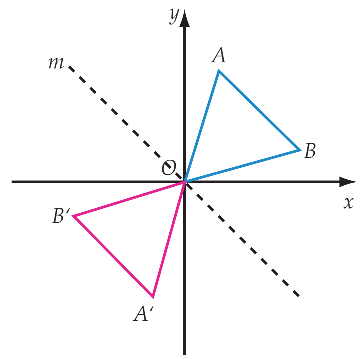
Challenge 10

1 The equilateral triangle *OAB* has been transformed into the equilateral triangle *OA′B′*.



(a) Which single transformation changes *OAB* into *OA′B′*?

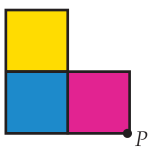
(b) Which two different transformations, applied one after the other, would change *OAB* into *OA′B′*?

(c) *OAB* is reflected in the line *m*. What is the name of the new position of *A*?

2 Jemima looks in a mirror and sees the clockface behind her. The hands appear to show 2:45. What will the time appear to be in 15 minutes?

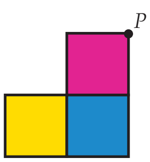
3 A horizontal line *CD* is copied three times, and each copy appears on top of the original. Using the terms ‘rotation’ and ‘translation’, describe how each copy must be moved in order to create a square.

4 If the shape

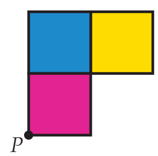


is rotated 90° clockwise about the point *P*, the resulting figure could be:

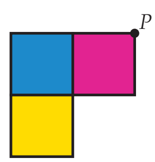
A



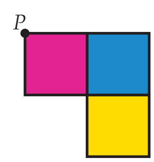
B



C



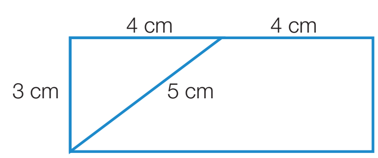
D



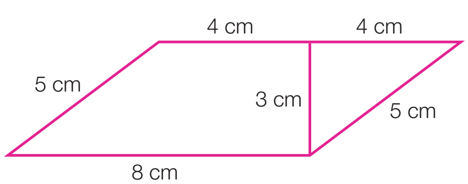
5 To be decoded, a message has to be read by looking in a mirror. Decode the following message: ‘TAƎB OT ᗡЯAH ƧI ӘӘƎ ᗡƎ⅃IOᙠ A’. To make sense of the message, what did you have to do?

6 A line is drawn on the 8 cm by 3 cm rectangle opposite to make a triangle and a trapezium.

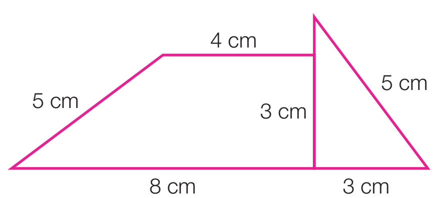
What transformation(s) need to be done to the triangle to create each of the following shapes?



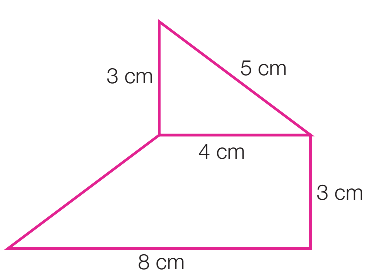
(a)



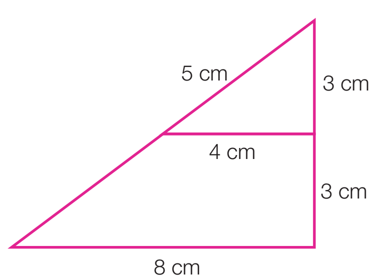
(b)



(c)



(d)



Chapter review 10

D.I.Y. Summary

Key Words

asymmetrical	isometric	perpendicular distance	rotation
axis of symmetry	line of reflection	plan views	rotational symmetry
centre of rotation	order of reflectional symmetry	reflection	transformation
elevations	order of rotational symmetry	reflectional symmetry	translation
image	original	rotate	

Copy and complete the following using the words and phrases from this list, where appropriate, to write a summary for this chapter. A word or phrase may be used more than once.

