Unit 15 · Plane Shapes

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 34

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

1 Possible or not?

ANSWER U · 5

i. **No.** All three angles of an equilateral triangle are 60°, so none of them is 90°.
ii. **Yes**: two equal short sides with a wide angle between them, such as sides 3 cm and 3 cm with 120° between them.
iii. **Yes**: two equal sides with a right angle between them, such as 3 cm and 3 cm at 90°, like a square cut along its diagonal.
iv. **No.** Two obtuse angles already add up to more than 180°, with nothing left for the third angle.
v. **Yes**: for example angles 90°, 60° and 30°, whose sides are all different (or 80°, 60°, 40°).

MARKING SCHEME

✓ No, its angles are all 60°.
✓ Yes, with an example.
✓ Yes, with an example.
✓ No, two obtuse angles make more than 180°.
✓ Yes, with an example.

2 Spot the error

ANSWER A · 3

i. $48° + 75° + 67° = \mathbf{190}°$, but the three angles of a triangle add up to 180°.
ii. $180° - 48° - 67° = \mathbf{65}°$.
iii. **Acute-angled** in every case. If 48° is wrong, it should be $180° - 75° - 67° = 38°$; if 75° is wrong, 65° (part ii); if 67° is wrong, $180° - 48° - 75° = 57°$. Each time all three angles are less than 90°.

MARKING SCHEME

✓ The sum is 190°, not 180°.
✓ 65°.
✓ Acute-angled, with the three cases.

3 Angles of a parallelogram

ANSWER A · 3

i. The angle next to it is $180° - 65° = 115°$, and the opposite angles are equal: **65°, 115°, 65°, 115°**.
ii. The two angles make 3 equal parts of 180°: $180° \div 3 = 60°$. The angles are **60°, 120°, 60°, 120°**.
iii. **No.** Opposite angles must be equal, but 110° and 100° are opposite each other. (Also, $70° + 100°$ is 170°, not 180°.)

MARKING SCHEME

✓ 65°, 115°, 65°, 115°.
✓ 60°, 120°, 60°, 120°.
✓ No: 110° and 100° should be equal.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

4 Which names fit?

ANSWER U · 4

Property	Square	Rectangle	Rhombus	Parallelogram	Trapezium
All four sides equal	✓	✗	✓	✗	✗
All four angles 90°	✓	✓	✗	✗	✗
Opposite sides equal	✓	✓	✓	✓	✗
Both pairs of opposite sides parallel	✓	✓	✓	✓	✗
Only one pair of opposite sides parallel	✗	✗	✗	✗	✓

The **square**: it is a rectangle, a rhombus and a parallelogram all at once.

MARKING SCHEME

- ✓ The first two rows right.
- ✓ The third and fourth rows right.
- ✓ The last row right.
- ✓ The square.

5 True or false?

ANSWER A · 4

i. **True.** A rectangle's opposite sides are parallel.

ii. **False.** A rhombus that leans has four equal sides but no right angles, so it is not a square.

iii. **True.** For example, draw the two parallel sides 5 cm and 3 cm long, both starting on one upright line at right angles to it, 2 cm apart, and join their other ends. It has two right angles.

iv. **False.** The angle next to a right angle is $180° - 90° = 90°$, and the opposite angles are equal too, so all four angles are right angles: it is a rectangle.

MARKING SCHEME

- ✓ True, with a reason.
- ✓ False, with a reason.
- ✓ True, with an example.
- ✓ False: all four angles become 90°.

6 One wire, many shapes

ANSWER A · 4

i. $36 \div 3 = $ **12 cm**.

ii. $36 \div 4 = $ **9 cm**.

iii. Still **9 cm**: the wire's length didn't change, only the angles.

iv. Length + breadth $= 36 \div 2 = 18$ cm. The length is 2 parts and the breadth 1 part: $18 \div 3 = 6$. Breadth **6 cm**, length **12 cm**.

MARKING SCHEME

- ✓ 12 cm.
- ✓ 9 cm.
- ✓ 9 cm, the sides don't change.
- ✓ 6 cm and 12 cm.

7 On squared paper

ANSWER

i. All four sides are as long as **5 squares**. (AD goes 3 across and 4 up, and measures the same as AB.)

ii. A **rhombus**: all four sides are equal, and its angles are not right angles, so it is not a square.

iii. $\angle DAB \approx$ **53**° and $\angle ABC \approx$ **127**° (they add up to 180°).

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

iv. For example: P at a point, Q 6 squares to its right, S 3 squares up from P, and R 3 squares up and 2 squares left from Q. Then PQ (6 squares) ∥ SR (4 squares), with right angles at P and S, and QR slants. Any four-sided shape with exactly one pair of parallel sides and two right angles. **A · 4**

MARKING SCHEME

- ✓ Four equal sides.
- ✓ A rhombus, not a square.
- ✓ About 53° and 127°.
- ✓ A trapezium with exactly two right angles.

8 Think: triangles in a square

ANSWER **HA · 4**

i. **8 triangles**: 4 small ones, $\triangle AOB$, $\triangle BOC$, $\triangle COD$, $\triangle DOA$, and 4 big ones, $\triangle ABC$, $\triangle BCD$, $\triangle CDA$, $\triangle DAB$.

ii. OA = OB ≈ 2.8 cm and AB = 4 cm; $\angle AOB = 90°$, and the other two angles are 45° each. A **right-angled isosceles** triangle.

iii. AB = BC = 4 cm and AC ≈ 5.7 cm; $\angle B = 90°$, the other two 45° each. Also **right-angled isosceles**.

MARKING SCHEME

- ✓ 8 triangles.
- ✓ Their names.
- ✓ AOB right-angled isosceles.
- ✓ ABC right-angled isosceles.

9 Think: make the frame stiff

ANSWER **HA · 3**

i. **2 diagonals** from one corner make **3 triangles**.

ii. **3 diagonals** from one corner make **4 triangles**.

iii. Each time a side is added, one more diagonal is needed. The number of diagonals is 3 less than the number of sides: 10 − 3 = **7 diagonals** (making 8 triangles).

MARKING SCHEME

- ✓ 2 diagonals, 3 triangles.
- ✓ 3 diagonals, 4 triangles.
- ✓ 7 diagonals, with the rule.

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): Each of the five triangles has two equal sides and one right angle: isosceles by its sides and right-angled by its angles.
- **Pythagoras in Squares** (exhibit): The white triangle has a right angle, and the squares built on its three sides are all different sizes, so it is a right-angled scalene triangle.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	9	18	7	**34**

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking