Practice Book *UNIT 7 Transformations* Answers

7.1 Shapes

1. (a) Rectangle or square (b) Trapezium (c) Square, rhombus or kite

2. (a) C and H (b) B, C, H and I

3.

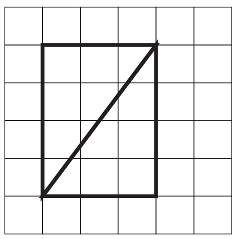
Length (cm)	*Width* (cm)	*Area* (cm^2)
1	19	19
2	18	36
3	17	51
4	16	64
5	15	75
6	14	84
7	13	91
8	12	96
9	11	99
10	10	100

Length (cm)	*Width* (cm)	*Area* (cm^2)
9	11	99
9.1	10.9	99.19
9.2	10.8	99.36
9.3	10.7	99.51
9.4	10.6	99.64
9.5	10.5	99.75
9.6	10.4	99.84
9.7	10.3	99.91
9.8	10.2	99.96
9.9	10.1	99.99
10	10	100

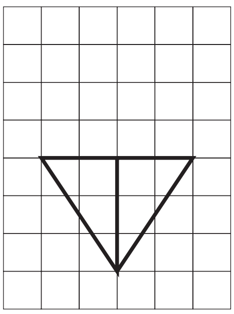
The first table gives the integer possibilities, but pupils should be encourged to justify the correct maximum area by looking at rectangles close in size to a square of side 10 cm, as in the second table.

The shape that gives the maximum area is a square of side 10 cm.

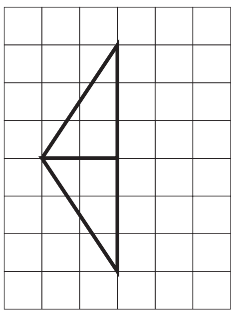
4. (a)



(b)

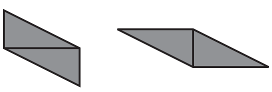


(c)

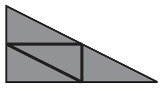


N.B. The answers for parts (b) and (c) are interchangeable.

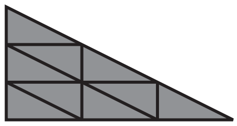
5. (a) and (b) In either order



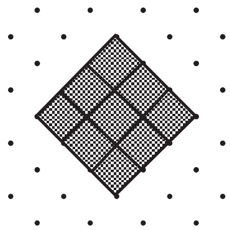
(c)



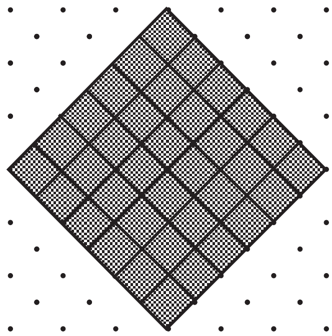
(d) Any suitable combination of 9, 16, 25, 36, ... triangles to make a larger triangle, e.g.



7.1 Answers

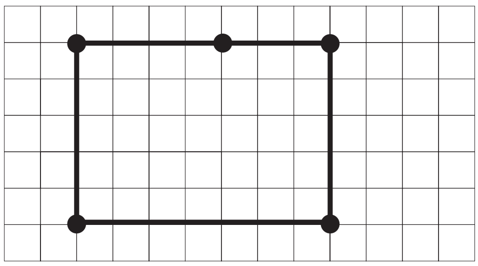
6. (a) 

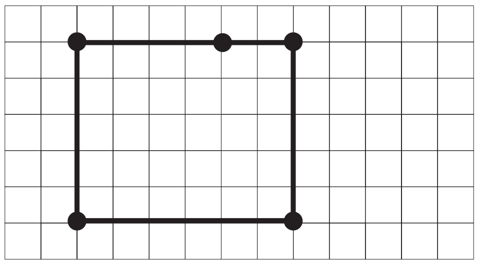
(b) A suitable combination of 16, 25, 36, ... square tiles. In the case illustrated, there are 36 tiles:



(c) Any three square numbers from the list 16, 25, 36, 49, 64, 81, 100, ... excluding the number of tiles given as the answer to part (b).

7. (a) There are two possible combinations using the rods 5, 5, 7 and 4 + 3 or 5, 5, 6, and 4 + 2.





(c) The possible solution are given in the following table:

Rods Used				*Rectangle Size*
5	5	8 + 3	7 + 4	5×11
5	5	8 + 2	7 + 3	5×10
5	5	8 + 2	6 + 4	5×10
5	5	7 + 3	6 + 4	5×10
5	5	7 + 2	6 + 3	5×9
8	6 + 2	7	4 + 3	8×7
8	5 + 3	7	5 + 2	8×7
8	5 + 3	6	4 + 2	8×6

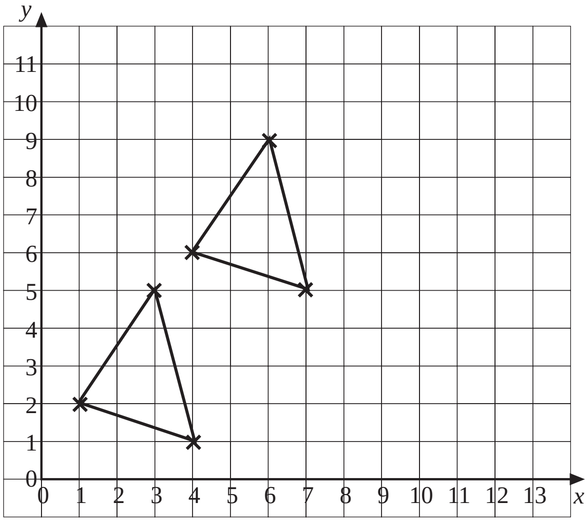
(d) The total length of all the rods is 40 cm so the square must have sides of length 10 cm. There is only one combination here:

5 + 5, 6 + 4, 7 + 3 and 8 + 2

7.2 **Answers**

7.2 Translations

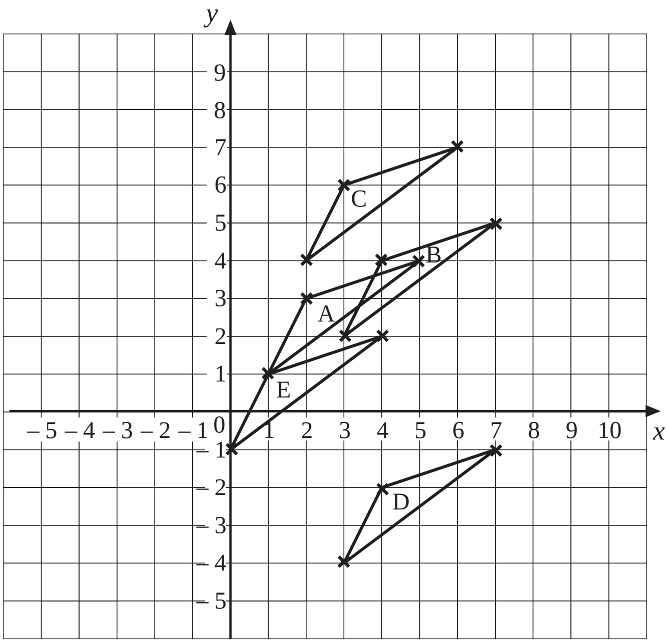
1. (a) and (b)



(c) (7, 5), (6, 9), (4, 6)

2. (a) $\begin{pmatrix} 0 \\ 6 \end{pmatrix}$ (b) $\begin{pmatrix} 11 \\ 0 \end{pmatrix}$ (c) $\begin{pmatrix} 6 \\ 7 \end{pmatrix}$ (d) $\begin{pmatrix} 9 \\ 4 \end{pmatrix}$ (e) $\begin{pmatrix} 6 \\ 1 \end{pmatrix}$

3. (a) and (b)



4. A to B $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ A to C $\begin{pmatrix} 5 \\ -11 \end{pmatrix}$ A to D $\begin{pmatrix} -3 \\ -9 \end{pmatrix}$

A to E $\begin{pmatrix} -15 \\ -7 \end{pmatrix}$ A to F $\begin{pmatrix} -11 \\ -3 \end{pmatrix}$ A to G $\begin{pmatrix} -12 \\ 4 \end{pmatrix}$

5. (a) $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$ (b) (11, 4)

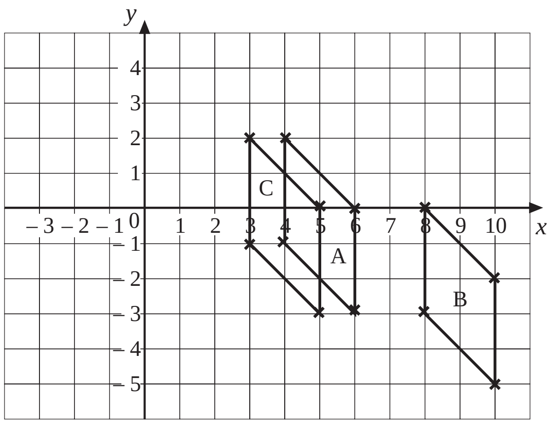
7.2 Answers

6. (a) $\begin{pmatrix} 6 \\ 3 \end{pmatrix}$ (b) $\begin{pmatrix} 6 \\ -4 \end{pmatrix}$ (c) $\begin{pmatrix} 12 \\ -1 \end{pmatrix}$

The relationship is $\begin{pmatrix} 6 \\ 3 \end{pmatrix} + \begin{pmatrix} 6 \\ -4 \end{pmatrix} = \begin{pmatrix} 12 \\ -1 \end{pmatrix}$, i.e. for the top numbers (the x movement), $6 + 6 = 12$

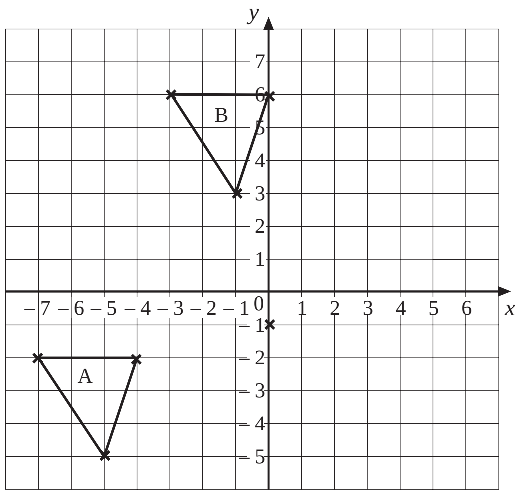
and for the bottom numbers (the y movement), $3 + (-4) = -1$.

