Vectors (H)

A collection of 9-1 Maths GCSE Sample and Specimen questions from AQA, OCR, Pearson-Edexcel and WJEC Eduqas.

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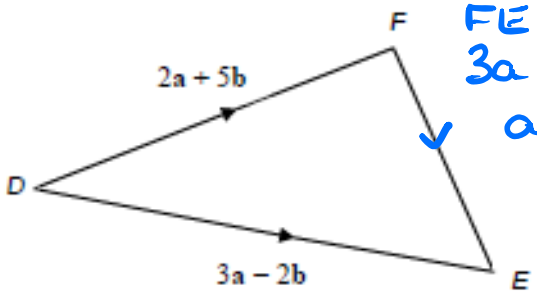
Total Marks:	

1. Vectors **DF** and DE **are** shown in the diagram below.



FE
3a - 2b - 2a - 5b
a - 7b

Line **PQ** is 3 times the length of line EF.

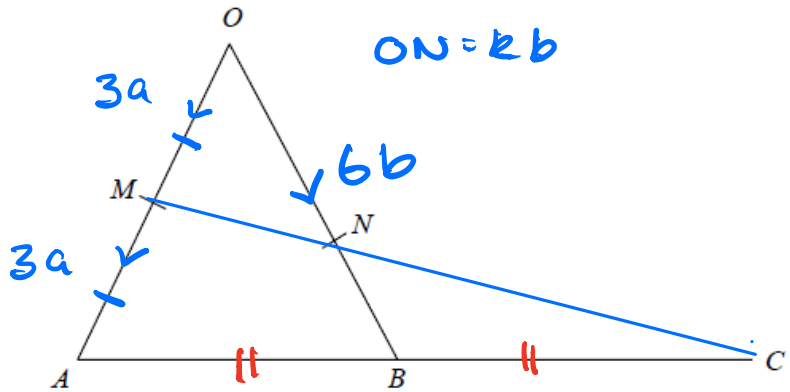
PQ is in the opposite direction to EF. ∴ FE

Find **PQ** in the form **m***a* + **n***b*.

PQ = 3FE
= 3(a - 7b)
= 3a - 21b

[4]

2.



ON = kb

6b

OMA, ONB and *ABC* are straight lines.
M is the midpoint of *OA*.
B is the midpoint of *AC*.

$\overrightarrow{AB}$ = 6b - 6a

∴ $\overrightarrow{BC}$ = 6b - 6a

$\overrightarrow{OA}$ = 6**a**

$\overrightarrow{OB}$ = 6**b**

$\overrightarrow{ON}$ = *k***b** where *k* is a scalar quantity.

Given that *MNC* is a straight line, find the value of *k*.

