G53... Vector Geometry Adding Vectors

OCR

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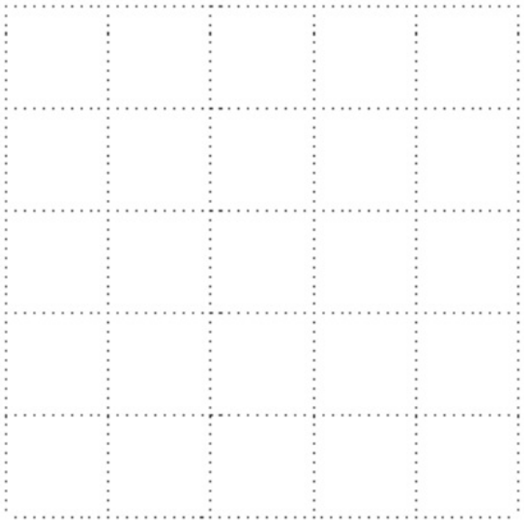
11 Vector $\mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$, vector $\mathbf{b} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$.

GS2
GS3

(a) On each grid below, draw a vector to represent

(i) 2**a**,



(ii) **a** + **b**.

[2]

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$\begin{pmatrix} 2 \\ 1 \end{pmatrix} + \begin{pmatrix} -2 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$ R/4x ↑2

11 Vector $\mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$, vector $\mathbf{b} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$.

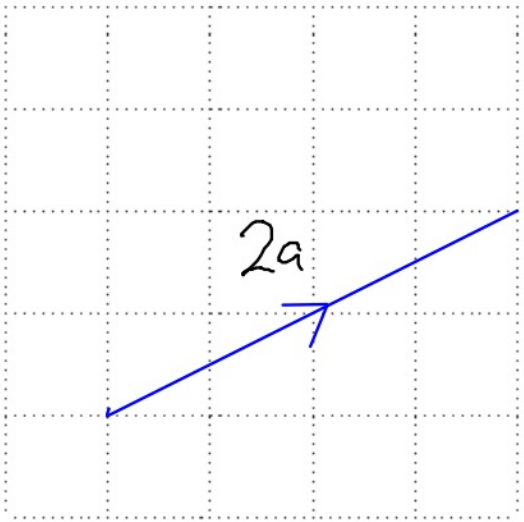
(a) On each grid below, draw a vector to represent

GS2
GS3

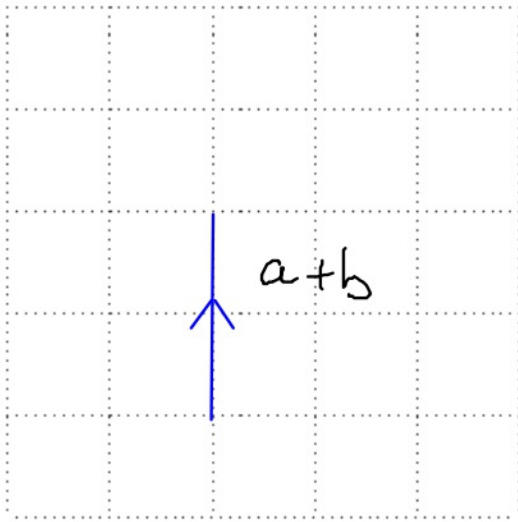
(i) 2**a**,

$2\begin{pmatrix} 2 \\ 1 \end{pmatrix}$

$\begin{pmatrix} 4 \\ 2 \end{pmatrix}$ R4 U2



(ii) **a** + **b**.



[2]

16 ABCD is a parallelogram.

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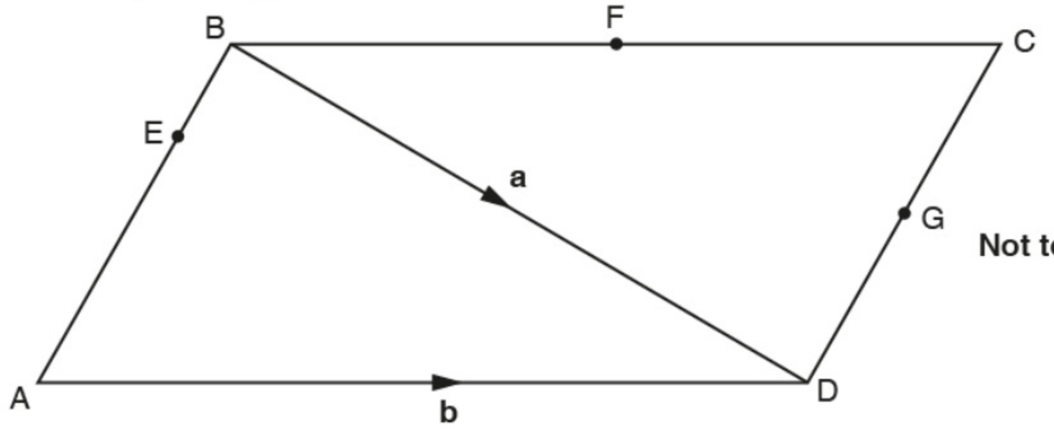


