



IG-Math

0580

Vectors and Transformations

Exercise: Paper-4

SP-20; M-19; M-18; S-19; S-18

W-18.

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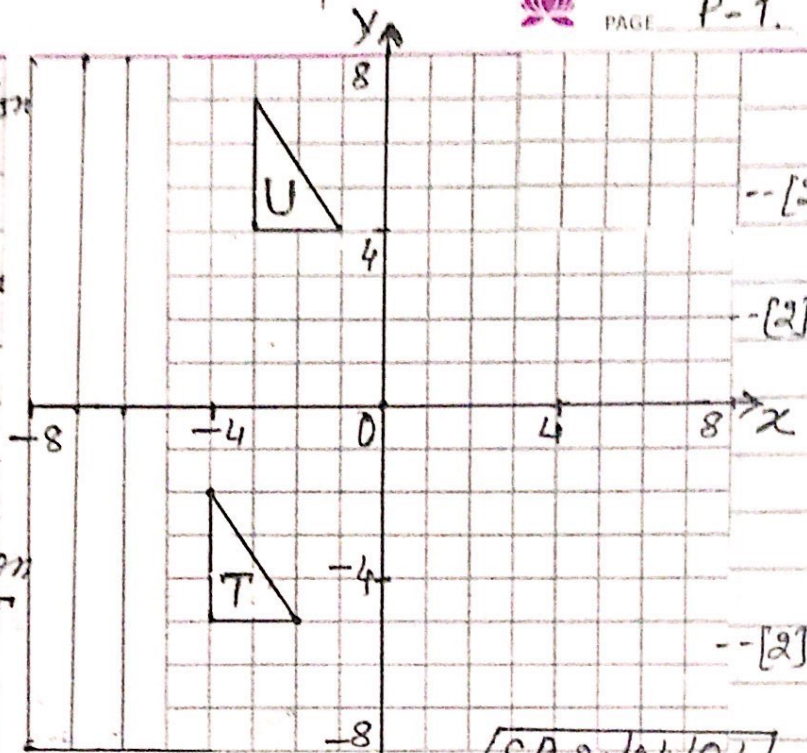
Noide, Delhi - NCR,

INDIA.

1. (a)(i) Draw the reflection of triangle T in the line $x=0$

(ii) Draw the rotation of triangle T about $(-2, -1)$ through 90° clockwise.

(b) Describe fully the single transformation that maps triangle T onto triangle U.



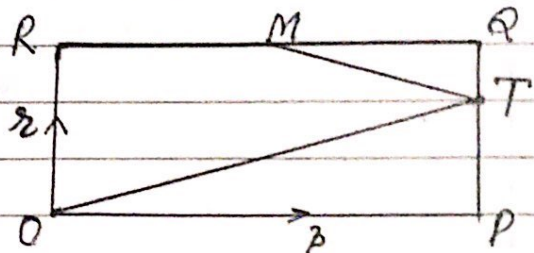
--[2]

--[2]

--[2]

SP-20/04/Q4

2. OPQR is a rectangle and O is the origin. M is the mid point of RQ and $PT:TQ = 2:1$. $\vec{OP} = p$ and $QR = r$.



(a) Find, in terms of p and/or r , in its simplest form,

(i) \vec{MQ}

---[1]

(ii) \vec{MT}

--[1]

(iii) \vec{OT}

--[1]

(b) RQ and OT are extended and meet at U.

Find the position vector of U in terms of p and r .

Give your answer in its simplest form.

