Geometry

Practice pack: 3 levels, with full answers

What is geometry?

Geometry is the branch of maths that studies shapes, sizes, angles and the positions of objects in space. The word comes from Greek and means "earth measurement". Approach every problem the same way: 1) draw and label a diagram, 2) mark what is given, 3) pick the rule or formula, 4) calculate with units, 5) check the answer.

Angles

Complementary: add to 90°
Supplementary: add to 180°
Angles on a line add to 180°
Angles around a point add to 360°
Vertically opposite angles are equal

Triangles

Angle sum = 180°
Exterior angle = sum of the two opposite interior angles
Equilateral, isosceles, scalene
Area = ½ × base × height

Pythagoras theorem

In a right triangle: $a^2 + b^2 = c^2$
c is the hypotenuse (longest side)
Common triples: 3-4-5, 5-12-13, 8-15-17, 7-24-25

Quadrilaterals and polygons

Quadrilateral angle sum = 360°
Polygon with n sides: $(n - 2) \times 180°$
Regular polygon: exterior angle = 360° / n

Area and perimeter

Rectangle: area $l \times b$, perimeter $2(l + b)$
Parallelogram: area $b \times h$
Trapezium: area $\frac{1}{2} (a + b) \times h$
Square: area s^2, perimeter $4s$

Circles and cones

Circumference = $2\pi r$
Area = πr^2
Cone: slant height $l^2 = r^2 + h^2$
Curved surface area = $\pi r l$

Tips

Always write the unit: cm for length, cm^2 for area, degrees for angles.
Take π = 22/7 (or 3.14) as the question says.
Draw the figure even if the question does not show one.
In every right triangle, find the hypotenuse first: it is opposite the right angle.

Level 1: Basics

Angles, triangles, area and perimeter

1. Classify each angle as acute, right, obtuse or straight: 35°, 90°, 130°, 180°.

2. Find the complement of 65°.

3. Find the supplement of 110°.

4. Two angles on a straight line: one is 125°. Find the other.

5. Two angles of a triangle are 50° and 60°. Find the third angle.

6. Find the perimeter and the area of a rectangle 9 cm long and 4 cm wide.

7. Find the area of a triangle with base 10 cm and height 6 cm.

8. A triangle has sides 5 cm, 5 cm and 8 cm. What type of triangle is it, by its sides?

9. Find the circumference and the area of a circle of radius 7 cm. Use π = 22/7.

10. Three angles of a quadrilateral are 80°, 100° and 90°. Find the fourth angle.

Level 2: Applications

Combine two or more rules

1. Two straight lines cross. One of the four angles is 70°. Find the other three.

2. The angles of a triangle are in the ratio 2 : 3 : 4. Find each angle.

3. An exterior angle of a triangle is 110° and one of the opposite interior angles is 45°. Find the other opposite interior angle and the adjacent interior angle.

4. A 13 m ladder leans against a wall. Its foot is 5 m from the wall. How high up the wall does it reach?

5. Is a triangle with sides 7 cm, 24 cm and 25 cm right-angled? Show your working.

6. Find the area of a trapezium whose parallel sides are 8 cm and 12 cm and whose height is 5 cm.

7. Find the sum of the interior angles of a hexagon, and each angle of a regular hexagon.

8. One angle of a parallelogram is 70°. Find the other three angles.

Level 3: Challenge

Multi-step and exam-style problems

1. A rectangular field is 40 m by 30 m. Find the length of its diagonal. How much shorter is the diagonal than walking along two sides?

2. The sides of a triangle are 6 cm, 8 cm and 10 cm. Show that it is right-angled. Find its area and the length of the altitude to the hypotenuse.

3. The exterior angle of a regular polygon is 40°. Find the number of sides and each interior angle.

4. A circular park of radius 21 m has a path 3.5 m wide all around it. Find the area of the path. Use π = 22/7.

5. In triangle ABC, angle B = 90°, AB = 6 cm and BC = 8 cm. D is the midpoint of AC. Find the length of BD.

6. A cone has base radius 7 cm and height 24 cm. Find its slant height and its curved surface area. Use π = 22/7.

Stuck? Draw the figure and label every length and angle. Look for a hidden right triangle. The median to the hypotenuse of a right triangle is half the hypotenuse.

