G259 Vectors 2

Q1.

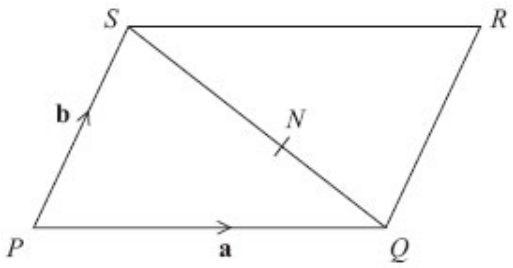


Diagram **NOT** accurately drawn

PQRS is a parallelogram.
N is the point on *SQ* such that *SN* : *NQ* = 3 : 2

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

(a) Write down, in terms of **a** and **b**, an expression for $\overrightarrow{SQ}$.

$\overrightarrow{SQ}$ = ...

(1)

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

$\overrightarrow{NR}$ = ...

(3)

(Total for Question is 4 marks)

Q2.

The diagram shows a regular hexagon *OABCDE*.

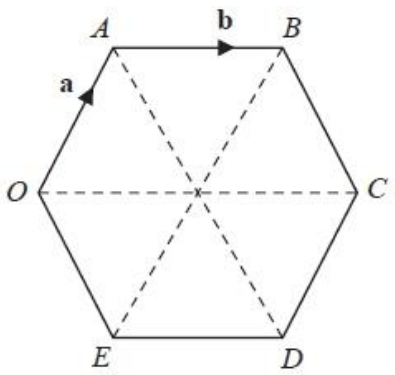


Diagram **NOT** accurately drawn

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

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

M is the midpoint of *OE*.
N is the midpoint of *AB*.

(a) Find $\overrightarrow{MN}$ in terms of **a** and/or **b**.

$\overrightarrow{MN}$ = ...

(3)

(b) Describe fully what your answer to part (a) shows about the lines *OA* and *MN*.

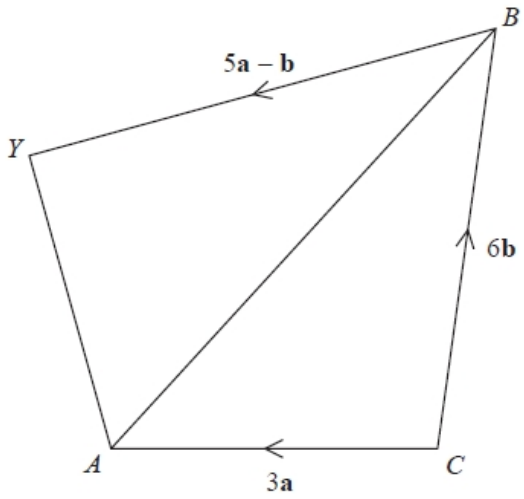
.....

.....

(2)

(Total for question = 5 marks)

Q3.



CAYB is a quadrilateral.

$\overrightarrow{CA} = 3\mathbf{a}$
$\overrightarrow{CB} = 6\mathbf{b}$
$\overrightarrow{BY} = 5\mathbf{a} - \mathbf{b}$

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

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

(Total for question is 5 marks)

Q4.

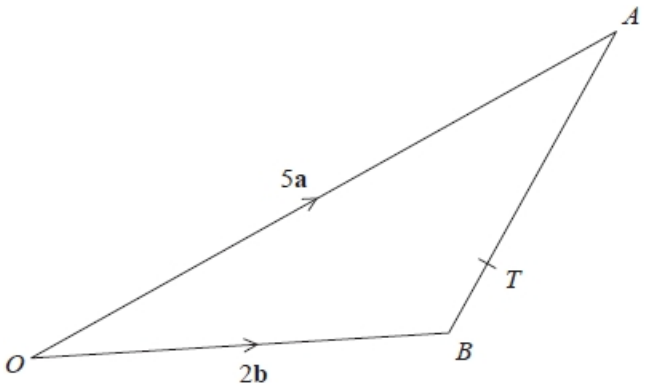


Diagram **NOT** accurately drawn

OAB is a triangle

$\overrightarrow{OA}$ = 5**a**

$\overrightarrow{OB}$ = 2**b**

T is the point on *AB* such that *AT* : *TB* = 5 : 1

Show that *OT* is parallel to the vector **a** + 2**b**

(Total for question = 4 marks)

Q5.

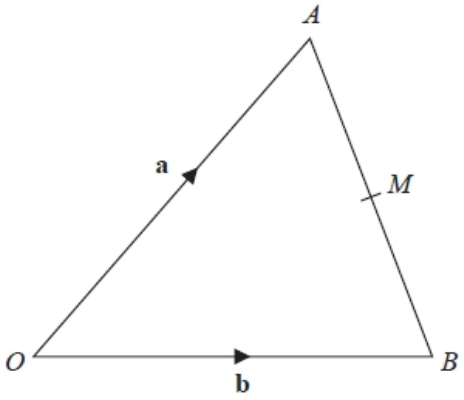


Diagram **NOT** accurately drawn

OAB is a triangle.

