## Key focus

This objective teaches students to recognise and explain what makes a graph misleading, and to describe the five features of a good, honest graph: a *good title*, *clearly labelled axes* (with units), *simplicity*, *clear data points*, and an *uninterrupted* (zero-baseline) axis. The two techniques covered in depth are the *truncated axis* (a y-axis that doesn't start at zero, so small real differences look huge) and *area distortion* (a pictogram icon scaled up in width and height for a bigger value, so its area – and the visual impression – grows far faster than the true value). Students learn to quantify how misleading a graph is using the actual numbers, not just describe it as "looks wrong."

## Suggested teaching sequence

1. Introduce the five features of a good graph: good title, clearly labelled axes (with units), simplicity, clear data points, and an uninterrupted axis.
2. Show a bar chart with a truncated y-axis (e.g. starting at 90 instead of 0) alongside its honest zero-baseline correction, using the same data. Ask students to describe the difference in visual impression.
3. Introduce the axis-break (zig-zag) symbol as a partial honesty signal – it tells the reader the axis doesn't start at zero, but the visual exaggeration is still present.
4. Model calculating the true percentage difference between values from a truncated graph, and comparing that to the visual impression the graph gives.
5. Introduce area distortion using a pictogram where an icon's width and height both scale with the value. Ask students to compare the printed values (correct) against the apparent size difference (misleading).
6. Model the maths of area distortion: doubling both dimensions of a shape multiplies its area by four, not two – so a value that doubles can look four times bigger.
7. Discuss why someone might deliberately choose a misleading graph style (to make a small change look dramatic, or a large change look small) and the ethical implications.
8. Practise redesigning a misleading graph honestly, and critiquing real or constructed examples using specific numbers rather than vague impressions.

## Core examples to model

- Truncated axis: sales of £92m, £95m, and £98m plotted on an axis from 90 to 100 make the smallest bar look tiny next to the largest, even though the true difference is only £6m out of roughly £95m (about 6%).
- Honest correction: the same three values plotted on an axis from 0 to 100 show three bars of nearly equal height, correctly showing the small real difference.
- Area distortion: a value doubling from 20 to 40 is shown by doubling an icon's width and height – but this makes its area (and apparent size) four times as large, not twice.
- Axis break symbol: a zig-zag mark at the foot of the y-axis is a convention for "this axis does

not start at zero" – it makes a truncated axis more honest, but the visual exaggeration above the break is still present.

**Watch for**

- Assuming a graph is trustworthy just because the numbers printed on it are correct – a graph can be numerically accurate and still visually misleading through axis choice or distortion.
- Confusing an axis break symbol with an honest graph – the break signals the truncation but does not undo its exaggerating effect.
- Underestimating area distortion: students often assume doubling a shape's linear size doubles its apparent size, when it actually multiplies the area by four.
- Treating cherry-picked data ranges (e.g. showing only the months that support a claim) as a graph-design issue – it's a data-selection issue, and can mislead even on a perfectly designed, honest-looking graph.
- Describing a misleading graph vaguely ("it looks wrong") instead of citing the specific feature (axis baseline, missing break, distorted area) and quantifying the true numbers.

## Checks for understanding

- Can students list the five features of a good graph?
- Can they explain why a truncated y-axis exaggerates apparent differences, using the actual data values?
- Can they identify and explain the meaning of an axis-break (zig-zag) symbol?
- Can they explain why area distortion misleads, including the doubling-width-and-height-quadruples-area relationship?
- Can they redesign or describe an honest correction of a misleading graph?
- Can they critique a misleading graph with specific figures rather than a vague impression, and reason about the ethics of deliberately misleading design choices?