1 Reflections, rotations and translations are three types of _____s.

2 When an object is turned about a point, a _____ has been performed.

3 When a figure is moved in a horizontal and vertical direction, a _____ has been performed.

4 When a figure is a reversed image of the original, a _____ has been performed.

5 The transformed version of a shape or diagram is called an _____.

6 A _____ acts as a mirror to reflect an object.

7 A point about which a figure is turned is called the _____.

8 The _____ indicates how many times the image is identical to the original in a complete 360° rotation.

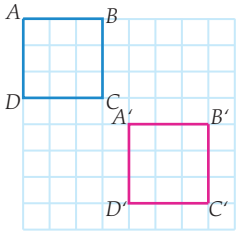
9 A 2D representation of a 3D solid can be drawn on _____ paper.

Equipment required: Grid paper for Questions **2**, **4**, **5**, **6**, **7**, **9**, **23** and **28**, isometric dot paper for Questions **14**, **16** and **17**, and a protractor for Questions **7**, **9**, **23** and **28**

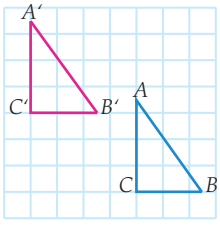
Fluency

1 Describe the translation shown in each of the following diagrams. Ex 10.1

(a)

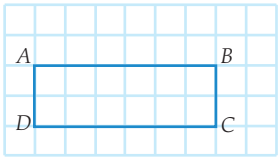


(b)

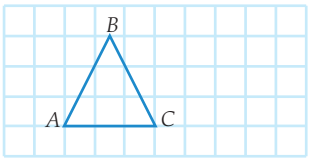


2 Copy each figure below and draw the resulting image after the translation required. Ex 10.1

(a) 3 units right and 1 unit up



(b) 3 units left and 3 units up



3 What would be the reverse translation of 7 units right and 4 units down?

Ex.10.1

A 7 units up and 4 units right **B** 7 units left and 4 units up

C 7 units left and 4 units down **D** 4 units left and 7 units up

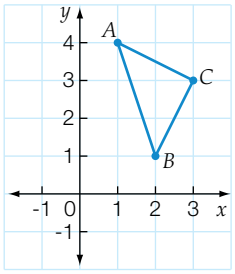
4 For the figure in the diagram opposite:

Ex.10.1

(a) write the coordinates of the vertices

(b) copy the figure and translate it 4 units left and 3 units down, marking the image vertices with image notation

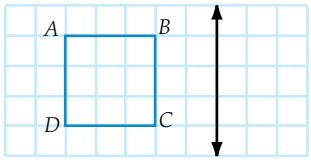
(c) write the coordinates of the vertices of the image.



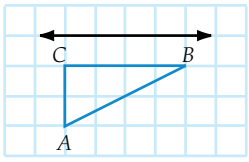
5 Copy each of the following figures onto grid paper and draw the resulting image when the figure is reflected in the line shown.

Ex.10.2

(a)



(b)



6 For the figure in the diagram opposite:

Ex.10.2

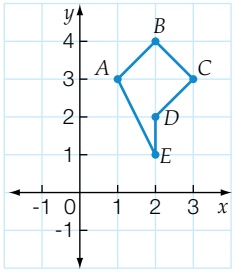
(a) write the coordinates of the vertices

(b) copy the figure and reflect it in the x-axis, marking the image vertices with image notation

(c) write the coordinates of the vertices of this image

(d) copy and reflect the original figure in the y-axis, marking the image vertices with image notation

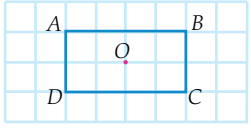
(e) write the coordinates of the vertices of this image.



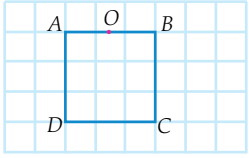
7 Copy each of the following figures onto grid paper and draw the resulting image after the given rotation. Use a protractor to help you.

