# Unit 15 · Congruent Figures

**HARDER PRACTICE QUESTIONS · ANSWER KEY**

Full marks 35

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

## 1 Spot the errors

**ANSWER** U · 4

i. **Not necessarily.** A 3 cm × 4 cm and a 2 cm × 6 cm rectangle both have 12 cm$^2$, but they are different shapes. Same area is not enough.

ii. **Not necessarily.** Same angles give the same shape, but one can be bigger (a set square and its enlarged photo).

iii. $AB = PQ$**.** The corners match in order, $A$ with $P$ and $B$ with $Q$, so $AB$ matches $PQ$. ($BC = QR$.)

iv. **They are congruent.** Flipping a shape over doesn't change its shape or size: after the flip it fits exactly.

**MARKING SCHEME**

✓ i. Not necessarily: same area, different shapes.

✓ ii. Not necessarily: same shape, different sizes.

✓ iii. $AB = PQ$.

✓ iv. Congruent: flipping changes nothing.

## 2 Matching parts

**ANSWER** A · 4

i. $KL = DE =$ **6 cm**; $LM = EF =$ **10 cm**.

ii. $\angle K = \angle D =$ **90**°; $\angle L = \angle E =$ **53**°.

iii. $\angle M = \angle F = 180° - 90° - 53° =$ **37**°.

iv. $KM = DF = 8$ cm, so the perimeter is $6 + 10 + 8 =$ **24 cm**.

**MARKING SCHEME**

✓ i. 6 cm and 10 cm.

✓ ii. 90° and 53°.

✓ iii. 37°.

✓ iv. 24 cm.

## 3 Find the unknowns

**ANSWER** A · 4

i. $AB = XY$: $2x + 1 = 9$, $x =$ **4**.

ii. $\angle C = \angle Z$: $3y = 51$, $y =$ **17**.

iii. $BC = YZ$: $3p - 2 = p + 6$, $2p = 8$, $p =$ **4**, and $BC =$ **10 cm** ($YZ = 4 + 6 = 10$ ✓).

iv. $\angle X = \angle A = 2k°$. The angles of $\triangle XYZ$: $2k + (k + 9) + 51 = 180$, $3k = 120$, $k =$ **40** (angles 80°, 49°, 51°).

**MARKING SCHEME**

✓ i. $x = 4$.

✓ ii. $y = 17$.

✓ iii. $p = 4$, $BC = 10$ cm.

✓ iv. $k = 40$.

## 4 Cutting a tile

**ANSWER**

i. **Congruent**: two right-angled triangles with sides 40 cm and 40 cm round the right angle. Turn one half a turn and it covers the other.



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ii. **Congruent**: four triangles. The diagonals of a square are equal, bisect each other and cross at 90°, so each piece has two equal half-diagonals with a right angle between them, the same in all four: a quarter turn puts each piece on the next. U · 4

iii. **Congruent**: two rectangles, each 40 cm by 20 cm.

iv. **Not congruent**: one piece is a triangle and the other has four sides. Different shapes.

MARKING SCHEME

- ✓ i. Congruent triangles.
- ✓ ii. Four congruent triangles.
- ✓ iii. Two congruent rectangles, 40 cm × 20 cm.
- ✓ iv. Not congruent: a triangle and a four-sided piece.

## 5 Triangles in a rectangle

ANSWER A · 4

i. $\triangle AOB$, $\triangle BOC$, $\triangle COD$, $\triangle DOA$.

ii. $\triangle AOB \cong \triangle COD$ and $\triangle BOC \cong \triangle DOA$: half a turn about $O$ puts $A$ on $C$ and $B$ on $D$, so each triangle lands on the one opposite. $\triangle AOB$ is not congruent to $\triangle BOC$: their sides $AB$ and $BC$ are different.

iii. $\triangle ABC$, $\triangle BCD$, $\triangle CDA$, $\triangle DAB$. **Yes, all four**: each is a right-angled triangle with the rectangle's length and breadth round its right angle.

iv. **All four**: in a square every side is equal and the diagonals cross at 90°.