---[2]

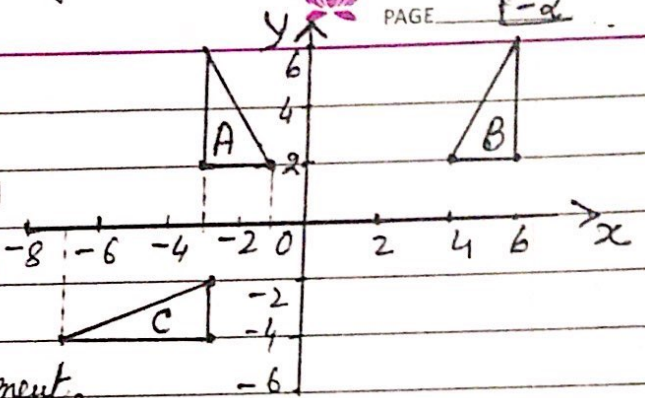
(c) $\vec{MT} = \begin{pmatrix} 2k \\ -k \end{pmatrix}$ and $|\vec{MT}| = \sqrt{180}$

Find the positive value of k .

SP-20/04/Q6

--[3]

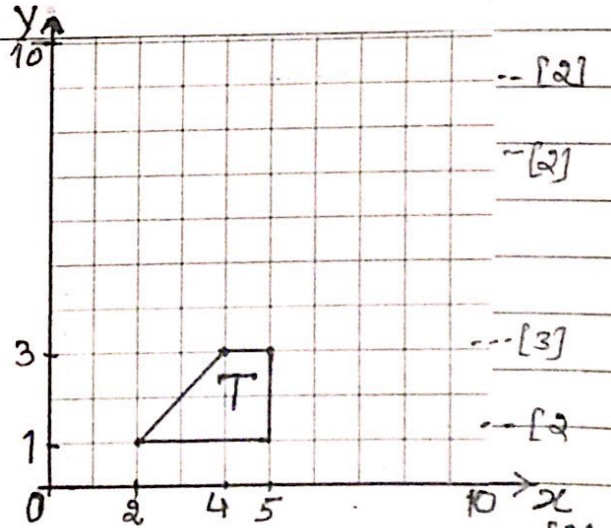
3. (a) Describe fully the single transformation that maps
 (i) triangle A onto triangle B, --- [2]
 (ii) triangle A onto triangle C, --- [3]



- (b) on the grid draw the image of,
 (i) triangle A after an enlargement, scale factor $\frac{1}{2}$, centre (3,0). --- [2]
 (ii) triangle A after a translation by the vector $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$ --- [2]
 (iii) triangle A after the transformation that is represented by the matrix $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ --- [3]

M-19/42/Q2

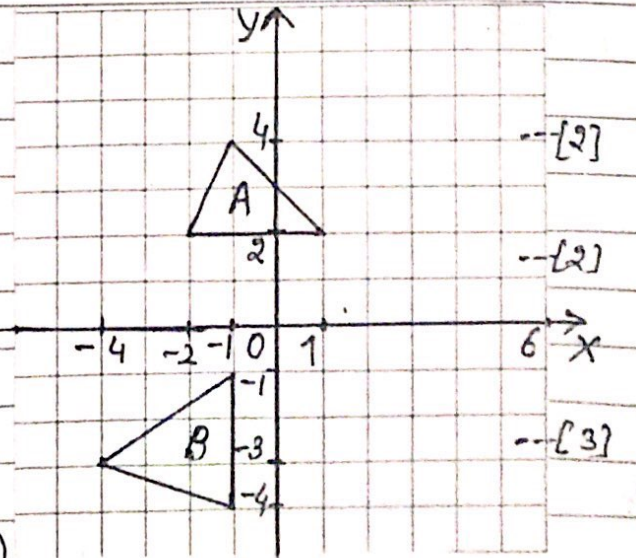
4. (a) (i) Translate shape T by the vector $\begin{pmatrix} -1 \\ 6 \end{pmatrix}$. Label the image A. --- [2]
 (ii) Rotate shape T about the point (5, 3) through 180° . Label the image B. --- [2]
 (iii) Describe fully the single transformation that maps shape A onto shape B. --- [3]



- (b) (i) Reflect shape T in line $y=x$. --- [2]
 (ii) Find the matrix that represents the transformation in part (b)(i). --- [2]

S-19/41/Q1

5. (a) On the grid, draw the image of
 (i) triangle A after a translation by the vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ --- [2]
 (ii) triangle A after a reflection in the line $y=x$. --- [2]



- (b) Describe fully the single transformation that maps triangle A onto triangle B. --- [3]

(Continued →)



(continued →)

5(c) (i) Find the matrix that represents an enlargement, scale factor -2, Centre (0,0). ---[2]

(ii) Calculate the determinant of the matrix in part (c)(i) ---[1]
[S-19/43/Q3]

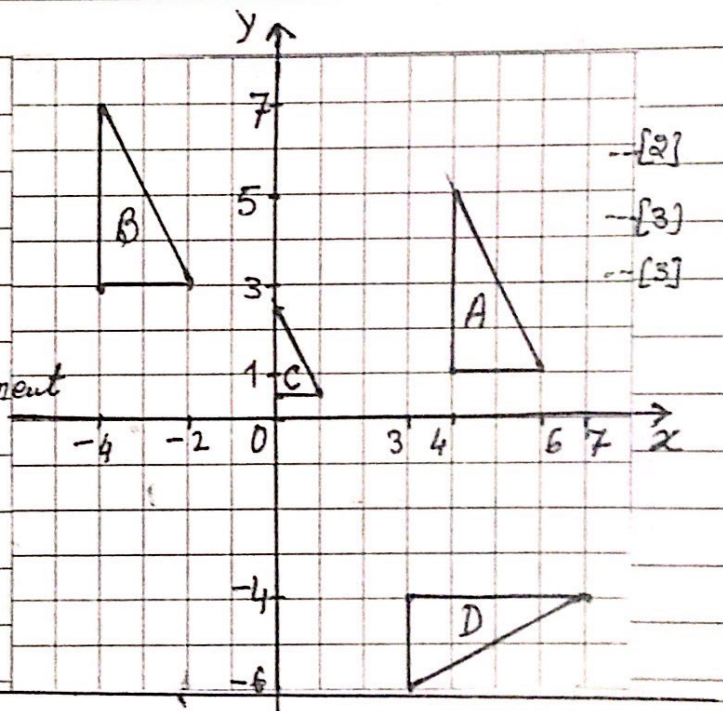
6 (a) Describe fully the single transformation that maps,

(i) triangle A onto triangle B. ---[2]

(ii) triangle A onto triangle C. ---[3]

(iii) triangle A onto triangle D. ---[5]

(b) On the grid, draw the image of triangle A after an enlargement by scale factor 2, Centre (7,3). ---[2]



[S-18/41/Q4]

7 (a) $\vec{OA} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ $\vec{AB} = \begin{pmatrix} 8 \\ -7 \end{pmatrix}$ $\vec{AC} = \begin{pmatrix} -3 \\ 6 \end{pmatrix}$

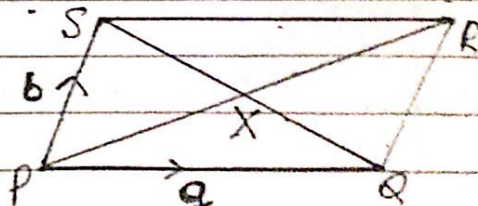
Find (i) $|\vec{OB}|$ ---[3]

(ii) \vec{BC} ---[2]

(b) PQRS is a parallelogram with diagonals PR and SQ intersecting at X, $\vec{PA} = \mathbf{a}$ and $\vec{PS} = \mathbf{b}$

Find \vec{QX} in terms of \mathbf{a} and \mathbf{b} .

