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VECTORS 4024 QUESTIONS

COMPILED BY : MUSTAFA ASIF

37. Vectors in two dimensions	• describe a translation by using a vector represented by $\begin{pmatrix} x \\ y \end{pmatrix}$, $\overrightarrow{AB}$ or **a** • add and subtract vectors • multiply a vector by a scalar • calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2+y^2}$ • represent vectors by directed line segments • use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors • use position vectors	Vectors will be printed as $\overrightarrow{AB}$ or **a** and their magnitudes denoted by modulus signs, e.g. $\lvert\overrightarrow{AB}\rvert$ or $\lvert\mathbf{a}\rvert$. In their answers to questions candidates are expected to indicate **a** in some definite way, e.g. by an arrow $\overrightarrow{AB}$ or by underlining as follows $\underset{\sim}{a}$.

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Vectors

M/J19/12/Q25

1 (a) $\mathbf{P} = \begin{pmatrix} 4 & 0 \\ -2 & 3 \end{pmatrix}$ $\mathbf{Q} = \begin{pmatrix} 1 & 2 \\ 0 & -1 \end{pmatrix}$

Evaluate **PQ**.

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

(b) $\mathbf{M} = \begin{pmatrix} 3 & -1 \\ 2 & k \end{pmatrix}$

The determinant of matrix **M** is -4.

(i) Find the value of k.

$k =$ .... [1]

(ii) Find $\mathbf{M}^{-1}$.

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

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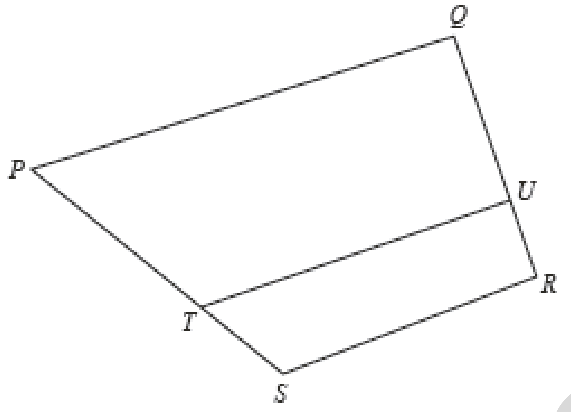
M/J19/21/Q9

2 (a)



In the diagram, $\overrightarrow{PQ} = 4\mathbf{p}$, $\overrightarrow{QR} = 3\mathbf{q}$ and $\overrightarrow{PT} = \mathbf{p} + 2\mathbf{q}$.

$\overrightarrow{QU} = \frac{2}{3}\overrightarrow{QR}$ and $\overrightarrow{PT} = \frac{2}{3}\overrightarrow{PS}$.

(i) Express, as simply as possible, in terms of **p** and/or **q**,

(a) $\overrightarrow{PS}$,

$\overrightarrow{PS}$ = ... [1]

(b) $\overrightarrow{SR}$.

$\overrightarrow{SR}$ = ... [2]

(ii) State the name of the special quadrilateral $PQRS$.
Using vectors, give a reason for your answer.

.... because ....

.... [2]

(iii) Find, in its simplest form, the ratio $|\overrightarrow{PQ}| : |\overrightarrow{SR}|$.

.... : .... [2]

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(b) $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\overrightarrow{BC} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$ $\overrightarrow{CD} = \begin{pmatrix} -7 \\ -3 \end{pmatrix}$

(i) Find $\overrightarrow{AD}$.

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

(ii) Find $|\overrightarrow{BC}|$.

.... [2]

(iii) Given that E is the midpoint of BC, find $\overrightarrow{AE}$.

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

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M/J19/22/Q10

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3 (a) $\mathbf{f} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$ $\mathbf{g} = \begin{pmatrix} 1 \\ -5 \end{pmatrix}$

(i) Find $\mathbf{g} - 2\mathbf{f}$.