Ex.10.3

(a) Rotate 90° in a clockwise direction about O.



(b) Rotate 180° in an anticlockwise direction about O.



8 A clockwise rotation of 90° is equivalent to an anticlockwise rotation of how many degrees?

Ex.10.3

A 180° **B** 360° **C** 90° **D** 270°

9 For the figure in the diagram opposite:

Ex.10.3

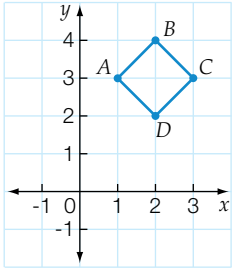
(a) write the coordinates of the vertices

(b) copy the figure and rotate it 90° in an anticlockwise direction about the origin, marking the image vertices with image notation

(c) write the coordinates of the vertices of this image

(d) copy and rotate the original figure 180° in an anticlockwise direction about the origin, marking the image vertices with image notation

(e) write the coordinates of the vertices of this image



(f) copy and rotate the original figure 270° in an anticlockwise direction about the origin, marking the image vertices with image notation

(g) write the coordinates of the vertices of this image.

10 What are the reverse transformations for a translation of 5 units right and 8 units down followed by a clockwise rotation of 90°? Ex 10.4

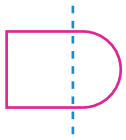
A An anticlockwise rotation of 90° and a translation of 5 units right and 8 units down

B A clockwise rotation of 180° and a translation of 5 units right and 8 units down

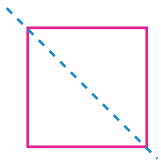
C An anticlockwise rotation of 90° and a translation of 5 units left and 8 units up

D A clockwise rotation of 90° and a translation of 5 units left and 8 units down

11 In which of the following shapes is the dotted line an axis of symmetry? Ex 10.5

A 

B 

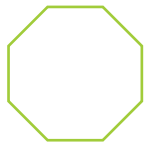
C 

D 

12 Copy the following shapes and draw lines of symmetry. Some shapes may have more than one line of symmetry. Ex 10.5

(a) 

(b) 

(c) 

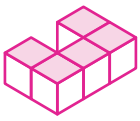
(d) 

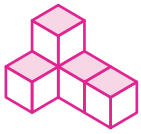
(e) 

(f) 

13 Identify the shapes from Question **12** that have rotational symmetry. Ex 10.5

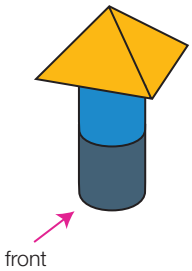
14 Two solids have been made using wooden cubes, as shown. Ex 10.6

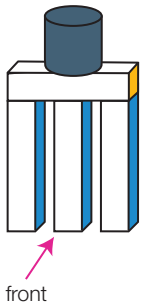
(a) 

(b) 

Use isometric dot paper to copy the shapes.

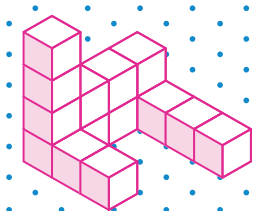
15 For each of the three-dimensional structures below, draw the front and side elevations. Ex 10.7

(a) 

(b) 

Understanding

16 Use isometric dot paper to draw the shape shown.

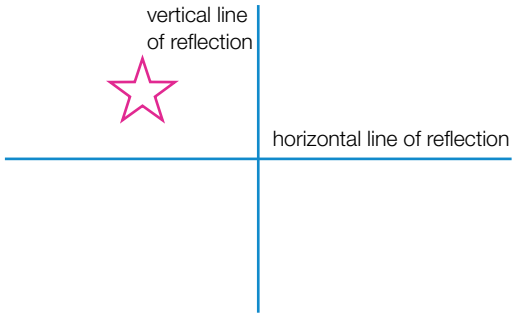


17 Use the shape above to draw:

(a) a front view **(b)** a top view **(c)** a side view.

18 What single translation would be equivalent to 6 units down, 7 units right, 2 units up, 8 units left, 4 units up and 5 units right?

19 **(a)** Using the diagram below, reflect the star in the vertical and then the horizontal lines of reflection.