Not to scale

$\overrightarrow{BD} = \mathbf{a}$ and $\overrightarrow{AD} = \mathbf{b}$.
F is the midpoint of BC.
G is the midpoint of DC.
AE = 3EB.

(a) Write down simplified expressions in terms of **a** and **b** for

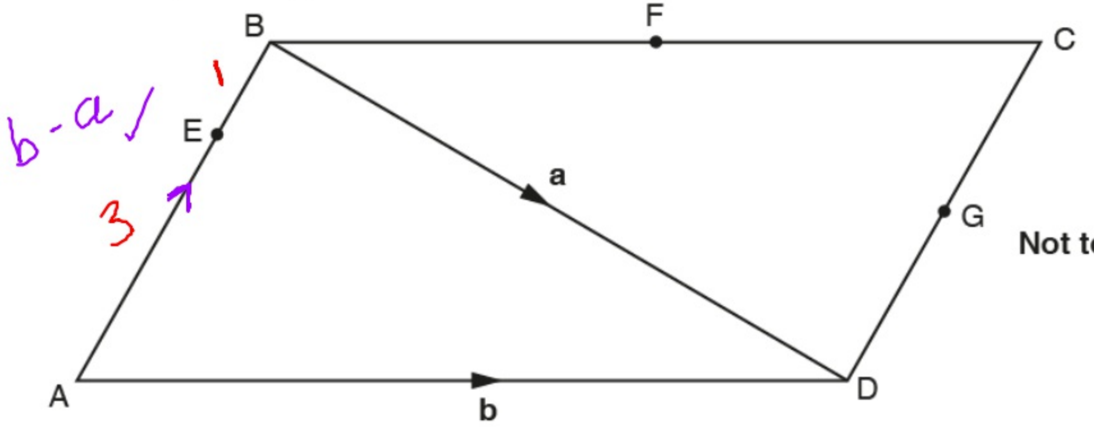
GS3 **(i)** $\overrightarrow{AB}$,

(a)(i) .... **[1]**

(ii) $\overrightarrow{EB}$.

(ii) .... **[1]**

16 ABCD is a parallelogram. Created by W Neill



Not to scale

$\overrightarrow{BD} = \mathbf{a}$ and $\overrightarrow{AD} = \mathbf{b}$.
F is the midpoint of BC.
G is the midpoint of DC.
AE = 3EB.

(a) Write down simplified expressions in terms of **a** and **b** for

GS3 **(i)** $\overrightarrow{AB}$,

(a)(i) $b - a$ .... **[1]**

(ii) $\overrightarrow{EB}$.

(ii) $\frac{1}{4}(b - a)$ .... **[1]** ... $\frac{1}{4}b - \frac{1}{4}a$ ✓

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3 Work out.

(a) $\begin{pmatrix} -3 \\ 2 \end{pmatrix} + \begin{pmatrix} 5 \\ 7 \end{pmatrix}$

(a) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ **[1]**

(b) $\begin{pmatrix} 3 \\ 4 \end{pmatrix} - 2\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

(b) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ **[2]**

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3 Work out.

