Unit 13 · Lines and Angles

STUDY NOTES

WHAT THE BLE ASKS

- **CDC's grid:** Geometry (Units 13, 14, 15, 16, 17, 18, 19, 20 together): 15 of 50 marks
- **In our 10 model papers:** 1-mark ×5 · 2-mark ×5
- **Model paper, Geometry: one 4-mark question**
  - **knowledge (1):** name a pair of co-interior angles
  - **understanding (2):** find x in a triangle made by the lines
  - **higher ability (1):** what value must an angle have for the two lines to be parallel?
- give the reason beside each step: "alternate angles are equal"

Key terms

Parallel lines ($AB \parallel CD$, AB // CD): straight lines that never meet, however far extended; the perpendicular distance between them is the same everywhere.

Transversal: a line that cuts two or more lines at different points.

Interior angles: the four between the two lines.
Exterior angles: the four outside.

Alternate angles (Z): non-adjacent interior angles on opposite sides of the transversal.

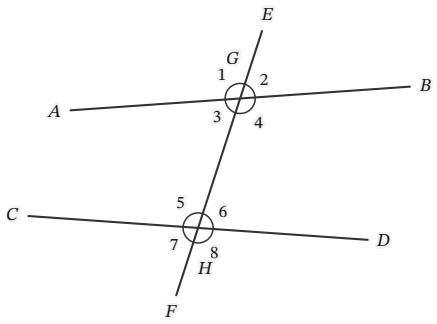
Corresponding angles (F): non-adjacent, same side of the transversal, one interior, one exterior; the same corner of each crossing.

Co-interior angles (C): non-adjacent interior angles on the same side of the transversal.

Adjacent angles on a line: side by side, adding up to 180°.

Vertically opposite angles: opposite each other where two lines cross; equal.

The eight angles



Transversal EF. Interior: 3, 4, 5, 6. Exterior: 1, 2, 7, 8. The lines aren't parallel here, and the names still apply.

Pair	Where	In AB, CD cut at G, H
Alternate	between, opposite sides	$\angle AGH$, $\angle DHG$; $\angle BGH$, $\angle CHG$
Corresponding	same side, one in, one out	$\angle AGE$, $\angle CHG$; $\angle BGE$, $\angle DHG$; $\angle CHF$, $\angle AGH$; $\angle BGH$, $\angle DHF$
Co-interior	between, same side	$\angle AGH$, $\angle CHG$; $\angle BGH$, $\angle DHG$

- names say **where** angles are, not their size
- run your finger along the transversal: which side?

When the lines are parallel

Pair	Fact	Reason to write
Alternate	equal	alternate angles are equal
Corresponding	equal	corresponding angles are equal
Co-interior	add up to 180°	sum of co-interior angles is 180°

The test works both ways:

- lines parallel → the fact is true
- the fact true → the lines are parallel
- the fact false → the lines aren't parallel
- to know whether lines ever meet: lay one across, compare two angles

Not parallel

- alternate, corresponding angles: not equal; they differ by the angle between the lines' directions (61°, 51°: 10°)
- co-interior: not 180°; the two sums always add up to 360° (190°, 170°)
- the lines meet on the side where the sum is less than 180°

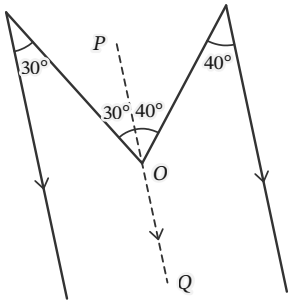
Why

- **corresponding:** slide the whole crossing along the transversal, without turning it
- set square sliding along a ruler: same angle, so parallel lines
- through a point there is only one line parallel to AB: a starting rule on a flat surface, not proved

Finding unknown angles

1. check the lines **are** parallel (arrows, or $AB \parallel CD$)
2. name the pair
3. equal, or adding up to 180°?
4. write the reason beside each step

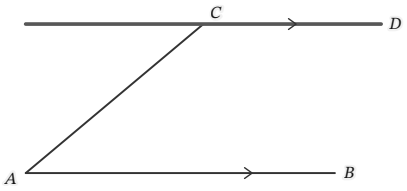
- with parallel lines **one** angle gives all eight: just two values, adding up to 180°
- rails, road edge at 65°: every angle is 65° or 115°
- 65° at the second rail: corresponding angles are equal
- $180° - 65° = 115°$: adjacent angles on a straight line
- with a letter: write the fact as an equation, solve
- making lines parallel: set the pair equal, or to 180°; solve
- a bend between parallel lines (no transversal): draw a third line through the bend, parallel to both; each part is an alternate angle: $2x = 30° + 40°$



Through O, PQ parallel to the arrows: $2x = 30° + 40° = 70°$, $x = 35°$.

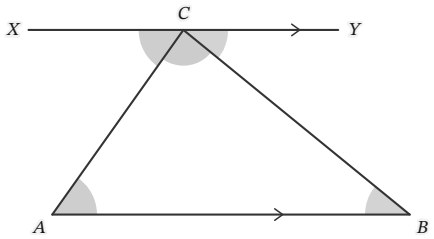
Drawing a parallel line

- through C, parallel to AB: measure the angle at A; draw the same angle at C to make a Z (alternate angles)
- or a set square sliding along a ruler; or copy the angle with a compass



$\angle BAC = 40°$; the alternate angle at C is 40°, so $CD \parallel AB$.

Angles of a triangle: 180°



Through C, draw XY parallel to AB.

- $\angle XCA = \angle CAB$ (alternate angles are equal)
- $\angle YCB = \angle CBA$ (alternate angles are equal)
- $\angle XCA + \angle ACB + \angle YCB = 180°$ (they make the straight line XY)
- so $\angle CAB + \angle ACB + \angle CBA = 180°$

Where it is used

- sleepers: transversals at right angles to both rails, rails 1,676 mm apart on the Janakpur line
- parallel ruler
- ruled paper
- zebra crossings
- Warren truss: each Z has equal alternate angles
- the Sun's rays reach us parallel

COMMON MISTAKES

✗ "alternate angles are equal" with lines not known parallel
✓ use it only to test them.

✗ adjacent and non-adjacent mixed up; same side and opposite sides mixed up
✓ run a finger along the transversal.

✗ co-interior angles made equal
✓ they add up to 180°; equal only if both are 90°.

✗ the wrong protractor scale
✓ count from the 0 on the arm of your angle.

✗ the reason left out
✓ write it beside each step.

✗ curved edges called parallel
✓ the word is kept for **straight** lines.