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

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

M is the midpoint of *AB*.
OMN is a straight line such that *ON* : *OM* = 3 : 2

Find, in terms of **a** and **b**, an expression for the vector $\overrightarrow{ON}$.
Write your answer in its simplest form.

.....

(Total for question = 4 marks)

Q6.

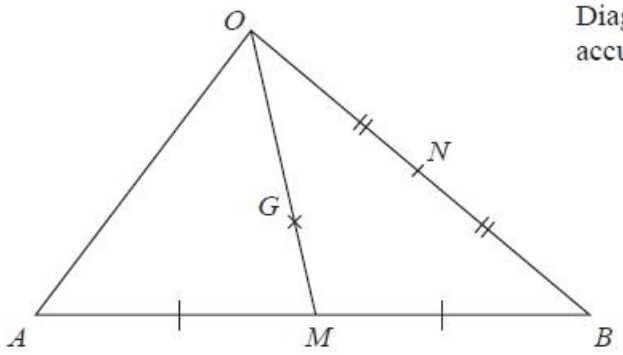


Diagram **NOT** accurately drawn

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

M is the midpoint of *AB*.

(a) Write $\overrightarrow{OM}$ in terms of **a** and **b**.

Give your answer in its simplest form.

.....

(2)

N is the midpoint of *OB*.

G is the point on *OM* such that *OG* : *GM* = 2 : 1

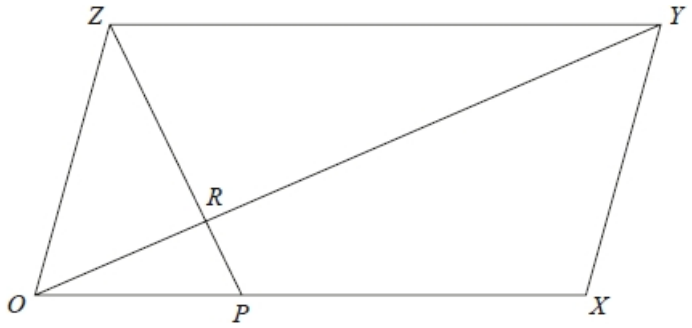
*(b) Show that *AGN* is a straight line.

(4)

(Total for question = 6 marks)

Q7.

OXYZ is a parallelogram.



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

$\overrightarrow{OY} = \mathbf{b}$

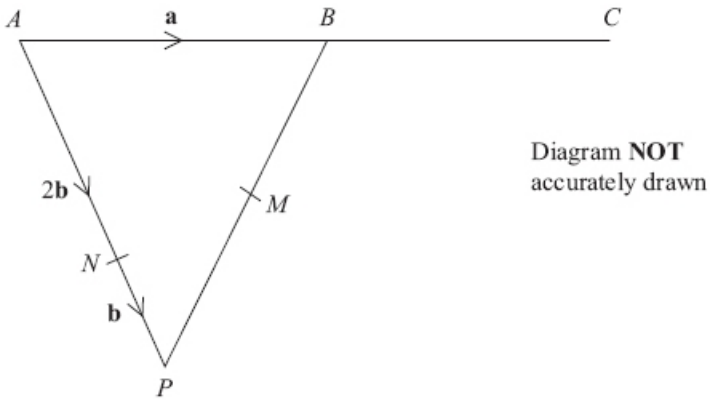
P is the point on *OX* such that *OP* : *PX* = 1 : 2
R is the point on *OY* such that *OR* : *RY* = 1 : 3

Work out, in its simplest form, the ratio *ZP* : *ZR*
You must show all your working.

.....

(Total for question = 5 marks)

Q8.



APB is a triangle.
N is a point on *AP*.

$\overrightarrow{AB} = \mathbf{a}$ $\overrightarrow{AN} = 2\mathbf{b}$ $\overrightarrow{NP} = \mathbf{b}$

(a) Find the vector $\overrightarrow{PB}$, in terms of **a** and **b**.

.....

(1)

B is the midpoint of *AC*.
M is the midpoint of *PB*.

***** (b) Show that *NMC* is a straight line.

(4)

(Total for Question is 5 marks)

Q9.

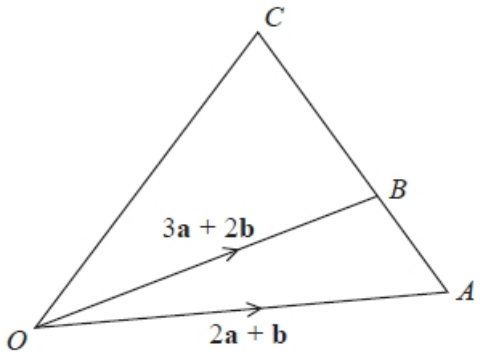


Diagram **NOT** accurately drawn

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.

.....

(Total for question = 4 marks)

Q10.

OACB is a parallelogram.