G53

(a) $\begin{pmatrix} -3 \\ 2 \end{pmatrix} + \begin{pmatrix} 5 \\ 7 \end{pmatrix}$

$-3+5$

$2+7=9$

(a) $\begin{pmatrix} 2 \\ 9 \end{pmatrix}$ **[1]**

(b) $\begin{pmatrix} 3 \\ 4 \end{pmatrix} - 2\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

$\begin{pmatrix} 3 \\ 4 \end{pmatrix} - \begin{pmatrix} 2 \\ -6 \end{pmatrix}$

$3-2=1$

$4--6=10$

(b) $\begin{pmatrix} 1 \\ 10 \end{pmatrix}$ **[2]**

G52
G53

10 Two vectors, **a** and **b**, are shown on the 1 centimetre grid below.

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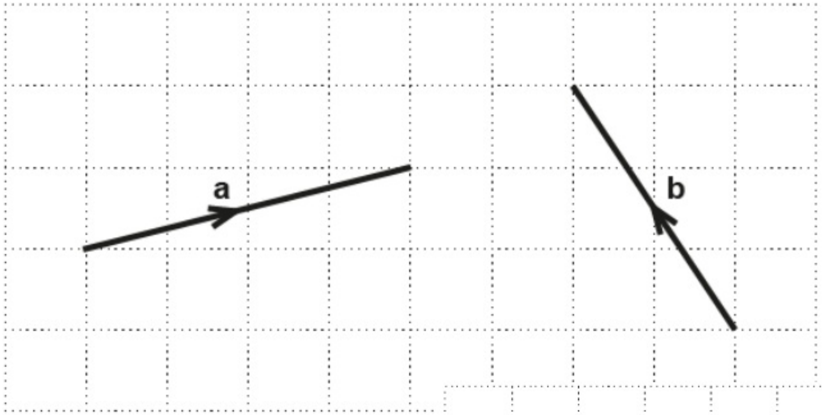

Show that the vector **a** + 2**b** has length 7 cm.
You may use the grid below.

G52
G53

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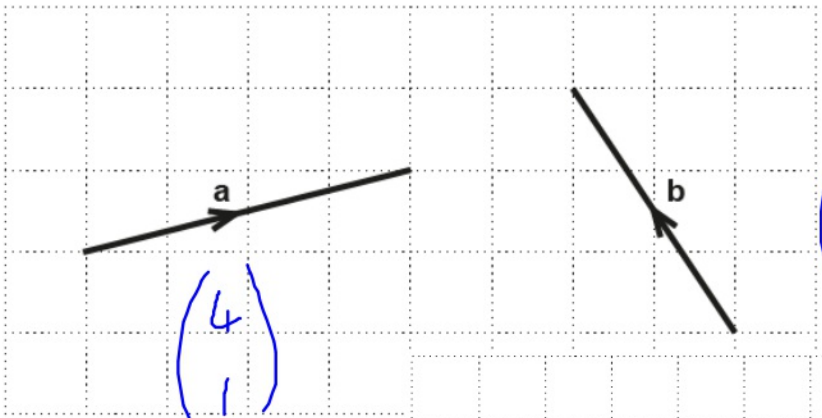
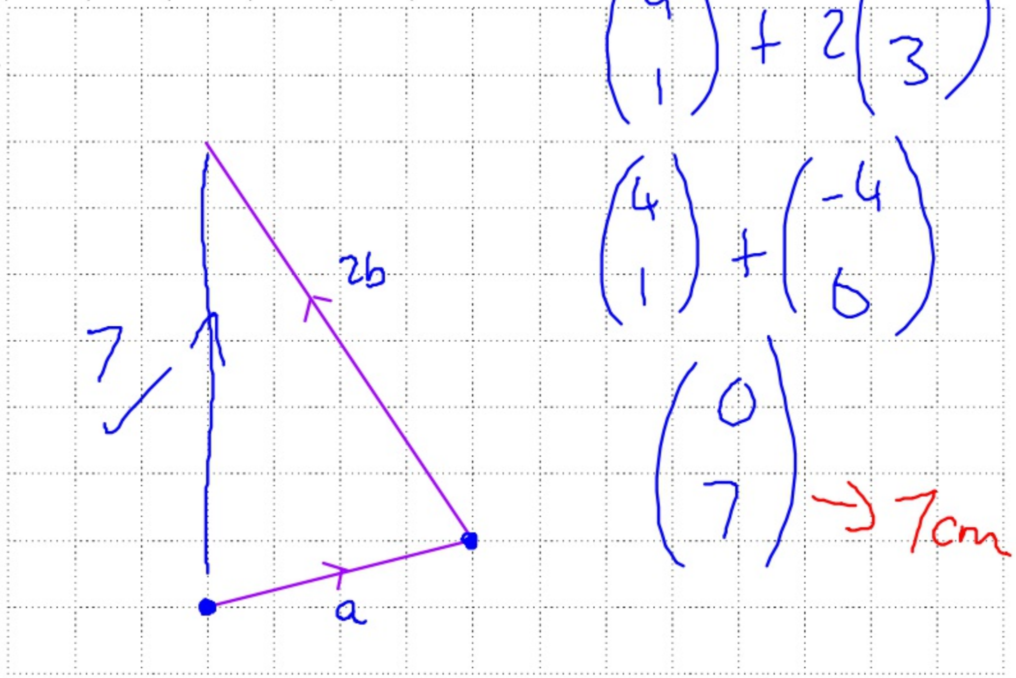
10 Two vectors, **a** and **b**, are shown on the 1 centimetre grid below.



