

Patterns and rules investigation

CURRICULUM ALIGNMENT

ALG.PRR.3a

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

INTERACTIVES Number Line · challenge, display, explore

WHAT THIS LESSON TEACHES

A growing pattern adds the same amount at every stage. The rule is the fixed jump size from one stage to the next.

→ Chairs around tables: 4, 8, 12 – the rule is add 4 each time.

→ Grow by 3: 3, 6, 9, 12 – next stage is 15.

MODEL THIS ON THE BOARD

PREDICT THE NEXT STAGE

- 1 Look at the stages 1, 4, 7
- 2 Jump from 1 to 4 is 3
- 3 Jump from 4 to 7 is 3
- 4 Rule is add 3 each time
- 5 Next stage is $7 + 3$ which is 10

LESSON ARC

Open on the tables-and-seats screen and take three hands-up guesses without confirming. Move to the number-line interactive and work three patterns live, drawing out the equal jump before revealing the next marker; the third pattern doubles, so the jumps grow. Pupils place markers together at the board, then build a grow-by-3 table in their copy and predict stage 5. The Class Challenge gives four more patterns, contrasting steady adds with doubling.

TEACHING MOVES

1. **Getting Started.** Count the seats around one square table aloud, then push two and three together on screen. Take exactly three hands-up guesses for how many each new table adds — no open call-outs — and hold the number back. The count is the whole lesson; don't confirm yet.
2. **Watch and Notice.** Work each number-line pattern live, never reading the answer. On the tables pattern, point to the equal gaps and ask 'what's the jump?' before anyone says 12; revoice 'it goes up in fours' as 'so the rule is add four each time'. On the doubling pattern, walk the jumps $1 \rightarrow 2$, $2 \rightarrow 4$, $4 \rightarrow 8$ and name that these jumps are growing, unlike the first two.
3. **Try It Together.** Pupils take turns at the board. For each pattern, ask the pupil to state the rule aloud ('add two') before dragging, then have the class predict the landing value and check the jump is equal. When someone adds a different amount each time, steer back with 'is every jump the same size?' Reset to the first stage as each new pattern starts.
4. **Build the Table in Your Copy.** Set the grow-by-3 table over four stages, then walk the room glancing for two things: is the rule written in words ('add 3 each time') and is stage 5 predicted as 15? No individual marking — this is whole-class copybook practice.

5. **Class Challenge.** Brisk board turns — pupils place each next marker and the class confirms before moving on. Remind them the doubling pattern has the growing-jump look they met earlier. On the matchstick pattern (add 3), have pupils count the jump against the minor ticks rather than eyeball it, and ask which pattern grows fastest.
6. **What Did We Notice?** Ask how the table helped them spot the rule and how sure they could be about an unbuilt stage. Revoice a strong answer: 'so once we know the jump, we don't have to build every stage — the rule tells us.' Draw out the add-each-time versus doubling contrast.

COMMON MISCONCEPTIONS

⚠ A pupil places the next marker by matching the size of the previous jump by eye instead of counting, so on the matchstick pattern (4, 7, 10) they land on $13\frac{1}{2}$ or 14 rather than 13.

Stop and count the ticks of one jump aloud together — 10 to 13 is three ticks — then have the pupil count, not eyeball, the same gap onto the line. The equal jump only holds if it's counted.

⚠ When they reach the doubling pattern, pupils say 'it adds 2 each time' because the first jump (1 to 2) is 2 — they lock the rule from one jump and miss that the jumps grow.

Point to each jump in turn on the number line: $1 \rightarrow 2$ is 1, $2 \rightarrow 4$ is 2, $4 \rightarrow 8$ is 4. Ask 'are these jumps staying the same?' Once they see the jumps growing, the rule 'double each time' names itself.

⚠ Pupils read the tables pattern as adding one seat per table because a new table 'is just one more table', giving 4, 5, 6 instead of 4, 8, 12.

Rebuild the join on screen slowly and count every seat around the two-table shape aloud with the class. The rule counts seats added, not tables added — separate the two counts explicitly.

DIFFERENTIATION

EMERGING

- Stay on the grow-by-2 and grow-by-5 patterns where the jump is easy to count; leave the doubling pattern as watch-only for these pupils.
- Pre-write the stage numbers 1–4 down the side of the copybook table so pupils only fill the values and the rule, not the whole structure.

DEVELOPING

- After the copybook table, ask pupils to predict stage 10 of the grow-by-3 pattern without listing every stage in between, then explain how they got there.
- Give a missing-middle variant on the number line: 3, ?, 9, 12 — what's the missing stage and how do you know?

PROFICIENT

- While the class finishes the Class Challenge, pose: two patterns both start at 4 — one adds 4, one doubles. At which stage does the doubling one first overtake, and can you prove it on the number line?
- Ask them to invent a growing pattern where stage 4 is exactly 20, write its rule in words, and check it holds for every jump.

✂ **Cross-curricular:** Tie to Geography — pupils read a bus timetable where each stop adds the same number of minutes, then predict the arrival time at a stop not shown.

ANSWER KEY

Scaffold: visual check on the page

Q1: 28

Q2: 31

Q3: 5

Q4: 23

Q5: 18

Q6: add 4

a) Always : That fixed jump is exactly what makes the pattern a growing pattern with a rule.

b) Never : The jump is 3 so the next number is 12, not 15.

c) Sometimes : Starting from an even number keeps them even, but starting from an odd number keeps them odd.

d) Always : The fixed jump lets you keep adding to reach any later stage.

EXTENSION SHEET · STRETCH ANSWERS

S1: 16 matchsticks. The rule is add 3 for each new square.

S2: A: 17, 21. B: 16, 32. Pattern B grows faster.

S3: 17

S4: Darragh. $4 + 4 = 8$, $8 + 4 = 12$ and $12 + 4 = 16$. Doubling 8 would give 16, not 12.

S5: Stage 4, when both have 16.

Investigation: Seats around the tables — open-ended; scan pupils' working for valid solution paths rather than a single answer.