Planner

Reflection, rotation and translation

- Knowing that translations, rotations and reflections preserve length and angle and map on to congruent images
- Carrying out combinations of reflections, rotations and translations
- Finding the symmetry properties of two-dimensional shapes
- Identifying and sketching planes of symmetry of 3-D solids

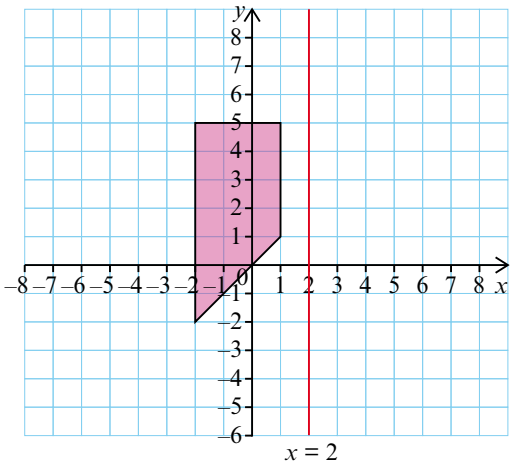
Keywords

You should know

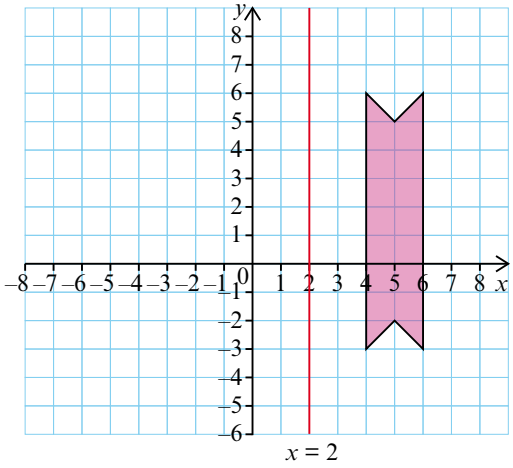
explanation 1a | explanation 1b | explanation 1c | online