7. (a) Parallelogram (b)



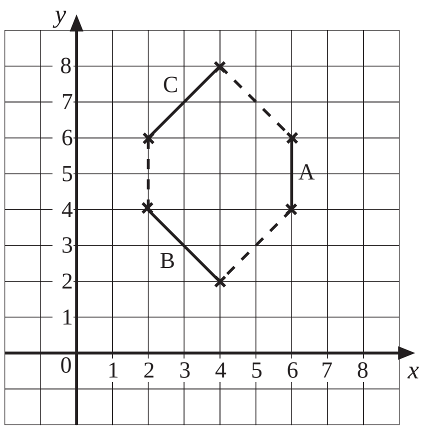
(c) Translation by the vector $\begin{pmatrix} -1 \\ 0 \end{pmatrix}$

8. (a)
(b)



(c) $\begin{pmatrix} -4 \\ -8 \end{pmatrix}$

9. (a)



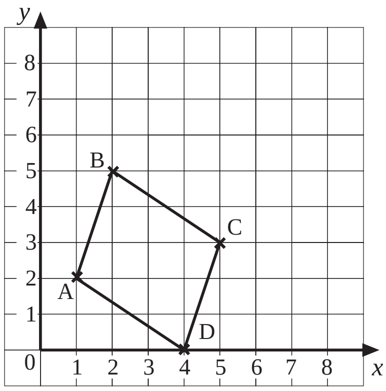
(b) A $\rightarrow \begin{pmatrix} -4 \\ 0 \end{pmatrix}$

B $\rightarrow \begin{pmatrix} 2 \\ 4 \end{pmatrix}$

C $\rightarrow \begin{pmatrix} 2 \\ -4 \end{pmatrix}$

7.2 Answers

10. (a)



(b) A B to D C $\begin{pmatrix} 3 \\ -2 \end{pmatrix}$

A D to B C $\begin{pmatrix} 1 \\ 3 \end{pmatrix}$

7.3 Enlargements

1. (a) 2 (b) 2 (c) 6

   (d) 4 (e) $1\frac{1}{2}$ (f) $\frac{1}{2}$

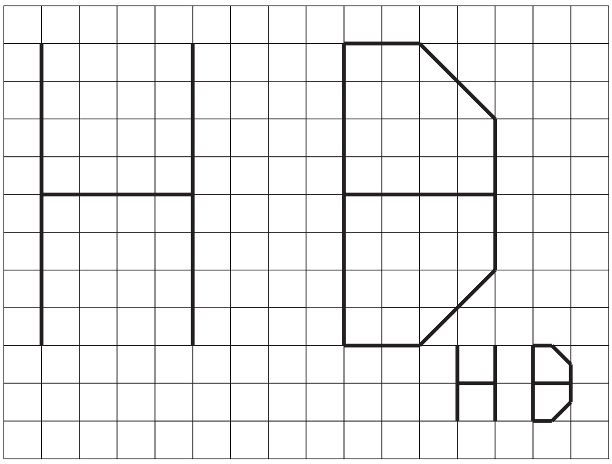
2. (a) An accurately drawn 2 cm × 4 cm rectangle.

   (b) Accurately drawn 4 cm × 8 cm, 6 cm × 12 cm, 8 cm × 16 cm and 1 cm ×2 cm rectangles.

3. (a) An accurately drawn triangle with sides 3 cm, 4 cm and 5.5 cm.

   (b) Accurately drawn triangles with sides 6 cm, 8 cm and 11 cm and 9 cm, 12 cm and 16.5 cm.

4.



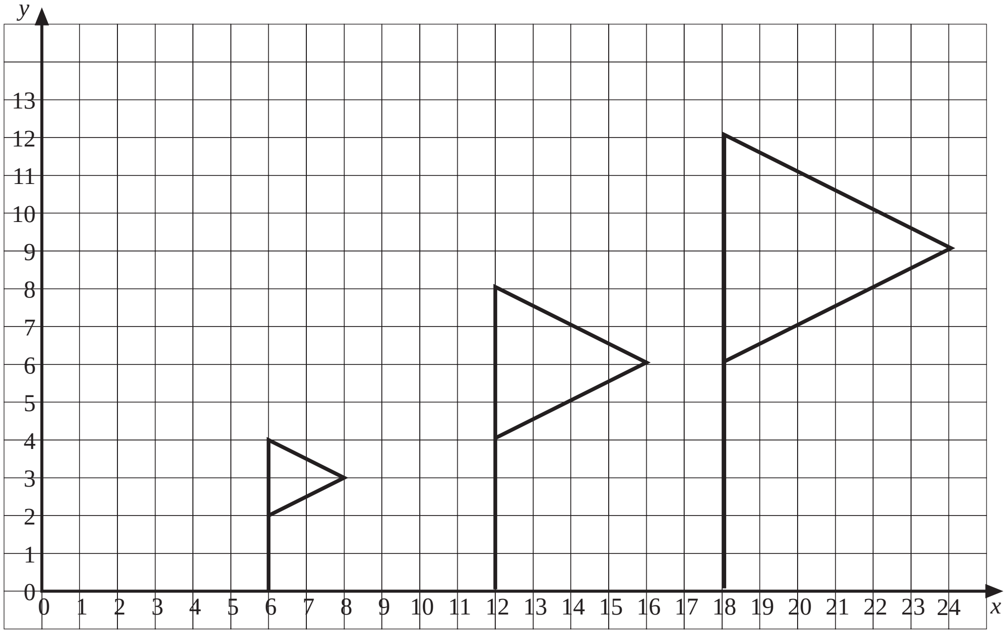
Scale factor 2

Scale factor $\frac{1}{2}$

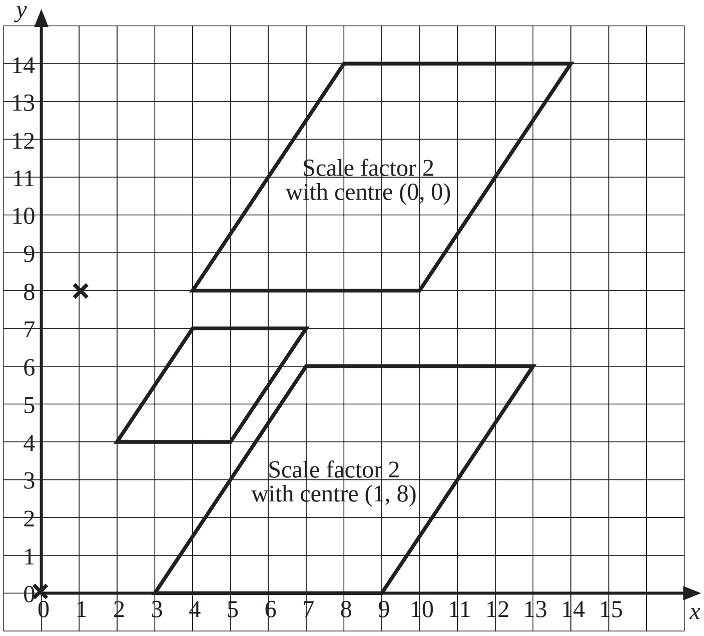
7.3 Answers

5. (a)

(b)