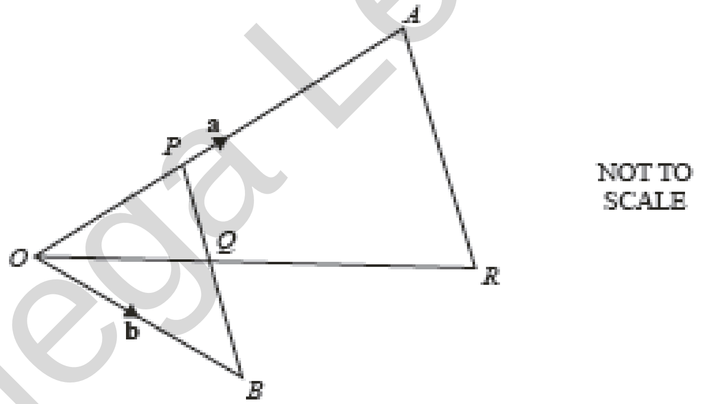
$\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) Petra writes $|\mathbf{f}| > |\mathbf{g}|$.

Show that Petra is wrong.

[3]

(b)



O, A and B are points with $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

P is the point on OA such that $OP = \frac{1}{3}OA$.

O, Q and R lie on a straight line and Q is the midpoint of PB.

(i) Find $\overrightarrow{PB}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

$\overrightarrow{PB}$ = ... [1]

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(ii) Find $\overrightarrow{OQ}$ in terms of **a** and **b**.
Give your answer in its simplest form.

$\overrightarrow{OQ}$ = ... [2]

(iii) $QR = 2OQ$.

Show that AR is parallel to PB.

[3]

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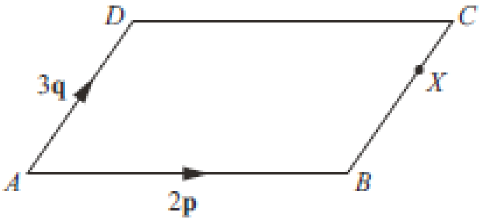
SM18/12/Q7

4



ABCD is a parallelogram.
X is the point on *BC* such that *BX* : *XC* = 2 : 1.

$\overrightarrow{AB} = 2\mathbf{p}$ and $\overrightarrow{AD} = 3\mathbf{q}$.

Find, in terms of **p** and **q**,

(a) $\overrightarrow{AC}$,

Answer $\overrightarrow{AC}$ = ... [1]

(b) $\overrightarrow{AX}$,

Answer $\overrightarrow{AX}$ = ... [1]

(c) $\overrightarrow{XD}$.

Answer $\overrightarrow{XD}$ = ... [1]

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O/N18/11/Q23

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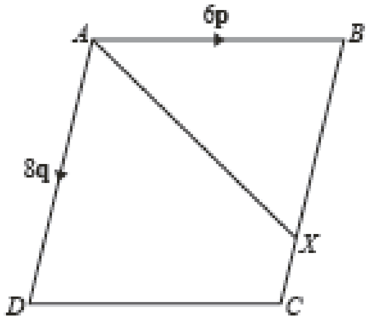
5



In the diagram, $ABCD$ is a parallelogram.
X is the point on BC such that $BX : XC = 3 : 1$.
$\overrightarrow{AB} = 6\mathbf{p}$ and $\overrightarrow{AD} = 8\mathbf{q}$.

(a) Express $\overrightarrow{BX}$ in terms of p and/or q.

Answer .... [1]

(b) Express $\overrightarrow{AX}$ in terms of p and/or q.

Answer .... [1]

(c) Y is the point such that $\overrightarrow{CY} = 3\mathbf{p} + \mathbf{q}$.

(i) Express $\overrightarrow{AY}$ in terms of p and/or q.

Answer .... [1]

(ii) Find the ratio $AX : AY$.

Answer .... : .... [1]

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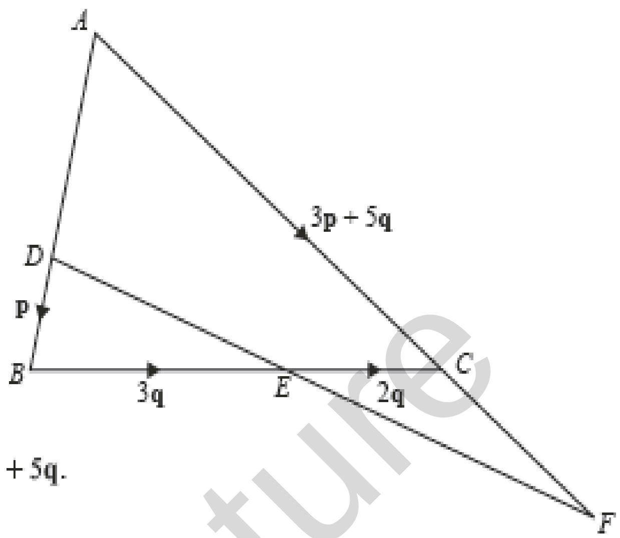
W18/12/Q25

6 In the diagram, ADB and ACF are straight lines.

BC intersects DF at E.



