"Full Coverage": Vectors

This worksheet is designed to cover one question of each type seen in past papers, for each GCSE Higher Tier topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com/homework, logging on, *Practise → Past Papers/Worksheets* (or *Library → Past/Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Add to vectors.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3F Q20ai, 3H Q4ai]

$\mathbf{a} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$

(a) Write down as a column vector

(i) $\mathbf{a} + \mathbf{b}$

....

Question 2

Categorisation: [IGCSE only?] Find the magnitude (i.e. length) of a vector: The magnitude of $\begin{pmatrix} a \\ b \end{pmatrix}$ is $\sqrt{a^2 + b^2}$.

[Edexcel IGCSE Jan2015-4H Q19c]

$\mathbf{a} = \begin{pmatrix} 5 \\ -2 \end{pmatrix} \qquad \mathbf{b} = \begin{pmatrix} 1 \\ 7 \end{pmatrix} \qquad \mathbf{c} = \begin{pmatrix} -7 \\ 0 \end{pmatrix}$

Work out the magnitude of $\mathbf{a}$. Give your answer as a surd.

....

Question 3

Categorisation: Appreciate scalar multiplication of vectors.

[Edexcel IGCSE Jan2015-4H Q19b]

$\mathbf{a} = \begin{pmatrix} 5 \\ -2 \end{pmatrix} \qquad \mathbf{b} = \begin{pmatrix} 1 \\ 7 \end{pmatrix} \qquad \mathbf{c} = \begin{pmatrix} -7 \\ 0 \end{pmatrix}$
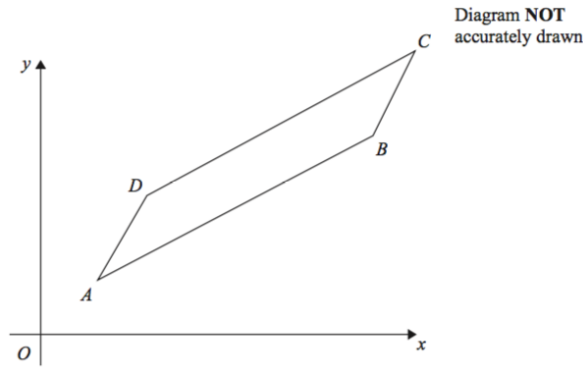
Write, as a column vector, $3\mathbf{b} - \mathbf{c}$

....

Question 4

Categorisation: Determine the coordinates of a point using an initial coordinate and subsequent translation by one or more vectors.

[Edexcel IGCSE Jan2015(R)-4H Q15b]

Here is the parallelogram *ABCD*.

Diagram **NOT** accurately drawn

$\overrightarrow{AD} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$, $\overrightarrow{AB} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$
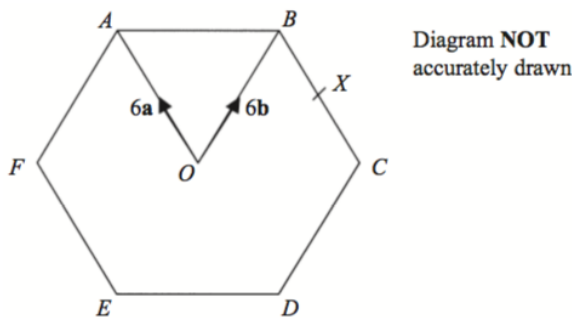
The point *A* has coordinate (4, 2).

Work out the coordinates of the point *C*.

....

Question 5

Categorisation: Appreciate that two vectors with the same magnitude and same direction are the same vector.

[Edexcel GCSE June2003-5H Q23aii]

Diagram **NOT** accurately drawn

The diagram shows a regular hexagon *ABCDEF* with centre *O* .

$\overrightarrow{OA} = 6\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$

Express in terms of **a** and/or **b** the vector $\overrightarrow{EF}$.

$\overrightarrow{EF} = $ ....

