Answers

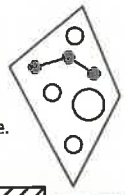
Please note that all questions are worth one mark unless stated otherwise in brackets.

A Numbers, shapes and relationships

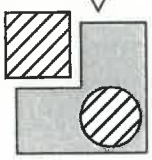
Most unlike (page 8)

Have a go

1 The number of sides of the outer shape matches the number of white circles inside it. Each picture has three black circles connected by a line. The fourth picture should be drawn with four white circles inside the quadrilateral and three black circles connected by a line.
Distractors: size of circles does not matter.



2 Each large shape has a circle in the corner opposite the cut-off corner and this circle and cut-off corner are in the same shading. The fourth picture should show a circle in the bottom-right corner of the L-shape, shaded in same way as the separate square top left, with the large L-shape shaded in different style.



3 Each picture has a small circle, a larger circle, a square, a triangle and a diamond, all connected by a line in any order. The central shape of the five is shaded black and one end shape is shaded with diagonal lines.
Distractors: The order of shapes and the angle of the line do not matter.

4 b does not belong because it includes one separate equilateral triangle.

5 b does not belong because the shading of the small circle is horizontal rather than vertical.

Test yourself

1 c **shape** – the two parts of the shape are not equal size
Distractors: **shading** – inside the shapes; **shape** – outline shape

2 d **line style** – only large triangle with one dashed side
Distractors: **line style** – of small triangle; **size** – (a) of triangles, (b) of circles; **position** – (a) of circle on large triangle, (b) of arrow

3 c **line style** – both figure-of-eight shapes at the ends of the picture have dashed lines
Distractors: **size** – of figure-of-eight shapes; **shape** – arrow style; **shading** – of elements of the figure-of-eight shapes

4 a **angle** – two corners of the small square are inside the larger square, whereas there is only one corner inside in the others
Distractors: **number** – of circles; **orientation** – (a) of line with white circles, (b) relative position of the quadrilaterals and triangles; **line style** – of 'string'

Try it out

Additional shapes and/or shading with one feature of option c making it different from the others.

Matching features 1 (page 10)

Have a go

1 Accept any four sensible answers, which could include the following:
All use the same line style for the three shapes within each figure
All have a circle as the innermost shape
All have a circle as the outermost shape
All have diagonal line shading on inner circle
In all of them the outermost circles are the same size

2 Accept any four sensible answers, which could include the following:
All have three lines making a zig-zag
All have solid lines for the zig-zag
All have a solid line in a curve
All have a circle crossing the curved line
All have half the circle shaded black
All have a short straight line across one end of the curved line

3 Accept any four sensible answers, which could include the following:
All within a curved irregular shape
Outline shape is always a solid line style
All have two white shapes within the outline
One of the inner shapes is half the other
Inner shapes have a solid line style
All have the same number of black circles as there are short lines on the curved line

4 d the two angles along the zig-zag line are outside the triangle
e the triangle has two dashed lines

Test yourself

1 e **shape** – (a) outline shape is a quadrilateral, (b) shape of intersecting shape across side of quadrilateral is the same as the shape inside it; **number** – there are three elements in addition to the quadrilateral

2 c **number** – zig-zag made up of three parts; **line style** – one part of zig-zag is a dashed line; **shape** – a C-shaped curve crosses the zig-zag in three places
Distractors: **size** – length of zig-zag sections; **shape** – arrowhead style; **proportion** – of lines and angles within the zig-zags

3 d **number** – (a) total of white circles is same as number of black spots, (b) total number of crosses is same as number of black spots
Distractors: **proportion** – (a) of crosses in first and third squares, (b) of white circles in first and third squares

4 d **size** – one half of circle shaded
Distractors: **number** – of sections within the circle; **size** – of the sections within each circle; **shading** – style of shading of sections

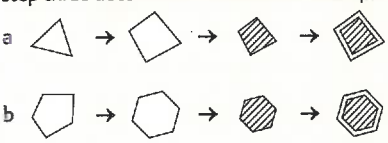
Try it out

For example, **b** has a rectangle and a square rather than two squares.

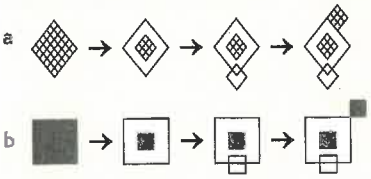
Applying changes 1 (page 12)

Have a go

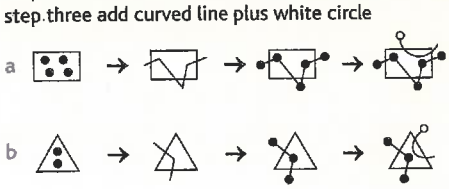
1 For example:
i step one increases the number of sides of the polygon
ii step two adds diagonal shading
iii step three adds double line round the shape



2 For example:
i step one adds a smaller version of the shape in the centre and shade central small shape only
ii step two adds another small white shape overlapping the bottom of the main shape
iii step three adds another small shaded shape touching the outside of the main shape in the top-right quarter



3 For example:
i step one draw a zig-zag line across the shape with the same number of sections as there are black circles
ii step two add black circles to ends and angles of zig-zag line
iii step three add curved line plus white circle



Test yourself

1 e **number** – three rectangles will give three concentric shapes; **shape** – rectangles give ovals; **shading** – none in the second shape
Distractors: **shading** – of elements in the first shape

2 c **number** – the number of lines across the arrow gives the number of sides of the polygon; **shape** – five lines gives a pentagon; **size** – one circle increases in size; **shading** – both circles are black; **position** – the smallest and largest shapes are circles and the shapes sit inside each other

