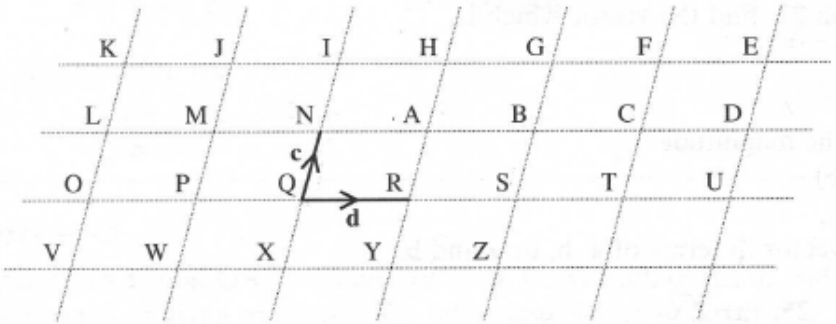
Vectors - 1

Exercise A

In Questions **1** to **15**, use the diagram below to describe the vectors given in terms of **c** and **d** where $\mathbf{c} = \overrightarrow{QN}$ and $\mathbf{d} = \overrightarrow{QR}$, e.g. $\overrightarrow{QS} = 2\mathbf{d}$, $\overrightarrow{TD} = \mathbf{c} + \mathbf{d}$.



1. $\overrightarrow{AB}$ **2.** $\overrightarrow{SG}$ **3.** $\overrightarrow{VK}$ **4.** $\overrightarrow{KH}$ **5.** $\overrightarrow{OT}$

6. $\overrightarrow{WJ}$ **7.** $\overrightarrow{FH}$ **8.** $\overrightarrow{FT}$ **9.** $\overrightarrow{KV}$ **10.** $\overrightarrow{NQ}$

11. $\overrightarrow{OM}$ **12.** $\overrightarrow{SD}$ **13.** $\overrightarrow{PI}$ **14.** $\overrightarrow{YG}$ **15.** $\overrightarrow{OI}$

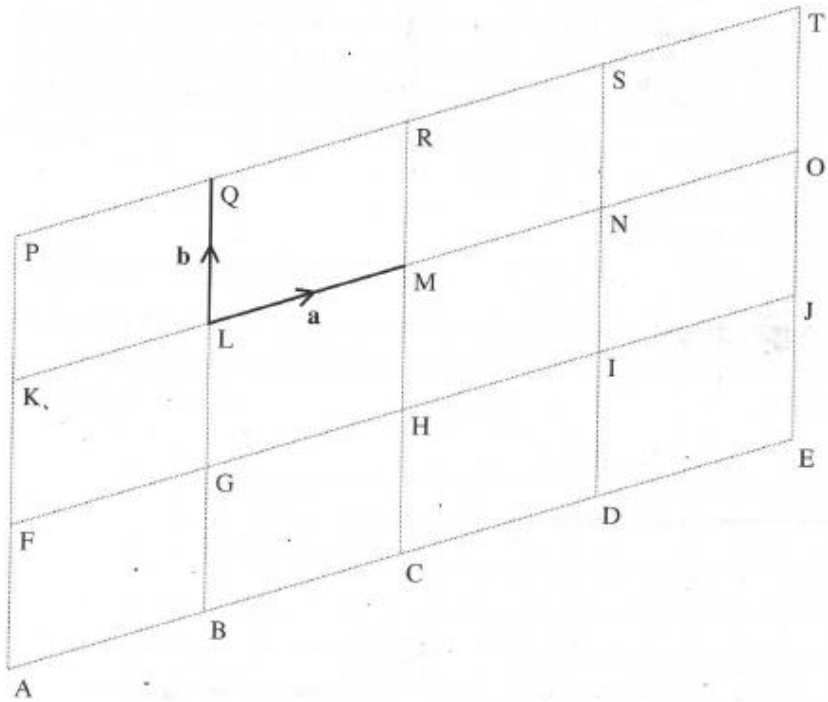
In Questions **16** to **21**, use the same diagram above to find vectors for the following in terms of the capital letters, starting from Q each time.

e.g. $3\mathbf{d} = \overrightarrow{QT}$, $\mathbf{c} + \mathbf{d} = \overrightarrow{QA}$.

16. $2\mathbf{c}$ **17.** $4\mathbf{d}$ **18.** $2\mathbf{c} + \mathbf{d}$

19. $2\mathbf{d} + \mathbf{c}$ **20.** $3\mathbf{d} + 2\mathbf{c}$ **21.** $2\mathbf{c} - \mathbf{d}$

In Questions **22** and **23**, use the diagram below. $\overrightarrow{LM} = \mathbf{a}$, $\overrightarrow{LQ} = \mathbf{b}$.



22. Write these vectors in terms of **a** and **b**.

(a) $\overrightarrow{GN}$ (b) $\overrightarrow{CO}$ (c) $\overrightarrow{TN}$

(d) $\overrightarrow{FT}$ (e) $\overrightarrow{KC}$ (f) $\overrightarrow{CJ}$

23. From your answers to Question **22**, find the vector which is:

(a) parallel to $\overrightarrow{LR}$

(b) 'opposite' to $\overrightarrow{LR}$

(c) parallel to $\overrightarrow{CJ}$ with twice the magnitude

(d) parallel to the vector $(\mathbf{a} - \mathbf{b})$.

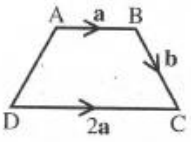
In Questions **24** to **27**, write each vector in terms of **a**, **b**, or **a** and **b**.

24. (a) $\overrightarrow{BA}$

(b) $\overrightarrow{AC}$

(c) $\overrightarrow{DB}$

(d) $\overrightarrow{AD}$

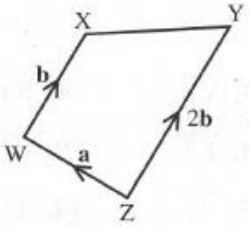


25. (a) $\overrightarrow{ZX}$

(b) $\overrightarrow{YW}$

(c) $\overrightarrow{XY}$

(d) $\overrightarrow{XZ}$

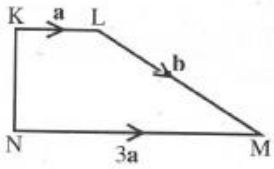


26. (a) $\overrightarrow{MK}$

(b) $\overrightarrow{NL}$

(c) $\overrightarrow{NK}$

(d) $\overrightarrow{KN}$

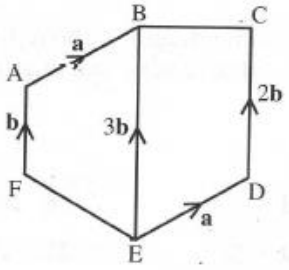


27. (a) $\overrightarrow{FE}$

(b) $\overrightarrow{BC}$

(c) $\overrightarrow{FC}$

(d) $\overrightarrow{DA}$



28. The points A, B and C lie on a straight line and the vector $\overrightarrow{AB}$ is $\mathbf{a} + 2\mathbf{b}$. Which of the following vectors is possible for $\overrightarrow{AC}$:

(a) $3\mathbf{a} + 6\mathbf{b}$ (b) $4\mathbf{a} + 4\mathbf{b}$ (c) $\mathbf{a} - 2\mathbf{b}$ (d) $5\mathbf{a} + 10\mathbf{b}$?

29. Find three pairs of parallel vectors from those below.

$\mathbf{a} + 3\mathbf{b}$	$\mathbf{a} - \mathbf{b}$	$6\mathbf{a} - 3\mathbf{b}$	$2\mathbf{a} + 6\mathbf{b}$	$3\mathbf{a} - 3\mathbf{b}$	$2\mathbf{a} - \mathbf{b}$	$\mathbf{a} + \mathbf{b}$
A	B	C	D	E	F	G

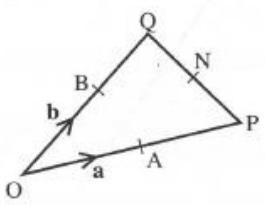
Exercise B

In Questions **1** to **4**, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. Copy each diagram and use the information given to express the following vectors in terms of **a**, **b** or **a** and **b**.

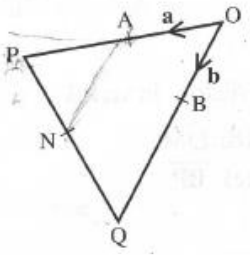
(a) $\overrightarrow{AP}$ (b) $\overrightarrow{AB}$ (c) $\overrightarrow{OQ}$ (d) $\overrightarrow{PO}$ (e) $\overrightarrow{PQ}$

(f) $\overrightarrow{PN}$ (g) $\overrightarrow{ON}$ (h) $\overrightarrow{AN}$ (i) $\overrightarrow{BP}$ (j) $\overrightarrow{QA}$

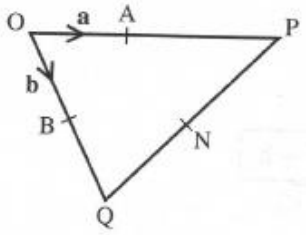
1. A, B and N are mid-points of OP, OB and PQ respectively.



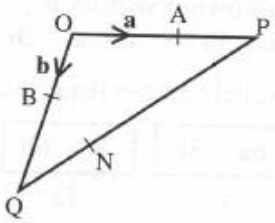
2. A and N are mid-points of OP and PQ; BQ = 2OB.



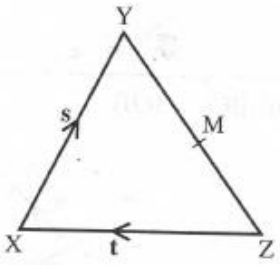
3. AP = 2OA, BQ = OB, PN = NQ.



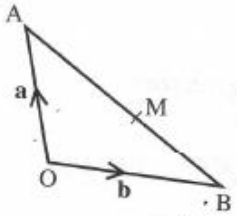
4. OA = 2AP, BQ = 3OB, PN = 2NQ.