$AC : CF = 2 : 1$.

$\overrightarrow{DB} = \mathbf{p}$, $\overrightarrow{BE} = 3\mathbf{q}$, $\overrightarrow{EC} = 2\mathbf{q}$ and $\overrightarrow{AC} = 3\mathbf{p} + 5\mathbf{q}$.

(a) Express $\overrightarrow{AB}$ in terms of $\mathbf{p}$.

Answer $\overrightarrow{AB} =$ .... [1]

(b) Express $\overrightarrow{CF}$ in terms of $\mathbf{p}$ and/or $\mathbf{q}$.

Answer $\overrightarrow{CF} =$ .... [1]

(c) Express $\overrightarrow{EF}$ in terms of $\mathbf{p}$ and/or $\mathbf{q}$.

Answer $\overrightarrow{EF} =$ .... [1]

(d) $\overrightarrow{EF} = k\overrightarrow{DE}$.

Find k.

Answer $k =$ .... [2]

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O/N18/21/Q7

7 The position vector, $\overrightarrow{OA}$, of point A is $\begin{pmatrix} -4 \\ 7 \end{pmatrix}$ and $\overrightarrow{AB} = \begin{pmatrix} 6 \\ -3 \end{pmatrix}$.

(a) Find the position vector, $\overrightarrow{OB}$, of point B.

Answer $\overrightarrow{OB} = \begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) Find $|\overrightarrow{AB}|$.

Answer .... [2]

(c) Given that $\overrightarrow{AB} = 3\overrightarrow{CB}$, find the coordinates of point C.

Answer (.................... , ...) [2]

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(d) Line L is parallel to $\overrightarrow{AB}$ and passes through the point $(-2, 5)$.

(i) Find the equation of line L.

Answer .... [3]

(ii) Line M is perpendicular to line L and passes through the origin.

Find the equation of line M.

Answer .... [1]

M/J18/11/Q21

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8 $\mathbf{p} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ $\mathbf{q} = \begin{pmatrix} -4 \\ 3 \end{pmatrix}$

(a) Write $3\mathbf{p} - \mathbf{q}$ as a column vector.

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

(b) R is the point (11, −2) and O is the point (0, 0).
The vector $\overrightarrow{OR}$ can be written in the form $\mathbf{p} + n\mathbf{q}$, where n is an integer.

Find the value of n.

Answer $n =$ .... [2]

M/J18/22/Q8

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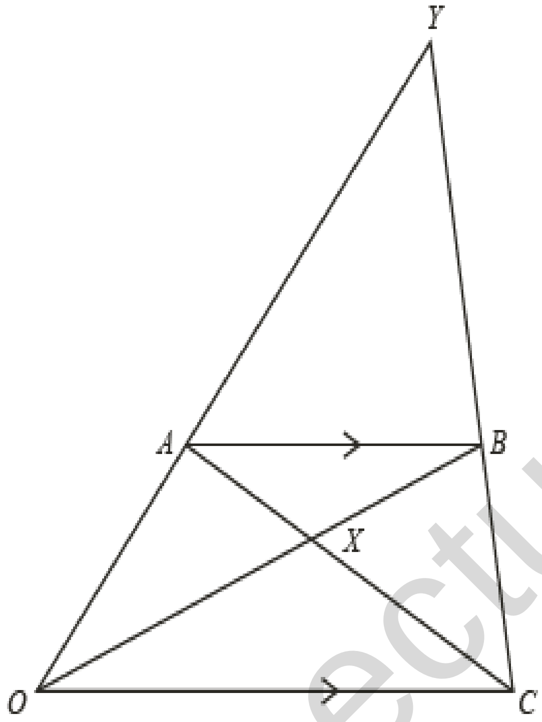
9



OYC is a triangle.
A is a point on OY and B is a point on CY.
AB is parallel to OC.
AC and OB intersect at X.