$\vec{MN} = kb - 3a$

$\vec{MC} = \vec{MA} + \vec{AC}$

$= 3a + 12b - 12a$

$= 12b - 9a$

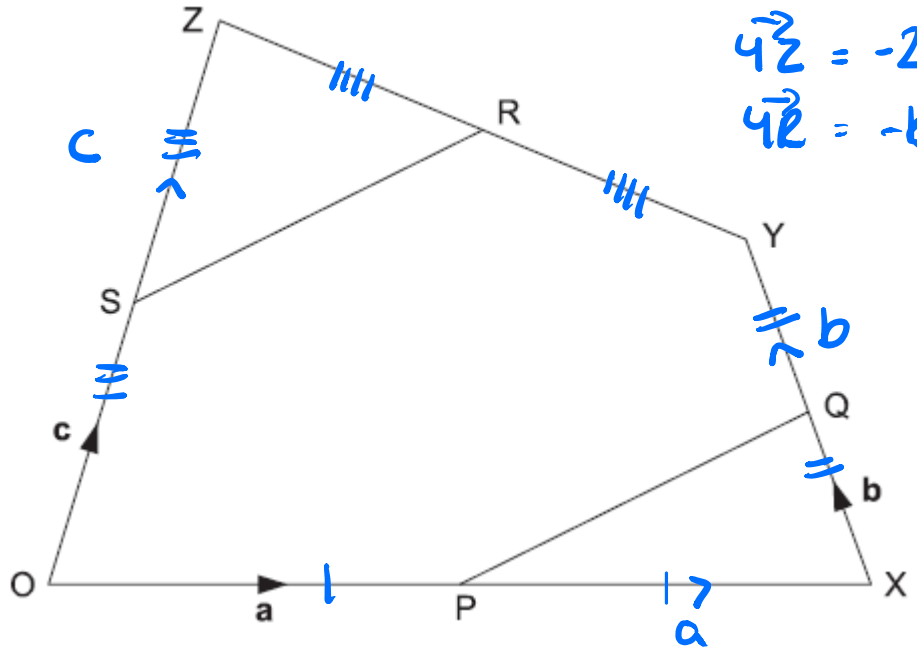
since MNC are on a straight line

$\vec{MN} = kb - 3a$ ÷3

$\vec{MC} = 12b - 9a$ 12÷3 = 4

$\therefore k = 4$ [5]

3. P, Q, R and S are the midpoints of OX, XY, YZ and OZ respectively.



$\vec{4Z} = -2b - 2a + 2c$

$\vec{4R} = -b - a + c$

$\overrightarrow{OP}$= **a**, $\overrightarrow{XQ}$= **b** and $\overrightarrow{OS}$= **c**.

Show that PQ is parallel to SR.

$\vec{PQ} = a + b$

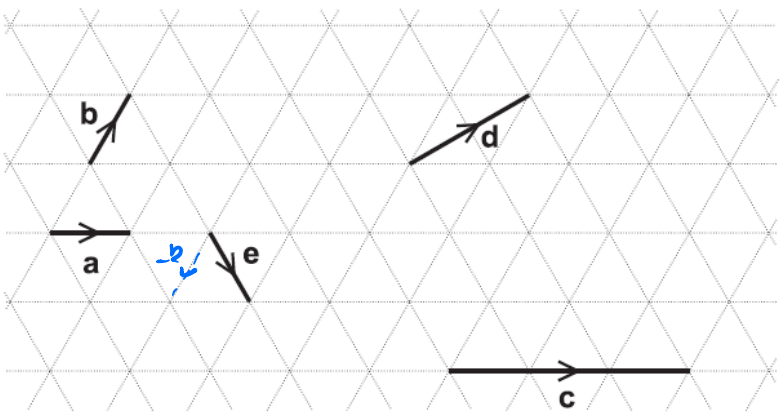
$\vec{SR} = \vec{SZ} + \vec{ZR}$

$= c + b + a - c$

$= a + b$

$\therefore$ PQ is parallel to SR. [5]

4. Vectors a, b, c, d and e are drawn on an isometric grid.



Write each of the vectors c, d and e in terms of a and/or b.

c = $3a$

d = $a+b$

e = $-b+a = a-b$

[3]

5. **a** = $\begin{pmatrix}5\\-2\end{pmatrix}$ and **b** = $\begin{pmatrix}-2\\3\end{pmatrix}$

$\begin{pmatrix}5\\-2\end{pmatrix} - \begin{pmatrix}-2\\3\end{pmatrix} = \begin{pmatrix}7\\-5\end{pmatrix}$

Circle the vector **a** – **b**

[1]

$\begin{pmatrix}-3\\-5\end{pmatrix}$ $\begin{pmatrix}7\\1\end{pmatrix}$

$\begin{pmatrix}3\\1\end{pmatrix}$ $\begin{pmatrix}7\\-5\end{pmatrix}$

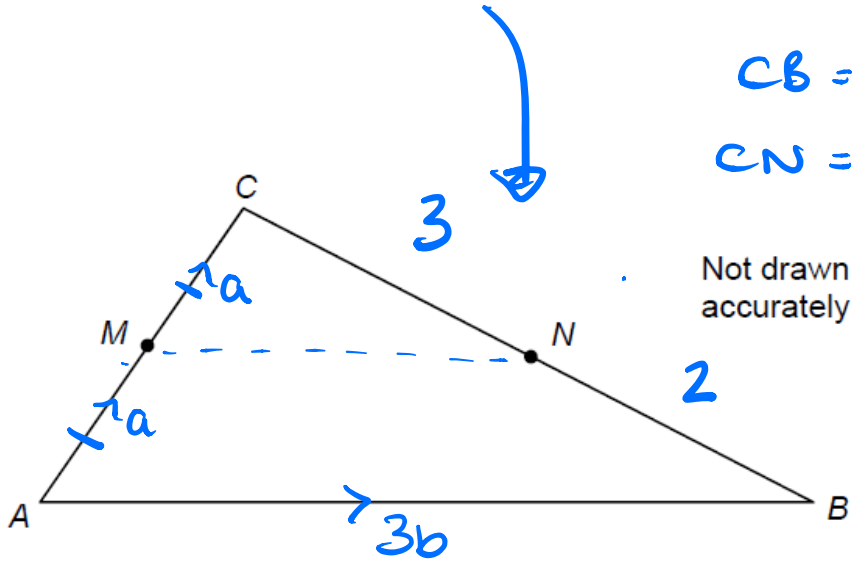
6. In triangle *ABC*

M is the midpoint of *AC*

N is the point on *BC* where *BN* : *NC* = 2 : 3

$\overrightarrow{AC}$ = 2**a**

$\overrightarrow{AB}$ = 3**b**



$CB = 3b - 2a$

$CN = \frac{3}{5}(3b-2a)$

a) Work out $\overrightarrow{MN}$ in terms of **a** and **b**.

Give your answer in its simplest form.

$\overrightarrow{MN} = \overrightarrow{MC} + \overrightarrow{CN} = a + \frac{3}{5}(3b-2a) = a + \frac{9}{5}b - \frac{6}{5}a$

$= \frac{9}{5}b - \frac{1}{5}a = \frac{1}{5}(9b-a)$

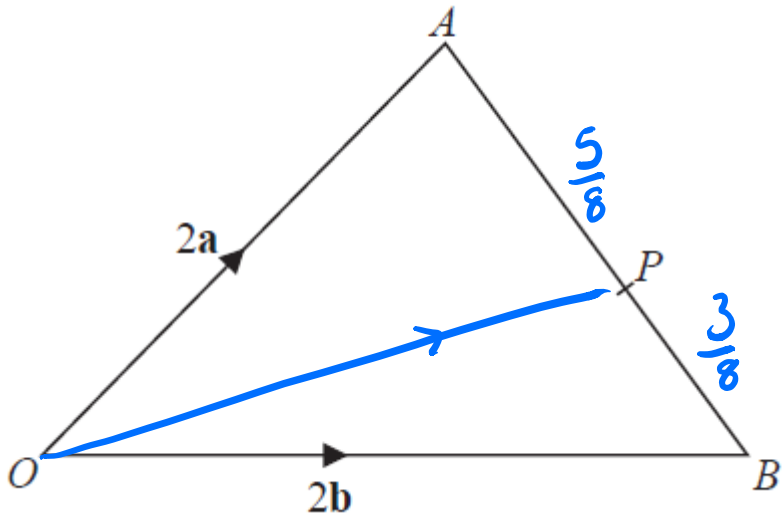
[3]

b) Use your answer to part (a) to explain why *MN* is not parallel to *AB*.

$\overrightarrow{MN}$ is not a scalar multiple of $\overrightarrow{AB}$ .. ie $\overrightarrow{MN}$ has an 'a' component $\overrightarrow{AB}$ doesn't

[1]

7.



OAB is a triangle.

P is the point on AB such that $AP : PB = 5:3$

$\overrightarrow{OA} = 2a$

$\overrightarrow{OB} = 2b$

$\overrightarrow{OP} = k(3a + 5b)$ where k is a scalar quantity.

Find the value of k.

$\overrightarrow{AB} = 2b - 2a$

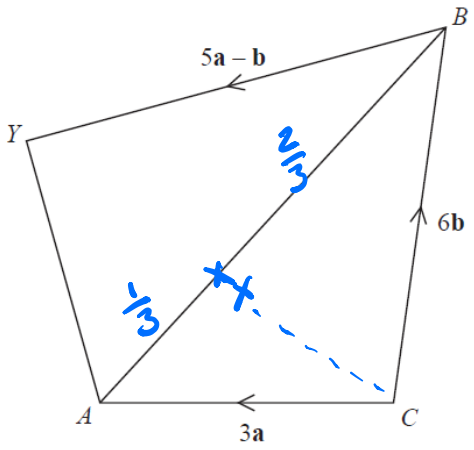
$\overrightarrow{AP} = \frac{5}{8}(2b - 2a)$

$\overrightarrow{OP} = 2a + \frac{5}{8}(2b - 2a)$

$= 2a + \frac{10}{8}b - \frac{10}{8}a$

$\overrightarrow{OP} = 2a + \frac{5}{4}b - \frac{5}{4}a = \frac{3}{4}a + \frac{5}{4}b = \frac{1}{4}(3a + 5b) \quad \therefore k = \frac{1}{4}$ [4]

8.