3 e **number** – the same number of small shapes as squares; **shading** – one shape with each style of shading
Distractors: **shape** of elements; **order** – (a) of shapes, (b) of shaded elements

4 d **number** – same number of straight and curved lines in second picture as in first picture; **line style** – (a) straight lines change from solid to dashed or vice versa, (b) curved lines remain same style; **shape** – arrowhead added at open end of curved lines
Distractors: **size** – length of lines

Try it out

1 Answer should be a quadrilateral with three small white circles and one cross inside.

2 Answer should show the line styles clockwise around a quadrilateral in the same order as the line styles given.

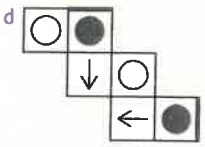
Matching 2D and 3D shapes 1 (page 14)

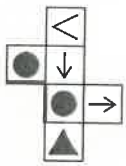
Have a go

In the first three questions all the faces will share an edge with the shaded face **except** the face that will be on the opposite side.

1 i abde ii bcdf iii acef iv bcdf
2 i acdf ii abce iii bdef iv acdf
3 i acef ii abdf iii bcde iv abdf

In the next two questions the faces that share an edge cannot be opposite. The two edges that will be next to each other when the net is folded are shown with a bold line.

4 d 

5 c 

Test yourself

1 c Once the net is folded, the opposite face is the only one that does not touch the original face. The white triangle, plus sign and double circle are already touching the face and the black spot will touch the given face when folded. The face with the black triangle is unable to touch the given face and so is the opposite face.

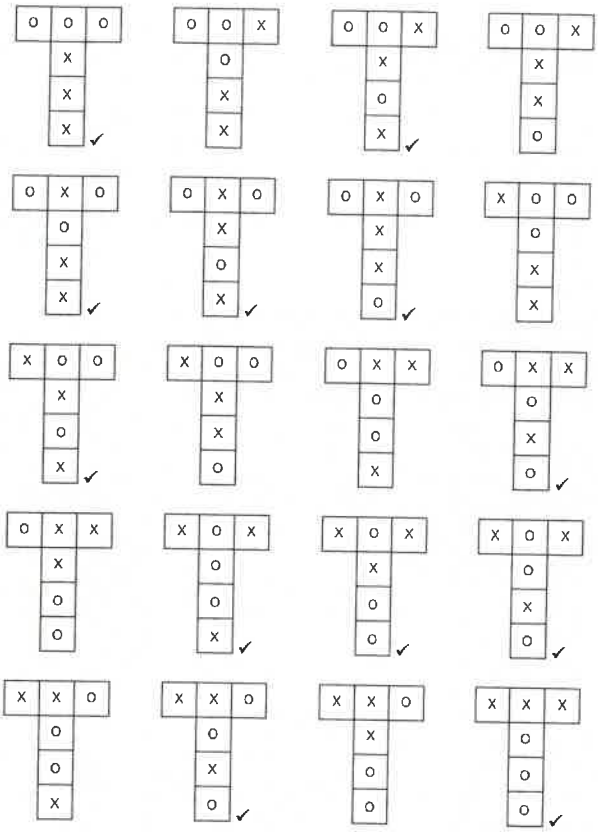
2 a Once the net is folded, the opposite face is the only one that does not touch the original face. The T-shape is already touching the face, the O-shape, the inverted V-shape and the C-shape will fold around and so touch the given face. The face with the U-shape is unable to touch the given face and so is the opposite face.

3 d Once the net is folded, the opposite face is the only one that does not touch the original face. The white square in a white box is already touching the face, the two squares with crosses and the smaller black square will also touch when folded up. The diagonally shaded square in the white box is unable to touch the given face and so is the opposite face.

4 e Once the net is folded, the opposite face is the only one that does not touch the original face. The white square is already touching, and the rectangle with one line, the Z-shape and the triangle will fold around and touch the given face. The face with the U-shape is unable to touch the given face and so is the opposite face.

Try it out

There are 20 possible permutations. Of these, 12 will have a pair of circles on opposite faces. The following is one example only – there are many other nets that could be drawn.



Matching features 2 (page 16)

Have a go

1 Accept any three sensible answers, including:
Made up of zig-zag shapes
Solid and dashed lines
Shapes at the end of each zig-zag are the same

2 Accept any three sensible answers, including:
All patterns made up of a triangle and a quadrilateral
Triangles are shaded
Shading style same throughout one set

3 Accept any three sensible answers, including:
All have three circles
All have an arrow crossing each circle
All arrowhead styles are the same
One section of each circle is shaded

4 b All shapes in this set have the arrow passing through them from the front to the back

5 c These strings are made up of more than two different shapes and do not have two black circles along them

Test yourself

1 d **number** – divided into three sections; **shading** – different shading styles used for two sections with one left white
Distractors: **shading** – styles used are unimportant; **shape** – the outline shape is unimportant; **size** – the size of the sections is unimportant

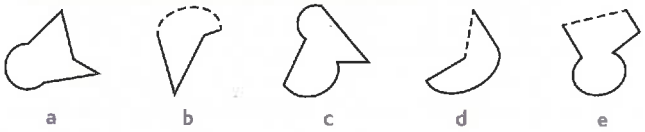
2 e **number** – (a) three lines form a zig-zag with two right-angles before continuing, (b) four more lines form a zig-zag with irregular angles
Distractors: **size** – line length of each section is unimportant

3 c **position** – (a) V-shapes have opening next to a solid line and away from a dashed line, (b) C-shapes have opening next to a dashed line and away from a solid line
Distractors: **size** of V- and C-shapes is unimportant; **number** – of V- and C-shapes is unimportant; **position** – of V- and C-shapes along the line is unimportant