(a) Prove that triangle ABX is similar to triangle COX.
Give a reason for each statement you make.

....

....

....

.... [3]

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(b) $\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OC} = 6\mathbf{c}$ and $CB : BY = 1 : 2$.

Find, as simply as possible, in terms of **a** and/or **c**

(i) $\overrightarrow{AB}$,

Answer $\overrightarrow{AB}$ = ... [1]

(ii) $\overrightarrow{CY}$.

Answer $\overrightarrow{CY}$ = ... [2]

(c) Find, in its simplest form, the ratio

(i) $OX : XB$,

Answer .... : .... [2]

(ii) area of triangle COX : area of triangle ABX,

Answer .... : .... [1]

(iii) area of triangle AYB : area of trapezium $OABC$.

Answer .... : .... [1]

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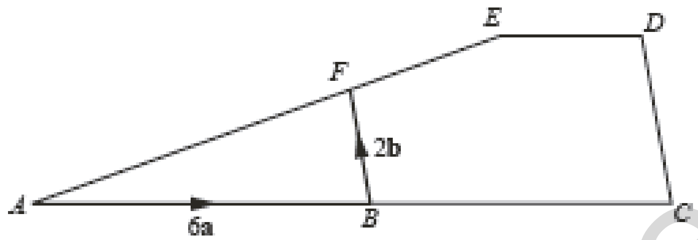
O/N17/11/Q24

10



In the diagram, ABC and AFE are straight lines.

$\overrightarrow{AB} = 6\mathbf{a}$ and $\overrightarrow{BF} = 2\mathbf{b}$.

(a) Express $\overrightarrow{AF}$ in terms of **a** and **b**.

Answer .... [1]

(b) $\overrightarrow{AE} = 9\mathbf{a} + k\mathbf{b}$.

(i) Find k.

Answer $k =$ .... [1]

(ii) ED is parallel to BC, CD is parallel to BF and $BC = AB$.

Find, in terms of **a** and/or **b**,

(a) $\overrightarrow{CD}$,

Answer .... [1]

(b) $\overrightarrow{DE}$.

Answer .... [1]

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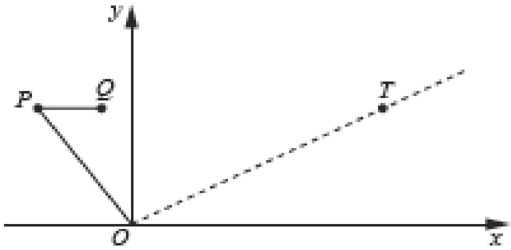
O/N17/12/Q27

11



In the diagram, $\overrightarrow{OP} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$ $\overrightarrow{PQ} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$.

(a) Find $|\overrightarrow{OP}| + |\overrightarrow{PQ}|$.

Answer .... [3]

(b) T is the point where $\overrightarrow{PT} = k\overrightarrow{PQ}$.

(i) Express $\overrightarrow{OT}$ as a column vector in terms of k.

Answer [1]

(ii) M is the point such that O, T and M lie on a straight line and $\overrightarrow{OM} = \begin{pmatrix} 24 \\ 16 \end{pmatrix}$.

Find the value of k.

Answer $k =$ .... [2]

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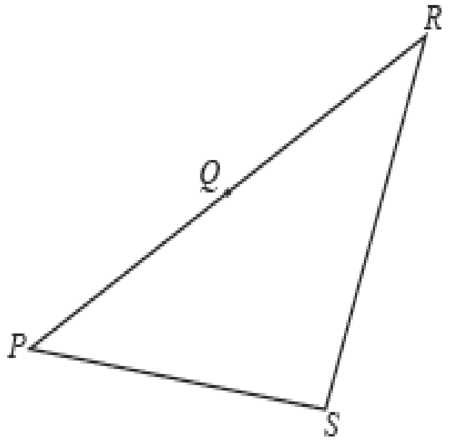
O/N17/21/Q10(b)

12 The diagram shows triangle PRS.



Q is the midpoint of PR.

$\overrightarrow{PQ} = \begin{pmatrix} 6 \\ 3 \end{pmatrix}$ and $\overrightarrow{PS} = \begin{pmatrix} 8 \\ -2 \end{pmatrix}$.