$\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$

Show that the vector **a** + 2**b** has length 7 cm.
You may use the grid below.



$\begin{pmatrix} 4 \\ 1 \end{pmatrix} + 2\begin{pmatrix} -2 \\ 3 \end{pmatrix}$

$\begin{pmatrix} 4 \\ 1 \end{pmatrix} + \begin{pmatrix} -4 \\ 6 \end{pmatrix}$

$\begin{pmatrix} 0 \\ 7 \end{pmatrix} \rightarrow 7\text{cm}$

EDEXCEL

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10 $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

$\overrightarrow{AB}$ is shown on the grid.

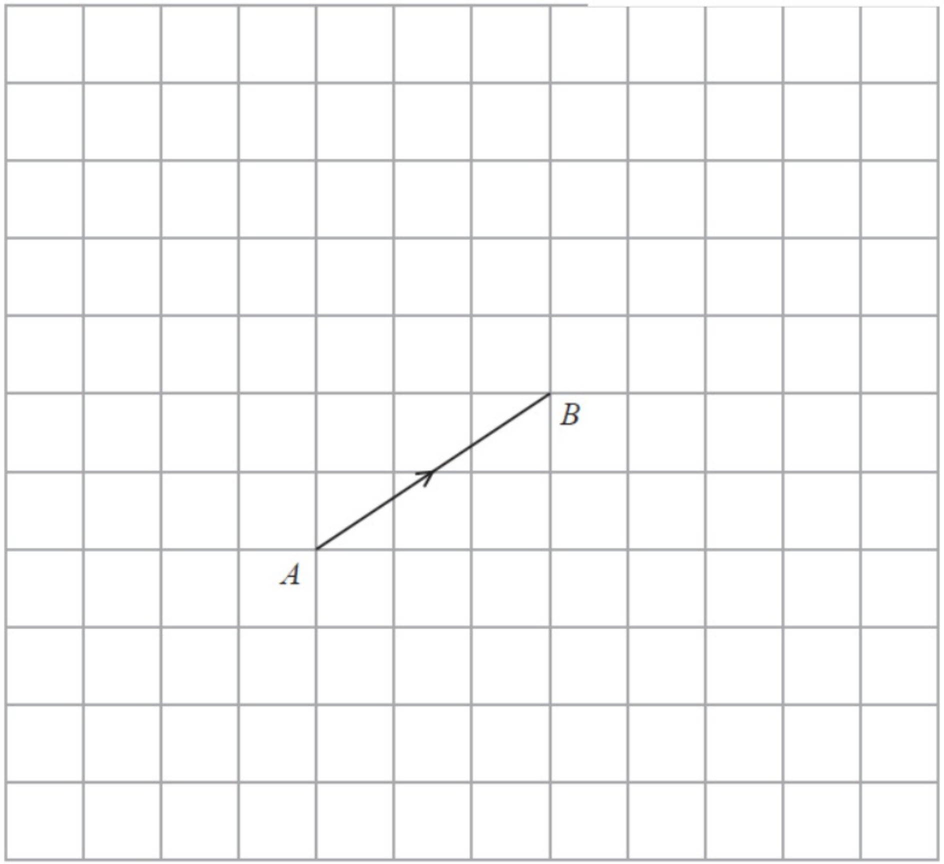
(a) On the grid, draw $\overrightarrow{BC}$.

(1)

$\overrightarrow{AD} = \overrightarrow{AB} - \overrightarrow{BC}$

(b) On the grid, mark with a cross (×) the position of D.
Label this point D.