MARKING SCHEME

- ✓ i. The four small triangles.
- ✓ ii. Opposite ones congruent, with a reason.
- ✓ iii. The four big triangles, all congruent.
- ✓ iv. All four.

## 6 Built from the same parts

ANSWER A · 4

i–ii. Each is two sides and the angle between them (SAS), constructed with a compass.

iii. **Congruent**: both have a 60° angle between sides of 5 cm and 6 cm. One fits on the other (turned, or flipped, depending on how they were drawn).

iv. $B$ matches $Q$ (the 60° corners); $A$, at the end of the 5 cm side, matches $R$; $C$ matches $P$: $\triangle ABC \cong \triangle RQP$.

MARKING SCHEME

- ✓ i. $\triangle ABC$ constructed.
- ✓ ii. $\triangle PQR$ constructed.
- ✓ iii. Congruent.
- ✓ iv. $\triangle ABC \cong \triangle RQP$.



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## 7 Same area, same perimeter

**ANSWER** HA · 4

i. One fits exactly on the other, so it covers exactly the same paper (same area) and its edge lies exactly on the other's edge (same perimeter).

ii. Both have an area of **5 squares** and a perimeter of **12 sides of squares**.

iii. **No**: one is straight and the other bent, different shapes. Same area and same perimeter do **not** make two figures congruent.

iv. Length + breadth = 7 and length × breadth = 12: only **4 cm by 3 cm**. So **yes, congruent**: for rectangles, the area and the perimeter together do fix the size.

**MARKING SCHEME**

✓ i. One covers the other exactly.

✓ ii. Both 5 squares and 12 sides.

✓ iii. Not congruent: same area and perimeter are not enough.

✓ iv. Yes: both 4 cm by 3 cm.

## 8 Think: four Ls make an L

**ANSWER** HA · 4

i. Number the columns 1–4 from the left and the rows 1–4 from the bottom; A, B, C, D are the pieces:

| | **column 1** | **column 2** | **column 3** | **column 4** |
|---|---|---|---|---|
| row 4 | C | C | | |
| row 3 | C | D | | |
| row 2 | A | D | D | B |
| row 1 | A | A | B | B |

One small L sits in each of the three outer corners (A, B, C), and the fourth (D) fills the middle, along the inside of the bend.

ii. **Yes**: the big L is the small L with every side **twice** as long.

iii. **Yes**: a square with sides twice as long holds 4 small squares, and with sides three times as long, 9.

iv. **He is wrong.** The small L's perimeter is 8 sides of squares and the big L's is 16: only **twice** as long, while the area is 4 times.

**MARKING SCHEME**

✓ i. Four congruent Ls covering the big L.

✓ ii. Same shape, sides twice as long.

✓ iii. Yes, 4 and 9 squares.

✓ iv. Perimeter 8 and 16: twice, not 4 times.

## 9 Make your own

**ANSWER** A · 3

For example:

i. A shape like the letter L, and the same L flipped (its foot pointing the other way).

ii. A Rs 1 coin and a Rs 2 coin; a photo and an enlarged print of it.

iii. For two triangles: $\triangle ABC \cong \triangle PQR$, with $A$ on $P$, $B$ on $Q$ and $C$ on $R$.

Any correct answers are right.

**MARKING SCHEME**

✓ i. Two congruent figures, one flipped.

✓ ii. Same shape, different sizes.

✓ iii. A congruence in matching order.



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## 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.

- **Tangram Puzzle** (exhibit): Lay one large triangle on the other: they match exactly, so they are congruent. The middle-sized triangle has the same shape but not the same size: not congruent.

| Marks by level | Knowledge | Understanding | Application | Higher ability | Total |
|---|---|---|---|---|---|
| **Marks** | 0 | 8 | 19 | 8 | **35** |