Unit 1 · Lines and Angles

STUDY NOTES

Key terms

Line segment: a straight line with two ends, like AB.

Angle: made by two line segments starting from the same point.

Arms: the two lines of an angle. **Vertex**: the point where they meet.

Degree (°): the unit for the size of an angle.

Protractor: the half circle in the geometry box; it measures and draws angles.

Constructing an angle: drawing it exactly.

Inside angles: the angles at the corners of a shape.

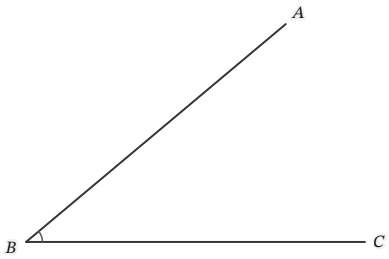
Set squares: the two triangles in the geometry box, each with one 90° corner.

Perpendicular lines (⊥): lines that meet at 90°.

Parallel lines (||, or //): the same distance apart all along; they never meet.

Intersecting lines: lines that cross each other.

Naming an angle



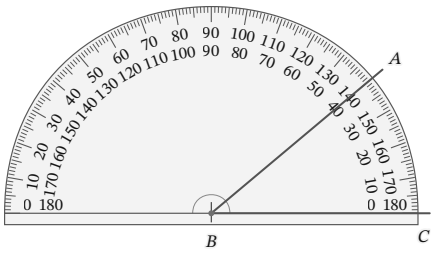
$\angle ABC$: arms BA and BC, vertex B.

- three letters, the sign $\angle$ in front
- the **vertex in the middle**: $\angle ABC = \angle CBA$, never $\angle BAC$
- a shape's corners: triangle ABC → $\angle ABC$, $\angle BCA$, $\angle CAB$
- quadrilateral PQRS → $\angle PQR$, $\angle QRS$, $\angle RSP$, $\angle SPQ$

The protractor

- half circle; straight edge = **base line**; its middle mark = **center**
- two rows of numbers, 0 to 180: outer row from 0 at the left, inner row from 0 at the right
- the two numbers on a mark add up to 180 (40 and 140)
- small line to small line = 1°; longer lines every 5° and 10°
- a whole turn = **360**°; a protractor is half a turn = **180**°

Measuring an angle



Base line, center, two rows. Here the base arm points right: read the row from the 0 at the right, 40°.

1. **center** on the **vertex**
2. **base line** along **one arm**
3. find the **0 on that arm**; count up to where the other arm crosses

- base arm points **right** → inner row; points **left** → outer row
- quick check: smaller than a square corner → less than 90
- the wrong row gives 180 minus the answer: 47° read as 133°
- any arm can be the base line: **turn the protractor** for a slanting corner
- pencil lines have width: 1° apart is fine

Drawing an angle of 25°

1. draw one arm PQ with a ruler
2. center on P, base line along PQ
3. count from the 0 on PQ up to 25; dot R
4. take the protractor away; join P and R: $\angle RPQ = 25°$

- 47°: count to 40, then 7 small lines more
- 180°: the dot lands on the base line, past the center; the arms make one straight line
- more than 90 → the arm leans away, wider than a square corner

Three kinds of angles

Kind	Size	Set square test
Acute	more than 0°, less than 90°	other arm inside it
Right	exactly 90°, a square corner	arm along its edge
Obtuse	more than 90°, less than 180°	other arm outside it

- right angle marked with a small **square**, not an arc
- 180°: arms in a straight line, **none** of the three (its name: Grade 6)
- 89° acute

- 90° right
- 91° obtuse
- the sign > means "is more than", < "is less than": $\angle XYZ < 90° \rightarrow$ acute

Set squares

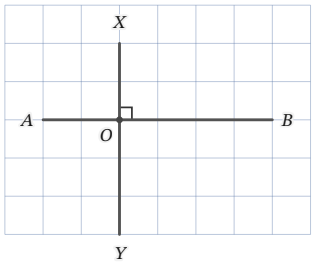
- **45° set square**: 90°, 45°, 45°
- **30°–60° set square**: 90°, 30°, 60°
- used to draw perpendicular and parallel lines, and to test angles
- **test:** square corner on the vertex, one edge along one arm, look at the other arm
- no set square: fold paper once for a straight edge, fold that edge onto itself → a 90° corner

Facts seen in the unit

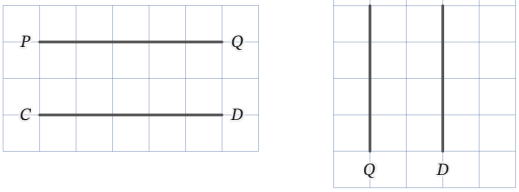
- a triangle's 3 angles add up to **180°**; a quadrilateral's 4 add up to **360°**
- O on a straight line AB, OC from O: $\angle AOC + \angle BOC = 180°$ (40° + 140°)
- two lines crossing: the opposite angles are **equal** (40°, 140°, 40°, 140°)
- an angle split by a line inside it: the two parts add up to the whole, $\angle PQS + \angle RQS = \angle PQR$ (30° + 40° = 70°)
- quadrilateral cut along a diagonal AC: $\angle DAC + \angle CAB = \angle DAB$ (47° + 32° = 79°)

Lines on a square grid

- **vertical**: straight up and down; **horizontal**: straight across
- every vertical grid line meets every horizontal one at 90° → perpendicular
- **perpendicular:** draw AB along a level line; XY along an upright line through it → XY ⊥ AB
- **parallel:** go the same number of squares from P and from Q (say 2), mark C and D, join → PQ ∥ CD
- a line **2 units above** (below, left, right) a given line: count 2 squares up from each end, join the two points



XY ⊥ AB, along grid lines.



CD ∥ PQ: the same number of squares from P and from Q; PQ level (left), upright (right).

- the gap is the same at both ends (4 squares and 4 squares) → parallel
- level lines are parallel to each other; so are upright lines
- slanting lines are parallel when both go the same squares across for each square up (3 across, 1 up)
- perpendicular lines need not touch: made longer, they would meet at 90°

Where it is used

- door opened 30°: acute; at 90° it is at a right angle to the wall
- ladder at about 75° to the ground; wheelchair ramp less than 5°
- carpenters test corners with a **try square**
- minute hand: 360° an hour, 6° a minute; hour hand: 30° an hour
- between the hands: 2:00 → 60°, acute; 3:00 → 90°, right; 6:00 → 180°, none of the three; 7:40 → 10°, acute
- letters: T → 2 right angles; H → 4 right angles; M → 3 acute
- Nepal's flag: the corner at the bottom by the pole 90°; the two tips and the top corner acute; no obtuse corner

COMMON MISTAKES

✗ vertex not in the middle, $\angle BAC$ for the angle at B
✓ the middle letter is the vertex.

✗ the row of numbers whose 0 is on the other arm
✓ count from the 0 on the base arm.

✗ longer arms make a bigger angle
✓ the size is how far it opens; arms of any length.

✗ a tilted right angle called acute or obtuse
✓ turn the set square to match; 90° is right however it lies.

✗ crossing lines called perpendicular
✓ only if they meet at exactly 90°.

✗ 180° called obtuse
✓ obtuse stops below 180°.