

## G298 Vectors 2

Q1.

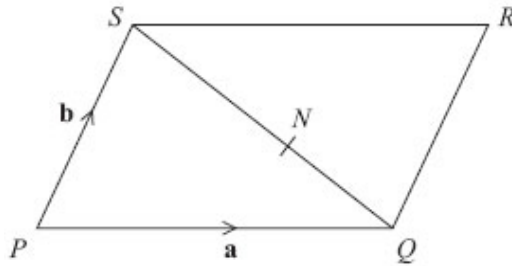


Diagram NOT  
accurately drawn

$PQRS$  is a parallelogram.

$N$  is the point on  $SQ$  such that  $SN : NQ = 3 : 2$

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

$$\vec{PS} = \mathbf{b}$$

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

$$\vec{SQ} = \dots\dots\dots$$

(1)

(b) Express  $\vec{NR}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

$$\vec{NR} = \dots\dots\dots$$

(3)

**(Total for Question is 4 marks)**

Q2.

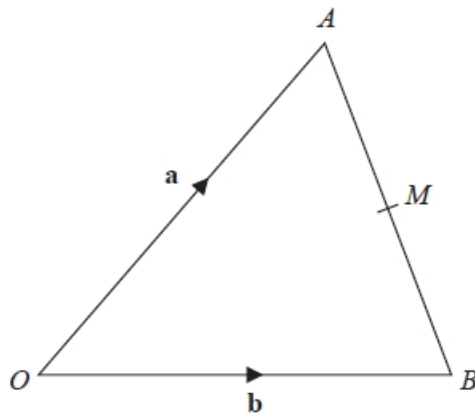


Diagram NOT  
accurately drawn

$OAB$  is a triangle.

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

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

$M$  is the midpoint of  $AB$ .

$OMN$  is a straight line such that  $ON : OM = 3 : 2$

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

.....  
**(Total for question = 4 marks)**

**Q3.**

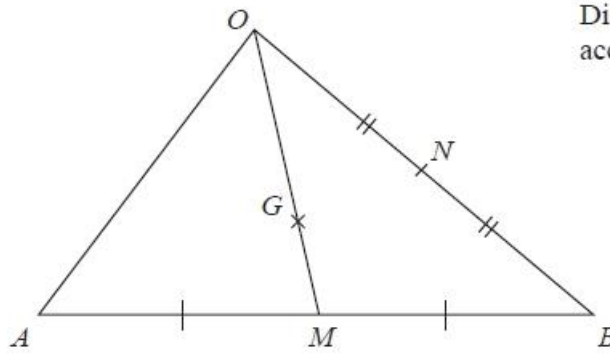


Diagram **NOT**  
accurately drawn

$\vec{OA} = 6\mathbf{a}$  and  $\vec{OB} = 6\mathbf{b}$   
 $M$  is the midpoint of  $AB$ .

(a) Write  $\vec{OM}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

Give your answer in its simplest form.

.....

(2)

$N$  is the midpoint of  $OB$ .

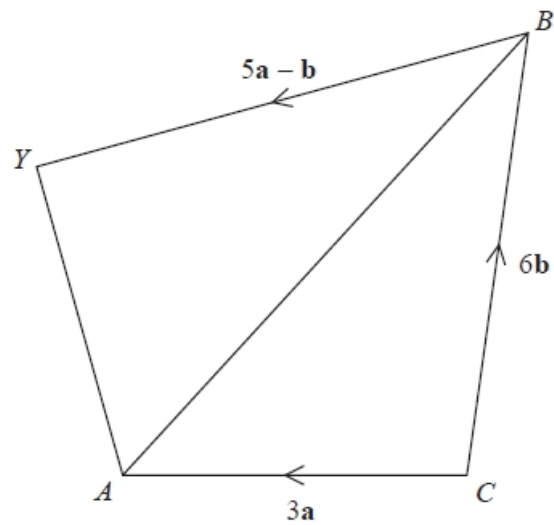
$G$  is the point on  $OM$  such that  $OG : GM = 2 : 1$

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

(4)

**(Total for question = 6 marks)**

Q4.



