# CLASS VIII – MATHEMATICS

## Chapter Test: Quadrilaterals – Step-by-Step Solutions & Marking Scheme

(Ganita Prakash, Grade 8, Part I – Chapter 4)

M. M.: 40 | Marks for each step are shown in square brackets.

### Section A – Multiple Choice Questions (1 mark each)

| Q. | Ans. | Solution |
|---|---|---|
| **1** | **(B)** | Sum of angles of a quadrilateral = 360°. Fourth angle = 360° − (85° + 95° + 110°) = 360° − 290° = **70°**. |
| **2** | **(C)** | A quadrilateral whose diagonals are equal and bisect each other is a **rectangle**. |
| **3** | **(A)** | Let the angles be 2k and 3k. Adjacent angles add up to 180°, so 5k = 180°, k = 36°. Larger angle = 3 × 36° = **108°**. |
| **4** | **(D)** | The diagonals of a rhombus bisect each other at 90°, but they are **not necessarily equal** (they are equal only when the rhombus is a square). |
| **5** | **(A)** | Diagonals of a rectangle are equal and bisect each other, so QS = PR = 18 cm and OS = ½ × 18 = **9 cm**. |
| **6** | **(B)** | AB ∥ DC and AD is a transversal, so ∠A + ∠D = 180° (co-interior angles). ∠D = 180° − 70° = **110°**. |
| **7** | **(C)** | A square has all four sides equal, so it is a rhombus. The other statements are false (a rhombus or rectangle need not be a square). |
| **8** | **(B)** | In a kite the diagonal joining the vertices where equal sides meet (here BD) **bisects the other diagonal AC at right angles**. |
| **9** | **(A)** | In a rhombus AB = BC, so ΔABC is isosceles and ∠BAC = ∠BCA. Then ∠BAC = (180° − 70°) ÷ 2 = **55°**. |
| **10** | **(D)** | Diagonals of a rectangle are equal and bisect each other, so OP = OQ. In ΔPOQ, ∠OPQ = ∠OQP = (180° − 80°) ÷ 2 = **50°**. |

### Section B – Very Short Answer Questions (2 marks each)

**Q11. Venn diagram (Fig. 3)**

(i) Region 2 lies inside both ‘Rectangle’ and ‘Rhombus’. A quadrilateral that is a rectangle (all angles 90°) and also a rhombus (all sides equal) is a **square**. [1]

(ii) It has opposite sides parallel, so it is a parallelogram. Its angle is 60°, not 90°, so it is not a rectangle; its adjacent sides (5 cm and 3 cm) are unequal, so it is not a rhombus. It lies in **region 4** (parallelogram only). [1]

**Q12.**

(A) Let the angles be 3k, 4k, 5k and 6k. Sum of angles = 360°, so 18k = 360° and k = 20°. [1]

Angles = 60°, 80°, 100° and 120°. (Check: 60 + 80 + 100 + 120 = 360.) [1]

(B) ∠P + ∠Q + ∠R + ∠S = 360°, so ∠P + ∠Q = 360° − 90° − 60° = 210°. [1]

With ∠P = 2∠Q: 3∠Q = 210°, so **∠Q = 70°** and **∠P = 140°**. [1]

**Q13. Rectangle with unequal-looking diagonals**

Diagonals of a rectangle are equal, so 3x + 4 = 5x − 6. [1]

10 = 2x, so **x = 5**; AC = 3(5) + 4 = **19 cm**. (BD = 25 − 6 = 19 cm ✓.) [1]

### Section C – Short Answer Questions (3 marks each)

**Q14. Parallelogram PQRS (Fig. 4)**

(i) Adjacent angles of a parallelogram add up to 180°: (4x + 20) + (2x + 10) = 180, so 6x + 30 = 180 and **x = 25**. [1]

(ii) ∠P = 4(25) + 20 = 120° and ∠Q = 2(25) + 10 = 60°. Opposite angles are equal, so ∠R = 120° and ∠S = 60°. (Sum = 360° ✓.) [1]

(iii) Opposite sides are equal, so 2y + 3 = y + 9, giving **y = 6** and PQ = 2(6) + 3 = **15 cm**. [1]

**Q15.**

(A) Diagonals of a rhombus bisect each other at 90°. So the half-diagonals are 8 cm and 6 cm, and they form a right-angled triangle with the side. [1]

Side$^2$ = $8^2$ + $6^2$ = 64 + 36 = 100 (Pythagoras theorem). [1]

Side = **10 cm**; all four sides are equal, so perimeter = 4 × 10 = **40 cm**. [1]

(B) P, O, R lie on a line, so ∠POQ = 180° − ∠QOR = 180° − 70° = 110° (linear pair). [1]

Diagonals of a rectangle are equal and bisect each other, so OP = OQ. Hence ∠OPQ = (180° − 110°) ÷ 2 = **35°**. [1]

∠QPS = 90°, so ∠OPS = 90° − 35° = **55°**. [1]

**Q16.**

(A) In ΔAOP and ΔCOQ: ∠AOP = ∠COQ (vertically opposite angles). [1]

OA = OC (diagonals of a parallelogram bisect each other). [½]

∠PAO = ∠QCO (alternate angles, since AB ∥ DC and AC is a transversal). [½]

So ΔAOP ≅ ΔCOQ by the ASA condition. [½]

Therefore OP = OQ (corresponding parts of congruent triangles). [½]

