Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Column vectors and magnitude

Time allowed: 55 minutes

Subject code **0580**

Mathematics

Questions from Paper 1, Paper 2 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
You may use a calculator.

Total marks

/ 45

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 10 questions worth 45 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

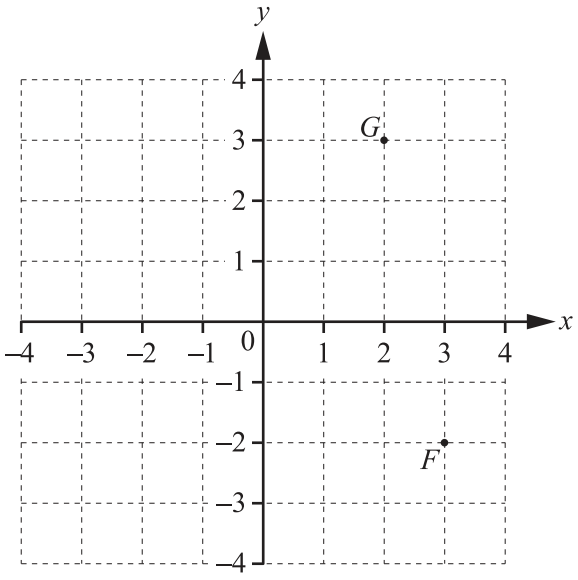
Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1



Points F and G are marked on the grid.

(a) Write $\overrightarrow{FG}$ as a column vector.

$\overrightarrow{FG} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) $\overrightarrow{GH} = \begin{pmatrix} -5 \\ -6 \end{pmatrix}$

Mark the point H on the grid. [1]

(a) Position and displacement vectors (b) Vectors as diagrams Click for more variations

1	**(a)**	$\begin{pmatrix} -1 \\ 5 \end{pmatrix}$	**1**	
	(b)	H marked at (–3,–3)	**1**	

2 $\mathbf{v} = \begin{pmatrix} -1 \\ 3 \end{pmatrix}$ $\mathbf{y} = \begin{pmatrix} 2 \\ 5 \end{pmatrix}$

Find

(a) $\mathbf{v} - \mathbf{y}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) $2\mathbf{v}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(a) Column vectors (b) Column vectors Click for more variations

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2(a)	$\begin{pmatrix}-3\\-2\end{pmatrix}$	**1**	
2(b)	$\begin{pmatrix}-2\\6\end{pmatrix}$	**1**	

3 $\overrightarrow{AB} = \begin{pmatrix}-3\\5\end{pmatrix}$

Find $|\overrightarrow{AB}|$.

Answer ..... [2]

Magnitude of a vector Click for more variations

3	5.83 or 5.830 to 5.831	**2**	**M1** for $\sqrt{(-3)^2+5^2}$

4 **(a)** D is the point $(2, -5)$ and $\overrightarrow{DE} = \begin{pmatrix}7\\1\end{pmatrix}$.

Find the co-ordinates of the point E.

(..... , ...) [1]

(b) $\mathbf{v} = \begin{pmatrix}t\\12\end{pmatrix}$ and $|\mathbf{v}| = 13$.

Work out the value of t, where t is negative.

$t =$ ..... [2]

(a) Position and displacement vectors (b) Magnitude of a vector Click for more variations

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4(a)	$(9, -4)$	**1**	
4(b)	-5	**2**	**M1** for $t^2 + 12^2 = 13^2$ oe or **SC1** for answer 5 or ± 5

5 $\overrightarrow{BC} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$ $\overrightarrow{BA} = \begin{pmatrix} -5 \\ 6 \end{pmatrix}$

(a) Find $\overrightarrow{CA}$.

$\overrightarrow{CA} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

(b) Work out $|\overrightarrow{BA}|$.

