Geometric reasoning and proofs: 10 practice questions

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Name: _____ Date: _____

Attempt all questions and show your working. Suggested time: 15 to 20 minutes.

Section A: Consolidating (Questions 1-4)

Question 1

Lines AB and CD are parallel, with AB above CD, and A and C on the left. A transversal crosses AB at P and CD at Q. Angle BPQ = 65°.

(a) Find angle PQC, giving a reason.

(b) Find angle PQD, giving a reason.

Question 2

The angles of a triangle are x°, 2x° and 3x°. Find x and the size of each angle.

Question 3

Name the congruence test (SSS, SAS, AAS or RHS) that matches each description of two triangles.

(a) All three pairs of matching sides are equal.

(b) Two pairs of matching sides are equal, and the angles between those sides are equal.

(c) Both triangles are right-angled, their hypotenuses are equal, and one other pair of matching sides is equal.

(d) Two pairs of matching angles are equal, and one pair of matching sides is equal.

Question 4

(a) Find the sum of the interior angles of a hexagon.

(b) Find the size of each interior angle of a regular hexagon.

Section B: Standard (Questions 5-10)

Question 5

Triangle ABC is isosceles with AB = AC. Point M is the midpoint of BC, and the segment AM is drawn.

(a) Prove that triangle ABM is congruent to triangle ACM.

(b) Hence prove that AM is perpendicular to BC.

Question 6

ABCD is a parallelogram, so AB parallel DC and AD parallel BC. The diagonal AC is drawn.

Prove that triangles ABC and CDA are congruent, and hence that the opposite sides of a parallelogram are equal.

Question 7

In triangle ABC, point D is on AB and point E is on AC, with DE parallel BC. AD = 4 cm, DB = 6 cm and DE = 5 cm.

(a) Explain why triangle ADE is similar to triangle ABC.

(b) Find the length of BC.

Question 8

A circle has centre O.

(a) Points A, B and C lie on the circle, with C on the major arc. Angle ACB = 50°. Find angle AOB, giving a reason.

(b) PQ is a diameter of the circle and R is another point on the circle. Angle RPQ = 35°. Find angle PQR, giving reasons.

Question 9

PQRS is a cyclic quadrilateral (all four vertices lie on a circle), with vertices in that order. Angle P = 72° and angle Q = 105°.

Find angle R and angle S, giving a reason.

Question 10

In triangle ABC, side BC is extended past C to point D.

Prove that the exterior angle ACD equals the sum of angles A and B.

Geometric reasoning and proofs: answers

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Question 1

Answer: (a) 65° (alternate angles, AB parallel CD) (b) 115° (co-interior angles add to 180°; also accept angles on a straight line with (a))

Question 2

Answer: x = 30; angles 30°, 60°, 90° (6x = 180)

Question 3

Answer: (a) SSS (b) SAS (c) RHS (d) AAS (accept ASA if the side is between the angles)

Question 4

Answer: (a) 720° (4 × 180°) (b) 120°

Question 5

Answer: (a) AB = AC (given), BM = CM (M is the midpoint), AM is common, so the triangles are congruent (SSS). (b) So angle AMB = angle AMC (matching angles of congruent triangles); they are on a straight line so they add to 180°, so each is 90°.

Question 6

Answer: Angle BAC = angle DCA (alternate, AB parallel DC); angle BCA = angle DAC (alternate, AD parallel BC); AC is common. So the triangles are congruent (AAS, accept ASA), and therefore AB = CD and BC = DA (matching sides).

Question 7

Answer: (a) Angle A is common, and angle ADE = angle ABC (corresponding angles, DE parallel BC), so they are similar (AA; also accept the third pair of corresponding angles). (b) 12.5 cm (5 × 10/4)

Question 8

Answer: (a) 100° (angle at the centre is twice the angle at the circumference on the same arc) (b) 55° (angle PRQ = 90° as the angle in a semicircle, then angle sum of a triangle)

Question 9

Answer: R = 108°, S = 75° (opposite angles of a cyclic quadrilateral add to 180°)

Question 10

Answer: Angle A + angle B + angle ACB = 180° (angle sum of a triangle), and angle ACD + angle ACB = 180° (angles on a straight line). So angle ACD = 180° - angle ACB = angle A + angle B.