4 d **number** – set of three adjoining squares; **position** – one triangle overlapping the set of squares; **shading** – (a) of squares can be seen through the triangles, (b) triangle is unshaded
Distractors: **number** – (a) of squares overlapped by the triangle, (b) of squares shaded; **shading** – style of shading used for the squares

Try it out

There are many possible answers. For example:

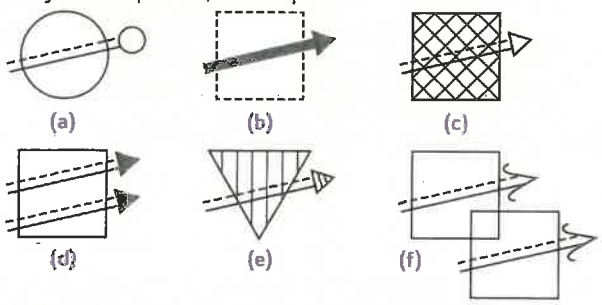


Applying changes 2 (page 18)

Have a go

1 (a) shape – outer triangle to circle
(b) number – one small circle to three small circles
(c) shading – large central circle white to shaded
(d) shape – central circle to a triangle
(e) shape – both shapes inside triangle from circle to square
(f) size – central shapes from large to small

2 Many answers possible, for example:



Test yourself

1 c **number** – six short horizontal lines from the upright, same as number of sides of the polygon; **shape** – at base is same as the shape in the centre of the polygon; **shading** – at base has same shading as the small shapes around the inside edge of the polygon
Distractors: **number** – of small shapes is not relevant

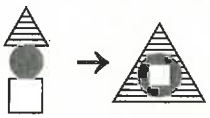
2 d **shading** – (a) top square shading same as the overlapping section of the top two circles, (b) middle square same shading as the overlapping section of the two circles on the left, (c) bottom square same shading as the overlapping section of the two circles on the right
Distractors: **shading** – styles of the other sections

3 b **shape** – (a) same shapes are used, (b) the outer shape is one of the shapes at the ends of the string; **relative position** – (a) three of the shapes overlap within the fourth shape; (b) overlapping shapes all within a large shape
Distractors: **relative position** – of the overlapping shapes

4 c **number** – outer shape has the same number of lines as the lines in the zig-zag; **shape** – a circle inside the polygon; **line style** – (a) same styles of the four lines in zig-zag around the quadrilateral, (b) line style of the curved line is used for the circle
Distractors: **length of lines** – in the zig-zags

Try it out

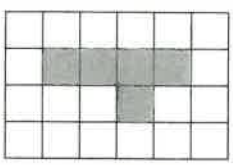
There are many possible answers. For example:



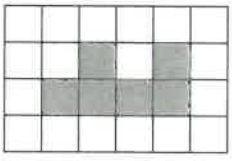
Matching 2D and 3D shapes 2 (page 20)

Have a go

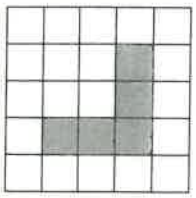
1 The upper layer of four cubes gives the shape of the plan as the single cube on the lower layer is directly beneath the top left-hand cube and so will not show on the plan (if you look at it from above).



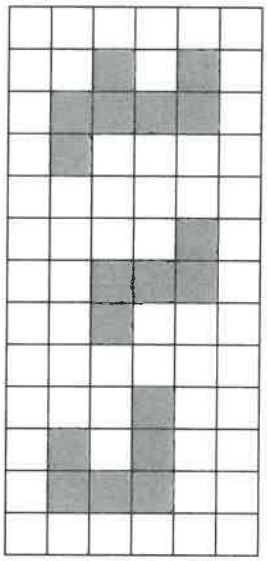
2 The middle layer of cubes gives the pattern of the plan as the cubes on the top and bottom layer are all directly above or beneath a cube in the middle layer.



3 The middle layer of cubes gives an L-shape where the vertical part of the L is two cubes and the horizontal section is three cubes long. The cubes in the two upper layers sit directly above cubes in the middle layer and so do not affect the plan. The cubes in the bottom layer extend for one cube beyond the middle layer on the right side, extending the vertical part of the L-shape, so that both parts are three cubes long in the plan.



4 Pair 1: a and f; Pair 2: b and c; Pair 3: d and e



Test yourself

1 c The bottom layer has two cubes in a line. This line is extended forward by the one cube on the second layer to become three in a line. The third layer does not extend beyond this, but the fourth layer extends by one cube each side across the central cube, making the plus shape plan of option **c**.

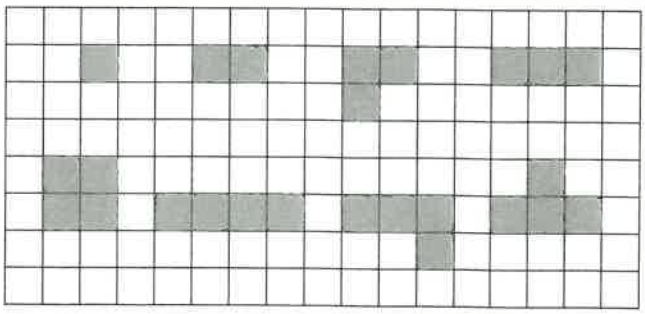
2 b The bottom layer has three squares in a line with two further squares on the right of one end, overlapping by one square and longer by one square. The middle layer single cube does not affect the plan. The top layer covers the original three cubes in a line and has a single cube projecting to the left side at the front end of the row, giving plan **b**.