Worked Examples

The 5-step method in action

Level 1: Two angles of a triangle are 47° and 68°. Find the third angle.

Given	Angles 47° and 68°
Find	The third angle
Rule	The angles of a triangle add up to 180°
Solve	47° + 68° = 115°. Third angle = 180° − 115° = 65°.
Check	47° + 68° + 65° = 180°. It matches.

Level 2: A 15 m pole is held by a wire fixed 9 m from its foot. Find the wire length.

Given	Pole = 15 m (vertical), distance from foot = 9 m (horizontal)
Find	The wire, which is the hypotenuse
Rule	$a^2 + b^2 = c^2$
Solve	$c^2 = 15^2 + 9^2 = 225 + 81 = 306$, so c = about 17.5 m.
Check	The hypotenuse must be longer than 15 m. It is.

Level 3: A circular garden of radius 14 m has a 7 m wide path around it. Find the area of the path.

Given	Inner radius 14 m. Outer radius = 14 + 7 = 21 m.
Find	Area of the ring-shaped path
Rule	Area = $\pi \times (R^2 - r^2)$, with $\pi = 22/7$
Solve	$(22/7) \times (441 - 196) = (22/7) \times 245 = 770$ m^2.
Check	Outer circle 1386 m^2 minus inner circle 616 m^2 = 770 m^2. It matches.

Mistakes to avoid

1. Mixing up area (cm^2) and perimeter (cm). Perimeter is a length, area is a surface.
2. Using the wrong side as the hypotenuse. It is always opposite the right angle.
3. Forgetting that the angles of a triangle add to 180°, not 360°.
4. Using the diameter where the radius is needed (r = d / 2).
5. Forgetting units, or leaving a surd or π unevaluated when a decimal is asked.

Answer Key

Check your work

Level 1

1. Acute, right, obtuse, straight
2. 25°
3. 70°
4. 55°
5. 70°
6. Perimeter 26 cm, area 36 cm^2
7. 30 cm^2
8. Isosceles
9. Circumference 44 cm, area 154 cm^2
10. 90°

Level 2

1. 110°, 70°, 110°
2. 40°, 60°, 80°
3. Other opposite interior angle 65°, adjacent interior angle 70°
4. 12 m
5. Yes. $7^2 + 24^2 = 49 + 576 = 625 = 25^2$
6. 50 cm^2
7. Sum 720°, each angle 120°
8. 110°, 70°, 110°

Level 3

1. Diagonal 50 m, which is 20 m shorter than 70 m
2. $6^2 + 8^2 = 100 = 10^2$. Area 24 cm^2, altitude 4.8 cm
3. 9 sides, each interior angle 140°
4. 500.5 m^2
5. BD = 5 cm (half of AC = 10 cm)
6. Slant height 25 cm, curved surface area 550 cm^2

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The Practise Ground

Classes 6-10 Maths

Geometry at a Glance

Key angle, triangle and area rules

1 Triangle angles add to 180°

Every triangle

Exterior angle = sum of the two opposite interior angles

2 $a^2 + b^2 = c^2$

Pythagoras theorem

Right-angled triangles only. c is the longest side

3 Quadrilateral angles add to 360°

Any four-sided shape

Polygon with n sides: $(n - 2) \times 180°$

4 Area = ½ × base × height

Triangle

Rectangle: $l \times b$. Circle: πr^2. Circumference: $2\pi r$

Angle rules

Complementary angles add to 90°.

Supplementary angles add to 180°.

Vertically opposite angles are equal.

Quick example

A triangle has angles 50° and 60°.

Third angle = 180° − 110° = 70°

Think you've got it? Test yourself.

Scan for the free practice pack with answers.

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