Give your answer in its simplest form. [S-18/41/11(a)(b)] ---[2]

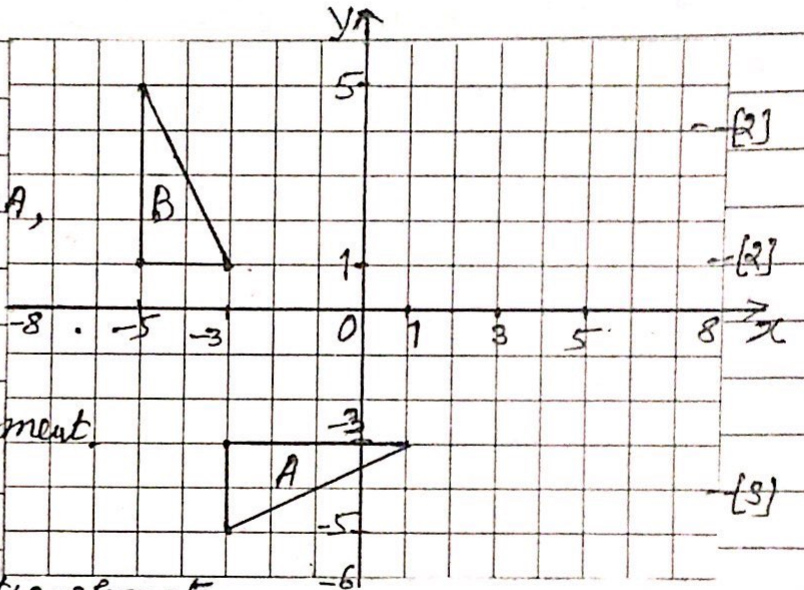




8 (a)(i) Draw the image of triangle A after a reflection in the line $x=2$. [2]

(ii) Draw the image of triangle A, after a translation by the vector $\begin{pmatrix} -2 \\ 4 \end{pmatrix}$. [2]

(iii) Draw the image of triangle A, after an enlargement by scale factor $-\frac{1}{2}$, centre $(3, 1)$. [3]



(b) Describe fully the single transformation that maps triangle A onto triangle B. [3]

(c) Describe fully the single transformation represented by the matrix $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$. [2]

[S-18/42/Q3]

9 (a) Describe fully the single transformation T that maps:

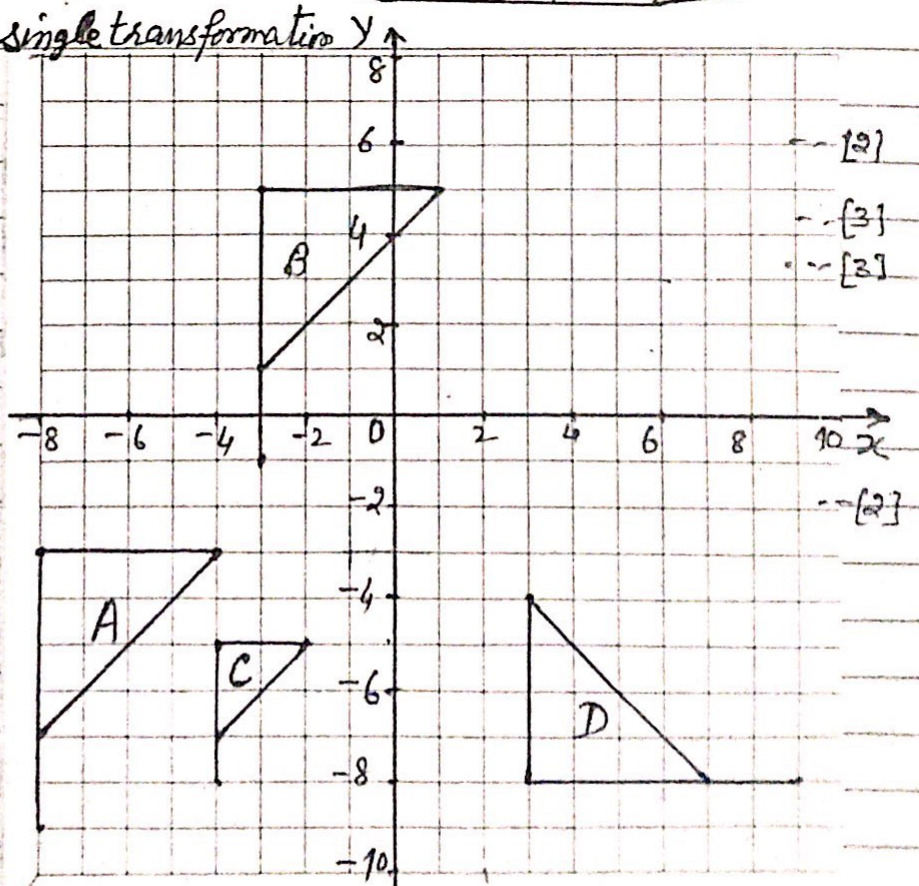
(i) flag A onto flag B. [2]