(B) Let AC and BD meet at O. Then OA = OC, OB = OD and ∠AOB = ∠BOC = ∠COD = ∠DOA = 90°. [½]

ΔAOB and ΔCOB: OA = OC, ∠AOB = ∠COB = 90° and OB is common, so ΔAOB ≅ ΔCOB (SAS) and AB = CB. [1]

In the same way ΔCOB ≅ ΔCOD gives CB = CD, and ΔCOD ≅ ΔAOD gives CD = AD. [1]

So AB = BC = CD = DA, and a quadrilateral with all four sides equal is a **rhombus**. [½]

**Q17.**

(A) In an isosceles trapezium the angles at the ends of a parallel side are equal, so **∠B = ∠A = 65°**. [1]

AB ∥ DC and AD is a transversal, so ∠A + ∠D = 180° and **∠D = 115°**. [1]

Similarly ∠B + ∠C = 180°, so **∠C = 115°**. (Sum = 65 + 65 + 115 + 115 = 360° ✓.) [1]

(B) ΔABC ≅ ΔADC (SSS), so ∠B = ∠D. Then ∠B + ∠D = 360° − 110° − 50° = 200°, so **∠B = ∠D = 100°**. [1]

Diagonal AC bisects ∠A (and ∠C) because the triangles are congruent, so ∠BAC = 110° ÷ 2 = 55°. [1]

∠ACB = ½ × 50° = **25°**. (Check in ΔABC: 55° + 100° + 25° = 180°.) [1]

## Section D – Long Answer / Case-based Questions (4 marks each)

**Q18.**

(A) (i) AB = 7 cm and AP = 3 cm, so PB = 4 cm. AD = 7 cm and DS = 3 cm, so AS = 4 cm. Also BQ = 3 cm. [½]

In ΔAPS and ΔBQP: AP = BQ = 3 cm, ∠A = ∠B = 90° and AS = BP = 4 cm. [1]

So ΔAPS ≅ ΔBQP by the SAS condition. [½]

(ii) In right-angled ΔAPS, PS$^2$ = AP$^2$ + AS$^2$ = 9 + 16 = 25 (Pythagoras theorem), so **PS = 5 cm**. [1]

(iii) From the congruence, ∠APS = ∠BQP. In right ΔBQP, ∠BQP + ∠BPQ = 90°, so ∠APS + ∠BPQ = 90°. [½]

A, P, B lie on a line: ∠APS + ∠SPQ + ∠BPQ = 180°, so ∠SPQ = 180° − 90° = **90°**. [½]

(B) (i) E, F, G, H are midpoints, so AE = EB = 8 cm (half of 16) and AH = HD = BF = FC = 6 cm (half of 12). The four corner triangles AEH, BEF, CGF and DGH are right-angled with legs 8 cm and 6 cm. [1]

They are congruent by SAS, so EH = EF = FG = GH. A quadrilateral with all four sides equal is a **rhombus**. [1]

(ii) Each corner triangle has legs 8 cm (half of 16) and 6 cm (half of 12). Side$^2$ = 64 + 36 = 100, so each side = **10 cm**. [1]

(iii) **No.** A square needs a right angle; the diagonals of EFGH are 16 cm and 12 cm (the sides of the rectangle), which are not equal, so it is not a square. [1]

**Q19.**

(A) (i) AE bisects ∠A, so ∠DAE = ∠EAB. [½]

AB ∥ DC and AE is a transversal, so ∠DEA = ∠EAB (alternate angles). [½]

Hence ∠DAE = ∠DEA. In ΔADE, sides opposite equal angles are equal, so **DE = AD** = 7 cm. [1]

(ii) DC = AB = 12 cm (opposite sides of a parallelogram). EC = DC − DE = 12 − 7 = **5 cm**. [1]

(iii) ∠A = 180° − 110° = 70° (adjacent angles). ∠DAE = ½ × 70° = **35°**. [1]

(B) (i) Diagonals of a parallelogram bisect each other, so PO = OR: 2x + 3 = 4x − 5, 8 = 2x, **x = 4**. [1]

(ii) QO = OS: y + 4 = 3y − 8, 12 = 2y, **y = 6**. [1]

(iii) PO = 2(4) + 3 = 11 cm, so PR = 22 cm. QO = 6 + 4 = 10 cm, so QS = 20 cm. [1]

(iv) The diagonals (22 cm and 20 cm) are not equal. A rectangle has equal diagonals, so PQRS is **not** a rectangle. [1]

**Q20. Case Study: Ravi the carpenter**

(i) The diagonals of a rectangle are equal, so **BD = AC = 130 cm**. [1]

(ii) OA = OB = 65 cm (diagonals of a rectangle are equal and bisect each other), so in ΔAOB: ∠OAB = (180° − 100°) ÷ 2 = **40°**. [1]

(iii) The strips must be equal, must bisect each other, and must cross at **90°** (diagonals of a square bisect each other at right angles). [1]

(iv) Diagonals bisect each other at right angles, so the frame is a **rhombus**. Half-diagonals are 60 cm and 80 cm, so side$^2$ = $60^2$ + $80^2$ = 3600 + 6400 = 10000 and side = **100 cm**. [1]

**Note for teachers:** Award full marks for any correct alternative method. In proof questions (Q16, Q18, Q19) every reason must be stated; a correct statement without its reason earns only part of the marks. In Q11 and Q20 any reasonable wording of the explanation may be accepted.