(i) Find $\overrightarrow{SR}$.

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

(ii) T is the point on SR such that $ST : TR = 1 : 3$.

Find $\overrightarrow{PT}$.

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

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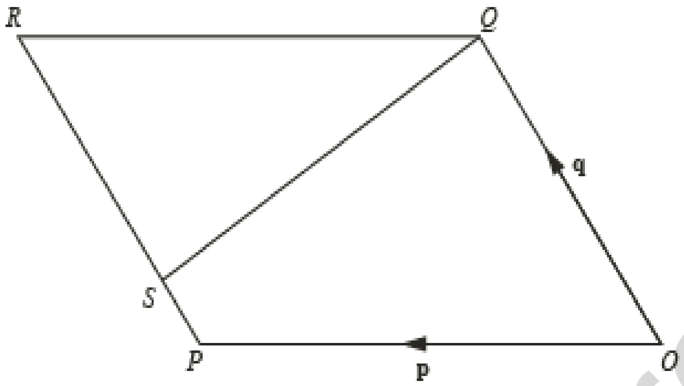
M/J17/11/Q23

13



$OPRQ$ is a parallelogram and S is a point on PR such that $PS : SR = 1 : 3$.

$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.

(a) (i) Express $\overrightarrow{PQ}$ in terms of **p** and/or **q**.

Answer .... [1]

(ii) Express $\overrightarrow{QS}$, as simply as possible, in terms of **p** and/or **q**.

Answer .... [1]

(b) T is a point on QS extended such that $\overrightarrow{QT} = \frac{4}{3}\overrightarrow{QS}$.

(i) Express $\overrightarrow{PT}$, as simply as possible, in terms of **p** and/or **q**.

Answer .... [2]

(ii) What can you conclude about the points O, P and T ?

.... [1]

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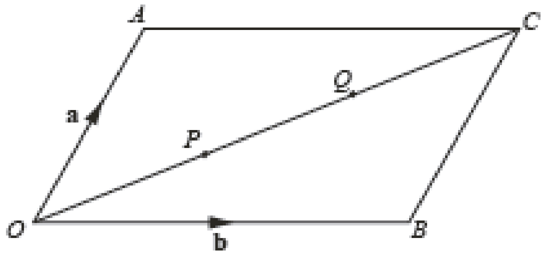
M/J17/12/Q21

14



OACB is a parallelogram.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
P and *Q* are points on *OC* such that $OP = PQ = QC$.

(a) Express, as simply as possible, in terms of **a** and **b**,

(i) $\overrightarrow{OP}$,

Answer .... [1]

(ii) $\overrightarrow{BP}$.

Answer .... [1]

(b) Show that triangles *OAQ* and *CBP* are congruent.

[2]

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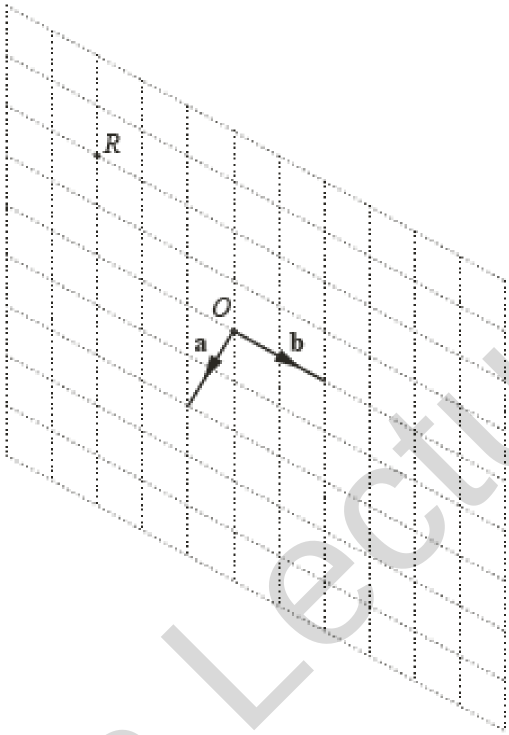
O/N16/11/Q19

15



The diagram shows the points O and R and the vectors **a** and **b**.