1 Copy each diagram. Reflect each shape in the line $x = 2$.

a

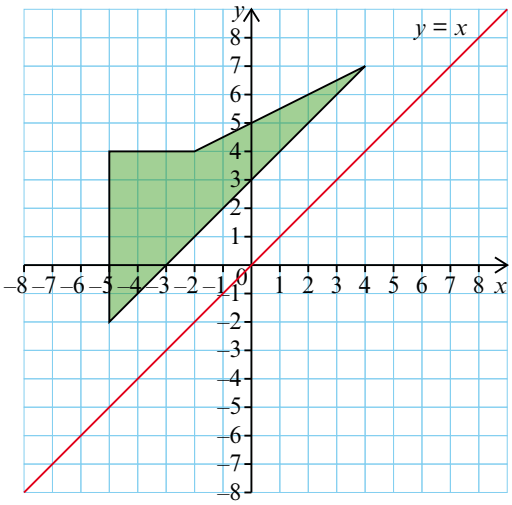


b

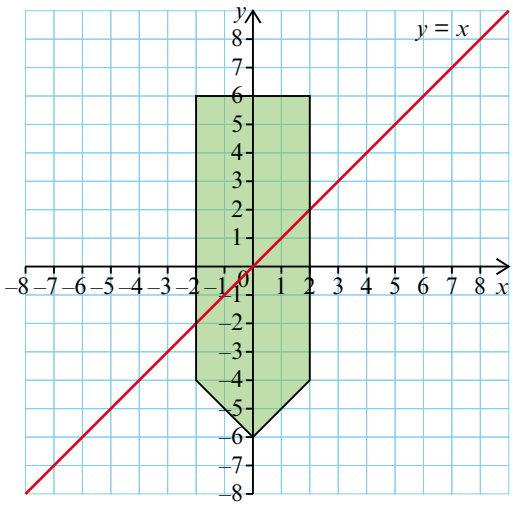


2 Copy each diagram. Reflect each shape in the line $y = x$.

a



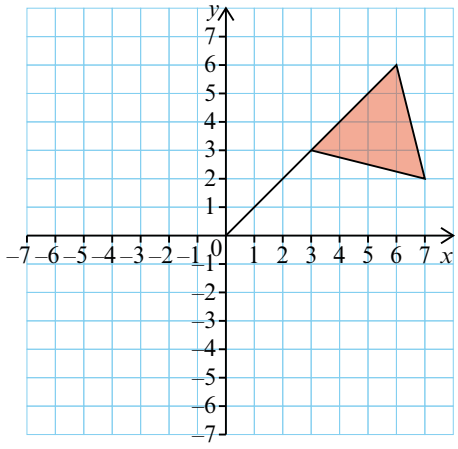
b



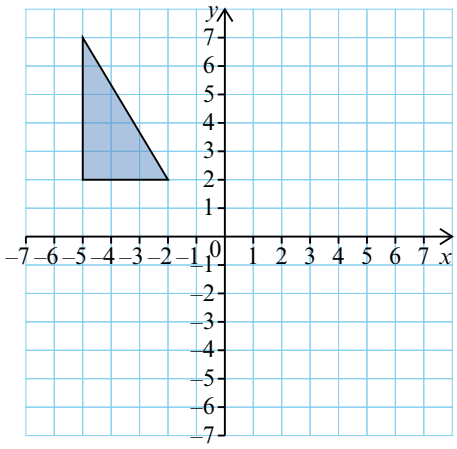
explanation 2a explanation 2b

3 Copy each diagram. Rotate each shape 180° about (0, 0).

a

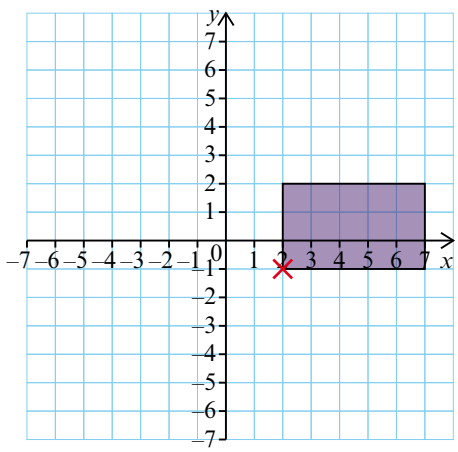


b

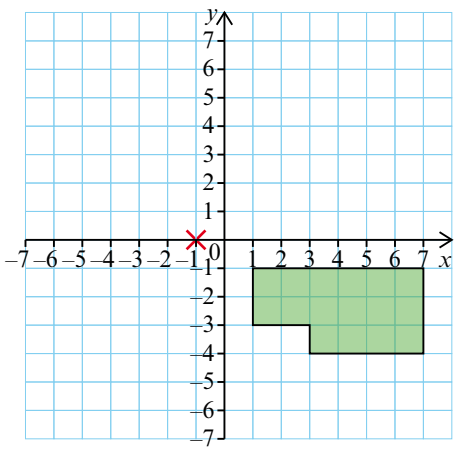


4 Copy each diagram. Rotate each shape 90° anticlockwise about the point shown.

a

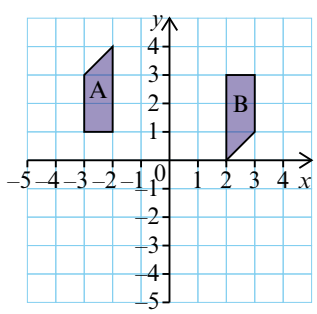


b

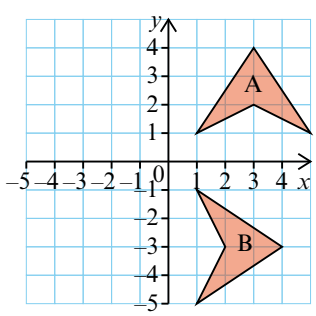


5 In each diagram, shape B is the image of object A after a single rotation. Describe each rotation fully.

a



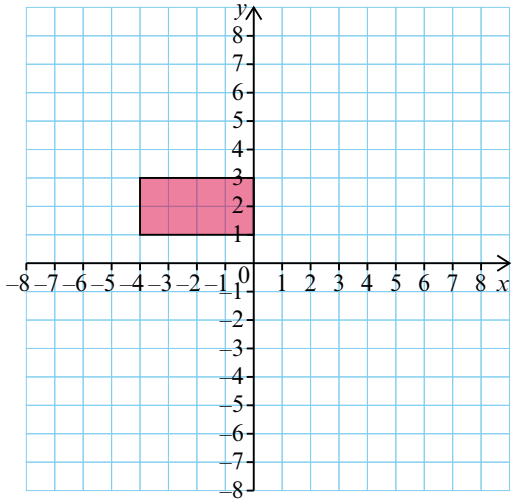