Question 6

Categorisation: Find a vector $\overrightarrow{XY}$ between two points using an appropriate path.
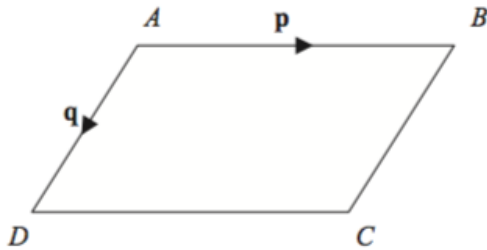
[Edexcel GCSE June2006-6H Q13aii]

Diagram **NOT** accurately drawn

$ABCD$ is a parallelogram.

AB is parallel to DC. AD is parallel to BC.

$$\overrightarrow{AB} = \mathbf{p} \qquad \overrightarrow{AD} = \mathbf{q}$$

Express $\overrightarrow{BD}$ in terms of $\mathbf{p}$ and $\mathbf{q}$.

$$\overrightarrow{BD} = \text{.........................}$$

Question 7

Categorisation: Appreciate that multiplying a vector by a scalar multiplies its magnitude by this scalar.

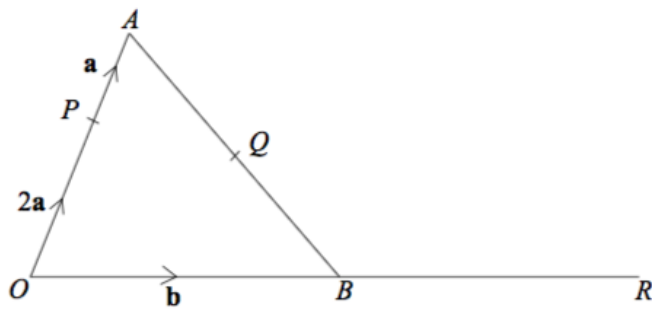*[Edexcel GCSE Nov2006-5H Q22c Edited]*

Diagram **NOT** accurately drawn

OAB is a triangle. B is the midpoint of OR. Q is the midpoint of AB.

$$\overrightarrow{OP} = 2\mathbf{a} \quad \overrightarrow{PA} = \mathbf{a} \quad \overrightarrow{OB} = \mathbf{b} \quad \overrightarrow{PR} = 4\overrightarrow{PQ}$$
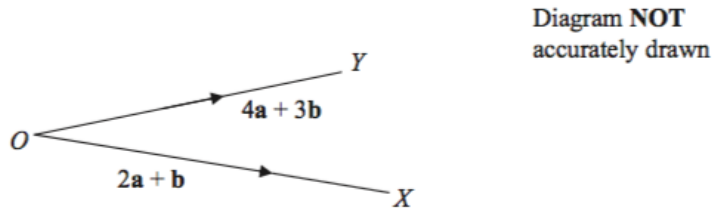
The length of PQ is 3 cm.

(c) Find the length of PR.

.... cm

Question 8

Categorisation: Determine a vector where the vector between points is a more complex combination of multiple vectors.

[Edexcel GCSE Nov2008-4H Q26a]

Diagram **NOT** accurately drawn

$$\overrightarrow{OX} = 2\mathbf{a} + \mathbf{b} \qquad \overrightarrow{OY} = 4\mathbf{a} + 3\mathbf{b}$$

(a) Express the vector $\overrightarrow{XY}$ in terms of **a** and **b** Give your answer in its simplest form.
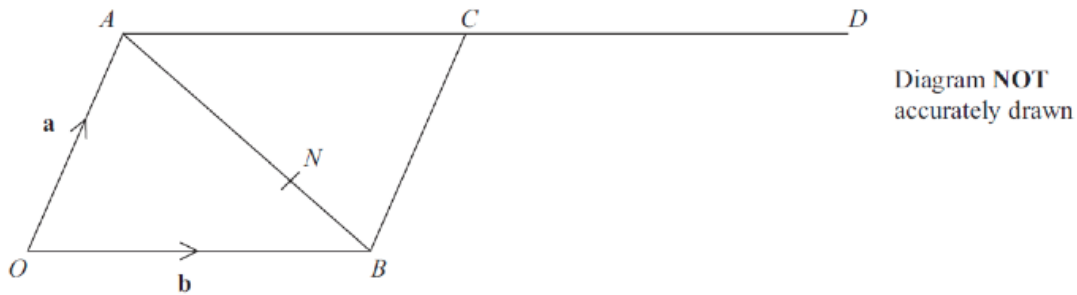
$$\overrightarrow{XY} = \text{.........................}$$

Question 9

Categorisation: Determine a vector involving a fraction of the distance between two points.