CAYB is a quadrilateral.

$$\vec{CA} = 3\mathbf{a}$$

$$\vec{CB} = 6\mathbf{b}$$

$$\vec{BY} = 5\mathbf{a} - \mathbf{b}$$

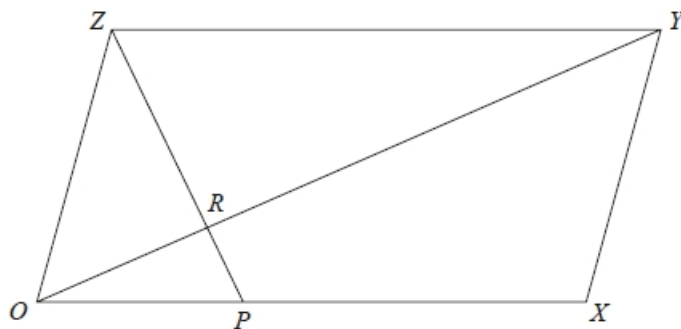
X is the point on AB such that  $AX : XB = 1 : 2$

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

(Total for question is 5 marks)

**Q5.**

$OXYZ$  is a parallelogram.



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

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

$P$  is the point on  $OX$  such that  $OP : PX = 1 : 2$

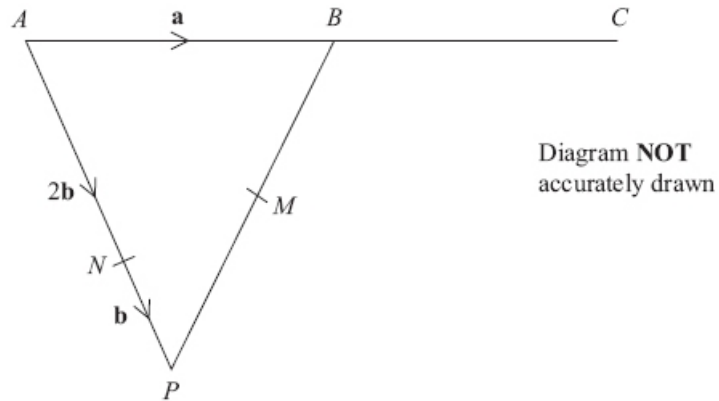
$R$  is the point on  $OY$  such that  $OR : RY = 1 : 3$

Work out, in its simplest form, the ratio  $ZP : ZR$

You must show all your working.

.....  
**(Total for question = 5 marks)**

Q6.



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

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

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

..... (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)

**Q7.**

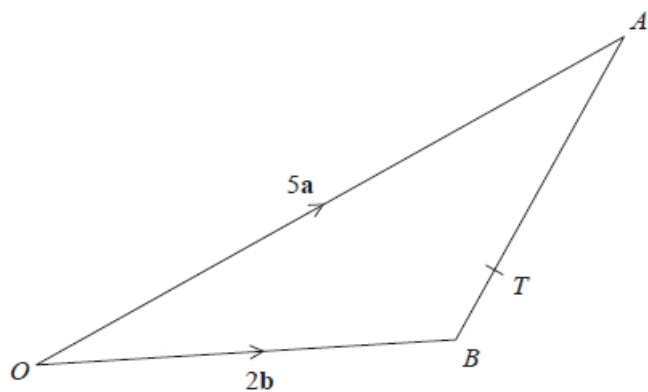


Diagram **NOT**  
accurately drawn

$OAB$  is a triangle

$$\vec{OA} = 5\mathbf{a}$$

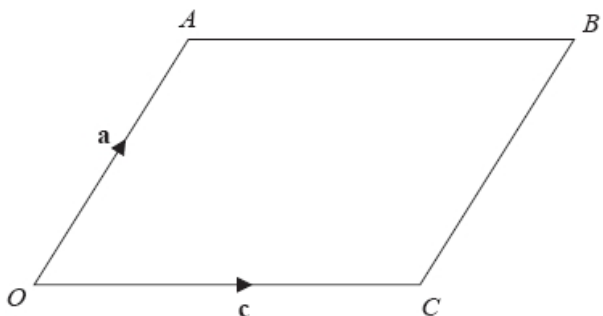
$$\vec{OB} = 2\mathbf{b}$$

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

Show that  $OT$  is parallel to the vector  $\mathbf{a} + 2\mathbf{b}$

**(Total for question = 4 marks)**

**Q8.**



OABC is a parallelogram.

$$\vec{OA} = \mathbf{a} \text{ and } \vec{OC} = \mathbf{c}$$

X is the midpoint of the line AC.