(a) Given that $\overrightarrow{OP} = 2\mathbf{a}$, mark and label the position of P on the grid. [1]

(b) Given that $\overrightarrow{OQ} = 2\mathbf{b} - \mathbf{a}$, mark and label the position of Q on the grid. [1]

(c) Express $\overrightarrow{OR}$ in terms of **a** and **b**.

Answer $\overrightarrow{OR}$ = ... [2]

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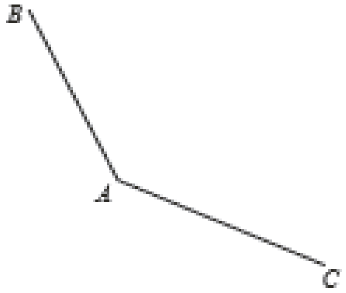
O/N16/21/Q11(a)

16 (a)



In the diagram, $\overrightarrow{AB} = \begin{pmatrix} -6 \\ 11 \end{pmatrix}$, $\overrightarrow{AC} = \begin{pmatrix} 12 \\ -5 \end{pmatrix}$.

(i) Find $|\overrightarrow{AC}|$.

Answer .... [2]

(ii) D is the point such that $\overrightarrow{AD} = \begin{pmatrix} 0 \\ k \end{pmatrix}$, where $k > 0$.

BD is parallel to AC.

(a) Show that $\overrightarrow{BD} = \begin{pmatrix} 6 \\ k-11 \end{pmatrix}$.

[1]

(b) Find k.

Answer $k =$ .... [2]

(c) Find the difference between the lengths of AD and AC.

Answer .... [1]

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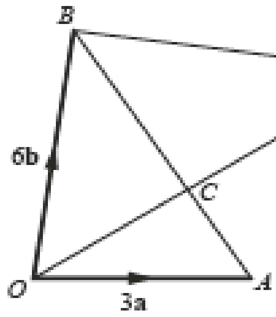
O/N16/Q10(a)

17 (a)



ACB and OCD are straight lines.
$AC : CB = 1 : 2$.
$\overrightarrow{OA} = 3\mathbf{a}$ and $\overrightarrow{OB} = 6\mathbf{b}$.

(i) Express $\overrightarrow{AB}$ in terms of **a** and **b**.

Answer .... [1]

(ii) Express $\overrightarrow{AC}$ in terms of **a** and **b**.

Answer .... [1]

(iii) $\overrightarrow{BD} = 5\mathbf{a} - \mathbf{b}$.

Showing your working clearly, find $OC : CD$.

Answer .... : .... [4]

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MARKING SCHEME

Question	Answer	Marks	Partial Marks
1(a)	$\begin{pmatrix} 4 & 8 \\ -2 & -7 \end{pmatrix}$	2	**B1** for two or three correct elements
1(b)(i)	–2	1	
1(b)(ii)	$-\frac{1}{4}\begin{pmatrix} -2 & 1 \\ -2 & 3 \end{pmatrix}$ oe isw or $\begin{pmatrix} \frac{1}{2} & -\frac{1}{4} \\ \frac{1}{2} & -\frac{3}{4} \end{pmatrix}$ oe isw	1	**FT** $-\frac{1}{4}\begin{pmatrix} \textit{their } k & 1 \\ -2 & 3 \end{pmatrix}$
2(a)(i)(a)	$\frac{3}{2}(\mathbf{p} + 2\mathbf{q})$ oe simplified expression	1	
2(a)(i)(b)	$\frac{5}{2}\mathbf{p}$ or $2\frac{1}{2}\mathbf{p}$ or 2.5**p**	2	**M1** for a correct vector route
2(a)(ii)	Trapezium	B1	
	$\overrightarrow{PQ}$ is a multiple of $\overrightarrow{SR}$ or PQ is parallel to SR since $\overrightarrow{PQ}$=4**p** and $\overrightarrow{SR}$ =2.5**p** oe	B1	
2(a)(iii)	8 : 5	2	FT *their* $\overrightarrow{SR}$ of form *k***p** **B1** for 4 : 2.5 oe
2(b)(i)	$\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ final answer	1	
2(b)(ii)	6.32 or 6.324 to 6.325	2	**M1** for $6^2 + (-2)^2$
2(b)(iii)	$\begin{pmatrix} 6 \\ 1 \end{pmatrix}$ final answer	2	**B1** for $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$