[Edexcel GCSE Nov2013-1H Q24a]

OACB is a parallelogram.

Diagram **NOT** accurately drawn

$\overrightarrow{OA} = a$ and $\overrightarrow{OB} = b$ *D* is the point such that $\overrightarrow{AC} = \overrightarrow{CD}$.

The point N divides AB in the ratio 2 : 1.

Write an expression for $\overrightarrow{ON}$ in terms of **a** and **b**.

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Question 10

Categorisation: Determine a vector involving multiple fractions.

[Edexcel IGCSE May2014(R)-3H Q21]
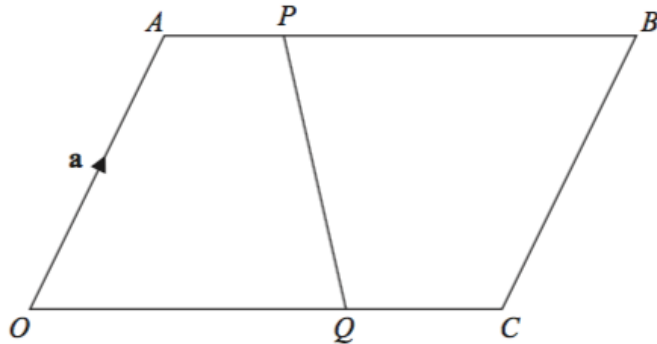
Diagram **NOT** accurately drawn

OABC is a parallelogram. $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$

P is the point on *AB* such that $AP = \frac{1}{4}AB$

Q is the point on *OC* such that $OQ = \frac{2}{3}OC$

Find, in terms of **a** and **c** , $\overrightarrow{PQ}$.

Give your answer in its simplest form.

$$\overrightarrow{PQ} = \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$$

Question 11

Categorisation: Prove that three points form a straight line.
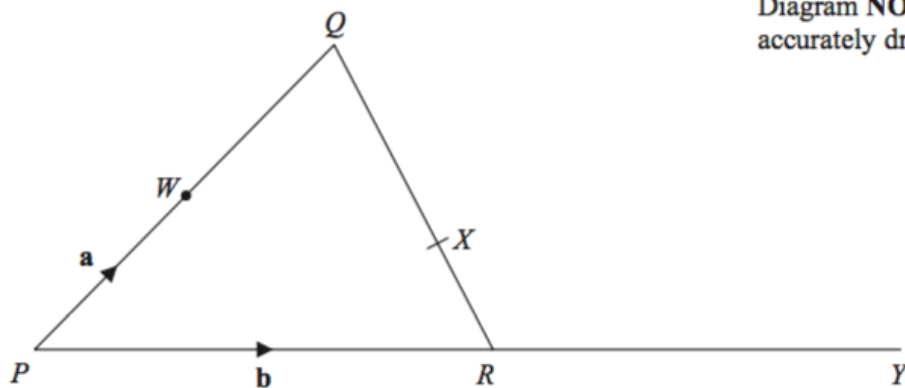
[Edexcel IGCSE May2015(R)-3H Q18b Edited]

Diagram **NOT** accurately drawn

PQR is a triangle.

The midpoint of *PQ* is *W*.

X is the point on *QR* such that *QX* : *XR* = 2 : 1

PRY is a straight line.

$\overrightarrow{PW} = \mathbf{a}$ and $\overrightarrow{PR} = \mathbf{b}$

R is the midpoint of the straight line *PRY*.

Use a vector method to show that *WXY* is a straight line.