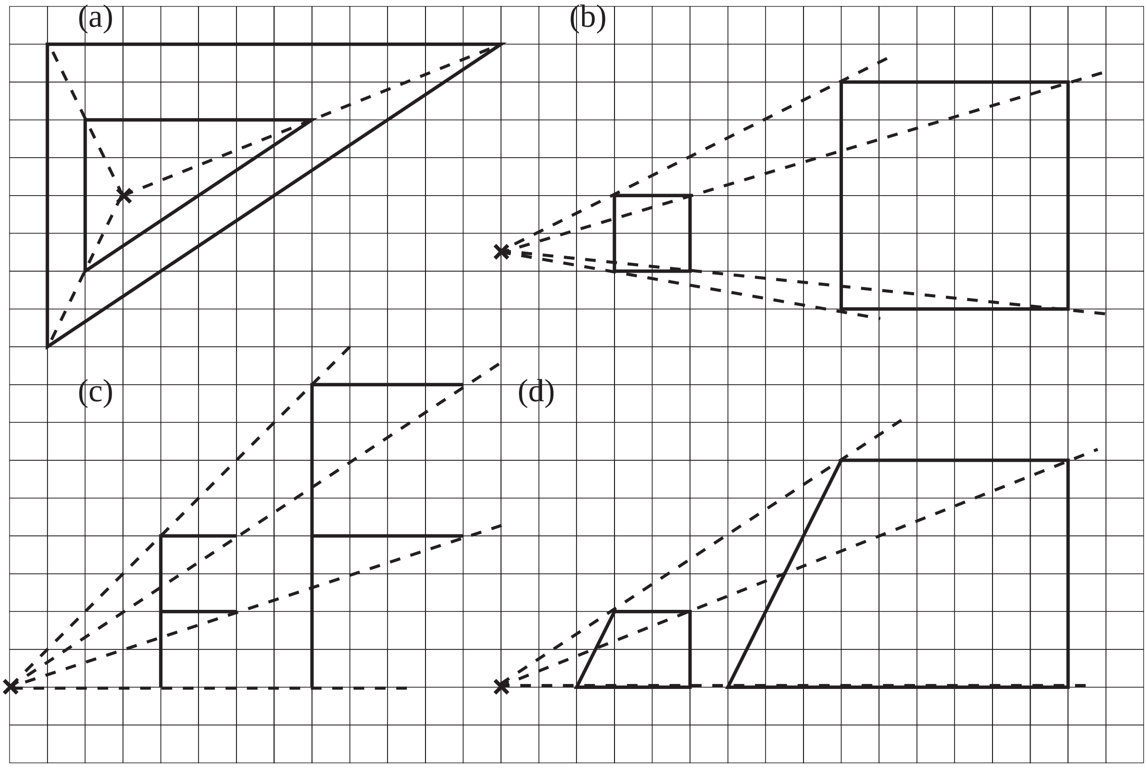


6.

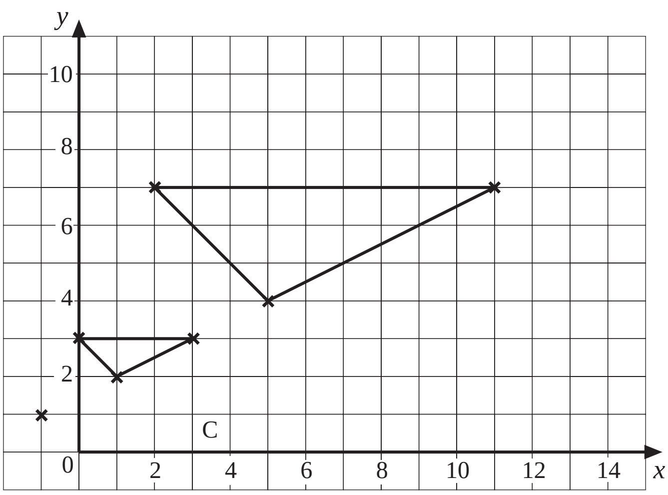


7.3 Answers

7.



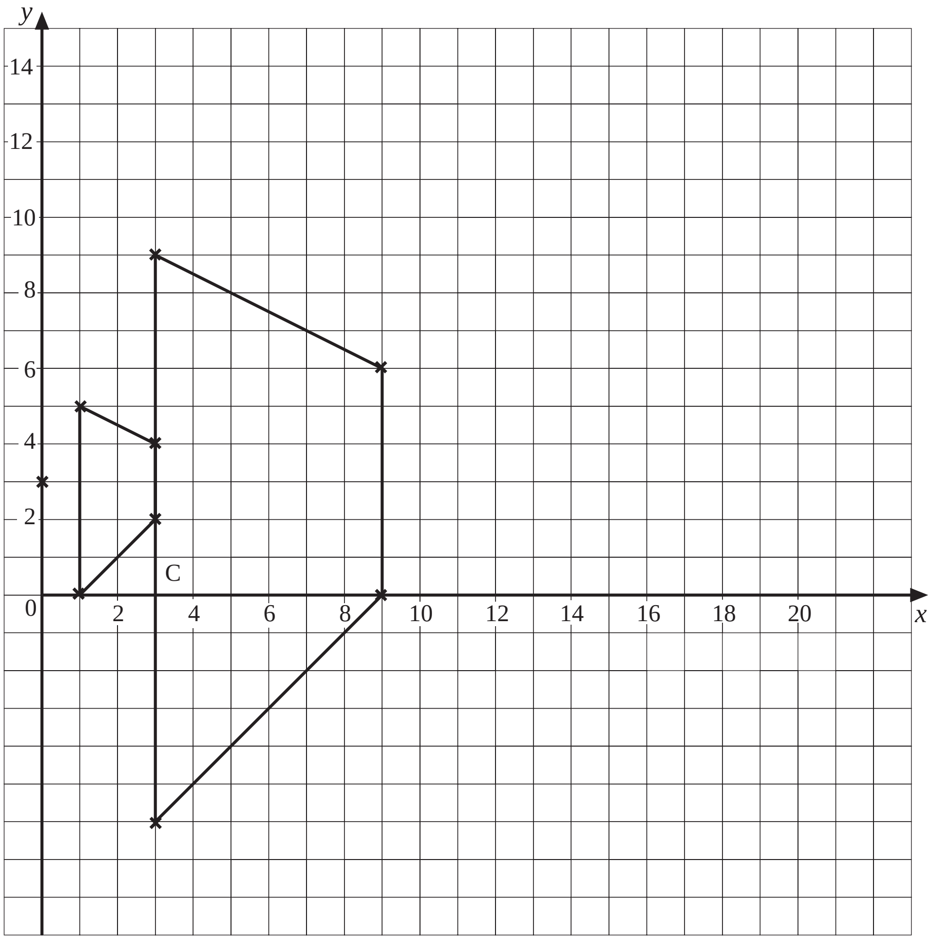
8.



Scale factor = 3.
Centre of enlargement is at (– 1, 1).

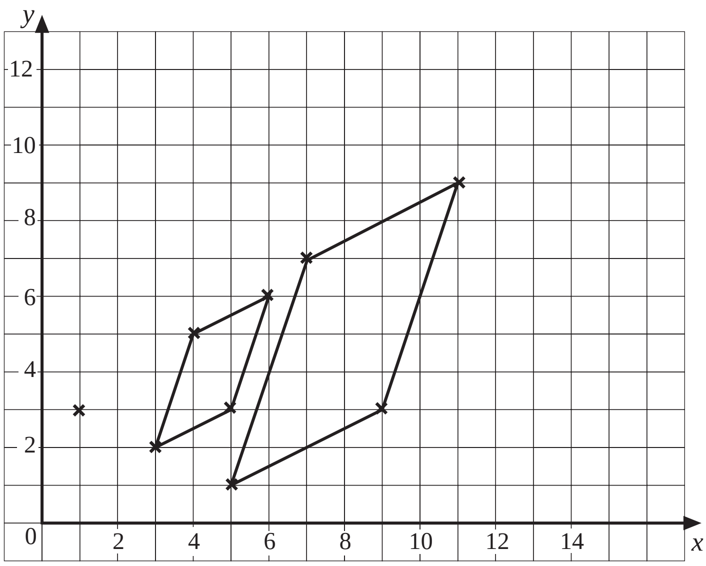
7.3 Answers

9.



Corners of enlarged trapezium are at (3, – 6), (3, 9), (9, 6) and (9, 0).

10.



11. (a) The scale factor for heights must be at most $24 \div 6.5 = 3.692$ (to 3 d.p.);

the scale factor for widths must be at most $12 \div 4 = 3$,

so the maximum scale factor Jill can use is 3.

7.3 Answers

(b) The scale factor for heights must be at most $2.7 \div 6.5 = 0.415$ (to 3 d.p.);

the scale factor for widths must be at most $2.7 \div 4 = 0.675$,

so the maximum scale factor Jill can use is 0.415 (to 3 d.p.).

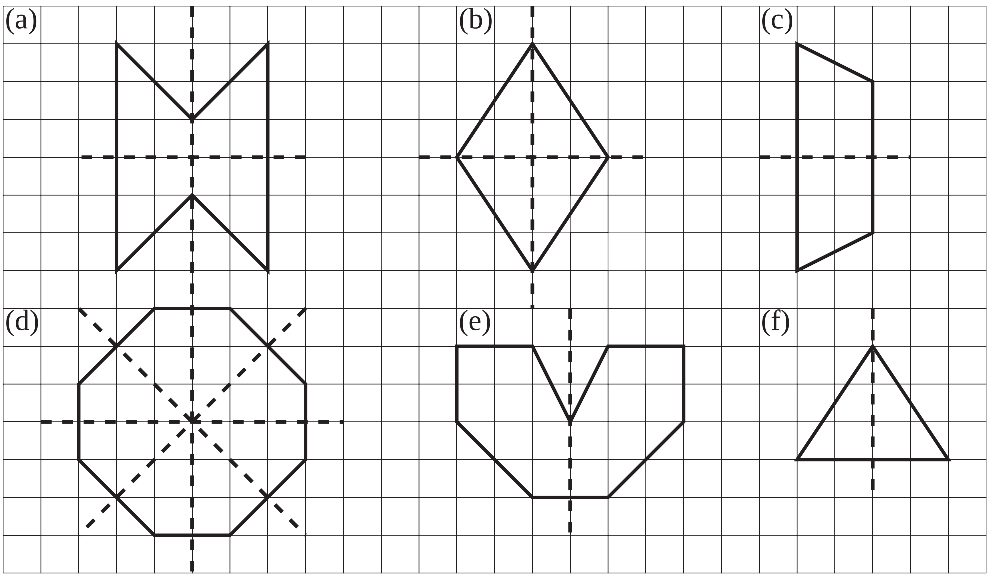
(c) The perimeter $= (\pi \times 6.6) + (2 \times 6.6)$

$= 33.93451151$ cm

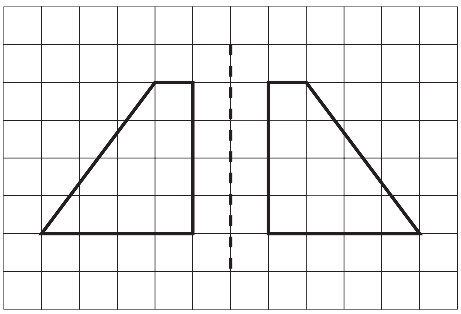
$= 33.93$ cm (to 2 d.p.)

