

Lesson 118 ALGEBRA

Algebra investigation: patterns and rules

CURRICULUM ALIGNMENT

ALG.PRR.3a

identify rules that describe the structure of a pattern and use these rules to make predictions.

INTERACTIVES Number Line · display, explore

WHAT THIS LESSON TEACHES

A growing pattern gets bigger by the same set amount at every step. To find the rule, spot the starting number and the fixed jump you add each time.

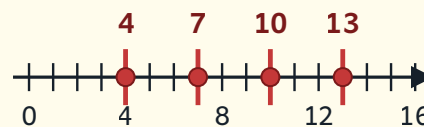
→ Matchstick squares: 1 square is 4 sticks, 2 squares is 7, 3 squares is 10. Start at 4, add 3.

→ The sequence 5, 8, 11, 14 has the rule 'start at 5, add 3 each time'.

MODEL THIS ON THE BOARD

FINDING THE RULE FOR STICKS

- 1 The counts marked on the line are **4, 7 and 10**.
- 2 Each jump is the same: $7 - 4 = 3$ and $10 - 7 = 3$.
- 3 The rule is start at **4** and add **3** each time, so the next count is **13**.



DISCUSSION STARTER

REFLECT How did you work out the rule for a growing pattern you had not built yet?

LESSON ARC

Open with the matchstick-square row on the IWB — 1 square is 4 sticks, 2 is 7, 3 is 10 — and take three hands-up guesses for the fourth before building. Move to the number-line interactive to compare a same-jump pattern against a speeding-up one, naming each gap. Pupils build the pattern record table in their copy (4, 7, 10, 13) and write the rule, then investigate 'add 3' all the way to step 10.

TEACHING MOVES

1. **Getting Started.** Take exactly three hands-up guesses for the fourth square row — no open call-outs — and don't confirm yet. Press each guesser with 'what made you say that number?' so the sense of 'about 3 more each time' gets voiced before it's proven.
2. **Watch and Notice.** On the number-line interactive, point at the gaps $4 \rightarrow 7 \rightarrow 10$ and wait for a pupil to name it as three — don't say it for them. Then reveal the second pattern's gaps (2, 3, 4) and ask what's different about the jumps; this is the beat that catches pupils who assume every pattern adds the same amount.
3. **Try It Together.** A pupil marks each count on the line while the class agrees or corrects aloud. Keep adding 3 past step 4 (13, 16, 19) so pupils see the skip-ahead happen, then reset the line for the shrinking $20 \rightarrow 16 \rightarrow 12$ pattern. Listen for pupils naming the starting count as well as the jump.
4. **Build the Pattern Record Table in Your Copy.** Pupils draw the first four square steps and a two-column table (step number, stick count) filling in 4, 7, 10, 13. Walk the room checking pupils count each shared

stick at a join only once — that's where the count drifts. No marking; this table is reused for the rest of the lesson.

5. **Class Challenge.** Brisk practice — groups work the four parts from their table and the class confirms each stage before moving on. Insist a stated rule carries both parts ('start at 4, add 3'), not just 'add 3'. If a group stalls on step 10, point them back at the column: keep adding 3 down it.

6. **What Did We Notice?** Ask how the table made the rule easier to see than the matchsticks alone. Revoice a strong answer: 'the gaps between the numbers are the rule, and the table puts every gap in one place.' Head off any sense that you must build every step.

COMMON MISCONCEPTIONS

⚠ Pupils count the two-square row as 8 sticks ($4 + 4$), double-counting the shared middle stick, so their table reads 4, 8, 12 instead of 4, 7, 10.

Build the two-square row with matchsticks at the front and physically touch the shared middle stick — 'this one belongs to both squares, so we count it once.' Have the pupil recount the joins before fixing their table.

⚠ Pupils state the rule as just 'add 3' and can't predict step 6, because they've dropped where the pattern starts.

Ask 'add 3 to what?' and point at the first count in their table. Get them to say the whole rule — 'start at 4, add 3' — aloud before predicting, so the starting count travels with the jump.

⚠ On the second Watch and Notice pattern, pupils assume the jump stays the same and predict the next mark by adding the first gap again.

Have them read each gap off the line in turn — 2, then 3, then 4 — and say what's happening to the gap itself. 'The jump is growing by one, so the next jump is 5.' Contrast directly with the steady 'add 3' line still on screen.

DIFFERENTIATION

EMERGING

- Give these pupils the squared-paper fallback — sketching each square step and physically counting the sticks keeps the shared-stick idea concrete before the table.
- Pre-draw the two table columns with the step numbers already filled so pupils only enter the counts, not build the structure.

DEVELOPING

- After step 10, ask them to find step 12 using the ' $3 \times \text{step} + 1$ ' shortcut and check it against repeated adding — do both routes agree?
- Pose the shrinking pattern as a table too: 20, 16, 12 — how many steps until it reaches 0, and does it land exactly?

PROFICIENT

- Narrate a harder variant at the board: a pattern that starts at 5 and jumps 4 — ask them to find the step-number shortcut (' $4 \times \text{step} + 1$ ') and justify why the '+1' is there, tying it back to the shared stick.
- Pull them ahead into the Student Activity Book while the class finishes step 10.

✂ **Cross-curricular:** Tie to Geography — read a bus or DART timetable where departures repeat on a set interval, and find the 'jump' rule between times.

ANSWER KEY

b) 13

c) 16, 19

Q1: 9

Q2: 11

Q3: 18

Q4: 14, 17

Q5: 22, 34, 46, 58

EXTENSION SHEET · STRETCH ANSWERS

S1: $\times 5 + 1$

S2: $\times 3 + 6$

S3: $\times 4 + 4$

S4: $x = 11$

S5: $\times 3 + 2$

Investigation: How does your pattern grow? — open-ended; scan pupils' working for valid solution paths rather than a single answer.