(ii) flag A onto flag C. [3]

(iii) flag A onto flag D. [3]

(b)

Draw the reflection of flag A in the line $y = -1$. [2]



[W-18/41/Q2]

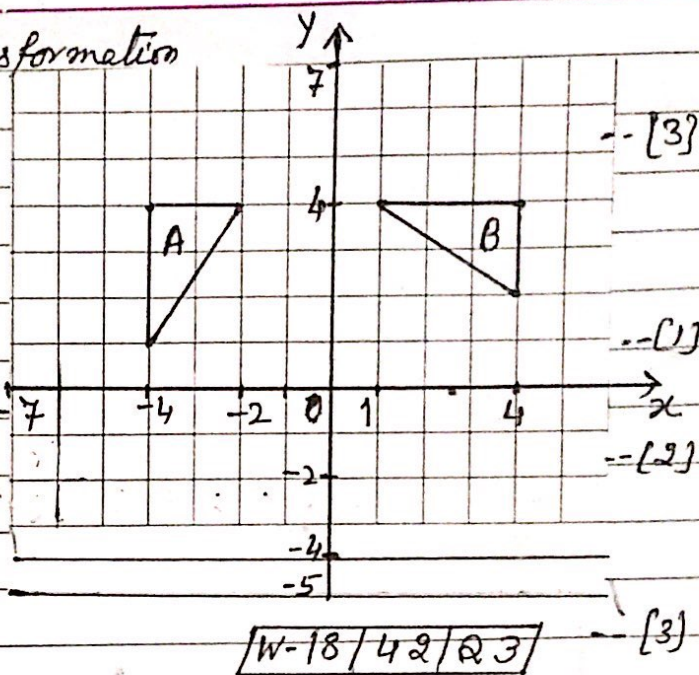
10 (a) describe fully the single transformation that maps triangle A onto triangle B.

(b) On the grid, draw the image of

(i) triangle A after a reflection in the x-axis.

(ii) triangle A after a translation by the vector $\begin{pmatrix} 7 \\ -5 \end{pmatrix}$.

(iii) triangle A after the transformation represented by the matrix $\begin{pmatrix} 0.5 & 0 \\ 0 & 0.5 \end{pmatrix}$



11(a) $a = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$ $b = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$ $c = \begin{pmatrix} 14 \\ 9 \end{pmatrix}$

(i) Find $3a - 2b$ -- [2]

(ii) Find $|a|$ -- [2]

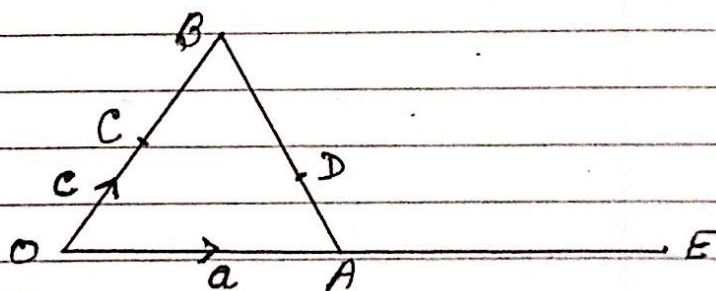
(iii) $ma + nb = c$

Write down two simultaneous equations and solve them to find the value of m and the value of n. Show all your working. -- [5]

(b) OAB is a triangle and C is the mid-point of OB.