b



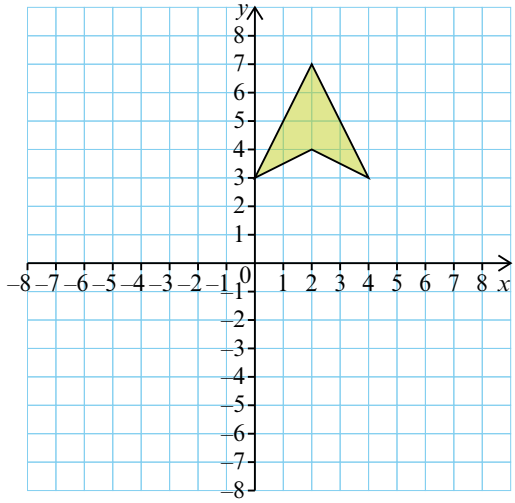
explanation 3a | explanation 3b | online

6 Copy each diagram. Translate each shape by the translation given.

a Translation $\begin{pmatrix} 5 \\ -8 \end{pmatrix}$

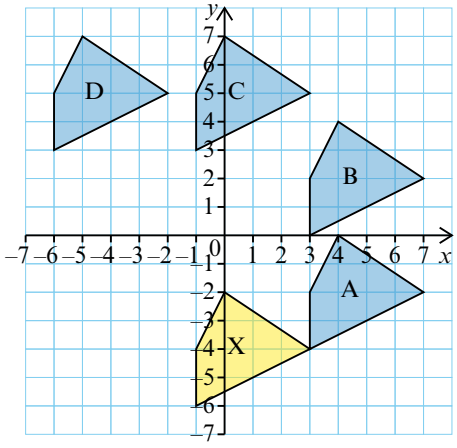


b Translation $\begin{pmatrix} -4 \\ -7 \end{pmatrix}$



7 **a** X has been translated to each of the shapes A, B, C and D. Describe the translation that has taken place each time. The first one has been done for you.

X to A: translation $\begin{pmatrix} 4 \\ 2 \end{pmatrix}$

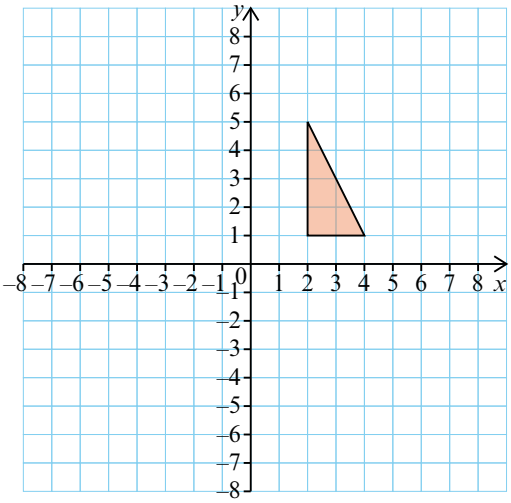


b Describe the translation A to B. Explain how you could work out this translation from your answers to part **a**, without using a diagram.

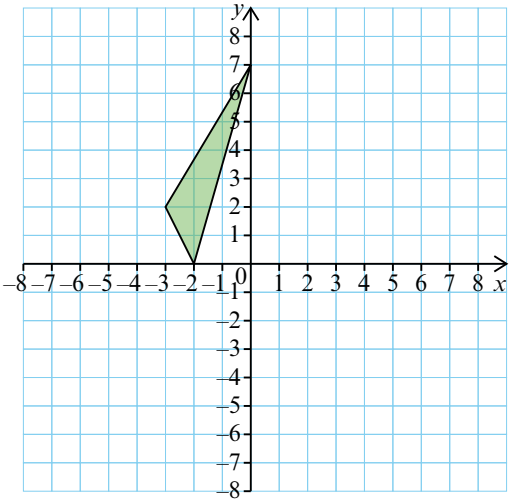
explanation 4a | explanation 4b | online

8 Copy each diagram. Reflect each shape in the x-axis and then reflect each image in the y-axis.

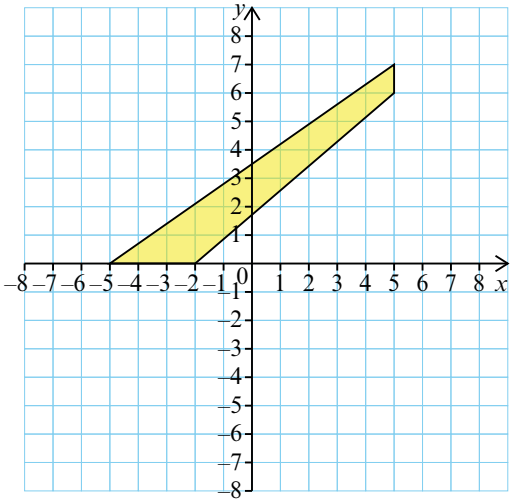
a



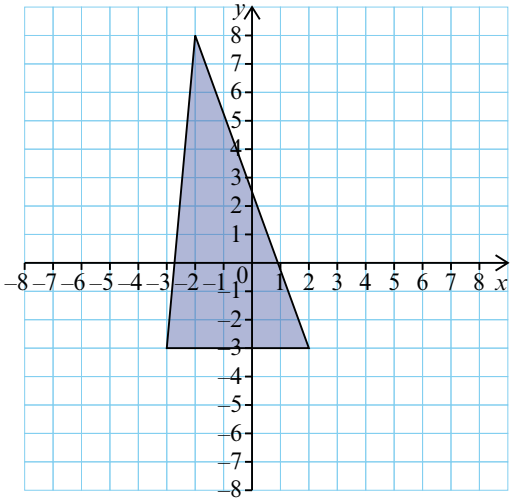
b



c



d



9 Look at your answers to question **8**.
What is the equivalent transformation for each combination of reflections?

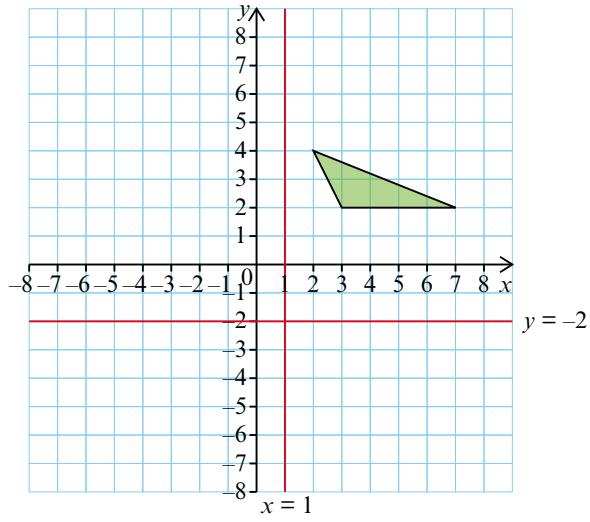
10 Copy the diagrams in question **8**.
Reflect each shape in the y-axis and then reflect each image in the x-axis.

11 Look at your answers to question **10**.
What is the equivalent transformation for each combination of reflections?

12 Copy each diagram.

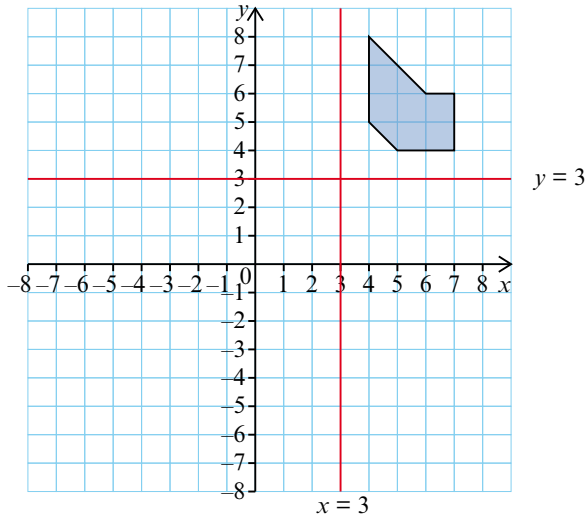
a **i** Reflect the shape in the line $x = 1$ and then reflect the image in the line $y = -2$.

ii What is the equivalent single transformation?

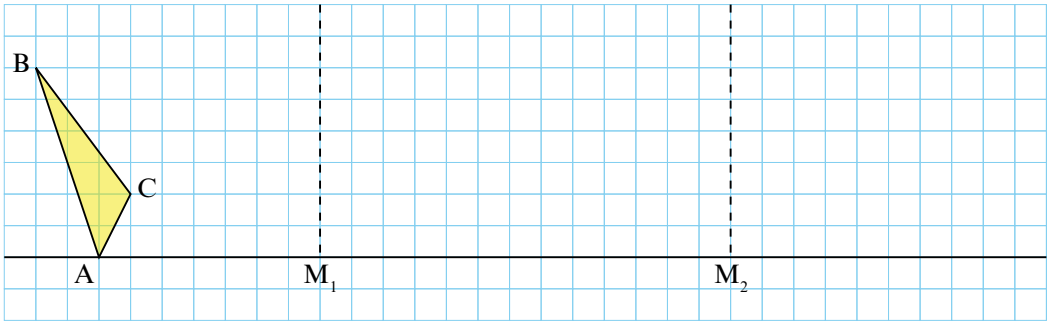


b **i** Reflect the shape in the line $y = 3$ and then reflect the image in the line $x = 3$.

ii What is the equivalent single transformation?



13 Copy this diagram onto squared paper.



a Reflect shape ABC in the mirror line M_1. Label the image A'B'C'.

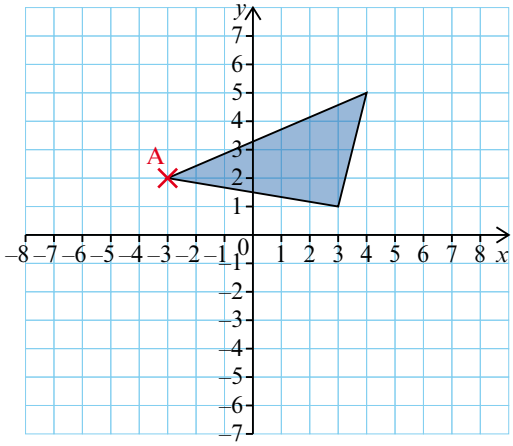
b Reflect image A'B'C' in the mirror line M_2. Label this image A"B"C".

c What do you notice about the lengths AA" and M_1M_2?

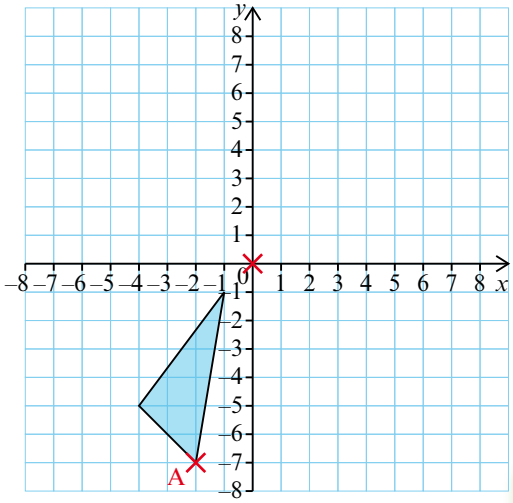
d What single transformation is equivalent to the two reflections?

14 Copy these diagrams. Draw the image of each shape after it has undergone the set of transformations given. Mark the image of point A and label it A'.

a Reflection in the y-axis and then translation $\begin{pmatrix} -4 \\ -2 \end{pmatrix}$.



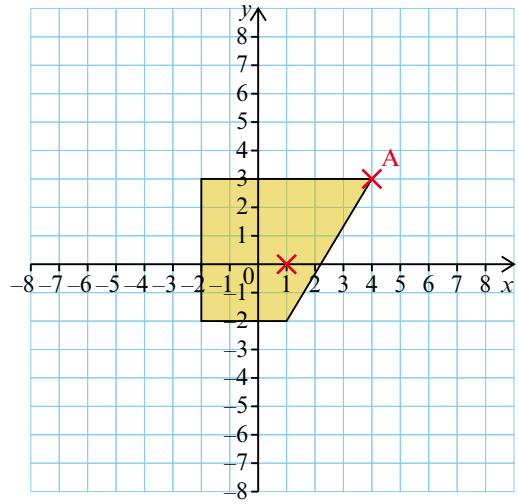
b Rotation 90° clockwise, centre (0, 0), and then translation $\begin{pmatrix} 5 \\ 3 \end{pmatrix}$.



15 Repeat question **14**, but this time carry out the transformations in the reverse order. What do you notice about your answers compared to your answer to question **14**?

16 **a** Copy the diagram. Draw the image of the shape after the following set of three transformations. Mark the image of point A and label it A'.