7.4 Reflections

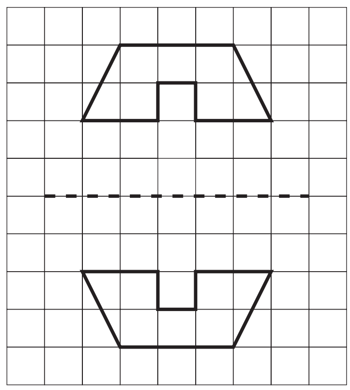
1.



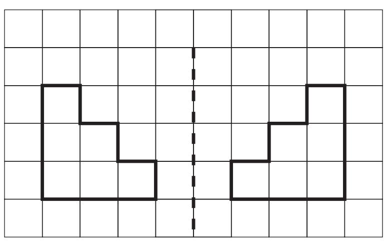
2. (a)



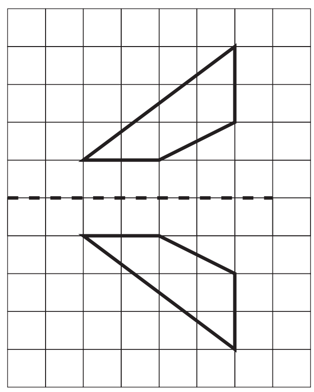
(b)



(c)

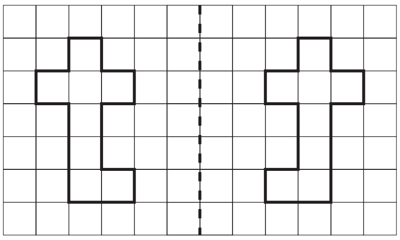


(d)

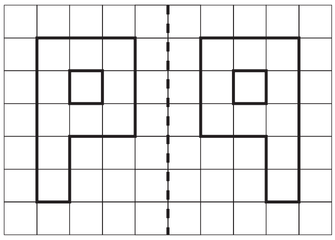


7.4 Answers

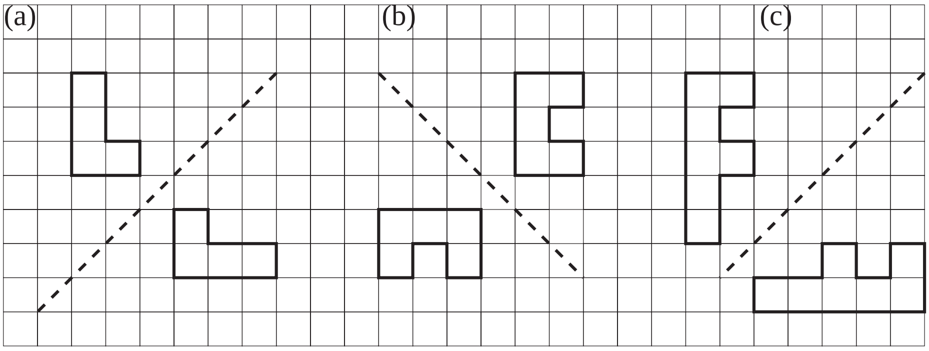
(e)



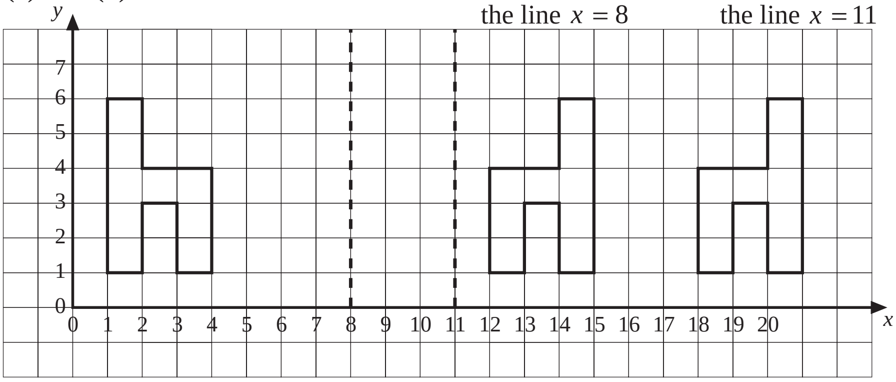
(f)



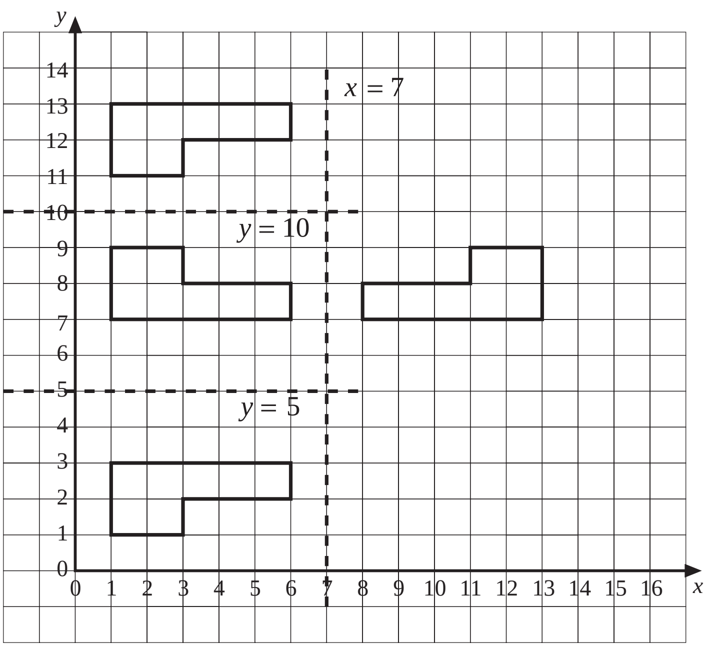
3\. (a) (b) (c)



4\. (a) and (b)

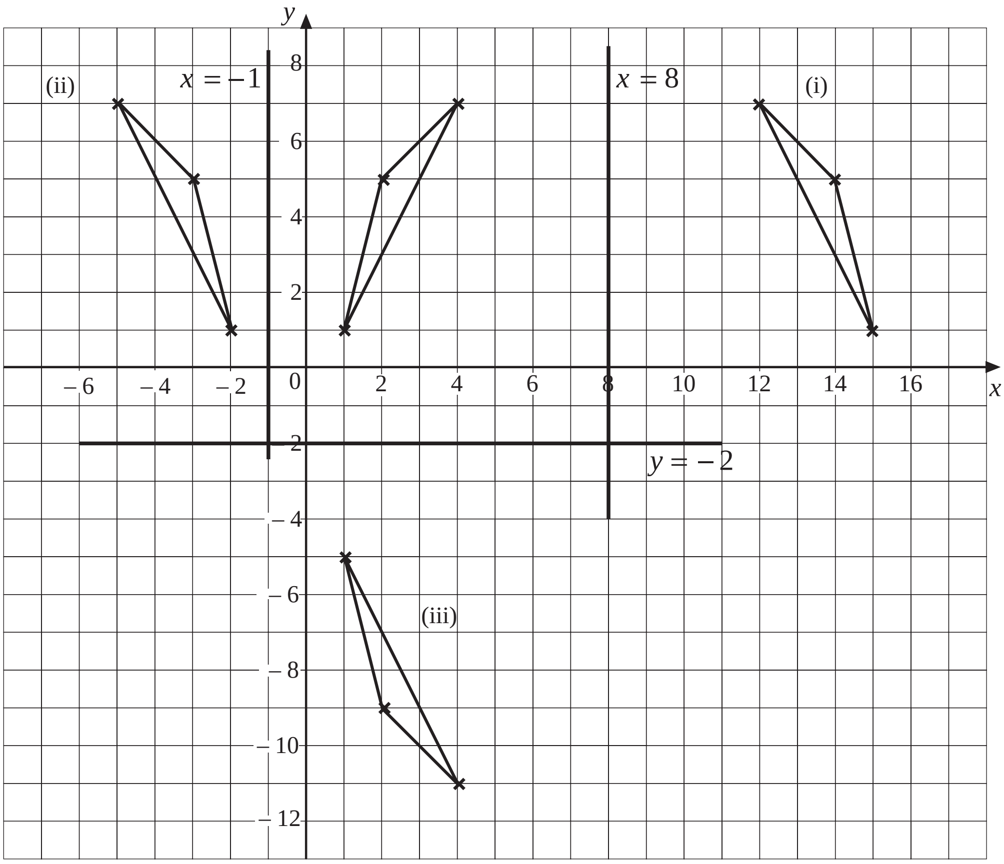


5\.