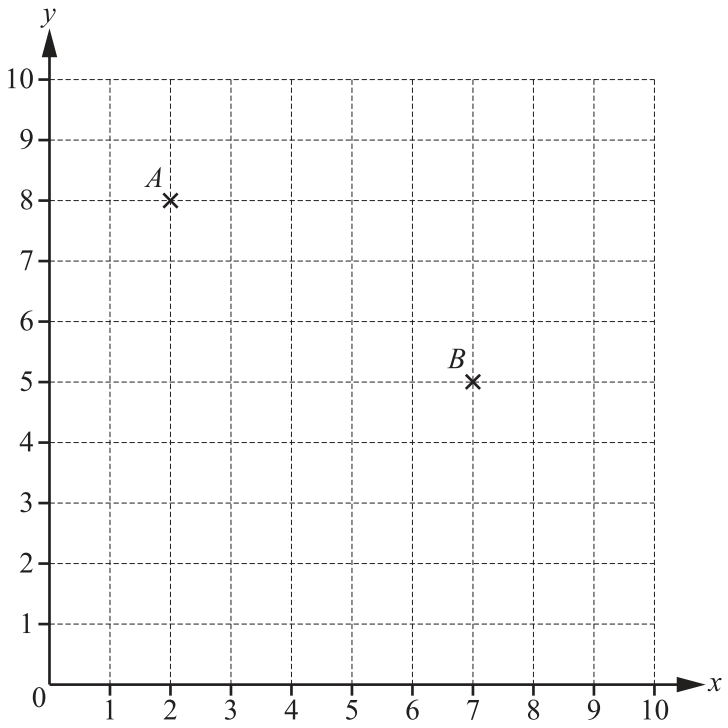
..... [2]

(a) Column vectors (b) Magnitude of a vector Click for more variations

5	**(a)**	$\begin{pmatrix} -7 \\ 3 \end{pmatrix}$	**2**	**M1** for $\overrightarrow{CB} = \begin{pmatrix} -2 \\ -3 \end{pmatrix}$ or for correct route allow e.g. $BA - BC$, $CB + BA$
	(b)	7.81 or 7.810….	**2**	**M1** for $\sqrt{(-5)^2 + 6^2}$

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6



Points A and B are marked on the grid.

$\overrightarrow{BC} = \begin{pmatrix} -4 \\ 0 \end{pmatrix}$

(a) On the grid, plot the point C. [1]

(b) Write $\overrightarrow{AC}$ as a column vector.

( ) [1]

(c) $\overrightarrow{DE}$ is a vector that is perpendicular to $\overrightarrow{BC}$.
The magnitude of $\overrightarrow{DE}$ is equal to the magnitude of $\overrightarrow{BC}$.

Write down a possible column vector for $\overrightarrow{DE}$.

( ) [2]

(a) Vectors as diagrams (b) Position and displacement vectors (c) Magnitude of a vector Click for more variations

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6	**(a)**	Point at (3, 5)	**1**	
	(b)	$\begin{pmatrix}1\\-3\end{pmatrix}$	**1FT**	**FT** their $\overrightarrow{AC}$
	(c)	$\begin{pmatrix}0\\4\end{pmatrix}$ or $\begin{pmatrix}0\\-4\end{pmatrix}$	**2**	**M1** for a vector of magnitude 4 or of form $\begin{pmatrix}0\\\pm k\end{pmatrix}$

7 $\mathbf{m} = \begin{pmatrix}11\\5\end{pmatrix}$ $\mathbf{n} = \begin{pmatrix}8\\-3\end{pmatrix}$

(a) Find $2\mathbf{m} - \mathbf{n}$.

$\begin{pmatrix}\quad\\\quad\end{pmatrix}$ [2]

(b) The vector $\begin{pmatrix}5\\\sqrt{y}\end{pmatrix}$ has a magnitude of 7.

Find the value of y.

$y =$ ..... [2]

(a) Column vectors (b) Magnitude of a vector Click for more variations

7(a)	$\begin{pmatrix}14\\13\end{pmatrix}$	**2**	**B1** for $\begin{pmatrix}14\\k\end{pmatrix}$ or for $\begin{pmatrix}k\\13\end{pmatrix}$ or for $\begin{pmatrix}22\\10\end{pmatrix}$
7(b)	24	**2**	**M1** for $y + 5^2 = 7^2$ or better

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8 F is the point $(1, -4)$, $\overrightarrow{FG} = \begin{pmatrix} 8 \\ -3 \end{pmatrix}$ and $\overrightarrow{GH} = \begin{pmatrix} -12 \\ 35 \end{pmatrix}$.

Find

(a) $3\overrightarrow{FG}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) $\overrightarrow{FG} + \overrightarrow{GH}$

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(c) the coordinates of the point G

(..... , ...) [1]

(d) the magnitude of vector $\overrightarrow{GH}$.

..... [2]

(a) Column vectors (b) Column vectors (c) Position and displacement vectors (d) Magnitude of a vector

Click for more variations

8(a)	$\begin{pmatrix} 24 \\ -9 \end{pmatrix}$	**1**	
8(b)	$\begin{pmatrix} -4 \\ 32 \end{pmatrix}$	**1**	
8(c)	$(9, -7)$	**1**	
8(d)	37	**2**	**M1** for $(-12)^2 + 35^2$ oe

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9 **(a)** $\mathbf{v} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

Find $5\mathbf{v}$.

