Assertion and Reason Questions on Class 9 Maths Chapter 6: Measuring Space: Perimeter and Area

Directions: In each question below, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:

(a) Both A and R are true, and R is the correct explanation of A.

(b) Both A and R are true, but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q1.

Assertion (A): The perimeter of a rectangle with length 12 cm and breadth 8 cm is 40 cm.

Reason (R): The perimeter of a rectangle with length a and width b is given by 2(a + b).

Answer: (a)

Explanation: Both statements are correct. The perimeter = 2(12 + 8) = 2 × 20 = 40 cm. The formula 2(a + b) = perimeter of a rectangle, and R correctly explains A.

Q2.

Assertion (A): For all squares, the ratio of perimeter to side length is always 4 : 1, regardless of the size of the square.

Reason (R): If you double the side of a square, its perimeter also doubles.

Answer: (b)

Explanation: Both A and R are individually true but R does not explain A. The fact that doubling the side doubles the perimeter is a consequence of this ratio, not the explanation for it.

Q3.

Assertion (A): The ratio of circumference (C) to diameter (D) is the same for all circles, regardless of their size.

Reason (R): This constant ratio C/D is an irrational number approximately equal to 22/7 or 3.14, called π.

Answer: (a)

Explanation: Both statements are true. The constant is π, which is irrational. R correctly and completely explains A.

Q4.

Assertion (A): The length of a semicircular arc of radius r is πr.
Reason (R): A semicircle subtends an angle of 180° at the centre, so its arc length = 2πr × (180°/360°) = πr.
Answer: (a)
Explanation: Both A and R are correct, and R is exactly the derivation of the formula in A.

Q5:
Assertion (A): In a 400 m athletics track, the runners in outer lanes need to start ahead of runners in inner lanes.
Reason (R):The curved parts of the track are semicircles. A runner in the outer lane covers a longer semicircle with a larger radius and therefore runs a greater distance, even though the straight sections are the same for all runners.
Answer: (a)
Explanation: Both A and R are true. Outer lanes have larger-radius semicircular curves, so their curved path is longer, while straight sections are equal. Therefore, runners in outer lanes start ahead so that all runners cover the same total distance. Hence, R correctly explains A.
Q6: Assertion (A): Two triangles that have equal area must be congruent to each other.
Reason (R): Equal area means equal base × height, which implies the triangles are the same shape.
Answer: (d)
Explanation: A is false. Two triangles can have identical areas but completely different shapes and need not be congruent at all. R is also false as equal area only means equal values of (1/2 × base × height), not that the base and height are individually equal.
Q7:
Assertion (A): For a triangle with sides 3 cm, 4 cm, and 5 cm, the area is 6 sq. cm.
Reason (R): A 3-4-5 triangle is right-angled (since $3^2 + 4^2 = 5^2$), so area = (1/2) × 3 × 4 = 6 sq. cm.
Answer: (a)

Explanation: Using Heron's formula ($s = 6$, Area $= \sqrt{[6\times3\times2\times1]} = 6$) and the right-angle formula we can see that the area pf the triangle is 6 sq. cm. R is a valid and correct explanation for A.

Q8:

Assertion (A): The area of a circle with radius r is πr^2.

Reason (R): Archimedes showed that the area of a circle equals the area of a right-angled triangle whose two legs are the radius and the circumference of the circle.

Answer: (a)

Explanation: Both are true. Archimedes' argument gives the area as: Area $= (1/2) \times$ circumference $\times$ radius $= (1/2) \times 2\pi r \times r = \pi r^2$.

Q9:

Assertion (A): The area enclosed by a circle (A) is proportional to the square of its circumference (C), that is, $C^2 : A$ is a fixed ratio for all circles.

Reason (R): This ratio $C^2/A = 4\pi$ for all circles, because $C = 2\pi r$ and $A = \pi r^2$.

Answer: (a)

Explanation: $C^2 = (2\pi r)^2 = 4\pi^2 r^2$. So $C^2/A = 4\pi^2 r^2/\pi r^2 = 4\pi$. R is correct and explains A.

Q10:

Assertion (A): The area of an equilateral triangle of side a is $\sqrt{3}/4a^2$.

Reason (R): The altitude of an equilateral triangle bisects its base into two equal parts.

Answer: B

Explanation: Both A and R are true, but R alone does not fully explain A.
The altitude does bisect the base. The altitude bisecting the base is only one step in the derivation, not the complete explanation.

Q11:

Assertion (A): A larger perimeter always means a larger area.

Reason (R): Different shapes can have the same perimeter but different areas.

Answer: D

Explanation: The assertion is false because shapes with larger perimeter may still have smaller area. The reason is true and gives a counterexample.

Q12:

Assertion (A): Brahmagupta's formula is used to find the area of a cyclic quadrilateral.

Reason (R): A cyclic quadrilateral is a quadrilateral whose vertices lie on a circle.

Answer: B

Explanation: Both statements are true. However, R only defines a cyclic quadrilateral and does not explain why Brahmagupta's formula is used.

Q13:

Assertion (A): Among all rectangles with a fixed perimeter of 40 cm, the square (10 cm × 10 cm) has the greatest area.

Reason (R): For a fixed perimeter, the area of a rectangle decreases as the rectangle becomes more elongated, and is maximised when length equals breadth.

Answer: (a)

Explanation: For perimeter = 40, we have $2(l + b) = 40$, so $l + b = 20$. Area $= l \times b = l(20 - l)$. This is maximised when $l = 10$ giving area = 100 sq. cm. Any other rectangle gives a smaller area. R correctly explains A.

Q14:

Assertion (A): The area of a semicircular disc of radius r is $(1/2)\pi r^2$.

Reason (R): A semicircle is half a full circle, and its area is half the area of the full circle.

Answer: (a)

Explanation: Area of full circle $= \pi r^2$. Half of that $= (1/2)\pi r^2$. R is sufficient explanation of A.

Q15:

Assertion (A): For all equilateral triangles, the ratio of perimeter to side length is 3 : 1, and this ratio stays constant regardless of the size of the triangle.

Reason (R): The perimeter of an equilateral triangle with side a is 3a.

Answer: (a)

Explanation: Both are true, and R correctly explains A. Since perimeter = 3a, the ratio perimeter : side = 3a : a = 3 : 1, which is constant.