$CAYB$ is a quadrilateral.

$\overrightarrow{CA} = 3\mathbf{a}$

$\overrightarrow{CB} = 6\mathbf{b}$

$\overrightarrow{AB} = 6b - 3a$

$\overrightarrow{AX} = \frac{1}{3}(6b - 3a) = 2b - a$

$\overrightarrow{BY}$ = 5**a** – **b**

X is the point on AB such that $AX : XB = 1 : 2$

Prove that $\overrightarrow{CX} = \frac{2}{5}\overrightarrow{CY}$

$\vec{CX} = 3a + 2b - a$
$= 2a + 2b$

$\vec{CY} = 6b + 5a - b$
$= 5a + 5b$
$\therefore \vec{CX} = \frac{2}{5}\vec{CY}$

[5]

9. $ABCD$ is a parallelogram.

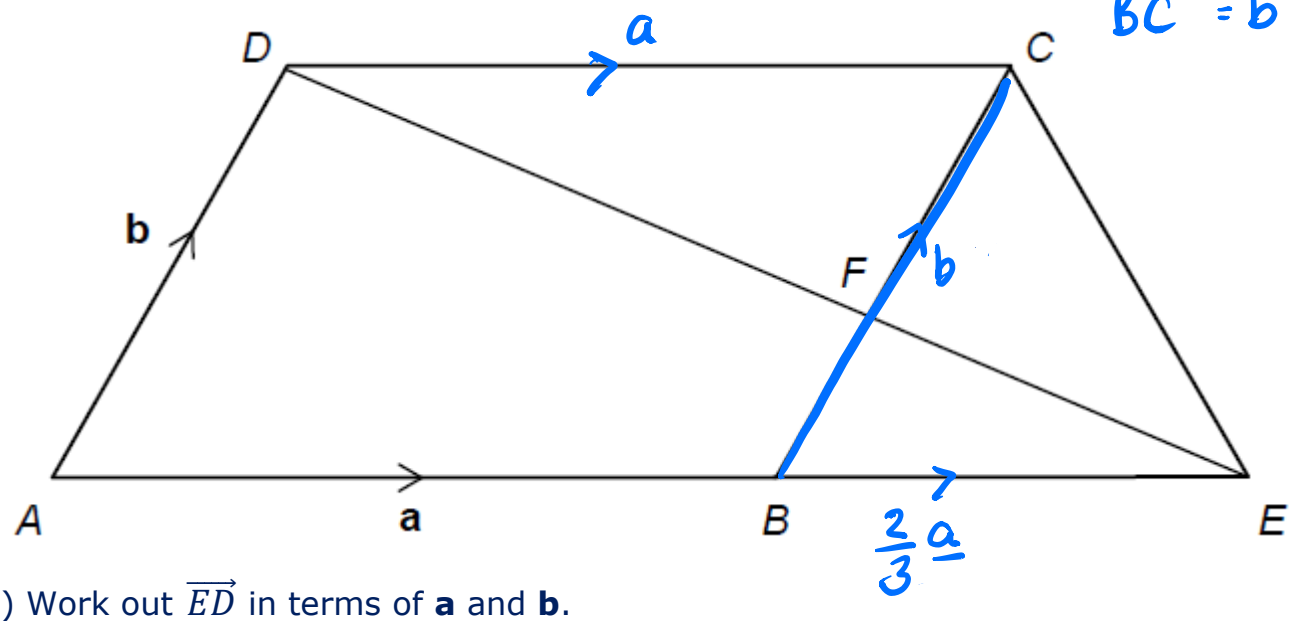
ABE is a straight line and $AB : BE = 3 : 2$

BC and ED intersect at F.