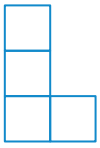
(b) Using the same starting position, reflect the star in the horizontal and then the vertical lines of reflection. Does it result in the same outcome as in **(a)**?

20 What rotation is equivalent to reflecting an object along horizontal, then vertical, lines of reflection?

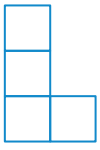
21 How many letters of the word 'MATHEMATICS' do not have reflectional or rotational symmetry?

22 The plan views of a three-dimensional shape made with cubes are shown. Draw the solid on isometric dot paper.

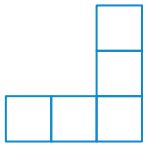
top view



front view



side view



23 On grid paper:

(a) draw the line joining the points $A(-1, 3)$ and $B(2, 5)$

(b) translate this line 3 units right and 2 units down

(c) reflect this image in the x-axis to form a new image

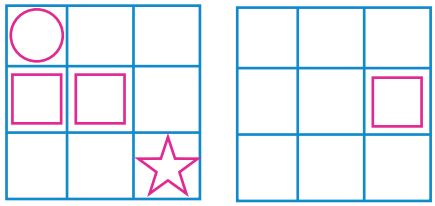
(d) rotate this image 90° in a clockwise direction (about the origin) to form a final image

(e) write the coordinates of the final image.

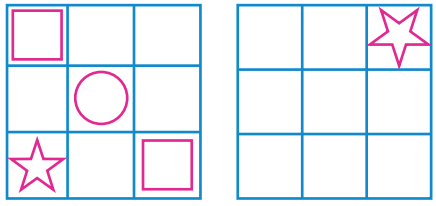
Reasoning

24 The following 3 by 3 squares comprise identical symbols, but each one has been reflected horizontally, vertically or along the diagonal and is missing three shapes. Your task is to draw the missing three shapes.

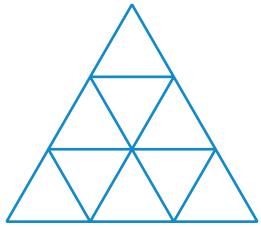
(a)



(b)



25 The following equilateral triangle comprises nine smaller equilateral triangles.

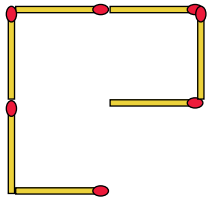


By shading the smaller equilateral triangles, create three different designs that have:

(a) one line of symmetry

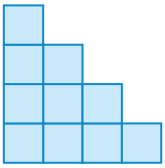
(b) three lines of symmetry.

26 The diagram at right shows a pattern made from sticking seven matchsticks of equal length to a piece of paper. What is the smallest number of matchsticks that need to be added so that the resulting image has at least one line of reflectional symmetry?

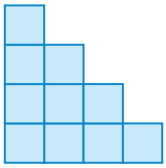


27 A solid is built using cubed blocks. The front, side and top views of the solid are shown. What is the minimum number of blocks this solid can have?

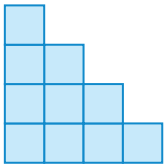
top view



front view



side view



28 Matt is asked to reflect a particular figure in the y-axis. This image is then rotated 180° in a clockwise direction.

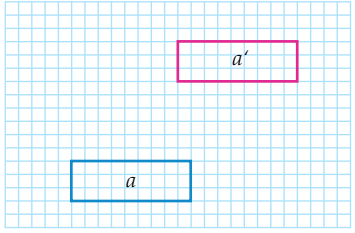
Matt believes he can replace these two combined transformations with one transformation.

Choose a shape of your own and perform the two transformations on it that Matt was required to perform. Is he correct? Can one transformation replace the two transformations? If so, write the required transformation.