Rotation 180° with centre (1, 0), then reflection in the x-axis, and then translation $\begin{pmatrix} -4 \\ -4 \end{pmatrix}$.



b Carry out the transformations in the reverse order. Mark the image of A and label it A"

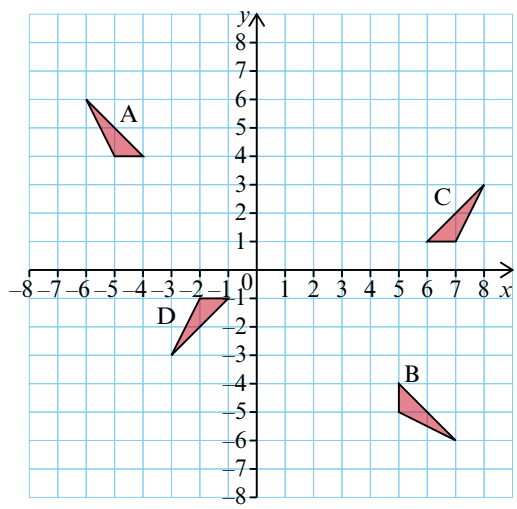
17 Find a combination of two transformations that will map these triangles onto each other.

a A onto C

b A onto D

c B onto C

d D onto A



18 Write the single equivalent transformation for each of these repeated transformations. Give examples to show your answers are correct.

a Two rotations about the same centre

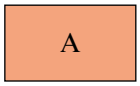
b Two translations

c Reflection in two parallel lines

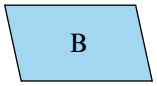
d Reflection in two perpendicular lines

explanation 5a | explanation 5b | online

19 These shapes have different symmetry properties.



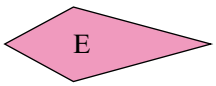
Rectangle



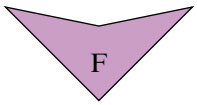
Parallelogram

Rhombus

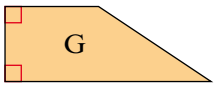
Isosceles trapezium



Kite



Arrowhead



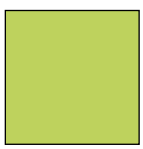
Trapezium

Copy and complete this symmetry table for the shapes.

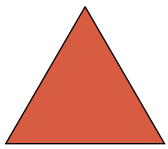
		Number of lines of symmetry		
		0	**1**	**2**
Rotation symmetry	**None**		D	
	Order 2			

20 Copy these shapes.

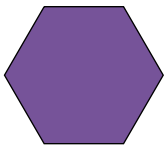
a


Square

b


Equilateral triangle

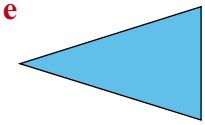
c


Regular hexagon

d


Rectangle

e


Isosceles triangle

f


Parallelogram

i Mark any lines of symmetry on each shape.

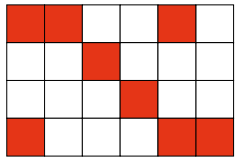
ii State the order of rotation symmetry of each shape.

21 State the order of rotation symmetry of these shapes.

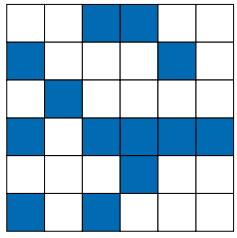
a regular pentagon **b** regular octagon **c** circle

22 The diagrams show incomplete mosaic patterns.
Each pattern has 4 coloured tiles missing.
Copy and complete the patterns so that they have the stated symmetry properties.

a Two lines of reflection symmetry, and rotation symmetry of order 2.



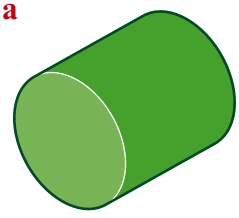
b One line of reflection symmetry, and rotation symmetry of order 1.



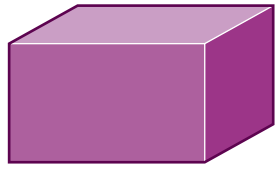
explanation 6

23 Sketch these shapes and draw the planes of symmetry on them.
You might want to draw them more than once.

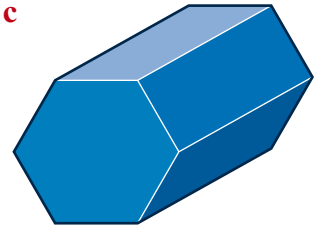
a



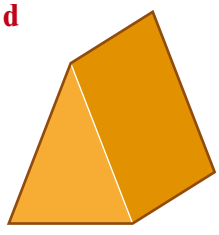
b



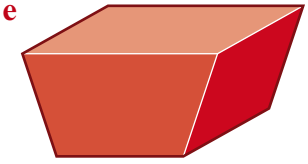
c



d



e



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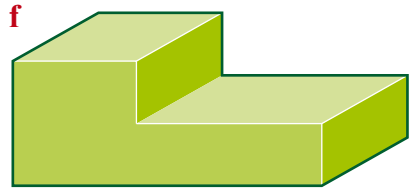

24 A cube has 9 planes of symmetry. Draw diagrams to show them.