3 c The bottom layer of two cubes gives a line that is extended back by another two cubes in the third layer, making a line of four. The second layer gives a cube on each side that is just one cube along from the end. The furthest end of the third layer has a single cube projecting to the right. The single cube in the fourth layer does not extend further, giving the plan in option **c**.

4 e The bottom layer gives three cubes in a row with one projecting forward at the right-hand end. The cubes in the second and third layers sit over these cubes. In the fourth layer two cubes project backwards from the central cube of the bottom row of three and an additional cube projects left from the central one of these three, giving the plan in option **e**.

Try it out

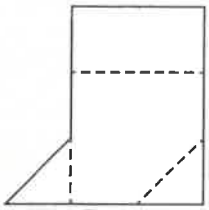
There are eight possibilities as shown here:



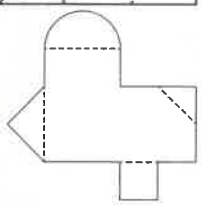
Following the folds 1 (page 22)

Have a go

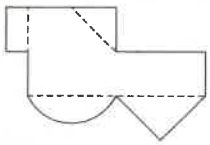
1 The triangle in the lower left corner of the diagram opens out to the left so a dashed line extends down to the bottom of the vertical left side. The lower right triangle opens out, so there is a dashed line diagonally in the lower right corner. The rectangle across the top opens up so needs a horizontal dashed line.



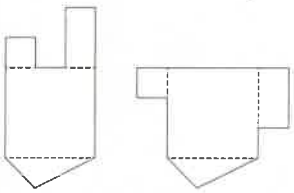
2 The semi-circle is folded in so there is a dashed line across the top of the plan beneath the semicircle. The straight vertical line on the left extends down with a dashed line as the triangle on the left folds in. A dashed fold line goes across the single square projecting down from the bottom edge. There is a diagonal fold line from lower right to upper left across the square corner on the right.



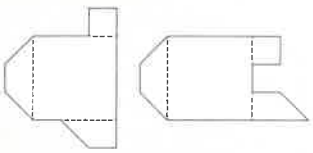
3 There should be dashed fold lines as shown.



4 For example, where a shaded section (representing a part folded in) shares two straight edges with the outside of the diagram, then there are two possible positions in the plan for that shape. So here the square could open up along the top edge or the left side and the rectangle could open up along the top edge or the right side. So there are four possible combinations.



5 For example, where a shaded section (representing a part folded in) shares two straight edges with the outside of the diagram, then there are two possible positions in the plan for that shape. So here the square could open up to the top or to the right and the trapezium can open up to the right or to the bottom. So there are four possible combinations.



Test yourself

In each of these the dashed fold lines act as lines of reflection for each small shape, so the mirror image of each small shape will be shown inside the larger shape.

1 c 2 b 3 d 4 e

Try it out

There are many possible answers.

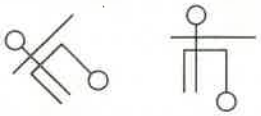
Matching a single image 1 (page 24)

Have a go

1 (i) a 45° b 90°
(ii) a 315° b 270°

2 (i) a 225° b 180°
(ii) a 135° b 180°

3



4

Test yourself

1 c 135° is one and a half right-angles. Rotating the figure clockwise by 45° gives option e, by 180° gives option a, by 90° anticlockwise gives option d and option b is a reflection

2 e 45° is half a right-angle. Rotating the figure by 90° gives option d, by 180° gives option b, by 135° gives option a, by 270° gives option c

3 b 270° is three right-angles or a three-quarter turn. Rotating the figure by 45° gives option a, by 90° gives option c, by 180° gives option d and 225° gives option e

4 e 90° is one right-angle. Rotating the figure 315° gives option a, by 225° gives option b, by 135° gives option c and 45° gives option d

Try it out

The correct answer must include this option:

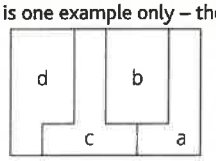
Translating and combining images 1 (page 26)

Have a go

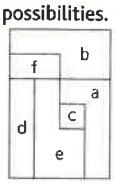
1 g is not needed – working across the top half of the rectangle are pieces a and b both rotated through 90°, then f and then e which is also rotated; on the lower part is d rotated through 90°, and then c and h both rotated through 180°

This is one example only – there are other possibilities.

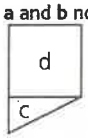
2



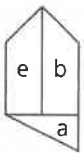
3



4 a and b not needed

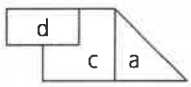


5 c and d not needed

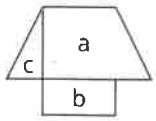


Test yourself

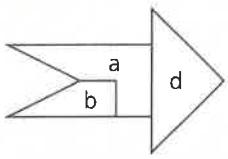
1 a c d



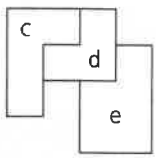
2 a b c



3 a b d

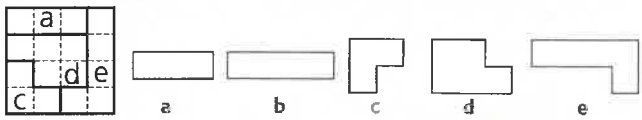


4 c d e



Try it out

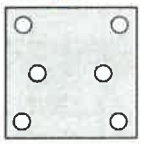
There are many possible answers. For example, b is not needed to complete this grid:



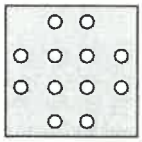
Following the folds 2 (page 28)

Have a go

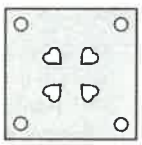
1



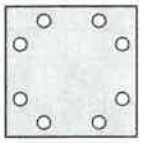
2



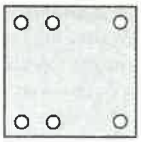
3



4



5



Test yourself

1 d The fold lines act like lines of reflection. When unfolding the second fold there will be two circles along the top of the rectangle, one at each end as it will be a reflection of the rectangular shape in the top section of the final folded piece. Unfolding the first fold to the left will give three circles in a vertical line.