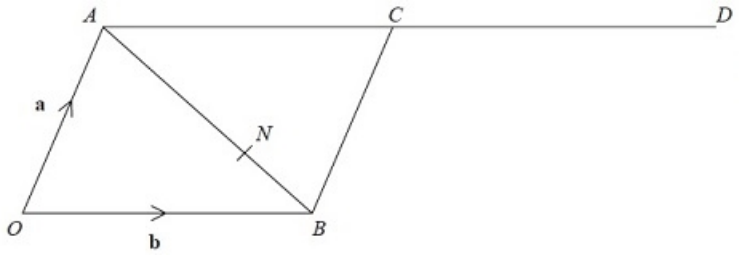


Diagram **NOT** accurately drawn

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

D is the point such that $\overrightarrow{AC} = \overrightarrow{CD}$

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

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

.....

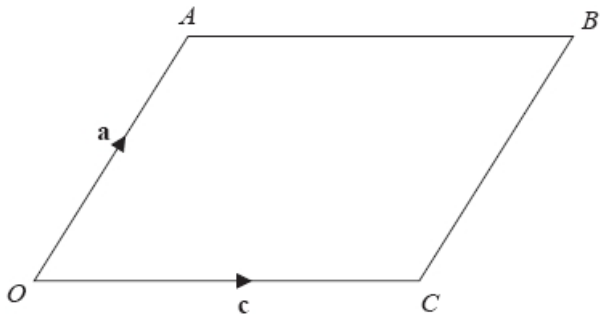
(3)

*(b) Prove that *OND* is a straight line.

(3)

(Total for Question is 6 marks)

Q11.



OABC is a parallelogram.

$\overrightarrow{OA}$ = **a** and $\overrightarrow{OC}$ = **c**

X is the midpoint of the line *AC*.
OCD is a straight line so that *OC* : *CD* = *k* : 1

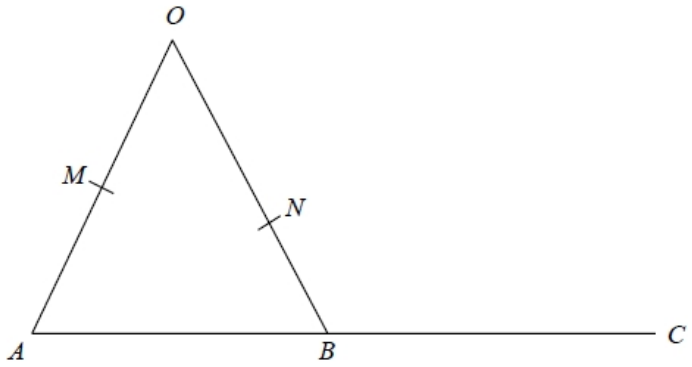
Given that $\overrightarrow{XD} = 3\mathbf{c} - \frac{1}{2}\mathbf{a}$

find the value of *k*.

k = ...

(Total for question = 4 marks)

Q12.



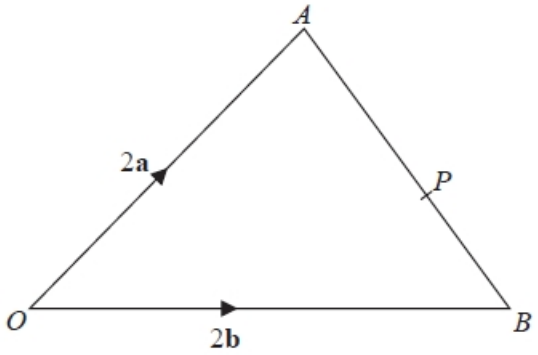
OMA, *ONB* and *ABC* are straight lines.
M is the midpoint of *OA*.
B is the midpoint of *AC*.

$\overrightarrow{OA} = 6\mathbf{a}$ $\overrightarrow{OB} = 6\mathbf{b}$ $\overrightarrow{ON} = k\mathbf{b}$ where *k* is a scalar quantity.

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

(Total for question = 5 marks)

Q13.



OAB is a triangle.
P is the point on *AB* such that *AP* : *PB* = 5:3

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

$\overrightarrow{OB}$ = 2**b**

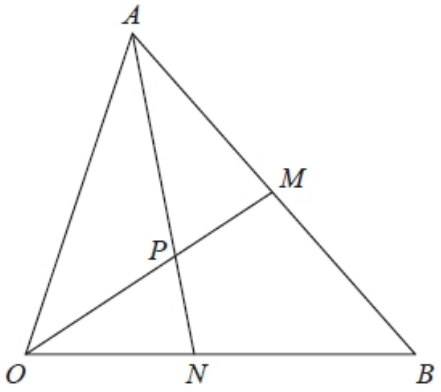
$\overrightarrow{OP}$ = *k*(3**a** + 5**b**) where *k* is a scalar quantity.

Find the value of *k*.

.....

(Total for question = 4 marks)

Q14.



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

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

OP : *PM* = 3 : 2

Work out the ratio *ON* : *NB*

.....

(Total for question = 5 marks)