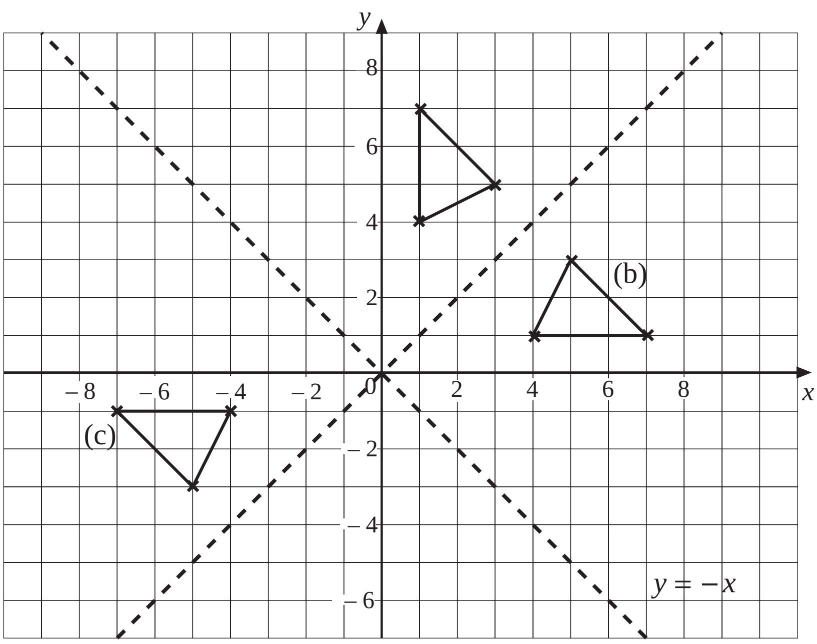
7.4 Answers

6. (a) and (b)



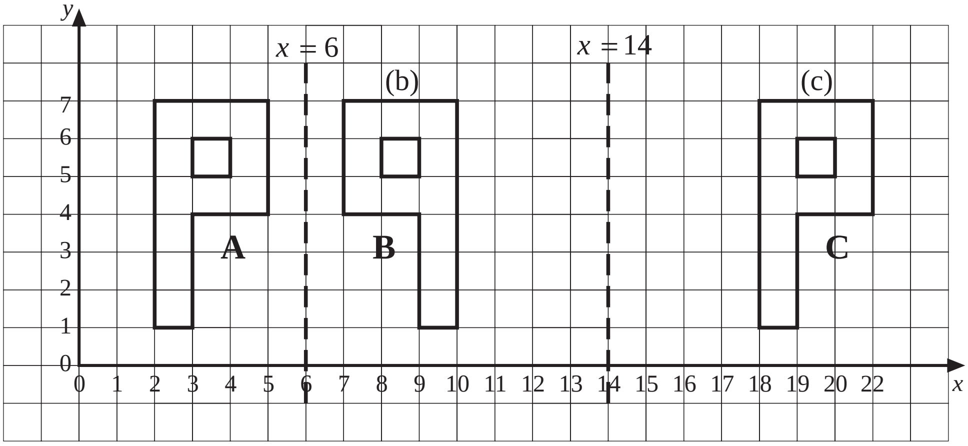
7. (a) $x = 5$ (b) $x = 9$ (c) $x = 10$
   (d) $x = 16$ (e) $x = 21$ (f) $x = 14$

8. (a)



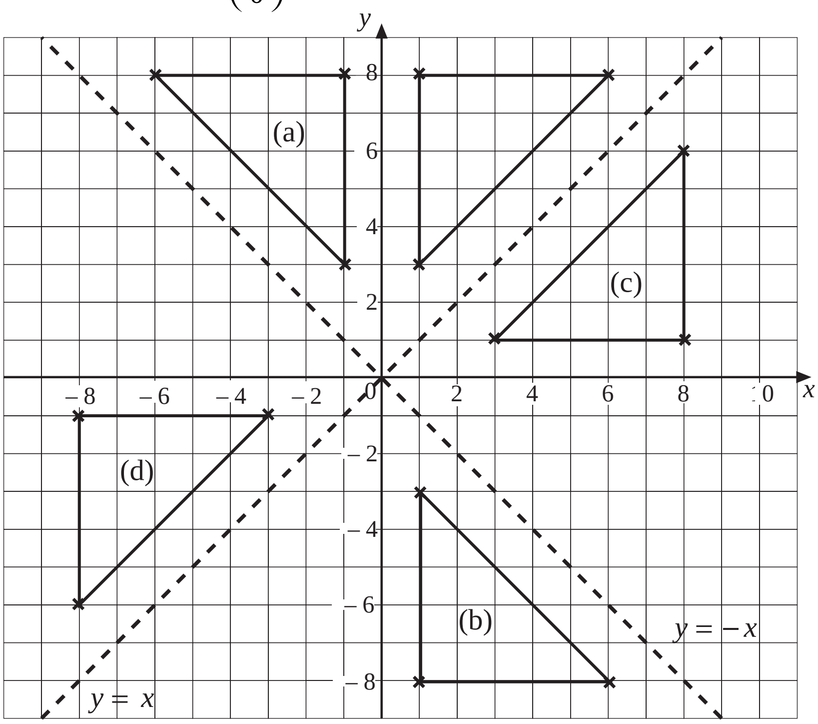
7.4 Answers

9. (a)

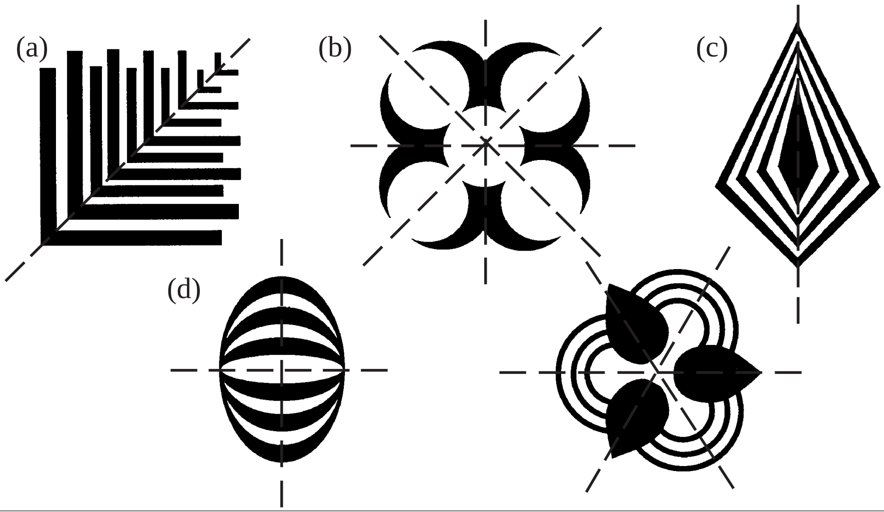


(d) Translation $\begin{pmatrix} 16 \\ 0 \end{pmatrix}$

10.

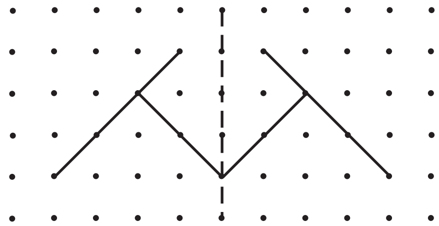


11. (a) (b) (c) (d)

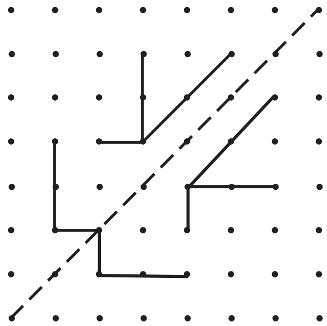


7.4 Answers

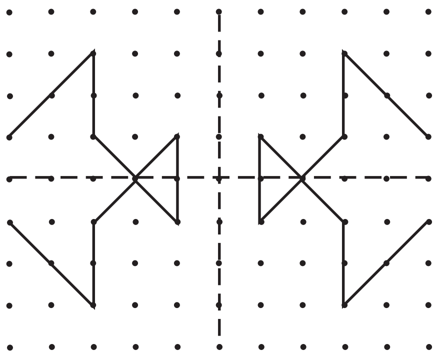
12. (a)



(b)



(c)



13. (a) $x = y$ (b) $14\frac{1}{2}$

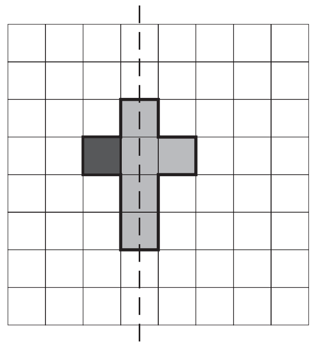
(c) (10, 12) is above the line because its y-coordinate is greater than its x-coordinate.

(d) Any x-coordinate less than 15, e.g. (13, 15).