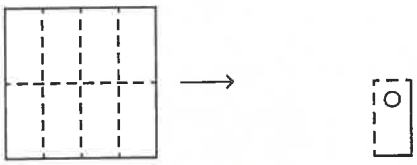
2 e The fold lines act like lines of reflection. Note that the heart shape will point towards the top of the square.

3 c The fold lines act like lines of reflection. Note that the two vertical holes are not in the centre of the vertical line.

4 c The fold lines act like lines of reflection. So, when unfolding the second fold, a right-angled triangle will be mirrored from the top-right corner of the lower left square into the lower right corner on the top (which still appears as a triangle). When the first diagonal fold is unfolded there will be a pair of right-angled triangles midway along the top edge of the large square, and four circles in the lower left smaller square, as reflected in a diagonal mirror line.

Try it out

The order of folding can vary but needs to end up with a small, vertical rectangle that is one-eighth of the square and has one circle punched out in the top half. For example:



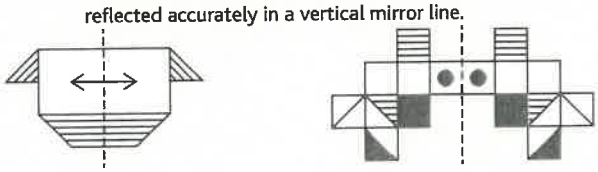
B Position and direction

Matching a single image 2 (page 30)

Have a go

1 c and d The easiest way to check is to hold a mirror vertically halfway along the picture, dividing it into two parts. The reflection will match the other part of the picture if it is reflected accurately in a vertical mirror line.

2



3 (a) AHIMOT (b) BCDEHIO

Test yourself

1 c **a** is an incorrect picture, **b** is nearly an exact copy of the question, **d** has no shading and the dashed line is in wrong position, **e** has inaccurate proportions

2 d **a** and **b** are not copies of the picture, **c** has line angle wrong in the top-right corner and an extra short diagonal line, **e** is nearly a copy of the question

3 e **a**, **c** and **d** all have some elements of the first picture incorrectly reflected and **b** is a horizontal reflection correctly reflected, but not accurately

4 e **a** and **c** have the arrow in the wrong position, **b** is a horizontal reflection, the diagonal line across the rectangle is incorrect in **d**

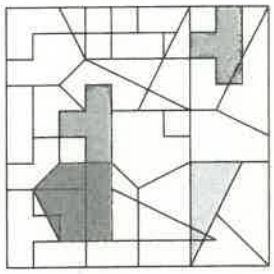
Try it out

There are many different possible answers. Check by holding a mirror along the dashed line.

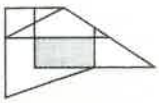
Translating and combining images 2 (page 32)

Have a go

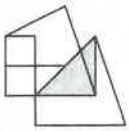
1 (i) 1
(ii) 1
(iii) 2



2 c The rectangles in **a** are not complete, in **b** they are too thin, there are no similar rectangles in **d**



3 b Looking for a right-angled triangle with the two short sides of equal length within the pattern eliminates **a**, **c** and **d**



Test yourself

1 c The two triangles are vertically opposite each other and both have right-angles at the point of contact. Look at the bottom left of option **c**.

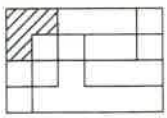
2 d The shape is made up of two pieces – the shape with the semi-circle on the right and the triangle.

3 d The most identifiable element of this long thin triangle is that the sharp 'point' or vertex is not vertically above the base line.

4 b The shape to find is a triangle with the tip cut off, or it can be envisaged as a triangle next to a small quadrilateral. The triangles in the other options lean the wrong way or do not match the shape exactly.

Try it out

There are many possible answers. For example:



Matching a single image 3 (page 34)

Have a go

1 i f ii c iii d iv e
2 i f ii a iii b
3 b
4 c
5 b Note direction of stripes

Test yourself

1 a and d **line length** – (a) the two end lines of the Z-shape are short, (b) the central line is long; **shading** – (a) one circle at one end is black, the other white, (b) central circle is white; **orientation** – **a** and **d** are rotations of the same picture and are therefore identical, but **e** is a reflection

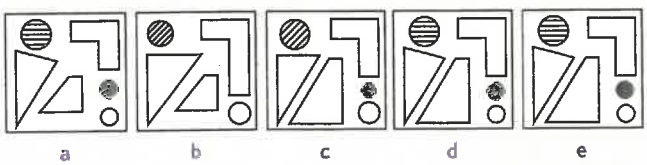
2 b and e **number** – six line segments; **rotation** – **e** is **b** rotated through 180°

3 b and c **number** – two small circles at each end of arc; **shading** – (a) both black at one end and white at the other end, (b) lines across the middle-sized circle; **position** – smaller black circle inside the line-shaded circle is touching the outer line at the top left

4 a and e **number** – (a) of horizontal lines, (b) of diagonal lines from central vertical line at base; **position** – of horizontal lines

Try it out

There are many possible answers. For example, **d** and **e** are identical here.



a b c d e

Translating and combining images 3 (page 36)

Have a go

1 i g ii e iii a iv c v h
2 i c and e ii b and d iii a and f
3 a 4 d 5 c

Test yourself

1 a One small right-angled triangle removed. In **c** the quadrilateral is too large. The triangle in **d** is not right-angled.