5. In △XYZ, the mid-point of YZ is M. If $\overrightarrow{XY}$ = **s** and $\overrightarrow{ZX}$ = **t**, find $\overrightarrow{XM}$ in terms of **s** and **t**.

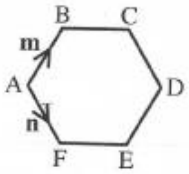


6. In △AOB, AM : MB = 2 : 1. If $\overrightarrow{OA}$ = **a**, and $\overrightarrow{OB}$ = **b** find $\overrightarrow{OM}$ in terms of **a** and **b**.



7. O is any point in the plane of the square ABCD. The vectors $\overrightarrow{OA}$, $\overrightarrow{OB}$, and $\overrightarrow{OC}$, are **a, b** and **c** respectively. Find the vector $\overrightarrow{OD}$, in terms of **a, b** and **c**.

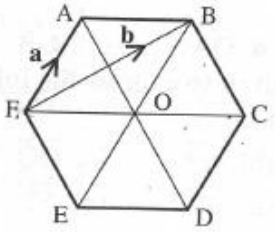
8. ABCDEF is a regular hexagon with $\overrightarrow{AB}$, representing the vector **m** and $\overrightarrow{AF}$, representing the vector **n**. Find the vector representing $\overrightarrow{AD}$.



9. ABCDEF is a regular hexagon with centre O. $\overrightarrow{FA}$ = **a** and $\overrightarrow{FB}$ = **b**.

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

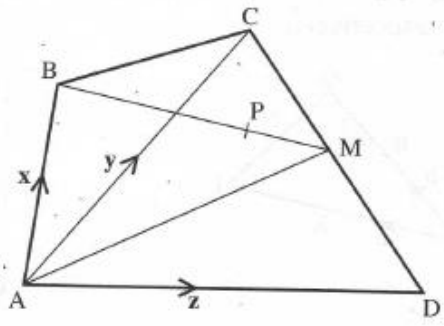
(a) $\overrightarrow{AB}$ (b) $\overrightarrow{FO}$ (c) $\overrightarrow{FC}$
(d) $\overrightarrow{BC}$ (e) $\overrightarrow{AO}$ (f) $\overrightarrow{FD}$



10. In the diagram, M is the mid-point of CD, BP : PM = 2 : 1, $\overrightarrow{AB}$ = **x**, and $\overrightarrow{AC}$ = **y** and $\overrightarrow{AD}$ = **z**.

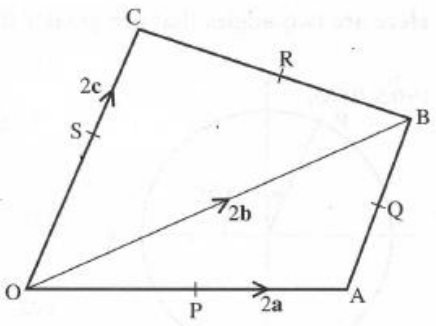
Express the following vectors in terms of **x**, **y** and **z**.

(a) $\overrightarrow{DC}$ (b) $\overrightarrow{DM}$ (c) $\overrightarrow{AM}$
(d) $\overrightarrow{BM}$ (e) $\overrightarrow{BP}$ (f) $\overrightarrow{AP}$



(Please turn over for more questions)

11. In the quadrilateral shown $\overrightarrow{OA} = 2\mathbf{a}$, $\overrightarrow{OB} = 2\mathbf{b}$, $\overrightarrow{OC} = 2\mathbf{c}$. Points P, Q, R and S are the mid-points of the sides shown.

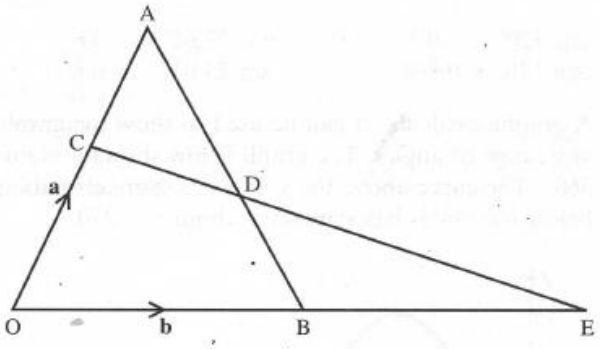


(a) Express in terms of **a**, **b** and **c**:
- (i) $\overrightarrow{AB}$
- (ii) $\overrightarrow{BC}$
- (iii) $\overrightarrow{PQ}$
- (iv) $\overrightarrow{QR}$
- (v) $\overrightarrow{PS}$.

(b) Describe the relationship between QR and PS.

(c) What sort of quadrilateral is PQRS?

12. In the diagram, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$, OC = CA, OB = BE and BD : DA = 1 : 2.



(a) Express in terms of **a** and **b**:
- (i) $\overrightarrow{BA}$
- (ii) $\overrightarrow{BD}$
- (iii) $\overrightarrow{CD}$
- (iv) $\overrightarrow{CE}$.

(b) Explain why points C, D and E lie on a straight line.