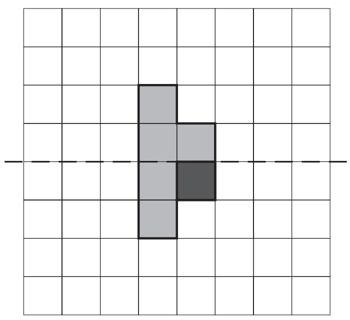
(e) Coordinates reversed

(f) (13, 20)

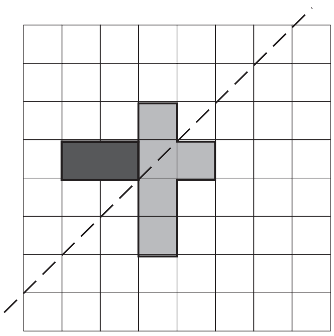
14. (a)



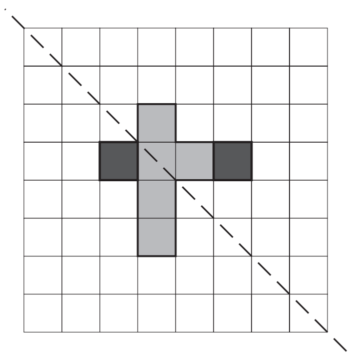
(b)



(c)



(d)

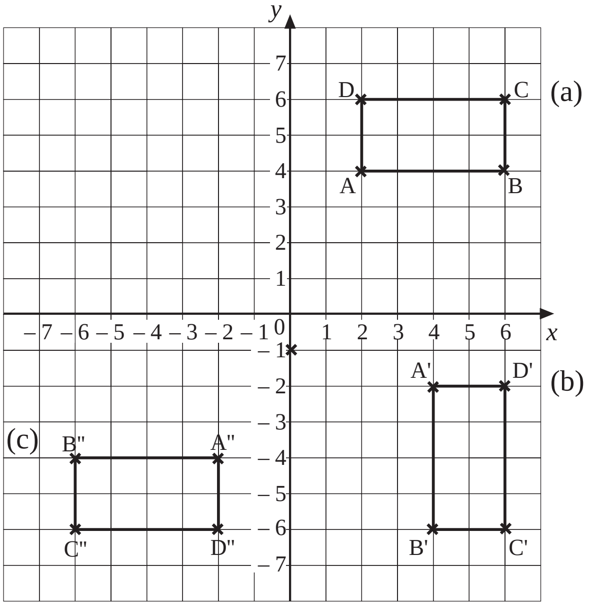


7.5 Rotations

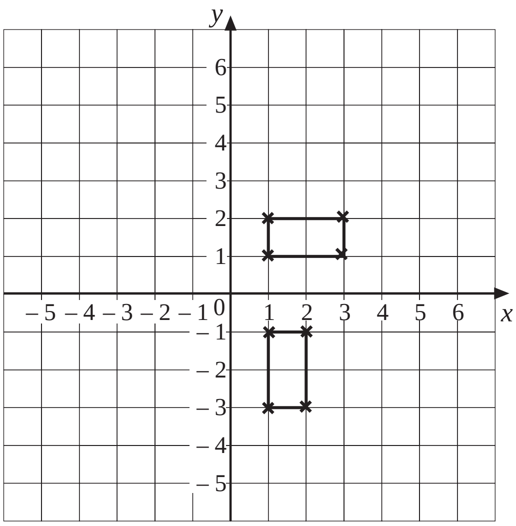
1. (a) 2 (b) 4 (c) 1
   (d) 3 (e) 4 (f) 6

2. H, I, N, O, S, X, Z (depending on how the letters are printed or written)

3.

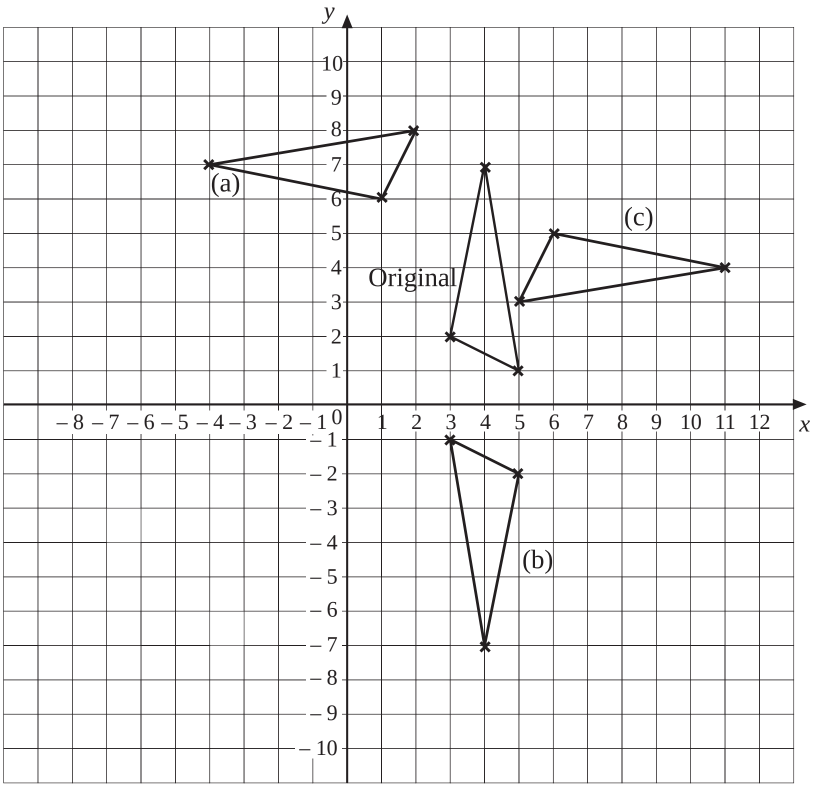


4.



7.5 Answers

5.



(a) (1, 6), (2, 8), (– 4, 7)

(b) (3, – 1), (4, – 7), (5, – 2)

(c) (5, 3), (11, 4), (6, 5)

6. (a) Rotation through $90°$ clockwise about the origin (0, 0)

   (b) Rotation through $180°$ about the origin (0, 0)

   (c) Rotation through $90°$ anticlockwise about the origin (0, 0)

   (d) Rotation through $180°$ about (8, 0).

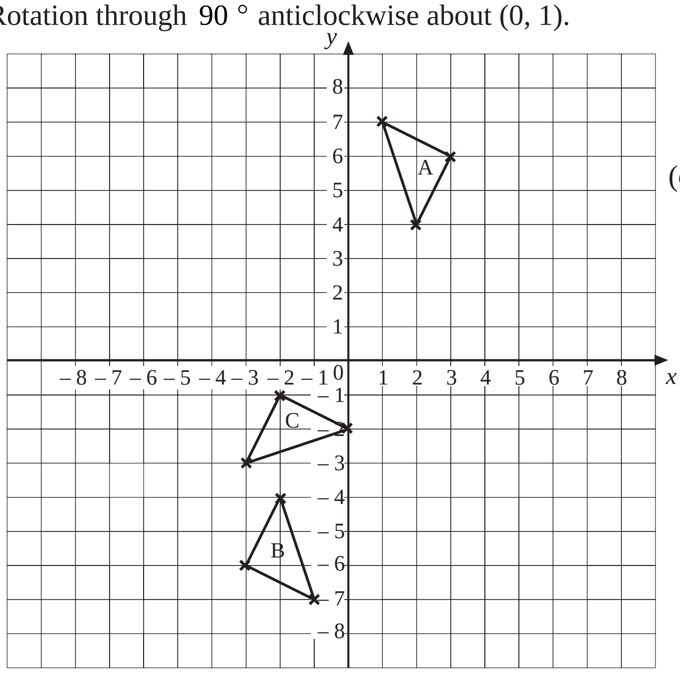
7. (a) Rotation through $90°$ clockwise about (5, 1)

   (b) Rotation through $90°$ clockwise about the origin (0, 0)

   (c) Rotation through $180°$ about the origin (0, 0)

   (d) Rotation through $90°$ anticlockwise about (0, 1).

8. (a), (b)

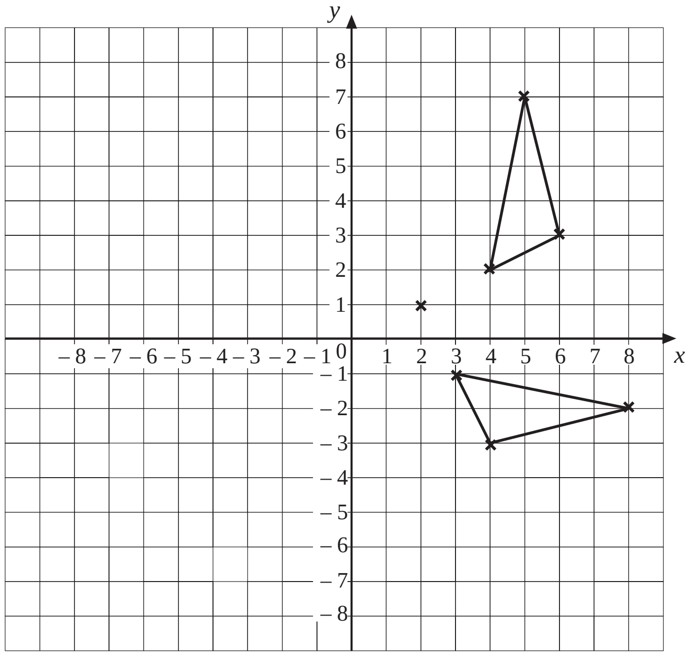


(c) Corners of triangle C have coordinates (– 3, – 3), (– 2, – 1), (0, – 2)

7.5 Answers

9. (a) (6, 7) (b) (1.5, 7.5)

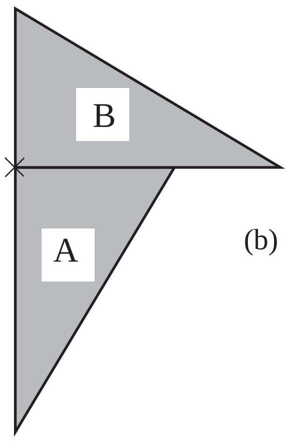
10. Rotation clockwise through $90°$ about the point (2, 1) (as diagram).