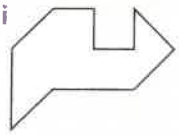
2 c The original shape is made up of a 'house' resting on a parallelogram, and an isosceles triangle is removed. Option **a** is a mirror image of the original. Some has been added to **b**. In **d** and **e** two triangles have been cut away. In **c** the triangle has been removed from one side of the parallelogram.

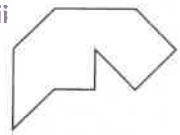
3 c In option **a** an additional triangle has been removed from the top. **b** has the triangle removed from the left-hand side but the pattern of triangles on the base is not the same as the original. Options **d** and **e** have small right-angled triangles cut away or added.

4 b Focus on the small rectangle, which, in **b**, has been cut out of the shape in the same orientation as the original. In **a** and **d** a small rectangle has been cut away, but the original smaller rectangular cut has been lost. Option **c** is the same as the original shape with no rectangle cut away and **e** is a different shape.

Try it out

There are many possible answers. For example, here i has a square cut away and ii has a triangle cut away.

i 

ii 

Translating and combining images 4 (page 38)

Have a go

1

Pattern	Block A	Block B	Block C	Block D
i	1	2	0	0
ii	1	1	1	0
iii	0	2	0	1
iv	1	2	0	1

2 b 3 a 4 c

Test yourself

1 c The L-shaped block is rotated 90° clockwise in a horizontal plane, with the front end resting on a cube that is placed next to the other cube. The cuboid is balanced on the top, extending over the cube beneath but not sitting on it.

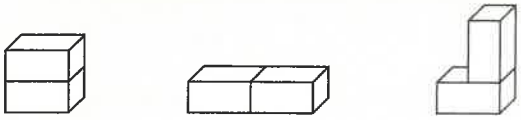
2 e One of the L-shaped blocks is rotated into a horizontal position and fitted into the other. The end of the upper L-shape is resting on the cuboid.

3 e One of the long cuboids is sitting on top of the inverted L-shaped block, and the other is beneath it at right-angles and resting on the single cube

4 a The T-shaped block is turned upside down and the L-shaped block fits round one side. The long cuboid sits along the base next to the horizontal bar of the T-shape.

Try it out

There are many possible answers. Here are three examples.



Maths workout 1 (page 40)

Working with 2D shapes

1 a b e f 2 b c d e

3 i (2,0) ii (3,1) (2 marks)

4 i (3,3) ii (2,0) (2 marks)

Working with 3D shapes

1 a 38 cm² b 28 cm² c 34 cm² d 38 cm² (4 marks)

2 (a) i 1 ii 1 (b) i 7 ii 1 (4 marks)

Codes, sequences and matrices

Connections with codes 1 (page 42)

Have a go

1 a Y – the number of circles is determined by the second letter
b A – the shape is determined by the first letter (the rotation of the shape is a distractor)

2 a S – the shape of the arrowhead is determined by the second letter
b M – the number of lines making up the arrow is determined by the first letter (the curved line is a distractor)

3 a E – the number of parallel lines is determined by the first letter
b M – the shading in the circle is determined by the second letter
Distractor 1: **number** – of sides on large outer shape
Distractor 2: **position** – of short lines across edge of shape

4 a Z – the number of circles is determined by the second letter
b B – the number of triangles is determined by the first letter
Distractor 1: **shape** – triangles
Distractor 2: **shading** – of circles
Distractor 3: **position** – of circles

5 a Y – the shading style is determined by the third letter
b N – the proportion of the shape shaded is determined by the second letter
c A – the outer shape is determined by the first letter

Test yourself

1 b **orientation** – the first letter represents the position of the shield: A pointing up, B to the right and C down; **number** – the second letter represents the number of lines across the straight edge of the shield: F two lines, G one line
Distractors: **number** – of points on the star; **shading** – of star

2 c The first letter refers to the **number** of squares in the pattern, A is for 3 and B for 4 squares; the second letter refers to the **shading** of the large circle, P has two lines across it, Q has one line and R is fully shaded; and the third letter refers to the **number** of black dots in one of the squares, X for 1, Y for 2 and Z for 3.
Distractors: **angle** – of line across white circle; **shape** – formed by the adjoining squares; **orientation** – of the black spots.

3 e the first letter is for the **number** of curved lines: A is for one; the second letter is for the basic **shape** (L, Z or F) so answer is Y for a Z-shape on its side; the third letter is for the **orientation** of the pair of short lines that cross one of the vertical lines, so G is for them crossing at right-angles
Distractors: **orientation** – of the letter; **line style** – of the pair of short lines

4 d the first letter is for the **number** of small white circles inside the large white circle, so M for three; the second letter is for the **shading** style of the section where the small circle overlaps the large circle: so X for remaining white, so answer is MX
Distractors: **size** – of smaller circle; **number** – of straight lines across the circle; **position** – of smaller circles across the large circle

Try it out

There are many possible answers. For example:

(a) AMT (b) ALS (c) CMR (d) BNR

where the first letter is for the number of short straight lines across the triangle, the second letter is for the shading of the circle inside the triangle and the third letter is for the shading of the shape outside the triangle.