$\overrightarrow{AB}$= **a** and $\overrightarrow{AD}$= b

$\vec{DC} = a$

$\vec{BC} = b$



a) Work out $\overrightarrow{ED}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$\vec{ED} = \vec{EB} + \vec{BA} + \vec{AD}$
$= -\frac{2}{3}a - a + b = b - \frac{5}{3}a$

[3]

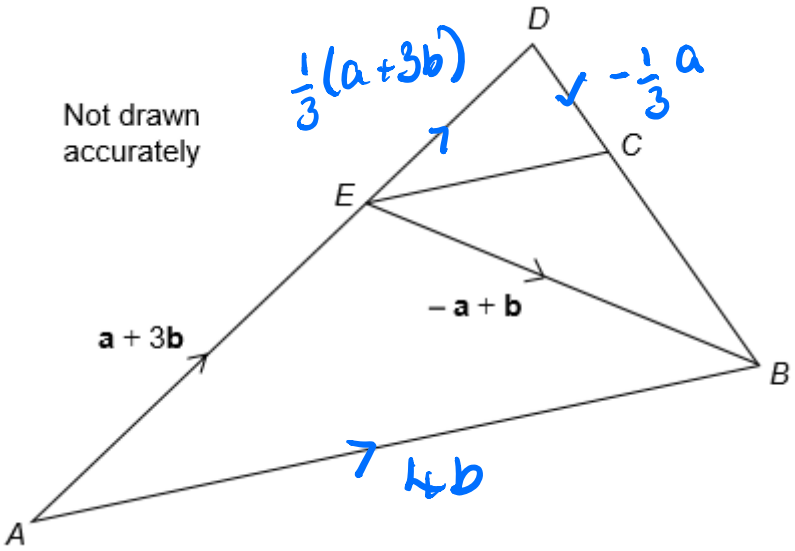
b) Deduce $\overrightarrow{EF}$ in terms of **a** and **b**.

$\vec{EF} = \frac{2}{5}\vec{ED} = \frac{2}{5}(b - \frac{5}{3}a)$

$= \frac{2}{5}b - \frac{10}{15}a = \frac{2}{5}b - \frac{2}{3}a$

[2]

10. AED is a straight line.



$\overrightarrow{AE}$ = **a** + 3**b**

$\overrightarrow{EB}$ = −**a** + **b**

a) Work out the vector $\overrightarrow{AB}$

$\vec{AB} = \vec{AE} + \vec{EB} = a + 3a - a + b$
$= 4b$

[1]

b) Also $\overrightarrow{ED} = \frac{1}{3}\overrightarrow{AE}$ and $\overrightarrow{DC} = -\frac{1}{3}$**a**

Prove that EC is parallel to AB.

$\vec{EC} = \vec{ED} + \vec{DC}$
$= \frac{1}{3}(a + 3b) - \frac{1}{3}a$
$= \frac{1}{3}a + b - \frac{1}{3}a = b$

$\therefore \vec{AB} = 4\vec{EC}$

$\therefore$ AB and EC are parallel.

[3]

CREDITS AND NOTES

Question	Awarding Body
1	WJEC Eduqas
2	Pearson Edexcel
3	OCR
4	OCR
5	AQA
6	AQA
7	Pearson Edexcel
8	Pearson Edexcel
9	AQA
10	AQA

Notes:

These questions have been retyped from the original sample/specimen assessment materials and whilst every effort has been made to ensure there are no errors, any that do appear are mine and not the exam board s (similarly any errors I have corrected from the originals are also my corrections and not theirs!).

Please also note that the layout in terms of fonts, answer lines and space given to each question does not reflect the actual papers to save space.

These questions have been collated by me as the basis for a GCSE working party set up by the GLOW maths hub - if you want to get involved please get in touch. The objective is to provide support to fellow teachers and to give you a flavour of how different topics "could" be examined. They should not be used to form a decision as to which board to use. There is no guarantee that a topic will or won't appear in the "live" papers from a specific exam board or that examination of a topic will be as shown in these questions.

Links:

AQA http://www.aqa.org.uk/subjects/mathematics/gcse/mathematics-8300

OCR http://ocr.org.uk/gcsemaths

Pearson Edexcel http://qualifications.pearson.com/en/qualifications/edexcel-gcses/mathematics-2015.html

WJEC Eduqas http://www.eduqas.co.uk/qualifications/mathematics/gcse/

Contents:

This version contains questions from:

AQA – Sample Assessment Material, Practice set 1 and Practice set 2

OCR – Sample Assessment Material and Practice set 1

Pearson Edexcel – Sample Assessment Material, Specimen set 1 and Specimen set 2

WJEC Eduqas – Sample Assessment Material