11. *Lines of Symmetry*

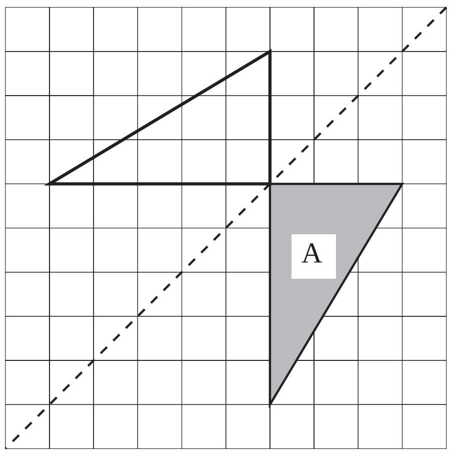
Order of Rotational Symmetry		0	1	2	3
	1	E	F		
	2	B		C	
	3	D			A

12. (a)



(b) $90°$

(c)



13. (a) B1 Rotate $90°$ clockwise and then rotate $90°$ clockwise again.

B2 Reflect vertical

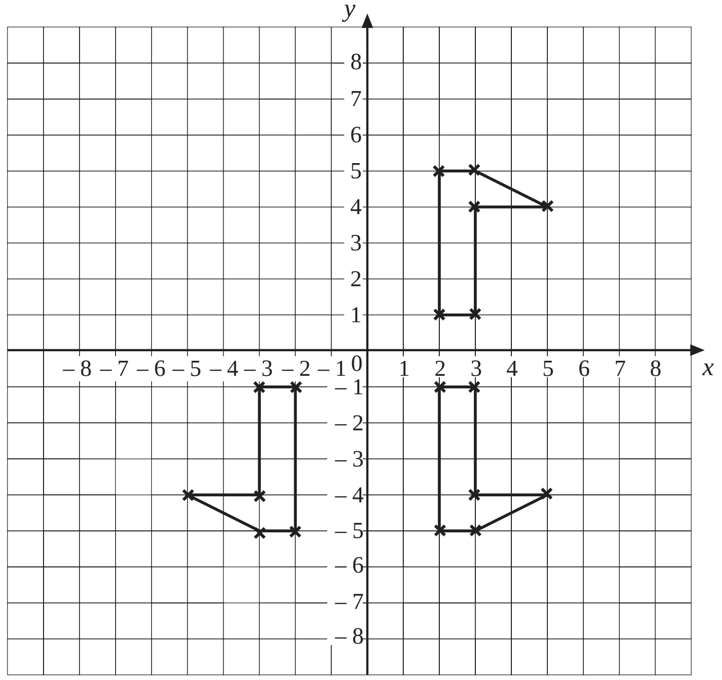
(b) A2 Rotate $90°$ clockwise and then rotate $90°$ clockwise again.

B1 Reflect vertical and then rotate $90°$ clockwise.

B2 Rotate $90°$clockwise.

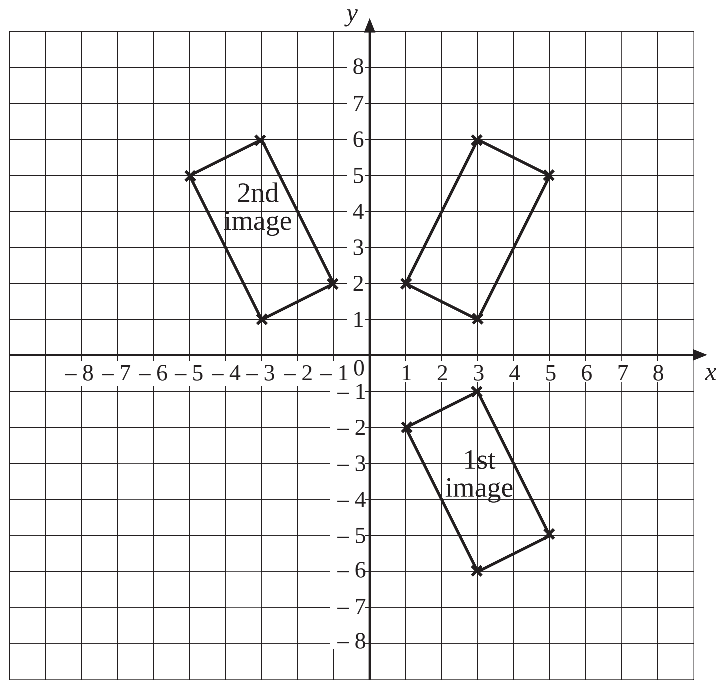
7.6 Combining Transformations

1. (a)



(b) Rotation of 180 ° about the origin.

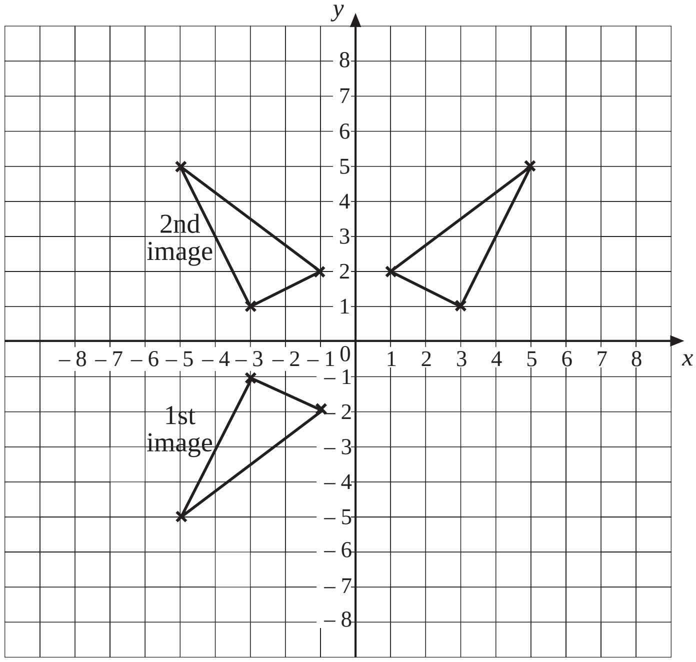
2. (a)



(b) The single transformation is a reflection in the *y*-axis.

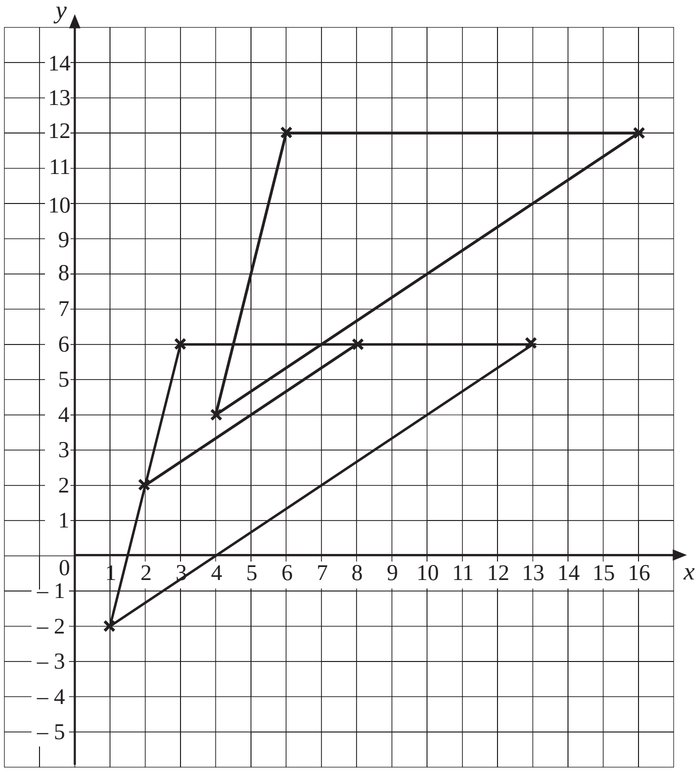
7.6 Answers

3. (a)



(b) The single transformation is a reflection in the *y*-axis.

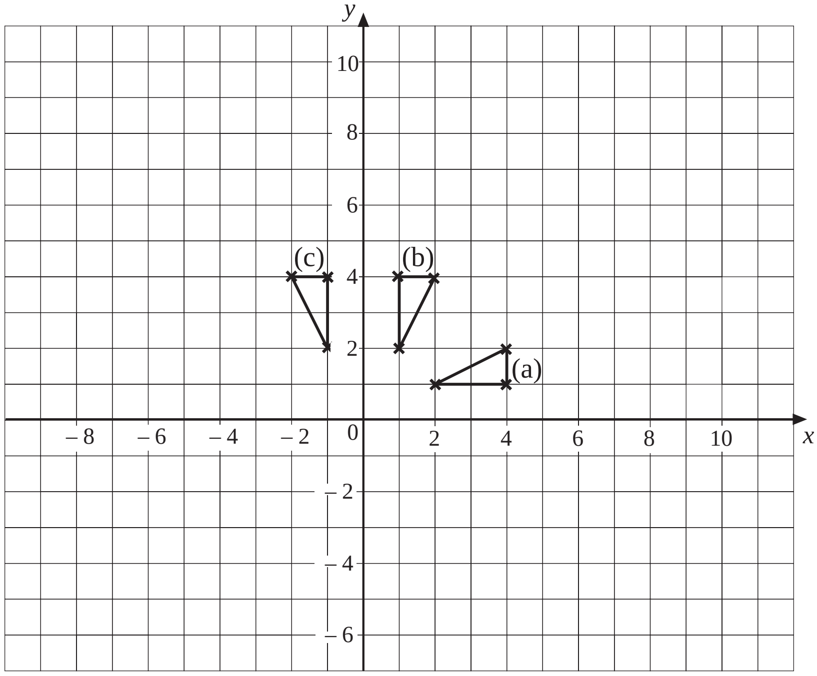
4. (a), (b)



(c) Enlargement, centre (3, 6), scale factor 2.

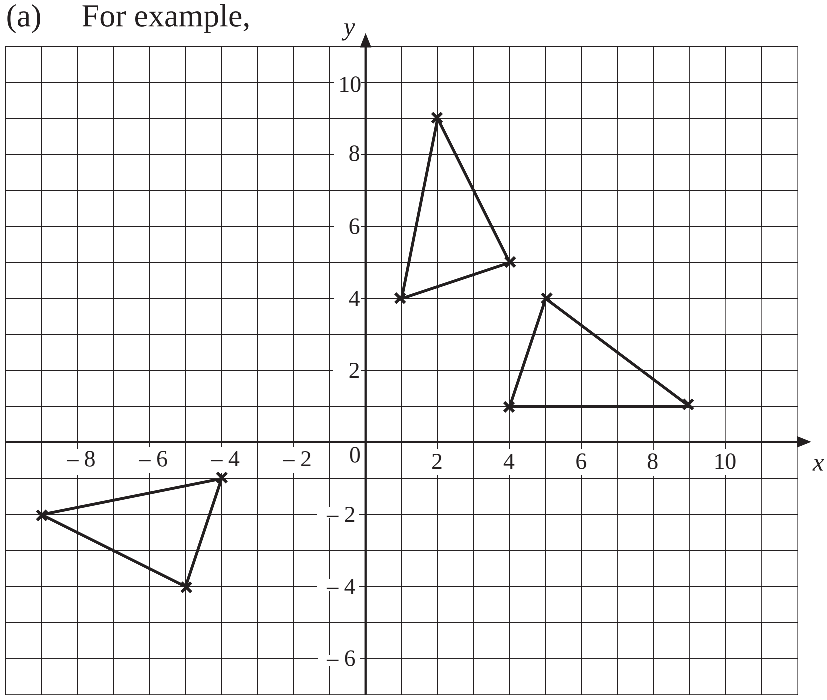
7.6 Answers

5.



(d) 90 ° anticlockwise rotation about the origin.

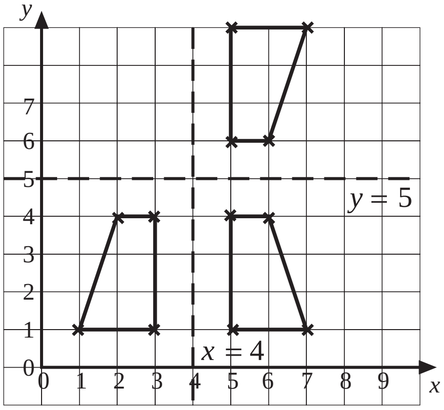
6. (a) For example,



(b) 180 ° anticlockwise rotation about the origin.

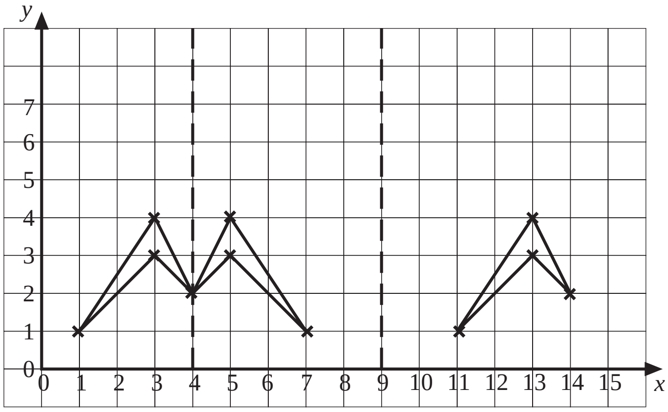
7.6 Answers

7. (a)



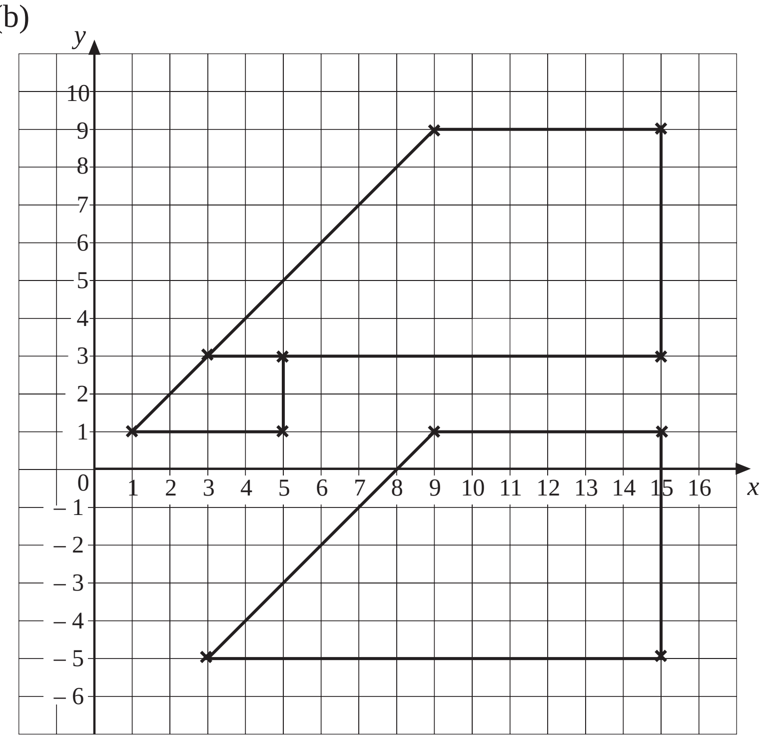
(b) 180 ° rotation about (4, 5).

8. (a)



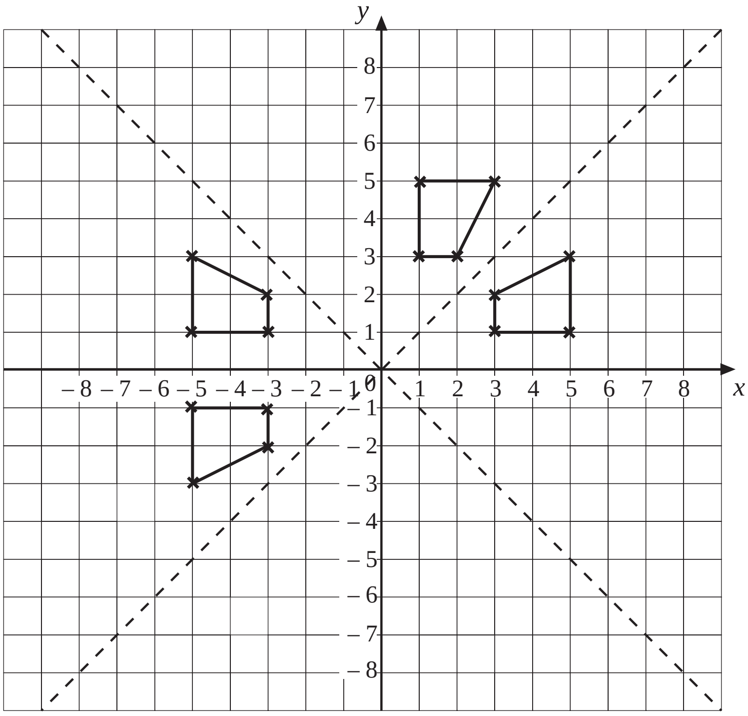
(b) There are many ways of doing this; one of the easiest is to reflect the original chevron in the line $x = 4$ and then to reflect its image in the line $x = 9$, as in the diagram.

9. (a), (b)



(c) Enlargement, scale factor 3, centre (4, 0).

7.6 Answers

10. 

Single transformation is a reflection in the y-axis.

11. There are 5 possible combinations, for any suitable value of k:

- rotate through $90°$ anticlockwise about $(k,\ k-1)$ then reflect in the line $x = k + 2$, e.g. rotate $90°$ anticlockwise about (3, 2) then reflect in the line $x = 5$,
- reflect in the line $y = k - 3$ then rotate through $90°$ anticlockwise about $(k, k-1)$,
- rotate through $90°$ anticlockwise about $(k, k-5)$ then reflect in the line $y = k - 3$.
- reflect in the line $x = k - 2$ then rotate through $90°$ clockwise about $(k, k-5)$,
- reflect in the line $y = k - x$ then rotate through $180°$ about $\left(\frac{k+5}{2}, \frac{k+5}{2} - 3\right)$.