MATHS FIELD GUIDE · GRADE 7

Angle relationships support geometric reasoning

OPENING PROBLEM

How much more completes a right angle?



02 Identify the angle relationship
03 Rules and worked cases
04 Trace an angle through a triangle
05 Use parallel lines to transfer information
06 Check your reasoning

ILLUSTRATED PROBLEM SHEET

Identify the angle relationship

Straight lines, full turns and right angles give different totals.

1



How much more completes a right angle?

30°. A right angle measures 90°.

2



How much more completes a straight angle?

55°. The adjacent angles together measure 180°.

3



How many such turns make a full turn?

Four. Four times 90° gives 360°.

4

Triangle angles	Given	Missing
A	50° and 60°	70°
B	35° and 35°	110°

Why do both rows use 180°?

The three interior angles of each plane triangle sum to a straight angle.

A straight angle split equally
two 90° angles.

A full turn split equally three ways
three 120° angles.

CHAPTER PROBLEM

Two crossing lines show one angle of 47°. What is its vertically opposite angle, and why?

47°. Opposite angles are equal because both supplement the same neighbouring angle.

MATHS REFERENCE · GRADE 7

Angle relationships support geometric reasoning

Geometric reasoning uses definitions and established relationships to justify a conclusion. An angle relationship can determine a value without measuring a drawing.

Adjacent angles share a vertex and one boundary ray. Vertically opposite angles arise when two lines cross.

Four cases to recognise

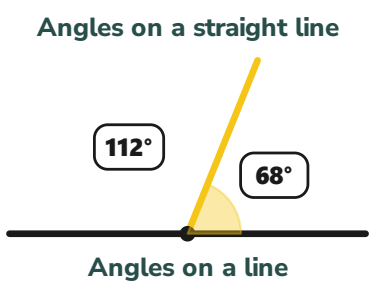
Situation	What to do and why
Triangle angles x, 2x and 3x	Six x sum to 180°, so the angles are 30°, 60° and 90°.
Parallel lines cut by a transversal	An alternate interior partner of 58° is 58°. Parallelism is the required condition.
Adjacent angles on a straight line	If one is 112°, the other is 180° − 112° = 68°.
Can a triangle have two obtuse interior angles?	Their sum alone would exceed 180°, leaving no possible third angle.

Read the model

Build the idea

A half turn along a straight line is 180°. Two adjacent angles that form that half turn therefore total 180°.

At a crossing, each angle forms a straight pair with a neighbouring angle. Comparing those pairs shows opposite angles are equal.



Why it works

The totals depend on the geometry, not the way the page is rotated. A complete turn remains 360° and a straight angle remains 180°.

With parallel lines cut by a transversal, corresponding and alternate angles match. The parallel condition is necessary.

adjacent angles Angles sharing a vertex and boundary ray.
transversal A line cutting other lines.
deduction A conclusion justified by established relationships.



How much of a right angle is shown?

Half of 90°. Two such turns in the same direction make a right angle.

WORKED INVESTIGATION

Trace an angle through a triangle

Two interior angles of a triangle are 48° and 67°. A straight line through the third vertex parallel to the opposite side helps explain the angle sum.

Look at this part	What it tells you
Known angles	48° and 67°
Their sum	115°
Third angle	180° − 115° = 65°

Work it through

Extend one side at the third vertex. The exterior angle supplements 65°, giving 115°, equal to the sum of the two remote interior angles.

Catch the mistake

The exterior angle at a vertex does not equal the adjacent interior angle in general. They form a linear pair.

Compare the cases

Follow an example

A straight pair contains a 68° angle and an unknown angle. The unknown is 180° − 68° = 112°.

If two lines cross and one angle is 68°, its opposite is also 68°, while each adjacent angle is 112°.

What changes? What stays true?

A picture that looks parallel is not proof of parallel lines. Use given markings or establish the relationship.

State the reason with the result: “112°, because the adjacent angles form a straight angle.” This separates reasoning from guessing.

Change one condition

Hold the 48° angle fixed and increase 67° by 10°. The third angle must decrease by 10° to preserve the total.



How many quarter-turns make a half-turn?

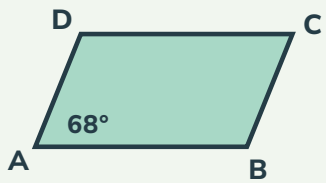
Two. Two right angles total 180°.

ILLUSTRATED PROBLEM SHEET

Use parallel lines to transfer information

A transversal makes equal corresponding angles with two parallel lines. A parallel cut in a triangle preserves ratios of corresponding lengths.

1



AB ∥ CD

In parallelogram ABCD, angle A is 68°. Find angle B.

Angles on the same side of a transversal between parallel lines sum to 180°. The neighbour is 112°.

2

DE ∥ BC in triangle ABC
↓
AD/AB = AE/AC
↓
3/9 = AE/15

D is on AB and E on AC. Find AE.

AE = 5. The small triangle has one third the full side lengths.

3

Segment	First part	Second part
AB	4	6
AC	6	9

Do these division ratios support a parallel cut?

4/6 = 6/9. For internal D and E on the two sides, the converse gives DE ∥ BC.

4

DE joins side midpoints
↓
Scale = ½
↓
DE = ½ BC

If the opposite side is 18 cm, how long is the midsegment?

9 cm. It is parallel to the opposite side.

Small-to-large scale 1:3
areas in ratio 1:9.

Scale 1:3
perimeters in ratio 1:3.

CHAPTER PROBLEM

Two angles of a triangle are 48° and 67°. Find the exterior angle next to the third angle.

The third interior angle is 180° − 115° = 65°. Its exterior neighbour is 115°, the sum of the two remote interior angles.

QUESTION BANK · FOLD OR COVER THE RIGHT COLUMN

Check your reasoning

Try the problem	Solution and reasoning
01 Two angles are both 65°. Must they be vertically opposite?	No. Equal measure alone does not tell you where the rays meet.
02 If two corresponding lengths double, must the two triangles be similar?	An additional condition is needed, such as equality of their included angles.
03 An exterior angle is 124° and one remote interior angle is 53°. Find the other remote angle and the adjacent interior angle.	The other remote angle is 124° – 53° = 71°. The adjacent interior angle is 180° – 124° = 56°.
04 An isosceles triangle has vertex angle 44°. Find each base angle.	The remaining 136° is shared equally, giving 68°.
05 Two adjacent angles sum to 180°. Must the original lines be parallel?	No. A linear pair arises at a single line intersection, without two parallel lines.



Which kind of angle is this?

Obtuse. It is larger than a right angle and smaller than a straight angle.

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