Understanding Quadrilaterals

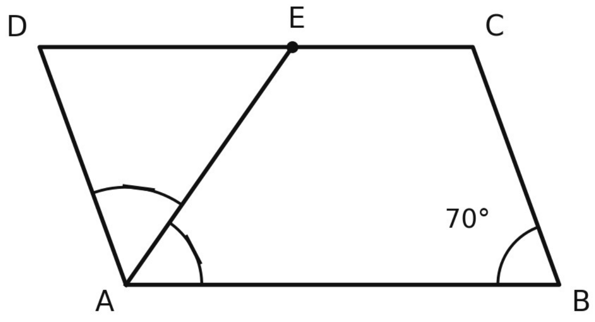
CLASS VIII · MATHEMATICS · PRACTICE WORKSHEET

5 questions · Maximum marks: 25 · Suggested time: 45 minutes

Name: ______________________________ Date: ______________

Show all steps. Figures are not drawn to scale unless stated. Give reasons wherever a property is used.

1. In parallelogram ABCD, ∠ABC = 70°. The bisector of ∠DAB meets the side DC at the point E, as shown in the figure. **[5]**



(a) Find ∠AED and ∠ADE. [2]

(b) Hence prove that DE = AD. [2]

(c) If AD = 3.5 cm and DC = 6 cm, find the length of EC. [1]

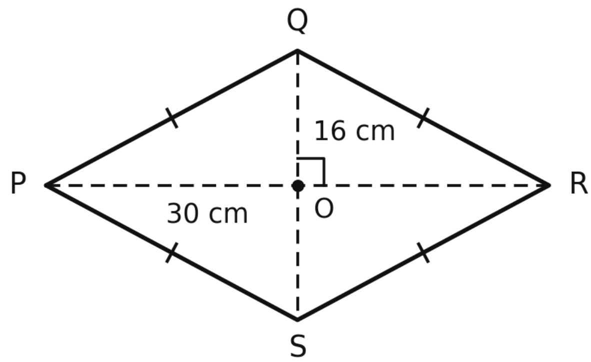
2. In a certain regular polygon, each interior angle is 5 times the measure of each exterior angle. **[3]**

(a) Find the number of sides of the polygon. [1]

(b) Find the sum of all its interior angles. [1]

(c) Find the measure of each interior angle. [1]

3. The diagonals of rhombus PQRS measure 30 cm and 16 cm, and they intersect at O. **[6]**



(a) Find the length of each side of the rhombus. [2]

(b) Find its perimeter. [1]

(c) Find its area. [1]

(d) Using your answers to (a) and (c), find the perpendicular distance between the parallel sides PQ and SR, correct to one decimal place. [2]

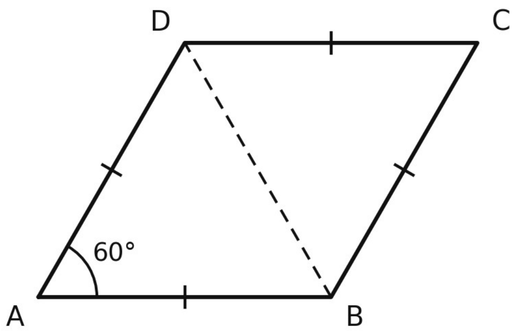
4. The angles of quadrilateral ABCD, taken in order, are in the ratio 3 : 4 : 5 : 6. **[5]**

(a) Find the measure of each of the four angles. [2]

(b) Can ABCD be a parallelogram? Give a reason for your answer. [2]

(c) Is ABCD a trapezium? If yes, name the pair of parallel sides and justify your choice. [1]

5. In quadrilateral ABCD, AB = BC = CD = DA and $\angle A = 60°$. The diagonal BD has been drawn in the figure. **[6]**



(a) Name the special quadrilateral that ABCD must be, and state the property that decides this. [1]

(b) Find $\angle B$, $\angle C$ and $\angle D$. [2]

(c) Prove that BD = AB. [2]

(d) Without measuring, state which of the two diagonals is longer, and give a reason. [1]

Rough work

Answer Key

Understanding Quadrilaterals · Class VIII

1.

(a) In a parallelogram, adjacent angles are supplementary, so $\angle DAB = 180° - 70° = 110°$. AE bisects it, so $\angle DAE = \angle EAB = 55°$.

Since AB ∥ DC and AE is a transversal, $\angle AED = \angle EAB = 55°$ (alternate angles). In $\triangle ADE$, $\angle ADE = 180° - 55° - 55° = 70°$. (This also equals $\angle ABC$, as expected for opposite angles.)

(b) In $\triangle ADE$, $\angle DAE = \angle AED = 55°$. Sides opposite equal angles are equal, so DE = AD.

(c) DE = AD = 3.5 cm, and DC = 6 cm, so EC = 6 − 3.5 = 2.5 cm.

2.

(a) Let each exterior angle be x. Then interior = 5x, and interior + exterior = 180°, so 6x = 180° and x = 30°. Number of sides n = 360° ÷ 30° = 12.

(b) Sum of interior angles = (n − 2) × 180° = 10 × 180° = 1800°.

(c) Each interior angle = 1800° ÷ 12 = 150° (check: 5 × 30° = 150° ✓).

3.

(a) Diagonals of a rhombus bisect each other at right angles, so OP = 15 cm and OQ = 8 cm, and $\angle POQ = 90°$. By Pythagoras, $PQ^2 = 15^2 + 8^2 = 225 + 64 = 289$, so PQ = 17 cm.

(b) Perimeter = 4 × 17 = 68 cm.

(c) Area = $\frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 30 \times 16 = 240\ cm^2$.

(d) A rhombus is a parallelogram, so area = base × height. Taking PQ as base: 240 = 17 × h, giving h = 240 ÷ 17 ≈ 14.1 cm.

4.

(a) Let the angles be 3x, 4x, 5x, 6x. Their sum is 360°, so 18x = 360° and x = 20°. The angles are $\angle A = 60°$, $\angle B = 80°$, $\angle C = 100°$, $\angle D = 120°$.

(b) No. In a parallelogram opposite angles are equal, but $\angle A = 60° \neq 100° = \angle C$. So ABCD cannot be a parallelogram.

(c) Yes. $\angle A + \angle D = 60° + 120° = 180°$, and these are co-interior angles for the lines AB and DC cut by the transversal AD. Therefore AB ∥ DC, and ABCD is a trapezium. (The same conclusion follows from $\angle B + \angle C = 80° + 100° = 180°$.) Note that $\angle A + \angle B = 140° \neq 180°$, so AD and BC are not parallel — exactly one pair of parallel sides.

5.

(a) A rhombus. A quadrilateral with all four sides equal is a rhombus — the equal sides force the diagonals to bisect each other, so it is automatically a parallelogram as well.

(b) A rhombus is a parallelogram, so $\angle C = \angle A = 60°$, and $\angle B = \angle D = 180° - 60° = 120°$.

(c) In $\triangle ABD$, AB = AD (equal sides of the rhombus), so it is isosceles and $\angle ABD = \angle ADB$. Since $\angle A = 60°$, these two angles are each (180° − 60°) ÷ 2 = 60°. All three angles are 60°, so $\triangle ABD$ is equilateral and BD = AB.

(d) AC is the longer diagonal. The diagonals bisect each other at right angles at O; if the side is s, then OB = BD/2 = s/2, so $OA = \sqrt{(s^2 - s^2/4)} = (\sqrt{3}/2)s$ and $AC = \sqrt{3}\,s \approx 1.73\,s$, which is greater than BD = s. (Equivalently, AC lies opposite the 120° angles while BD lies opposite the 60° angles.)