D is a point on AB, such that $AD:DB = 3:5$

OAE is a straight line such that $OA:AE = 2:3$



(i) Find in terms of a and c, in its simplest form,

(a) \vec{AB} -- [1]

(b) \vec{AD} -- [1]

(c) \vec{CE} -- [1]

(d) \vec{CD} -- [2]

(ii) $\vec{CE} = k\vec{CD}$, find the value of k. -- [1]

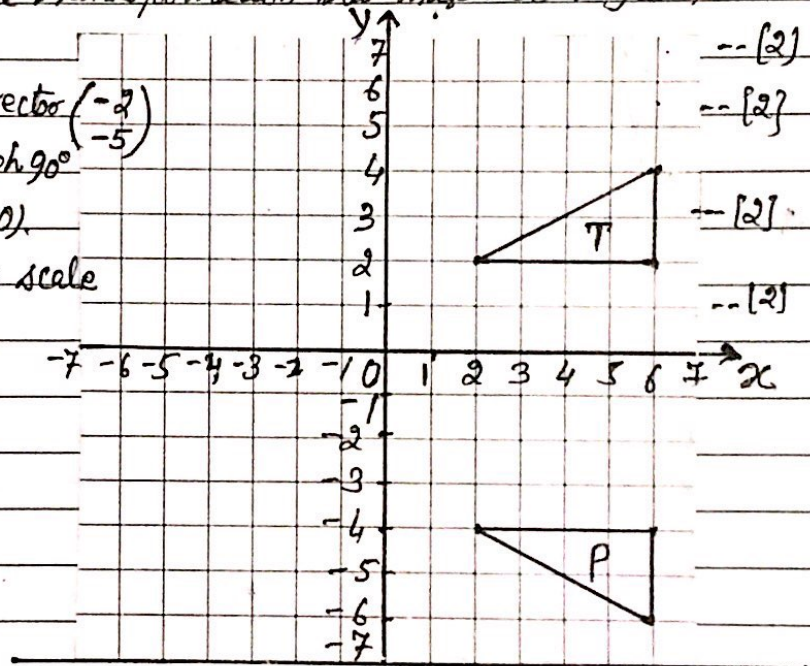
W-18/42/Q11

12(a) (i) Describe fully the single transformation that maps triangle T on triangle P. -- [2]

(ii) Translate triangle T by the vector $\begin{pmatrix} -2 \\ -5 \end{pmatrix}$ -- [2]

(iii) Rotate triangle T through 90° anticlockwise about $(0,0)$. -- [2]

(iv) Enlarge triangle T by scale factor $-\frac{1}{2}$ with centre $(0,0)$. -- [2]



(b)

(i) Find the column vector \vec{AB} $\times B(5,6)$ -- [1]

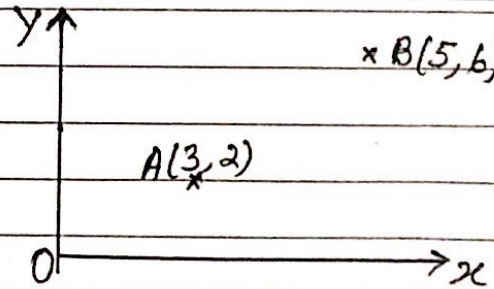
(ii) Find $|\vec{AB}|$ -- [2]

(iii) B is the mid point of AC, Find the coordinates of C. -- [2]

(iv) Find the equation of the

straight line that passes through A and B. -- [3]

(v) The straight line that passes through A and B cuts y-axis at D. Write down the co-ordinates of D. -- [1]