OCX is a straight line so that  $OC : CX = k : 1$

$$\text{Given that } \vec{OX} = 3\mathbf{c} - \frac{1}{2}\mathbf{a}$$

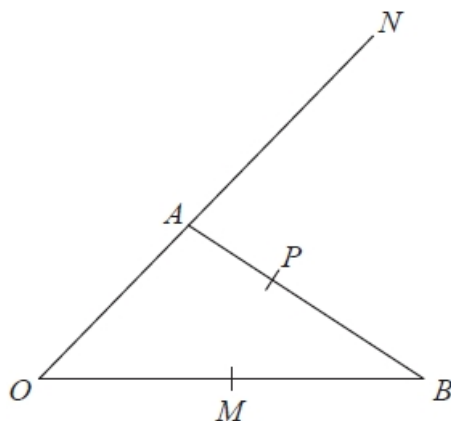
find the value of  $k$ .

$$k = \dots\dots\dots$$

**(Total for question = 4 marks)**



**Q9.**



$OAN$ ,  $OMB$  and  $APB$  are straight lines.

$AN = 2OA$ .

$M$  is the midpoint of  $OB$ .

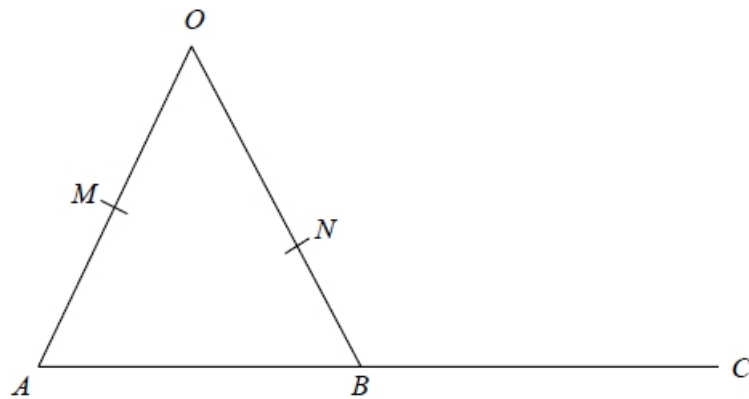
$\vec{OA} = \mathbf{a}$      $\vec{OB} = \mathbf{b}$

$\vec{AP} = k\vec{AB}$  where  $k$  is a scalar quantity.

Given that  $MPN$  is a straight line, find the value of  $k$ .

.....  
**(Total for question = 5 marks)**

**Q10.**



$OMA$ ,  $ONB$  and  $ABC$  are straight lines.

$M$  is the midpoint of  $OA$ .

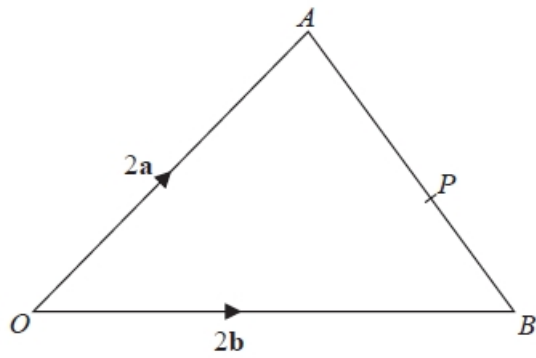
$B$  is the midpoint of  $AC$ .

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

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

**(Total for question = 5 marks)**

**Q11.**



$OAB$  is a triangle.

$P$  is the point on  $AB$  such that  $AP : PB = 5:3$

$$\vec{OA} = 2\mathbf{a}$$

$$\vec{OB} = 2\mathbf{b}$$

$$\vec{OP} = k(3\mathbf{a} + 5\mathbf{b}) \text{ where } k \text{ is a scalar quantity.}$$

Find the value of  $k$ .

