

**Key focus**

This objective develops students' fluency reading two physical measurement tools: a ruler and a protractor. Students learn to read a ruler correctly even when the measured object does not start at the zero mark, to read to the nearest millimetre, and to read a protractor using the correct one of its two number scales for the side the angle opens from.

Suggested teaching sequence

1. Start with a ruler flush at zero: model reading the end position directly as the length, in both centimetres and millimetres.
2. Introduce a non-zero start: show an object that begins partway along the ruler and model finding its length as end reading minus start reading, not just the end reading.
3. Practise millimetre precision: use the mm sub-ticks between each cm mark to read lengths that are not whole centimetres, and convert cleanly between cm and mm.
4. Introduce the protractor's two scales: place the protractor's straight edge along a baseline and show that the outer scale counts up from the right-hand zero line while the inner scale counts up from the left-hand zero line.
5. Model choosing the correct scale: for a given ray, show that reading it from the wrong zero line gives the supplementary angle (the two readings always add to 180°), and practise deciding which scale matches the side the angle is described from.
6. Combine both skills: use short applied problems that ask students to classify a protractor reading as acute or obtuse, or round a ruler reading to the nearest whole centimetre.

Core examples to model

- Flush ruler reading: an object spans 0 cm to 6 cm, so its length is 6 cm.
- Non-zero start: an object spans 2 cm to 8 cm, so its length is $8 - 2 = 6$ cm, not 8 cm.
- Millimetre precision: a span from 1.5 cm to 9.8 cm gives a length of $9.8 - 1.5 = 8.3$ cm = 83 mm.
- Outer-scale protractor reading: a ray drawn 38° counterclockwise from the right-hand zero line reads 38° on the outer scale.
- Inner-scale protractor reading: the same ray read from the left-hand zero line instead reads $180 - 38 = 142^\circ$ on the inner scale.
- Rounding a ruler reading: a length of 9.3 cm rounds to 9 cm to the nearest whole centimetre.

Watch for

- Reading straight off the end of the object without checking the start: if the object does not begin at zero, students must subtract the start reading, not just report the end reading.
- Reading the wrong protractor scale: choosing the inner scale when the question asks for the

reading from the right-hand zero line (or vice versa) gives the supplementary angle instead of the intended one.

- Losing millimetre precision: students may round to the nearest whole centimetre out of habit even when a question asks for the reading to the nearest millimetre.
- Forgetting that the two protractor scales always sum to 180° : this relationship is a useful check, not a coincidence, since both scales measure the same ray from opposite ends of the same straight baseline.
- Misclassifying acute and obtuse: students may guess from the drawn size of the angle in the diagram rather than comparing the actual numeric reading to 90° .

Checks for understanding

- Can students correctly read a ruler when the measured object does not start at the zero mark?
- Can they read a ruler to the nearest millimetre and convert the reading between cm and mm?
- Can they identify which protractor scale (outer or inner) matches the zero line stated in a question?
- Can they explain why a ray's outer-scale and inner-scale readings always add to 180° ?
- Can they classify a protractor reading as acute or obtuse from its numeric value?