$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(b) H is the point $(-3, 8)$ and K is the point $(-4, 0)$.

$\overrightarrow{HJ} = \begin{pmatrix} 7 \\ -2 \end{pmatrix}$

Find $\left|\overrightarrow{JK}\right|$.

..... [4]

(a) Column vectors (b) Magnitude of a vector Click for more variations

9(a)	$\begin{pmatrix} 10 \\ -15 \end{pmatrix}$	**1**	
9(b)	10	**4**	**B3** for answer ±10 OR **M3** for $(-4 - 4)^2 + (0 - 6)^2$ oe or better OR **M2** for $\begin{pmatrix} -4 \\ 0 \end{pmatrix} - \begin{pmatrix} 4 \\ 6 \end{pmatrix}$ oe or **B1** for [J =] (4, 6) soi or $\begin{pmatrix} -1 \\ -8 \end{pmatrix}$ **M1** for (*their* $-8)^2 + ($*their* $-6)^2$ oe or better

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10 (a) $\mathbf{a} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ -7 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} -10 \\ 21 \end{pmatrix}$

(i) Find $2\mathbf{a} + \mathbf{b}$.

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

(ii) Find $|\mathbf{b}|$.

Answer(a)(ii) ..... [2]

(iii) $m\mathbf{a} + n\mathbf{b} = \mathbf{c}$

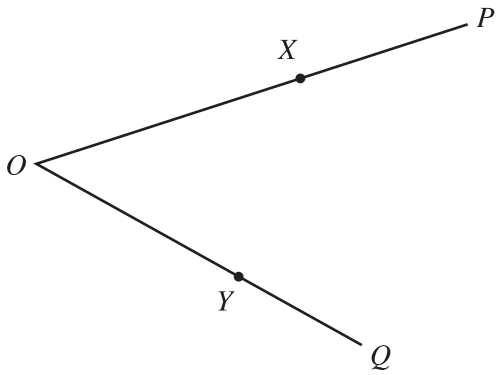
Find the values of m and n.
Show all your working.

Answer(a)(iii) m = ...

n = ... [6]

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(b)



NOT TO SCALE

In the diagram, $OX : XP = 3 : 2$ and $OY : YQ = 3 : 2$.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.

(i) Write $\overrightarrow{PQ}$ in terms of **p** and **q**.

Answer(b)(i) $\overrightarrow{PQ}$ = ... [1]

(ii) Write $\overrightarrow{XY}$ in terms of **p** and **q**.

Answer(b)(ii) $\overrightarrow{XY}$ = ... [1]

(iii) Complete the following sentences.

The lines XY and PQ are .....

The triangles OXY and OPQ are .....

The ratio of the area of triangle OXY to the area of triangle OPQ is ..... : ..... [3]

(a)(i) Column vectors (a)(ii) Magnitude of a vector (a)(iii) Column vectors

(b)(i) Position and displacement vectors (b)(ii) Finding vector paths (b)(iii) Problem solving with vectors

Click for more variations

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10	**(a) (i)** $\begin{pmatrix} -2 \\ -1 \end{pmatrix}$	**1**	
	(ii) 7.28 [0] or $\pm\sqrt{53}$ as final answer	**2**	**M1** for $\sqrt{2^2 + (-7^2)}$ oe
	(iii) [m =] 3.5 oe and [n =] –1.5 oe	**6**	**B1** for $-2m + 2n = -10$ oe and **B1** for $3m - 7n = 21$ oe and **M1** for correct attempt to equate one set of coefficients and **M1dep** for elimination allow 1 arithmetic error overall ft their sim eqns for both m's or **M1** for correct rearrangement (allow 1 slip) and **M1dep** for correct substitution ft their sim eqns for both m's and **A1** for 3.5 or –1.5
	(b) (i) **–p + q**	**1**	Condone column vector used
	(ii) $-\frac{3}{5}$ **p** + $\frac{3}{5}$ **q** oe	**1 FT**	Correct or ft $\frac{3}{5}$ (their **(b)(i)**) dep on $ap + bq$, $[a \neq 0, b \neq 0]$ Condone column vector used
	(iii) Parallel similar 9 : 25 oe	**1** **1** **1**	 Accept enlargement e.g 1 : 2.77 [7] or 0.36 : 1

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