.....  
**(Total for question = 4 marks)**

**Q12.**

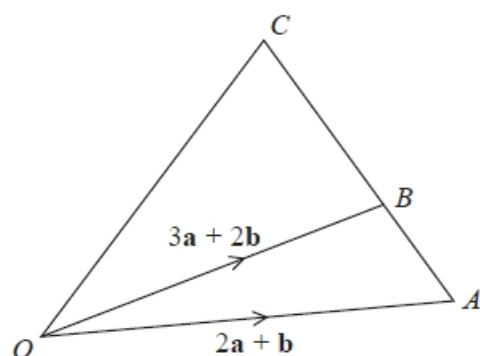


Diagram **NOT**  
accurately drawn

$ABC$  is a straight line.

$AB: BC = 2 : 5$

$$\vec{OA} = 2\mathbf{a} + \mathbf{b}$$

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

Express  $\vec{OC}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

Give your answer in its simplest form.

.....  
**(Total for question = 4 marks)**

**Q13.**

The diagram shows a regular hexagon  $OABCDE$ .

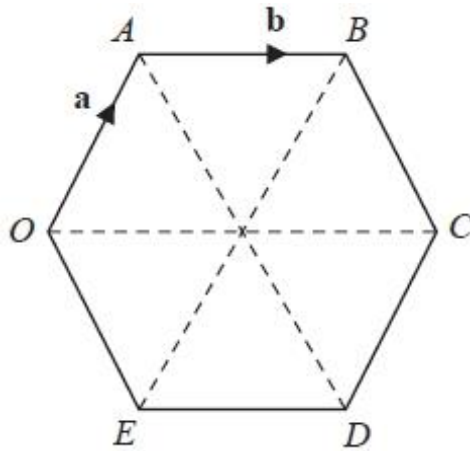


Diagram **NOT** accurately drawn

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

$$\vec{AB} = \mathbf{b}$$

$M$  is the midpoint of  $OE$ .

$N$  is the midpoint of  $AB$ .

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

$$\vec{MN} = \dots\dots\dots$$

(3)

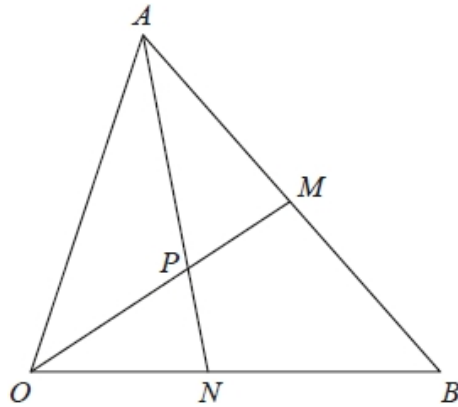
(b) Describe fully what your answer to part (a) shows about the lines  $OA$  and  $MN$ .

.....  
 .....

(2)

**(Total for question = 5 marks)**

**Q14.**



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

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

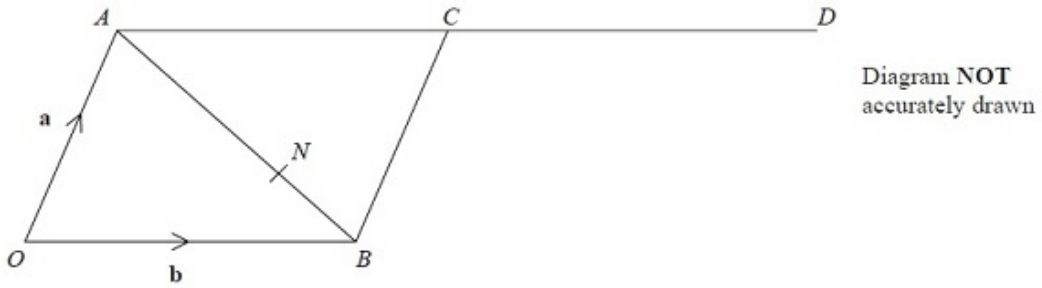
$$OP : PM = 3 : 2$$

Work out the ratio  $ON : NB$

.....  
**(Total for question = 5 marks)**

**Q15.**

$OACB$  is a parallelogram.



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

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

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

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

.....  
(3)

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

(3)

**(Total for Question is 6 marks)**