(2)



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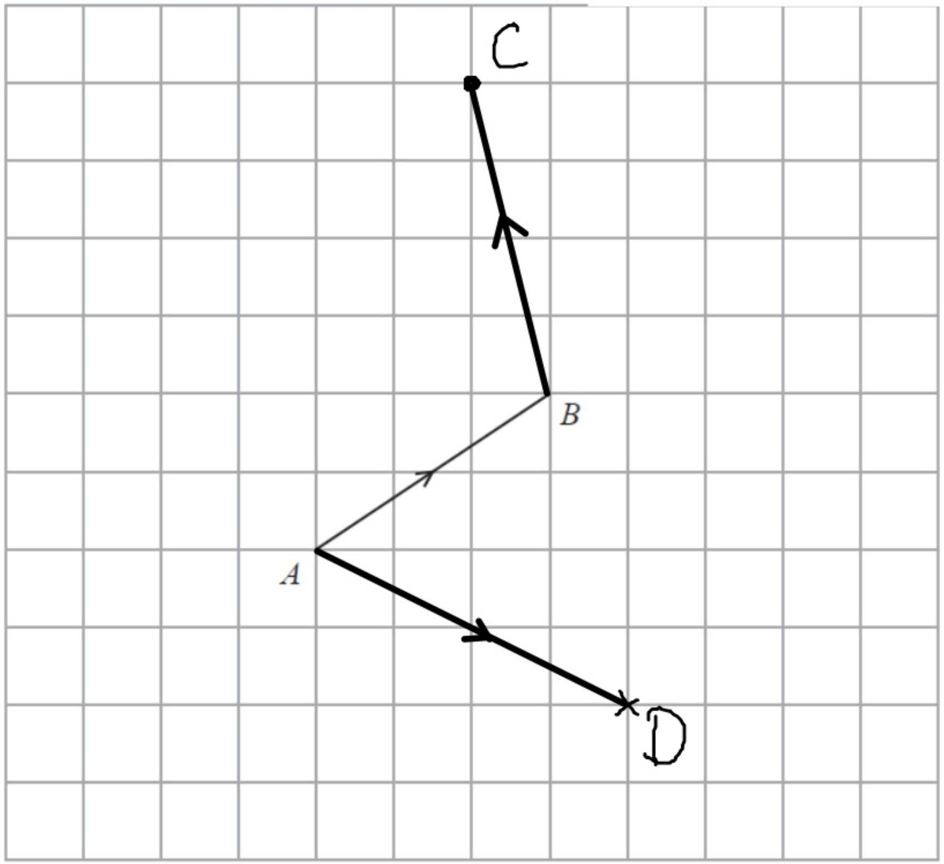
10 $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ and $\overrightarrow{BC} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

$\overrightarrow{AB}$ is shown on the grid.

$\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ ... Right / left (+ / −)
... Up / Down (+ / −)



(a) On the grid, draw $\overrightarrow{BC}$.

(1)

$\overrightarrow{AD} = \overrightarrow{AB} - \overrightarrow{BC}$

(b) On the grid, mark with a cross (×) the position of D.
Label this point D.

(2)

$\overrightarrow{AD} = \begin{pmatrix} 3 \\ 2 \end{pmatrix} - \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ -2 \end{pmatrix}$

21 *OAB* is a triangle.
OPM and *APN* are straight lines.
G53 *M* is the midpoint of *AB*.

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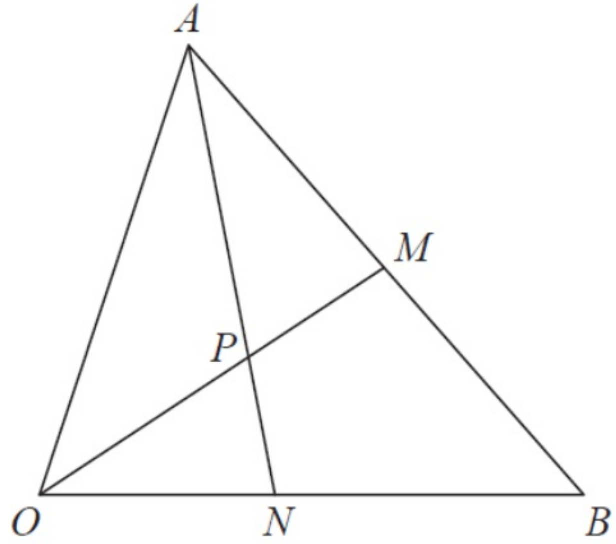
$\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

$OP : PM = 3 : 2$

Work out the ratio $ON : NB$



....