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3(a)(i)	$\begin{pmatrix} -7 \\ 1 \end{pmatrix}$ final answer	1	

Question	Answer	Marks	Partial Marks
3(a)(ii)	$4^2 + (\pm 3)^2$	M1	
	$1^2 + (\pm 5)^2$	M1	
	Correct concluding statement eg $\sqrt{25} < \sqrt{26}$ or $5 > 5.1[0]$ wrong or $\lvert f \rvert = 5$ $\lvert g \rvert = 5.099$ so $\lvert f \rvert$ is not greater than $\lvert g \rvert$	A1	

Question	Answer	Marks	Part marks
4(a)	**2p** + 3**q**	1	
4(b)	**2p** + 2**q**	1	
4(c)	–2**p** + **q** ft	1	Accept 3**q** – *their* **(b)** ft

5(a)	6**q** oe	1	
5(b)	6**p** + 6**q** isw	1	**FT** 6**p** + *their* **(a)** isw
5(c)(i)	9**p** + 9**q** oe	1	
5(c)(ii)	2 : 3 oe	1	

6(a)	3**p**	1	
6(b)	$\frac{1}{2}$(3**p** + 5**q**) oe	1	
6(c)	$\frac{1}{2}$(3**p** + 9**q**) oe	1	**FT** 2**q** oe + *their* **(b)** isw
6(d)	1.5 oe	2	**B1** for [$\overline{DE}$ =] **p** + 3**q** ; or for *k*(**p** + 3**q**)

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Question	Answer	Marks	Partial Marks
7(a)	$\begin{pmatrix} 2 \\ 4 \end{pmatrix}$	1	
7(b)	6.71 or 6.708…	2	**M1** for $6^2 + (-3)^2$ **oe**
7(c)	(0, 5)	2	**FT** *their* **(a)** ((*their* 2 – 2), (*their* 4 + 1)) **B1** for one value in coordinates correct or for $\left[\overrightarrow{CB} =\right]\begin{pmatrix} 2 \\ -1 \end{pmatrix}$ **soi**
7(d)(i)	$y = -\frac{1}{2}x + 4$ **oe final answer**	3	**B2** for $y = -\frac{1}{2}x + c$ **oe** OR **M1** for gradient = $\frac{-3}{6}$ **soi** **M1** for (–2, 5) substituted into $y =$ *their* $mx + c$
7(d)(ii)	$y = 2x$ **oe**	1	**FT** *their* gradient from **(d)(i)**

8(a)	$\begin{pmatrix} 13 \\ 9 \end{pmatrix}$	1	
8(b)	$n = -2$	2	**M1** for $\begin{pmatrix} 3 \\ 4 \end{pmatrix} + n\begin{pmatrix} -4 \\ 3 \end{pmatrix} = \begin{pmatrix} 11 \\ -2 \end{pmatrix}$ or 3 + (– 4n) = 1 or 4 + 3n = –2

9(a)	∠BAX = ∠OCX, alternate [angles] ∠ABX = ∠COX, alternate [angles] ∠AXB = ∠CXO, [vertically] opposite	3	**B1** for two correct pairs of angles **B1** for correct reason for one pair of angles
9(b)(i)	4**c**	1	
9(b)(ii)	9**a** – 6**c** or 3(3**a** – 2**c**)	2	**B1** for answer 9**a** + k**c** or k**a** – 6**c** ($k \neq 0$)
9(c)(i)	3 : 2	2	**B1** for 3k : 2k, where k is an integer
9(c)(ii)	9 : 4	1	**FT** *their* 3^2 : *their* 2^2
9(c)(iii)	4 : 5	1	

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10(a)	$6\mathbf{a} + 2\mathbf{b}$ oe	1	
10(b)(i)	3	1	
10(b)(ii)(a)	$3\mathbf{b}$; or FT $k\mathbf{b}$	1	
10(b)(ii)(b)	$-3\mathbf{a}$	1	

11(a)	7	3	**M1** for $\lvert\overrightarrow{OP}\rvert = \sqrt{(-3)^2 + (4)^2}$ **B1** for $\lvert\overrightarrow{PQ}\rvert = 2$
11(b)(i)	$\begin{pmatrix} -3+2k \\ 4 \end{pmatrix}$ oe	1	
11(b)(ii)	$4\frac{1}{2}$ oe	2	**B1** for expressing $\overrightarrow{OM}$ as a multiple (by 4) of $\overrightarrow{OT}$ or **B1** for T is (6, 4); or for $\overrightarrow{OT} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$