Sequences 1 (page 44)

Have a go

1 A rectangle made up of two adjacent squares, with one spot in the first square and two in a diagonal line across the second square from top left to bottom right

2 A circle with a solid arrow pointing to the left from a central spot in the circle, with the arrow ending at the circumference

3 A cross should be added to **c**, a small white triangle to **d**, a small white circle to **e**

4 The two circles should be black, the corner at the base of the triangle should be shaded with horizontal lines and the central square will be all black

5 A small black circle sitting inside the crescent shape, touching but not crossing it; and four short horizontal lines, two coming out to the left from the top and two from the bottom of the crescent should be added

Test yourself

1 c **position** – the larger circle moves down the string; **number** – (a) of small black spots reduces by one each time, (b) of lines in the solid zig-zag reduces by one each time, (c) of lines in the dashed zig-zag increases by one each time
Distractors: **position** – (a) of the zig-zags within the square, (b) of the point where the dashed zig-zag crosses the thread line

2 d **number** – (a) of circles decreases by two each time, (b) of shaded segments decreases by one each time
Distractors: **size** of circles; **position** of shaded sections

3 d **proportion** – shaded section in the circle on the left increases by a quarter each time; **shading** – style of shading in the left-hand circle alternates between diagonal stripes and black; **angle** – (a) the dashed radius line in right-hand circle moves 45° clockwise each time, (b) the solid radius line in right-hand circle moves 90° anticlockwise each time
Distractors: **shading** – style of background

4 d **position** – (a) the shaded square moves one place round the edge of the larger square anticlockwise each time, (b) the white circle is always directly opposite the shaded square, (c) the black circle is one square ahead of the white circle; **shading** – (a) angle of line shading in the square rotates 45° clockwise each time, (b) the central square alternates white and black

Try it out

Many different solutions are possible. For example:

Matrices 1 (page 46)

Have a go

1 The first grid has the same shape in each column and the shading along each row alternates so:
i **h** white diamond ii **a** black circle
iii **e** white triangle
In the second grid the pattern moves down the grid in a zig-zag way along the top row from left to right and then back across the middle row and along the bottom row. So the shapes go circle, triangle, diamond, circle, triangle, diamond, and so on while the shading goes stripes, black, black, white, stripes, black, black, white, and so on.
iv **g** black diamond v **f** striped triangle

2 There is a diagonal line from bottom-left corner to top right, the triangle on the upper left side is divided into two with a line from the top-left corner of the square to the centre of the square. The small triangle on the left has vertical line shading and the small triangle at the top right has horizontal line shading

3 There should be three circles in the square, each one shaded with grid line shading. The number of circles is indicated by the number of crosses in the triangle to their right and their shading is determined by the shading of the triangle beneath them.

4 (a) shading (b) shape (c) line
(d) background shading

5 This grid has four lines of symmetry – one vertically across the centre, one horizontally across the centre, and then two diagonal lines of symmetry also passing through the centre. The box should have a wide V-shape drawn in the lower half with the inner angle of the V shaded black, and two thin parallel lines going across the top of the square. It is a reflection of the top square in the grid.

Test yourself

1 b the **shapes** alternate down the columns, so it will be a triangle pointing left; **shading** style alternates along the rows so it will have vertical stripes

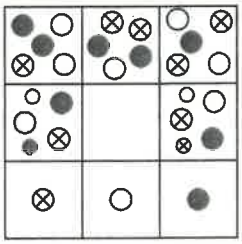
2 d **shape** – (a) the symbol in top-left corner of each square is the same along each diagonal line, so there will be a small right-angled triangle across the top-left corner, (b) shape in bottom-left corner is same along each row, so there will be a spade shape; **number** – of black spots on the right same in each row, so there will be three; **shading** – one of each style of shading on each row, so spade will be black

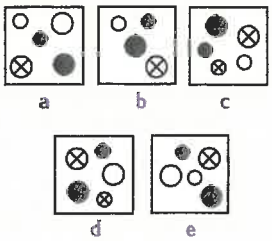
3 e **number/position** – two shapes, one in top-right corner and one in lower left corner (which is in the middle of the grid); **shape** – (a) the lower left shape in the square is taken from the border of the next square going clockwise, (b) the shape in the upper right corner is from the adjacent border and will be an L-shape; **shading** – (a) the lower left shape is black, (b) the upper right shape is white

4 b **rotation** – anticlockwise by 90°; **position** – of shaded element of the small circle pattern; **orientation** – of each element in relation to the sides of the square

Try it out

There are many possible answers. For example:





Connections with codes 2 (page 48)

Have a go

1 i AN a square with horizontal stripes
ii BL a black circle
iii CM a white triangle
iv BM a white circle
v CN a triangle with horizontal stripes
vi AL a black square

2 i EZ ii DX iii FZ
iv FY v DY

3 A one triangle
B two triangles
X no shading
Y two shapes shaded
Z one shape shaded

4 D zig-zag of three lines
E zig-zag of two lines
F zig-zag of four lines
S circle shaded black
T circle with diagonal cross line shading

5 Completed picture must include an arrow pointing down and a curved line with two black circles on it – the white circles and arrowhead style are distractors and so do not matter.

Test yourself

1 b first letter is for **shape** of base; second letter is for **number** of flowers
Distractors: **lines** – presence or absence of leaves; **shading** – of shape at base

2 e first letter is for **position** of the shaded shape in the line, so R for middle; second letter is for the **sequence** of shapes, so X for rectangle, circle and oval from bottom to top
Distractors: **angle** – of line across the square

3 c first letter is for **angle** of diagonal dashed line; second letter is for **number** of solid straight lines
Distractors: **orientation** – of straight lines; **angle** – of intersections of straight lines; **size** – of curved lines

4 d first letter is for the **shape** of the three diagonal items, so P for black dots, Q for white dots and R for crosses; second letter is for **position** of white circle on the top row, L for left and M for right
Distractors: **position/shapes/shading** of the other elements

Try it out

There are many possible answers.