(Total for Question 21 is 5 marks)

21 *OAB* is a triangle.
OPM and *APN* are straight lines.
M is the midpoint of *AB*.

G53

$\overrightarrow{OA} = \mathbf{a} \quad \overrightarrow{OB} = \mathbf{b}$

$OP : PM = 3 : 2$

Work out the ratio $ON : NB$

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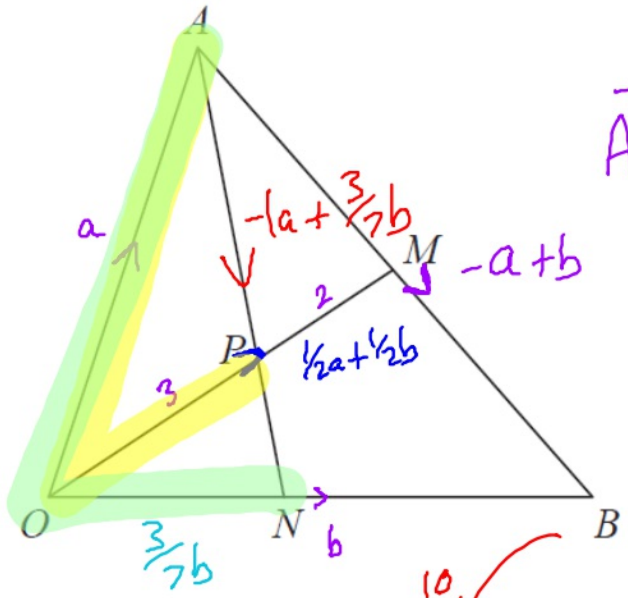

$\frac{3}{5}\left(\frac{1}{2}a + \frac{1}{2}b\right)$

$\frac{3}{10}a + \frac{3}{10}b$

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

$\overrightarrow{OM} = 1a - \frac{1}{2}a + \frac{1}{2}b$

$= \frac{1}{2}a + \frac{1}{2}b$

$\overrightarrow{AP} = -1a + \frac{3}{10}a + \frac{3}{10}b$

$= -\frac{7}{10}a + \frac{3}{10}b$

$-\frac{7}{10} \times \frac{10}{7} = -1$

$1 \div \frac{7}{10}$

$1 \times \frac{10}{7} = \frac{10}{7}$

$\frac{3}{10} \times \frac{10}{7} = \frac{30}{70} = \frac{3}{7}$

$\times \frac{10}{7}$ multiple

$\overrightarrow{AN} = -1a + \frac{3}{7}b$

$\overrightarrow{ON} = 1a - 1a + \frac{3}{7}b$

$= \frac{3}{7}b$

$\overrightarrow{NB} = \frac{4}{7}$

$\overrightarrow{OB} = a - a + b$

$= 1b$

$ON : NB$

$\frac{3}{7} : \frac{4}{7}$

3 : 4

(Total for Question 21 is 5 marks)

AQA

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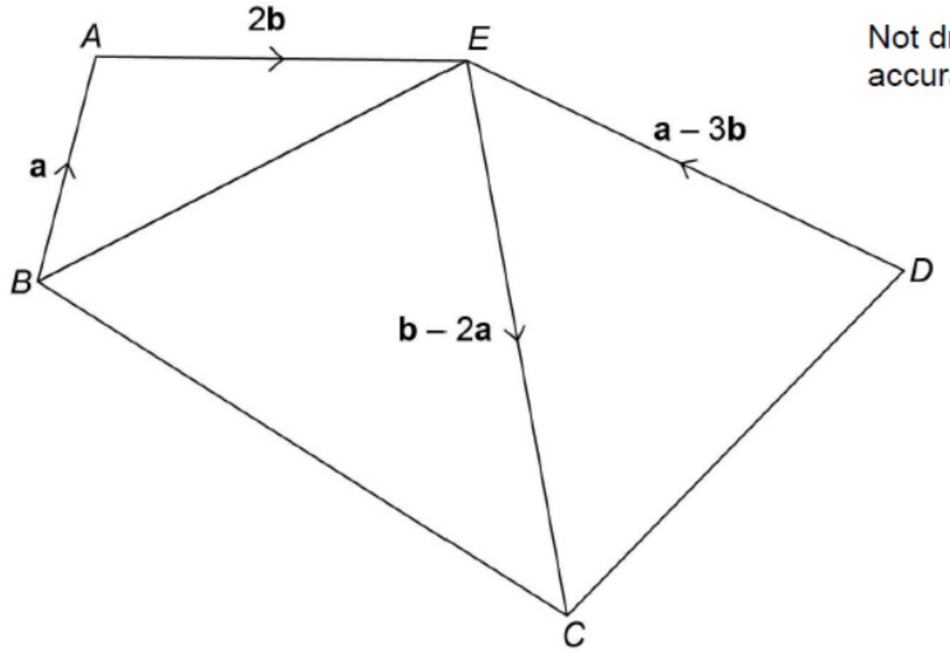
26 *ABCDE* is a pentagon.