W-18/43/Q1



Answers

1(a) (i) correct image (2, -5), (4, -5), (4, -2).
(ii) correct image (-3, 1), (-6, 1), (-6, -1).
(b) Translation by $\begin{pmatrix} 1 \\ 9 \end{pmatrix}$

2(a) (i) $\frac{1}{2}b$ (ii) $\frac{1}{2}b - \frac{1}{3}a$
(iii) $b + \frac{2}{3}a$
(b) $a + \frac{3}{2}b$
(c) 6

3(a) (i) Reflection $x = 1.5$
(ii) Rotation (0, -1), 90° anticlockwise.

(b) (i) image at (5, -1), (6, -1), (6, -3).
(ii) image at (-6, 3), (-4, 3), (-6, 7)
(iii) image at (2, -1), (2, -3), (6, -3).

4(a) (i) image at (1, 7), (4, 7), (4, 9), (3, 9)
(ii) image at (5, 3), (6, 3), (8, 5), (5, 5)
(iii) rotation 180° , (4.5, 6) or Enlargement (factor) -1, (4.5, 6)
(b) (i) image at (1, 2), (1, 5), (3, 5), (3, 4)
(ii) $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$

5(a) (i) Image at (-5, 4), (-2, 4), (-4, 6)
(ii) Image at (2, 1), (4, -1), (2, -2).
(b) rotation, 90° anticlockwise (1, -1).
(c) (i) $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$
(ii) strict FT their c(i)

6(a) (i) Translation $\begin{pmatrix} -8 \\ 2 \end{pmatrix}$
(ii) Enlargement, sf $\frac{1}{2}$, (-4, 0)
(iii) Rotation 90° clockwise, (1, -1).
(b) Triangle with (1, -1), (5, -1), (1, 7).

7(a) (i) 12.6 (ii) $\begin{pmatrix} -11 \\ 13 \end{pmatrix}$
(b) $\frac{1}{2}(b-a)$

8(a) (i) Image at (3, -3), (7, -3), (7, -5)
(ii) Image at (-5, 1), (-1, 1), (-5, -1)
(iii) Image at (6, 3), (6, 4), (4, 3)
(b) Rotation 90° anticlockwise, (-6, -2).
(c) Reflection $y = -x$

9(a) (i) Translation $\begin{pmatrix} 5 \\ 8 \end{pmatrix}$
(ii) Enlargement, sf 0.5, centre (0, -7)
(iii) Rotation 90° anticlockwise, origin.

(b) Image at (-8, 1), (-8, 5), (-4, 1)

10(a) Rotation 90° clockwise, origin
(b) (i) Image at (-4, -1), (-4, -4), (-2, -4)
(ii) Image at (3, -1), (5, -1), (3, -4).
(iii) Image at $(-2, \frac{1}{2})$, $(-2, 2)$, $(-1, 2)$

11(a) (i) $\begin{pmatrix} -19 \\ -2 \end{pmatrix}$ (ii) 3.6 (iii) $-3m + 5n = 14$
 $2m + 4n = 9$
 $\rightarrow m = -\frac{1}{2}, n = 2\frac{1}{2}$
(b) (i) (a) $-a + 2c$ (b) $\frac{2}{3}(-a + 2c)$
(c) $\frac{1}{2}(5a - 2c)$ (d) $\frac{1}{8}(5a - 2c)$
(ii) 4

12(a) (i) Reflection $y = -1$,
(ii) Triangle at (0, -3), (4, -1), (4, -3)
(iii) Triangle at (-2, 2), (-2, 6), (-4, 6)
(iv) Triangle at (-3, -1), (-3, -2), (-1, -1)
(b) (i) $\begin{pmatrix} 2 \\ 4 \end{pmatrix}$ (ii) 4.47 (iii) (7, 10)
(iv) $y = 2x - 4$
(v) (0, -4)