Sequences 2 (page 50)

Have a go

1 a Small circle with vertical stripes as the lines rotate by 45° anticlockwise each time, progressing along the sequence
b Three short arrows pointing right, in a vertical line as the orientation of the arrows remains the same along the top and bottom rows but the number increases by one
c Six small black circles arranged in any way in the bottom left corner because their number increases with no particular arrangement

2 a A white circle because alternate L-shapes have a circle at the top right that alternates between black and white shading
b A short horizontal arrow pointing left because there is an arrow at the top of the back-to-front L-shapes, rotating 45° clockwise each time
c A white equilateral triangle because there is an equilateral triangle beneath each arrow alternating between black and white

3 i c The number of short lines decreases by one each time so there should be four lines, with the centre of the crossed lines forming a shape with the same number of sides – option c has a quadrilateral in the middle
ii h The shaded third of the circle moves one position anti-clockwise each time and the shading style alternates

4 i b Equilateral triangles alternate with right-angled triangles, and alternate equilateral triangles are inverted. When the 'base' line is across the top it has a solid line outside, otherwise this line is dashed
ii h Right-angled triangle rotates 90° anticlockwise each time, with a solid line outside when 'base' line is across the top

5 Various possible options, for example:
a circle with an arrow through it pointing left
b equilateral triangle with diagonal stripes from lower left to top right
c square with three black circles forming a vertical line down the middle

Test yourself

1 e **position** – (a) U-shape along top line will be at the right-hand side of the square as it is moving along, (b) double dashed line across the bottom of the square; **shading** – a white circle in the middle

2 d **angle** – (a) solid line arc of outer circle encompasses 180°, (b) solid line arc completes outer circle encompasses 180°, (c) inner arc encompasses 90°; **rotation** – (a) outer arrow moves 45° anticlockwise each time, (b) inner arrow moves 90° clockwise each time; **shading** – (a) of quarter section of central circle moves anticlockwise round each time, (b) arrowhead of inner arrow alternates from black to white

3 c **position** – right-angled triangle in top-right corner; **shading** – (a) black square bottom left, (b) circle in centre of square has X inside

4 e **rotation** – arrow rotates 90° anticlockwise each time; **line style** – tail of arrow changes from solid to dashed to double lines each time; **shading** – small circle at end of line that crosses the arrow alternates from black to white; **position** – the larger circle that is divided into quarters moves from end of line with small circle, to middle, to open end and then back to the small circle end

Try it out

There are many possible answers. For example:

Matrices 2 (page 52)

Have a go

1

2 a Each column has same number of points on star or sides to shapes. Each column has one black star, one white shape on a black background and one white shape. Missing pattern is a white equilateral triangle on a black background.
b Small black circle in lower right corner and rectangle across the top with vertical line shading – mirror image of patterns in the top row.
c A white semi-oval with straight side across the bottom and diagonal stripes behind from bottom left to top right. White shapes in top row are reflected in the squares in the bottom row with same ones having a shaded background although the stripes stay the same rather than being reflected.

3 i b The top and bottom patterns combine to give the middle pattern in each of the other columns.
ii d Two of the patterns in each column combine to give the third pattern in each of the other columns.

4 The triangle will have grid lines, the top circle will be black and the bottom circle will have diagonal stripes from bottom left to top right.

Test yourself

1 c **shading** – in each column the top cell (with its pattern of shaded squares) overlays the square in the middle row, and where shaded squares overlap they disappear from the bottom row. If they are white in both the top and middle row they remain white in the bottom row.

2 e **shape** – (a) quarter circle in bottom-right corner of square, (b) small circles one each side of the short line; **shading** – (a) diagonal line shading from top left to bottom right in the quarter circle, (b) lower left small circle black, upper right circle white; **position** – short line from top-left corner to the centre of the box

3 c **number** – two shapes (same as number of spots in adjacent square); **shape** – small rectangles (same as shape in adjacent square); **shading** – black (same as shading of corner triangle)

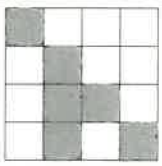
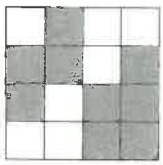
4 d **number** – two circles as numbers in rows increase by one each time and numbers in columns reduce by two down the columns; **shading** – white circles (middle column all white) Distractors: **numbers** and **shading** of surrounding spots

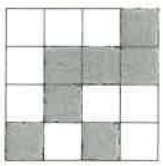
Try it out

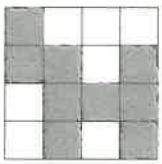
There many possible answers.

Maths workout 2 (page 54)

Rotating and translating images

1 (a)  (b) 

2 (a)  (b) 

3 

Working with numbers

1 (a) 8 (b) 11 (c) 11 (d) 22 (e) 19 (f) 12
(g) 31 (h) 41 (i) 41 (j) 72 (k) 154 (l) 154
(5 marks – 1 mark per row)

2 Each number is the sum of the two numbers above.
(a) 30 (b) 10 (c) 20 (d) 20 (e) 25 (f) 25
(4 marks – 1 mark per row)

3 Each number is half of the sum of the two numbers above.
(a) 14 (+1, +2, +3, +4)
(b) 24 (+2, +4, +6, +8)
(c) 54 (+5, +10, +15, +20) (3 marks)

Properties of 2D shapes

1 (a) pentagon (b) trapezium (c) equilateral triangle
2 36° 3 48° (top) 60° (bottom) 4 51° 5 125°