Unit 19 · Symmetry and Tessellation

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 28

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Fold the triangle

ANSWER U · 3

i. $\angle C$ lands on $\angle B$, so the two angles are **equal**.

ii. $\angle B + \angle C = 180° - 40° = 140°$, shared equally: $\angle B = \angle C = \mathbf{70}°$.

iii. Each fold shows two of its angles are equal, so **all three are equal**: $180° \div 3 = \mathbf{60}°$ each.

MARKING SCHEME

✓ ∠C lands on ∠B, so they are equal.

✓ 70° each.

✓ All equal, 60° each.

2 Words with a line of symmetry

ANSWER A · 3

- **MOM** and **TOOT**: a line **up and down** through the middle. Each letter has an up-and-down line, and the word reads the same from both ends.
- **BOX**, **CHOICE** and **HIDE**: a line **across** the middle. Every one of their letters has a line across.
- **NEPAL**: **none**. N has no line of symmetry at all.

MARKING SCHEME

✓ MOM and TOOT, up and down.

✓ BOX, CHOICE and HIDE, across.

✓ NEPAL, none.

3 Complete the cross

ANSWER HA · 4

i. The line is copied into the other three quarters: the figure is a **plus-shaped cross**, 8 squares across and 8 squares up and down, each arm 4 squares wide.

ii. **12 sides**. The pieces you drew on the dotted lines join their copies to make the four 4-square ends; the other 8 sides are 2 squares long.

iii. **4**: the two dotted lines and **both diagonals** through O. The part you drew is the same on both sides of the slanting line through O, so the diagonals are lines of symmetry too.

iv. The 8 by 8 square is 64 squares; the four 2 by 2 corners cut off are 16: $64 - 16 = \mathbf{48}$ **squares**.

MARKING SCHEME

✓ The completed cross.

✓ 12 sides.

✓ 4 lines, the diagonals included.

✓ 48 squares.

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4 Quadrilaterals folded

ANSWER A · 3

Shape	Square	Rectangle	Rhombus (not a square)	Parallelogram (not a rectangle or rhombus)	Trapezium with equal slanting sides	Trapezium with two right angles
Lines of symmetry	**4**	**2**	**2** (its diagonals)	**0**	**1**	**0**

A rhombus folds along each diagonal, but not across the middle; a rectangle folds across the middle both ways, but not along a diagonal.

MARKING SCHEME

- ✓ Square 4 and rectangle 2.
- ✓ Rhombus 2 and parallelogram 0.
- ✓ The trapeziums 1 and 0.

5 Spot the error

ANSWER U · 3

i. She **slid** the L across instead of **flipping** it. In a mirror image, everything that points towards the line still points towards it.

ii. The upright is **3 squares to the right** of the dotted line, 4 squares tall, and its foot points **left**, towards the line, ending 1 square from it.

iii. **Yes**: a figure and its mirror image together are always symmetric about the mirror line.

MARKING SCHEME

- ✓ She slid it instead of flipping it.
- ✓ Upright 3 squares right, foot pointing left.
- ✓ Yes, symmetric about the dotted line.

6 Which tiles fit?

ANSWER A · 4

i. The side must go exactly into both 300 cm and 240 cm. 20: 15 and 12 ✓. 25: 12 and 9.6 ✗. 30: 10 and 8 ✓. 40: 7.5 ✗. 50: 6 and 4.8 ✗. 60: 5 and 4 ✓. So **20 cm, 30 cm and 60 cm**.

ii. The biggest tile, **60 cm**: $5 \times 4 =$ **20 tiles**.

iii. $15 \times 12 =$ **180 tiles**.

MARKING SCHEME

- ✓ Each side must divide 300 cm and 240 cm.
- ✓ 20 cm, 30 cm and 60 cm.
- ✓ 60 cm, 20 tiles.
- ✓ 180 tiles.

7 Think: shapes that close up

ANSWER HA · 4

i. **No.** Two corners make 270°, too little; three make 405°, too much. They never make exactly 360°.

ii. $360° - 270° =$ **90°**: a **square** fits the gap. Octagons and squares together can cover a floor.

iii. **Yes**: $60° + 120° + 60° + 120° =$ **360°**.

iv. **Yes**: in rows, each tile beside the next, like bricks leaning over. Every point where corners meet takes the four different corners.

MARKING SCHEME

- ✓ No: 270° or 405°, never 360°.
- ✓ 90°, a square.
- ✓ 360°, yes.
- ✓ Yes, they tessellate.

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8 Think: coloring a brick wall

ANSWER HA · 4

i. **Two**, colored like a chessboard.

ii. The two bricks below are side by side, so they have different colors, say A and B. The brick on top touches both, so it can be neither A nor B: it needs a **third** color.

iii. Color the bottom row A, B, C, A, B, C, … Then give every brick in the next row the color that **neither of the two bricks under it** has: over A and B put C, over B and C put A, over C and A put B. Do the same for every row above. Bricks side by side in a row then always differ too.

MARKING SCHEME

- ✓ Two colors.
- ✓ The brick on top touches two bricks of different colors.
- ✓ A third color is needed.
- ✓ A working three-color pattern.

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Art with Hexagons** (exhibit): The crayons are packed into a regular hexagon. Like the hexagon in your book, its outline has 6 lines of symmetry. Do the colors match across each one too?
- **The Kaleidoscope** (exhibit): Look through a tube: each mirror shows the colored pieces again as their mirror image, so each mirror's line is a line of symmetry of the pattern.
- **Peepal** (garden): Look at a peepal leaf: its middle vein is a line of symmetry, with the two halves almost the same, though a real leaf is never quite perfect.
- **Pac-Man Cube Mosaic** (exhibit): Square cube faces cover each picture with no gaps and no overlaps: a tessellation of squares, colored to make a picture.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	6	10	12	**28**

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