NAPLAN practice 10

Numeracy: Non-calculator

1 The translation shown is:



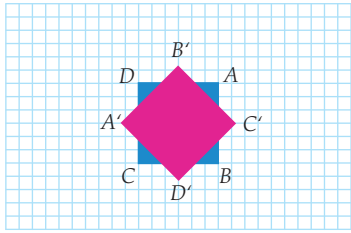
A 6 units right, 8 units up

B 8 units right, 9 units up

C 8 units down, 6 units left

D 6 units down, 8 units left

2 The rotation needed to transform the original shape (blue) to the new rotated image (pink) is:



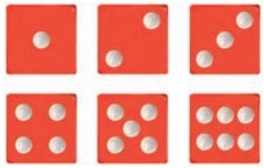
A 45° clockwise

B 135° anticlockwise

C 90° clockwise

D 90° anticlockwise

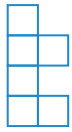
3 How many of the six faces of a die have fewer than three lines of symmetry?



A 1 **B** 2

C 3 **D** 4

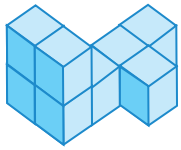
4 The top view of a shape is shown at right.



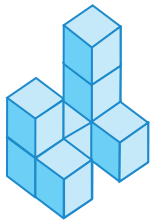
Which solid has this top view?

A

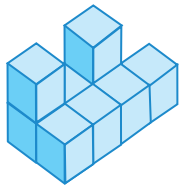
B



C



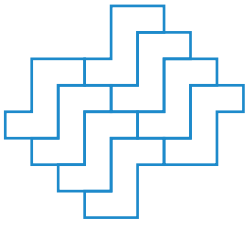
D



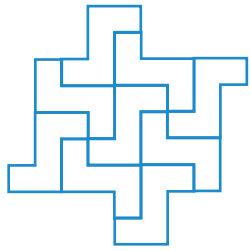
Numeracy: Calculator allowed

5 Mia has these S-shaped tiles.
They are blue on one side and red on the other side.
Mia wants to make a pattern with all the tiles blue side up.
Which one of the patterns can Mia not make?

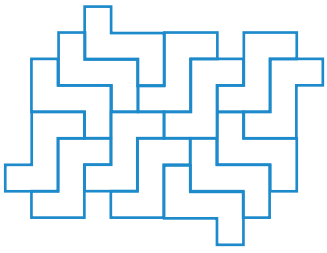
A



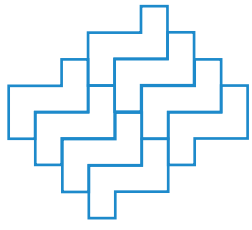
B



C



D

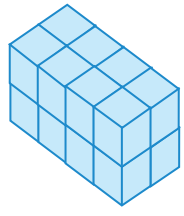


6 Which letter in the word SAME does not have an axis of reflectional symmetry?

A S **B** A **C** M **D** E

7 Janita glued small wooden cubes together to form the solid shown below.
She then painted the solid on all surfaces.

How many wooden cubes are painted on just one face?



A 0 **B** 2 **C** 4 **D** 8

Mixed review E

Equipment required: Grid paper and protractor for Questions **11**, **17** and **18**

Fluency

1 Simplify:

(a) $44 - 8 \times 4$ **(b)** $8 \times 6 \div 3 \times 4$ **(c)** $28 \div 4 + 3 \times 6$

Ex 1.5

2 Simplify:

(a) $2^4 - 3^2$ **(b)** $3^3 \times 10^2$ **(c)** $10^5 - 10^3$

Ex 1.2

3 Calculate:

(a) $15.006 + 2.45 + 0.059$ **(b)** 0.2×0.036 **(c)** $0.597 \div 0.3$

Ex 4.4–4.6

4 Use the following rules to complete the tables.

Ex 5.3

(a) $n = 3m$

m	4	0	11	25	15
n					

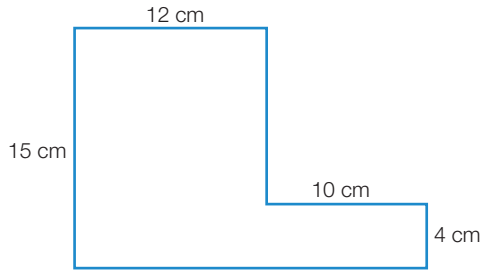
(b) $t = s - 12$

s	18	100	12	22	312
t					

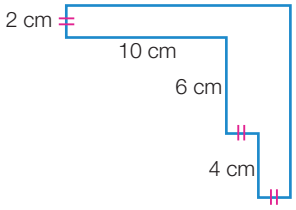
5 Find the area of each of the following shapes. (All angles are right angles.)