12(i)	$\begin{pmatrix} 4 \\ 8 \end{pmatrix}$	2	**B1** for one component correct or **M1** for $2\begin{pmatrix} 6 \\ 3 \end{pmatrix} - \begin{pmatrix} 8 \\ -2 \end{pmatrix}$ oe After 0 scored, **SC1** for answer $\begin{pmatrix} -4 \\ -8 \end{pmatrix}$
12(ii)	$\begin{pmatrix} 9 \\ 0 \end{pmatrix}$	2	**B1** for one component correct or **M1** for $-\frac{3}{4}(their\ \overrightarrow{SR})$ or $\frac{1}{4}(their\ \overrightarrow{SR})$ s

13(a)(i)	$\mathbf{q} - \mathbf{p}$	1	
13(a)(ii)	$\mathbf{p} - \frac{3}{4}\mathbf{q}$ or $\frac{4\mathbf{p} - 3\mathbf{q}}{4}$	1	
13(b)(i)	$\overrightarrow{PT} = \frac{1}{3}\mathbf{p}$	2	M1 for $\overrightarrow{PT} = \overrightarrow{PS} + \frac{1}{3}\overrightarrow{QS}$ soi or $\overrightarrow{PT} = \overrightarrow{PQ} + \overrightarrow{QT}$ soi
13(b)(ii)	O, P and T are collinear oe	1	e.g. T is on OP produced

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14(a)(i)	$\frac{1}{3}\mathbf{a}+\frac{1}{3}\mathbf{b}$ or $\frac{1}{3}(\mathbf{a}+\mathbf{b})$ or $\frac{\mathbf{a}+\mathbf{b}}{3}$ final answer	**1**	
14(a)(ii)	$\frac{1}{3}\mathbf{a}-\frac{2}{3}\mathbf{b}$ or $\frac{1}{3}(\mathbf{a}-2\mathbf{b})$ or $\frac{\mathbf{a}-2\mathbf{b}}{3}$ final answer	**1**	
14(b)	Any two pairs of vectors from $\overline{OA}=\overline{BC}$ oe $\overline{OQ}=\overline{PC}$ oe $\overline{QA}=\overline{BP}$ oe **Alternative method:** $OA=BC$ $OQ=PC$ $\angle AOQ=\angle BCP$	**2**	**B1** for any one pair of vectors stated **B1** for two of these pairs of sides stated or one of these pairs of sides and this pair of angles stated

15 (a)	the point *P* marked correctly	1	
(b)	the point *Q* marked correctly	1	
(c)	$-\mathbf{a}-2\mathbf{b}$ oe	2	C1 for $-\mathbf{a}$; or for $-2\mathbf{b}$

16 (a) (i)	13	**2**	**M1** for $\sqrt{(-5)^2+12^2}$
(ii) (a)	$[\overline{BD}=]\overline{BA}+\overline{AD}=\begin{pmatrix}6\\-11\end{pmatrix}+\begin{pmatrix}0\\k\end{pmatrix}=\begin{pmatrix}6\\k-11\end{pmatrix}$ **AG**	**1**	Or $[\overline{BD}=]\overline{AD}-\overline{AB}=\begin{pmatrix}0\\k\end{pmatrix}-\begin{pmatrix}-6\\11\end{pmatrix}=\begin{pmatrix}6\\k-11\end{pmatrix}$

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17 (a) (i)	6**b** – 3**a** oe isw	**1**	
(ii)	2**b** – **a** oe isw	**1ft**	
(iii)	2 : 3 cao **NB www**	**4**	M1+ M1 for two of $\overrightarrow{OC} = \overrightarrow{OA} + \overrightarrow{AC}$ $\overrightarrow{CD} = \overrightarrow{CB} + \overrightarrow{BD}$ $\overrightarrow{OD} = \overrightarrow{OB} + \overrightarrow{BD}$ A1 for $\overrightarrow{OC}$ = 2**a** + 2**b** ft or $\overrightarrow{CD}$ = 3**a** + 3**b** ft or $\overrightarrow{OD}$ = 5**a** + 5**b**

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