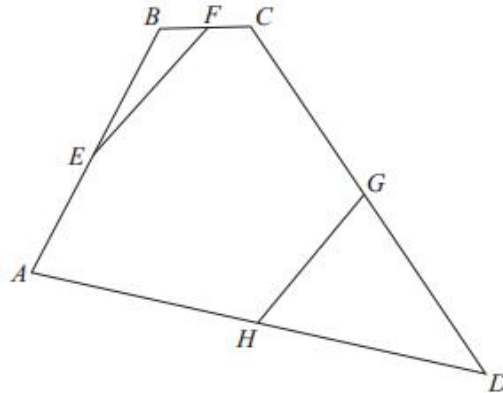


## Question 1

(a)



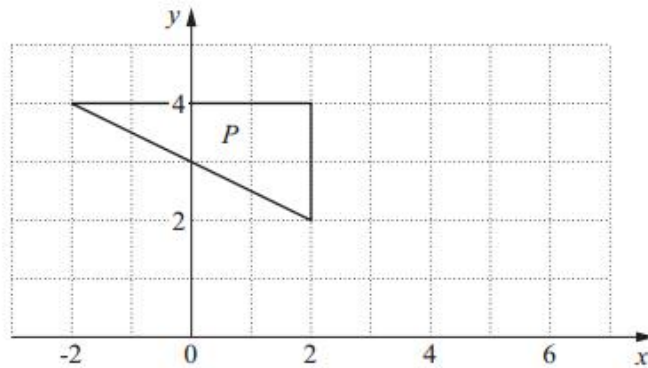
In the diagram,  $ABCD$  is a quadrilateral where  $\vec{AB} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$ ,  $\vec{BC} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$  and  $\vec{CD} = \begin{pmatrix} 8 \\ -12 \end{pmatrix}$ .  
 $E, F, G$  and  $H$  are the midpoints of  $AB, BC, CD$  and  $DA$  respectively.

(i) Find  $\vec{AD}$ . [1]

(ii) Calculate  $|\vec{AD}|$ . [2]

(iii) Show that  $EF$  and  $HG$  are opposite sides of a parallelogram. [2]

(b) The diagram shows triangle  $P$ .



Triangle  $Q$  has vertices  $(-2, 4)$ ,  $(6, 0)$  and  $(6, 4)$ .

Describe **fully** the **single** transformation that maps triangle  $P$  onto triangle  $Q$ . [3]

(c) The transformation represented by the matrix  $\begin{pmatrix} 5 & 2 \\ 0 & 3 \end{pmatrix}$  maps the square  $O(0, 0), U(1, 0), V(1, 1), W(0, 1)$  onto  $OU'V'W'$ .

(i) Find the coordinates of  $U', V'$  and  $W'$ . [2]

(ii) Find the matrix that represents the transformation that maps  $OU'V'W'$  onto  $OUVW$ . [2]

## Question 2

(a)  $\vec{PQ} = \begin{pmatrix} 12 \\ -35 \end{pmatrix}$  and  $\vec{QR} = \begin{pmatrix} 4 \\ 14 \end{pmatrix}$ .

(i) Find

(a)  $|\vec{PQ}|$ ,

(b)  $\vec{PR}$ .

(ii) Given that  $T$  is the midpoint of  $QR$ , find  $\vec{PT}$ .

(iii)  $PQRS$  is a parallelogram.  
The coordinates of  $R$  are  $(6, 16)$ .

Find the coordinates of  $S$ .



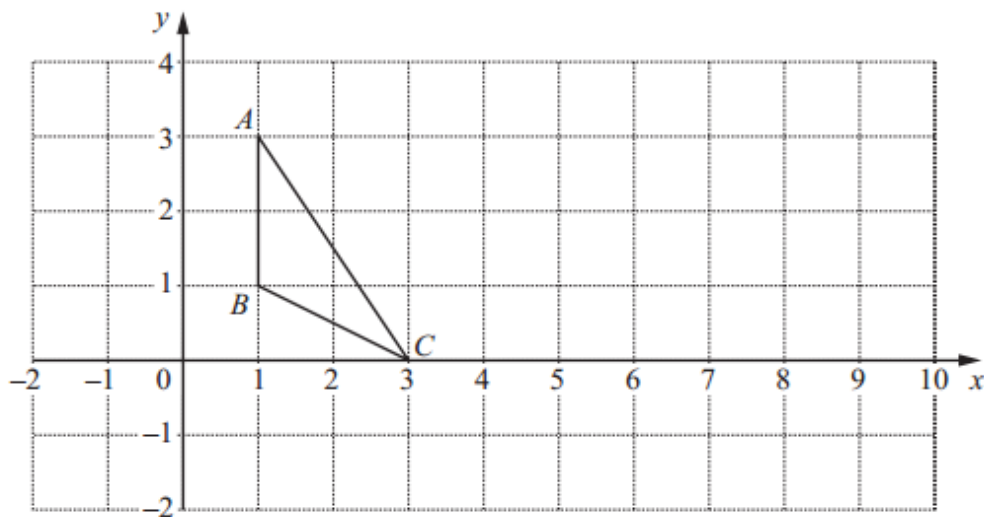
[1]

[1]

[2]

[2]

(b)



The diagram shows triangle  $ABC$ .

(i) Find the area of triangle  $ABC$ .

[1]

(ii) An enlargement, scale factor 4, maps triangle  $ABC$  onto triangle  $LMN$ .  
The point  $A$  maps onto the point  $L(10, 3)$ .

(a) Find the coordinates of the centre of enlargement.

[1]

(b) Write down the area of triangle  $LMN$ .

[1]

(iii) A shear, with the  $x$ -axis invariant, maps triangle  $ABC$  onto triangle  $DEF$ .  
The point  $A$  maps onto the point  $D(7, 3)$ .

(a) Find the coordinates of  $E$ , the image of  $B$ .

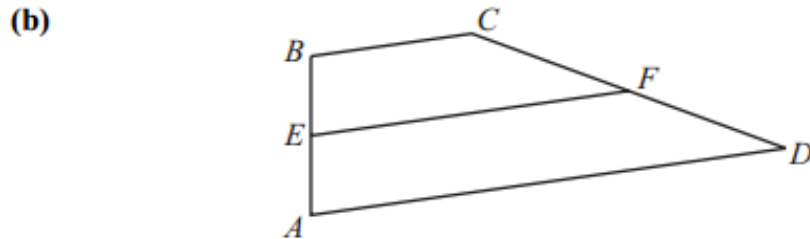
[2]

(b) Write down the area of triangle  $DEF$ .

[1]

### Question3

- (a) Given that  $\vec{PQ} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ ,  $\vec{QR} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$  and  $\vec{RS} = \begin{pmatrix} 1 \\ -5 \end{pmatrix}$ , find  $\vec{PS}$ . [1]



In the diagram,  $\vec{AB} = 2\mathbf{b}$ ,  $\vec{AD} = 3\mathbf{a}$  and  $\vec{DF} = \mathbf{b} - \mathbf{a}$ .  
E is the midpoint of AB and F is the midpoint of DC.

- (i) Express, as simply as possible, in terms of  $\mathbf{a}$  and/or  $\mathbf{b}$ ,
- (a)  $\vec{EA}$ , [1]
  - (b)  $\vec{DC}$ , [1]
  - (c)  $\vec{EF}$ , [1]
  - (d)  $\vec{BC}$ . [1]
- (ii) (a) Give the special name of the quadrilateral ABCD.  
Give your reason. [2]
- (b) Find the ratio  $|\vec{BC}| : |\vec{EF}| : |\vec{AD}|$ . [1]