Ex 6.5

(a)



(b)



6 Find the following probabilities.

Ex 9.7

(a) getting a 6 on one roll of a normal die

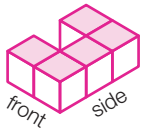
(b) getting a red king on a single draw from a normal pack of cards

(c) getting two heads when tossing two coins

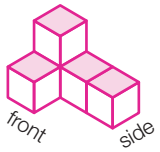
7 Two shapes have been made using wooden cubes, as shown.

Ex 10.7

(a)



(b)



For each shape, draw: **(i)** the front elevation **(ii)** the top elevation.

8 Solve each of the following equations using the balance method. Check your answer by substitution.

Ex 7.4

(a) $3(x - 1) = 6$ **(b)** $\frac{x}{4} + 1 = 7$ **(c)** $2(x + 3) = 12$

9 Find the supplementary angles for each of the following.

Ex 8.3

(a) 35° **(b)** 127° **(c)** 90°

10 The following numbers represent the heights of students in a class, to the nearest centimetre. Ex 9.1

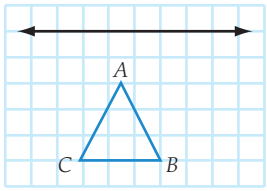
148, 163, 158, 162, 151, 153, 170, 167, 165, 162, 172, 173, 157, 162, 158, 155, 163, 159, 160, 161

Draw the frequency table showing the information. You will need to group the results. Use 145–149, 150–154, 155–159 etc.

11 Show the image of each of the following figures after each of the following combined transformations. Use a protractor to help you. Ex 10.4

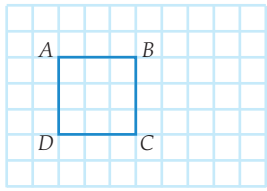
Reflect in the horizontal line of reflection and translate 4 units left and 3 units down.

(a)



Reflect in the line BC and rotate 90° in a clockwise direction about point C'.

(b)



12 For each of the following, identify the number of axes of symmetry. Ex 10.5

(a) isosceles triangle **(b)** square **(c)** rhombus

13 Find the mean, mode, median and range of the following data, noting any possible outliers. Ex 9.2

23, 34, 45, 26, 35, 42, 6, 34, 22, 36, 21, 29, 32, 34, 41, 39, 25, 27, 31, 30

Understanding

14 A figure is translated 7 units left, 4 units down, 8 units right and 3 units up. What would be the final position of the image compared to that of the original figure?

15 **(a)** Find the prime factors of 24.

(b) Find the prime factors of 30.

(c) Use the prime factors to find the highest common factor of 24 and 30.

(d) Use the prime factors to find the lowest common multiple of 24 and 30.

16 **(a)** What is the size of each angle in an equilateral triangle?

(b) A parallelogram has one angle that measures 126°. What size is each of the three remaining angles?

17 Which capital letters of the alphabet that have both reflectional and rotational symmetry also have reflectional and rotational symmetry in lower case form?

Reasoning

18 A point (1, 1) is translated 2 units right and 1 unit up. It is then reflected in the y-axis and then reflected in the x-axis. It is then translated 2 units right and 1 unit up. Finally, it is rotated 180° in a clockwise direction about the origin. What are the coordinates of the final image?

19 **(a)** Find a data set with at least six different values that has a median of 6 and a mean of 8.

(b) Describe the process you followed to find these values.

(c) Why might it be easier to use an odd number of values in a question of this type?

20 A game is played in which three different coins are being tossed. It costs 50 cents to play this game. You win $1 (plus your original 50 cents) if more than one of the coins shows heads, otherwise you lose your money.

(a) Write down the set of results that are possible.

(b) Is the game fair? Explain your reasoning.