Question 12

Categorisation: Prove that two vectors are parallel.
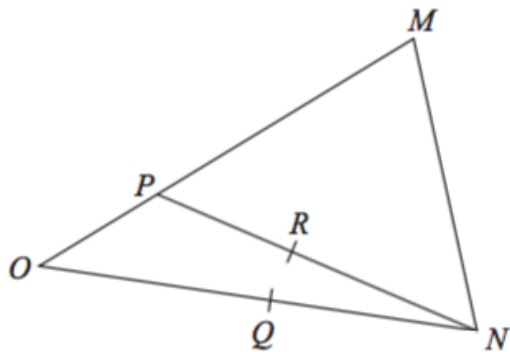*[Edexcel IGCSE May2016-4H Q22b Edited]*

Diagram **NOT**
accurately drawn

OMN is a triangle. P is the point on OM such that $OP = \frac{1}{4}OM$

Q is the midpoint of ON, R is the midpoint of PN

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

Use a vector method to prove that QR is parallel to OP

Question 13

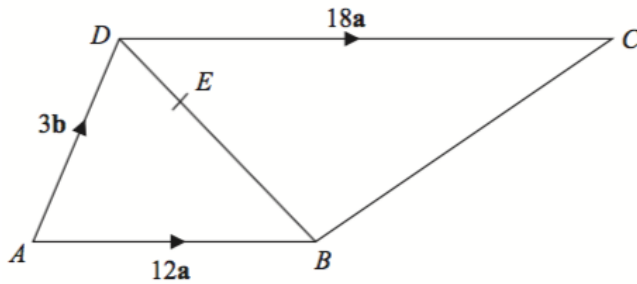**Categorisation: As above.**

[Edexcel IGCSE Jan2014-3H Q21b Edited]

Diagram **NOT**
accurately drawn

ABCD is a trapezium. *AB* is parallel to *DC*.

$$\overrightarrow{AB} = 12\mathbf{a} \qquad \overrightarrow{AD} = 3\mathbf{b} \qquad \overrightarrow{DC} = 18\mathbf{a}$$
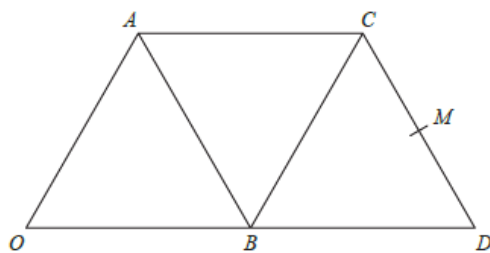
E is the point on the diagonal DB such that $DE = \frac{1}{3}DB$.

Show by a vector method that BC is parallel to AE .

Question 14

Categorisation: Determine the scalar multiplier that one vector is of another.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 1H Q20]

$OACD$ is a trapezium and $OACB$ is a parallelogram. B is the midpoint of OD . M is the midpoint of CD.

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

Given that $\overrightarrow{BM} = k \times \overrightarrow{OC}$ where k is a scalar, use a vector method to find the value of k .

....

Question 15

Categorisation: Show that a vector is a particular expression.

[Edexcel GCSE June2009-4H Q23b Edited]
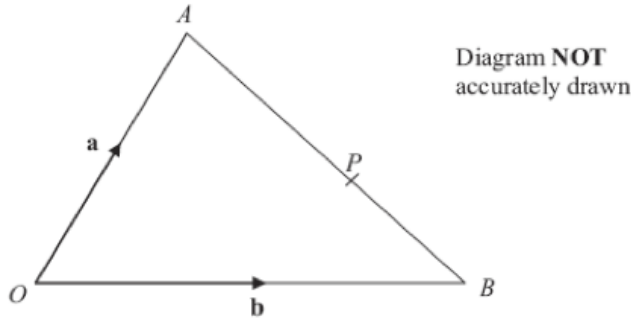
OAB is a triangle. $\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

P is the point on AB such that $AP:PB = 3:2$

Show that $\overrightarrow{OP} = x(2\mathbf{a} + 3\mathbf{b})$ where x is a fraction to be found.

$x = $ ....

Question 16

Categorisation: As above, but where no diagram is provided.