G53



Show that *BCDE* is a parallelogram.

[3 marks]

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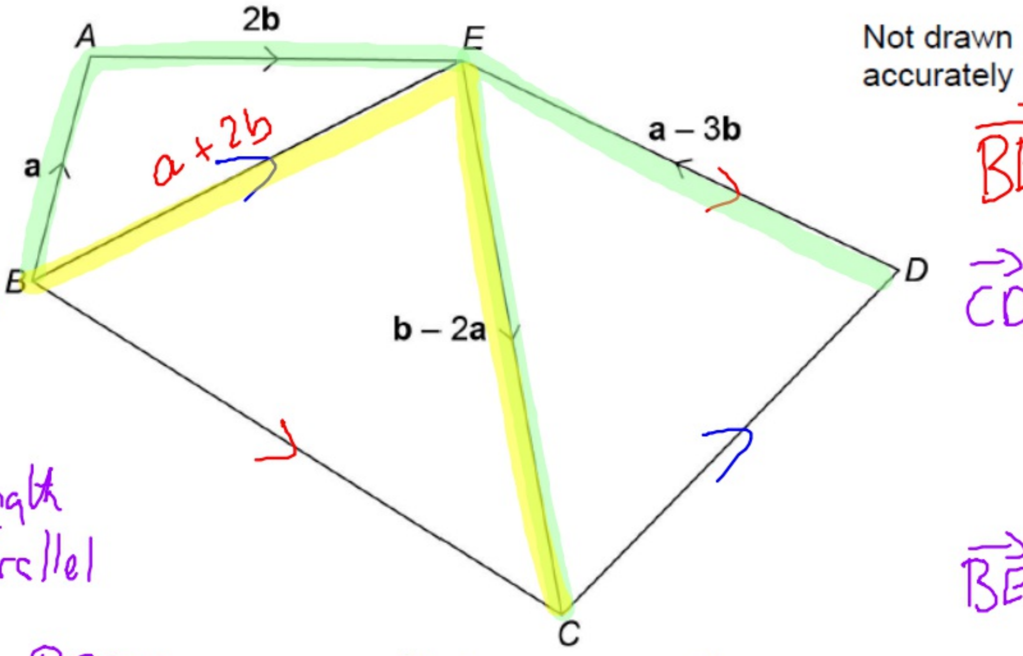
26 *ABCDE* is a pentagon.

G53



$\vec{ED} = -a + 3b$

$\vec{BC} = a + 2b + b - 2a$

$= -1a + 3b$

$\vec{ED} = \vec{BC}$ same length and parallel

$\vec{BE} = +a + 2b$

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

$= 2b + 1a$

$= 1a + 2b$

$\vec{BE}$ and $\vec{CD}$ are same length and parallel

∴ BCDE is a parallelogram ✓

Show that *BCDE* is a parallelogram.

[3 marks]

23 PQR is a straight line.

G53

$PQ : QR = 3 : 1$

$\overrightarrow{PQ} = \mathbf{a}$

Not drawn accurately

Circle the vector $\overrightarrow{RQ}$

[1 mark]

$\frac{1}{3}\mathbf{a}$ $\frac{1}{4}\mathbf{a}$ $-\frac{1}{3}\mathbf{a}$ $-\frac{1}{4}\mathbf{a}$

23 *PQR* is a straight line.

$PQ : QR = 3 : 1$

G53

$\overrightarrow{PQ} = \mathbf{a}$

Not drawn accurately

Circle the vector $\overrightarrow{RQ}$

[1 mark]

$\frac{1}{3}\mathbf{a}$ $\frac{1}{4}\mathbf{a}$ $-\frac{1}{3}\mathbf{a}$ $-\frac{1}{4}\mathbf{a}$