16.

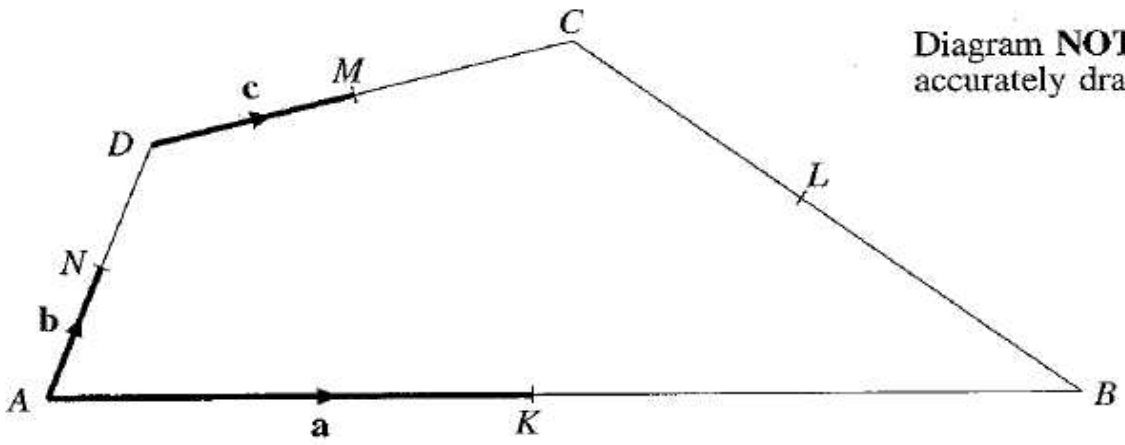

Diagram **NOT** accurately drawn

ABCD is a quadrilateral.

K is the midpoint of *AB*.
L is the midpoint of *BC*.
M is the midpoint of *CD*.
N is the midpoint of *AD*.

$\overrightarrow{AK} = \mathbf{a}$, $\overrightarrow{AN} = \mathbf{b}$ and $\overrightarrow{DM} = \mathbf{c}$.

(a) Find, in terms of **a**, **b** and **c**, the vectors

(i) $\overrightarrow{KN}$,

.....

(ii) $\overrightarrow{AC}$,

.....

(iii) $\overrightarrow{BC}$,

.....

(iv) $\overrightarrow{LM}$.

.....

(4)

(b) Write down two geometrical facts about the lines *KN* and *LM* which could be deduced from your answers to part (a).

.....

(2)

(Total 6 marks)

17.

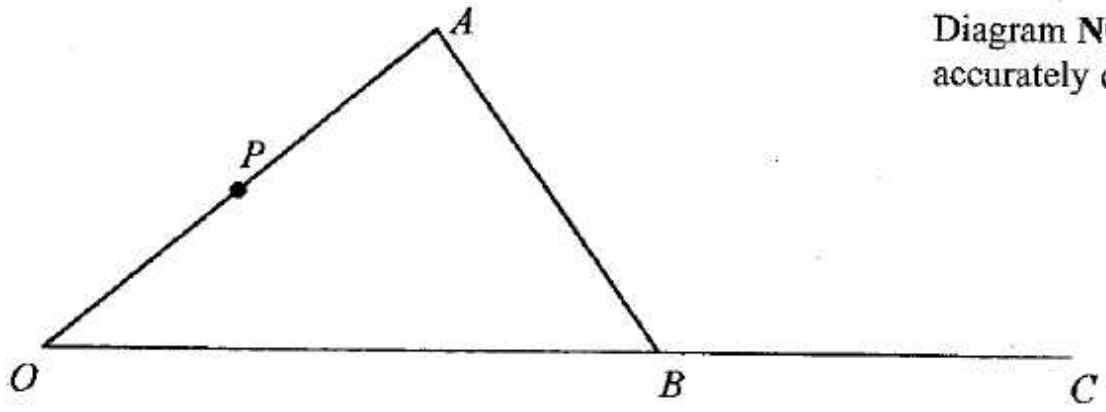

Diagram **NOT** accurately drawn

OAB is a triangle.
P is the mid point of OA.
B is the mid point of OC.

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

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

.....

(2)

(b) Use vectors to show that AC is parallel to PB.

(3)

The length of PB is 8 cm.

(c) Write down the length of AC.

.....cm

(1)

(Total 6 marks)

19.

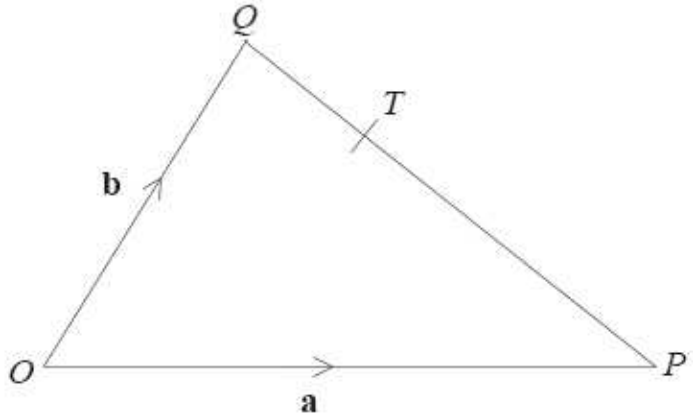

Diagram **NOT** accurately drawn

OPQ is a triangle.
T is the point on PQ for which $PT : TQ = 2 : 1$
$\overrightarrow{OP} = \mathbf{a}$ and $\overrightarrow{OQ} = \mathbf{b}$.

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

$\overrightarrow{PQ} =$ .....

(1)

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

$\overrightarrow{OT} =$ .....

(2)

21.

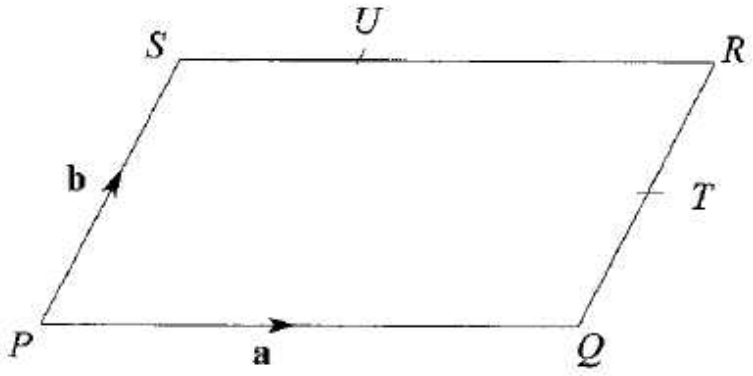

Diagram **NOT** accurately drawn.

$PQRS$ is a parallelogram.

T is the midpoint of QR.

U is the point on SR for which $SU : UR = 1 : 2$

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

Write down, in terms of **a** and **b**, expressions for

(i) $\overrightarrow{PT}$,

$\overrightarrow{PT} =$ .....

(ii) $\overrightarrow{TU}$.

$\overrightarrow{TU} =$ .....

(Total 2 marks)