[Edexcel IGCSE Jan2016(R)-3H Q19d]

$\overrightarrow{PQ} = 3\mathbf{a} + 4\mathbf{b}$ $\qquad\qquad$ $\overrightarrow{PR} = -4\mathbf{a} + 2\mathbf{b}$

The point M lies on PR such that $PM = \frac{2}{3}PR$
The point N lies on PQ such that $PN = \frac{1}{3}PQ$

Show that $\overrightarrow{MN} = k\mathbf{a}$ where k is a constant.
State the value of k .

$k = $ ....

Question 17

Categorisation: Determine a vector involving an extended line.

[Edexcel GCSE March2012-3H Q23b]
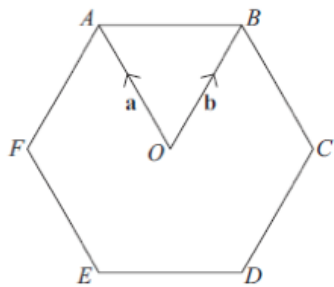
Diagram **NOT** accurately drawn

ABCDEF is a regular hexagon, with centre *O*. $\overrightarrow{OA} = \mathbf{a}$ $\overrightarrow{OB} = \mathbf{b}$

The line *AB* is extended to the point *K* so that *AB* : *BK* = 1 : 2

Write the vector $\overrightarrow{CK}$ in terms of **a** and **b** .

Give your answer in its simplest form.

$$\overrightarrow{CK} = \text{............................}$$

Question 18

Categorisation: Determine a vector when a fraction involved is greater than 1.

[Edexcel GCSE Jun2015-2H Q27]

Diagram **NOT** accurately drawn
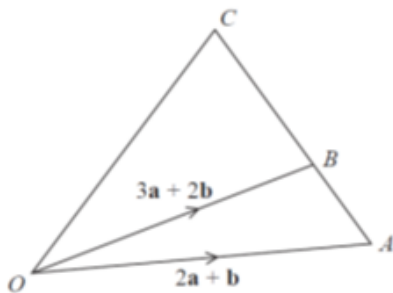
ABC is a straight line. $AB : BC = 2 : 5$

$\overrightarrow{OA} = 2\mathbf{a} + \mathbf{b}$ $\overrightarrow{OB} = 3\mathbf{a} + 2\mathbf{b}$

Express $\overrightarrow{OC}$ in terms of **a** and **b**. Give your answer in its simplest form.

$$\text{............................}$$

Answers

Question 1

$\begin{pmatrix} 4 \\ 6 \end{pmatrix}$

Question 2

$\sqrt{29}$

Question 3

$\begin{pmatrix} 10 \\ 21 \end{pmatrix}$

Question 4

$(10,7)$

Question 5

$\overrightarrow{EF} = 6a$

Question 6

$\overrightarrow{BD} = q - p$

Question 7

12 cm

Question 8

$\overrightarrow{XY} = 2a + 2b$

Question 9

$\frac{1}{3}a + \frac{2}{3}b$

Question 10

$\overrightarrow{PQ} = \frac{5}{12}c - a$

Question 11

$\overrightarrow{WX} = -\frac{1}{3}a + \frac{2}{3}b = \frac{1}{3}(-a + 2b)$

$\overrightarrow{WY} = -a + 2b$

$\overrightarrow{WX}$ is a multiple of $\overrightarrow{WY}$ ∴ parallel.
W is a common point.
∴ WXY is a straight line.

Question 12

$\overrightarrow{QR} = \frac{1}{2}\boldsymbol{p}$ $\overrightarrow{OP} = \boldsymbol{p}$
$\overrightarrow{QR}$ is a multiple of $\overrightarrow{OP}$ therefore parallel.

Question 13

$\overrightarrow{BC} = 3(2\boldsymbol{a} + \boldsymbol{b})$
$\overrightarrow{AE} = 2(2\boldsymbol{a} + \boldsymbol{b})$
$\overrightarrow{BC}$ is a multiple of $\overrightarrow{AE}$ ∴ parallel.

Question 14

$k = 0.5$

Question 15

$x = \frac{1}{5}$

Question 16

$k = \frac{11}{3}$

Question 17

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

Question 18

$\frac{11}{2}a + \frac{9}{2}b$