Lesson 106 ALGEBRA

Properties of operations and the distributive law

CURRICULUM ALIGNMENT

ALG.PRR.4a identify, explain and apply generalisations, including properties of operations, mathematical models and patterns.

ALG.PRR.4b represent mathematical structures in multiple ways, including verbal expressions, diagrams and symbolic representations.

NUM.OPS.4 build upon, select and make use of a range of operation strategies.

INTERACTIVES Area Model · challenge, display, explore

WHAT THIS LESSON TEACHES

Operations obey **properties**: order doesn't matter for + and × (commutative), and the **distributive law** splits a product over a sum.

→ 6 × 23 = 6 × 20 + 6 × 3 = 120 + 18 = **138**.

	× 20	× 3
6	120	18

Total: 120 + 18 =

LESSON ARC

Open with 6 × 13 on the IWB and take three hands-up splits before anything is revealed. Build the area-model rectangle, cut the 13 side into 10 and 3, and read off 60 and 18 as partial products. The 7 × 10 cut into 8 and 2 is the visual proof — give it room. Pupils rebuild three products together at the board, then write three splits in their copy. Student Activity Book carries the subtraction-split investigation.

TEACHING MOVES

1. **Getting Started.** Put 6 × 13 up and ask pupils to find an easy part of 13 to multiply by 6 — hands up, three ideas, no open call-outs. Resist revealing the answer or naming the method; if nobody offers 10 + 3, that gap is the lesson.
2. **Watch and Notice.** Walk all three area-model examples on the interactive, drawing the noticing out rather than stating the rule. Give the 7 × 10 cut into 8 and 2 the most time — the two pieces tile the rectangle exactly, so 7×8 + 7×2 must equal 7×10. Only after that third picture do you name the rule.
3. **Try It Together.** Rebuild 8 × 14, 5 × 23, 9 × 12 in turn on the interactive (reset and re-enter factors each time). Insist the split is read aloud before the check — 'eight times ten, plus eight times four' — and watch for pupils splitting the wrong factor or dropping the second partial product.
4. **Show the Split in Your Copy.** Walk the room glancing for the split written down before the answer, with both equal totals underlined. This is copybook practice, not marking — keep moving.
5. **Class Challenge.** Brisk turns at the board — pupils choose the place-value split, build it, check the pieces add to the whole. On the larger units (18, 24, 35) pause and model the tens/units choice aloud, since that's where pupils stall. Pause on 4 × 25 → 100 and ask why the answer is so tidy.
6. **What Did We Notice?.** Pose the subtraction-split question — does 6 × 18 = 6 × 20 − 6 × 2 work? Listen for pupils reasoning from the picture, not just the arithmetic. Revoice: 'if you take a slice off the rectangle, you take that whole partial product off too.' Leave it genuinely open as a preview.

COMMON MISCONCEPTIONS

⚠ Pupils split the wrong factor — for 8 × 14 they cut the 8 into 4 + 4 instead of the 14, then can't see why the pieces don't help.

Send them back to the area model and cut the 14 side instead. Show that splitting the long side gives a 8 × 10 piece and a 8 × 4 piece — both easy — whereas splitting the 8 just makes two awkward rectangles. The point of the split is to land an easy times-ten.

⚠ Pupils find the first partial product and stop — they write 8 × 14 = 80 and forget the 8 × 4 piece entirely.

Point at the second rectangle still sitting on the IWB: 'this piece has area too — what is it?' Insist on the split being read aloud in full ('eight times ten PLUS eight times four') before any total is written, so the second piece can't be dropped.

⚠ Pupils treat the split as a trick that only works for 6 × 13 and doesn't trust it on fresh numbers.

Lean on the 7 × 10 proof picture — the two pieces tile the rectangle exactly, so the totals MUST match, every time, for any split. It isn't luck; the rectangle can't hold more or less area than its parts.

DIFFERENTIATION

EMERGING

- Stay on splits where the second piece is a single-digit times-table fact (8 × 14, 6 × 13) and let pupils keep the area-model picture on screen while they work, so the two pieces are visible not imagined.
- Pre-write the split frame in their copy — '____ × 10 + ____ × ____' — so they fill the parts rather than invent the structure.

DEVELOPING

- After the copybook page, ask pupils to split the same product two different ways (17 as 10 + 7, then as 20 − 3) and check both land on the same total.
- Give a missing-piece variant: 6 × 17 = 6 × 10 + 6 × ?, and ask what the second factor must be and why.

PROFICIENT

- Pull them ahead into the Student Activity Book subtraction-split investigation, or pose: take a two-digit by two-digit product like 13 × 14, split BOTH sides, and predict how many partial-product rectangles you'll get before you draw it.

Cross-curricular: Tie to the column-multiplication method from the operations work — the partial products on the area model are the exact numbers the algorithm carries.

ANSWER KEY

W1: commutative property

W2: commutative property

Q1: associative property

Q2: associative property

Q3: distributive property

Q4: distributive property

EXTENSION SHEET · STRETCH ANSWERS

S1: distributive property

S2: associative property

S3: commutative property