

Continuing a pattern – what comes next?

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.

INTERACTIVES **Function Machine** · challenge, display, explore

WHAT THIS LESSON TEACHES

To continue a number pattern, look at how each term changes. The **rule** describes the change — usually 'add the same amount each time' or 'multiply by the same factor each time'.

→ **3, 7, 11, 15, ...** rule: add 4. Next: 19.

→ **2, 6, 18, 54, ...** rule: multiply by 3. Next: 162.

LESSON ARC

Open with 2, 5, 8, 11 on the IWB and harvest three predictions before confirming anything. Walk through four function machines — +3, $\times 2$, -5 , and double-then-add-1 — saying each input-output pair aloud so the rhythm of the rule does the teaching. Pupils drive the +3 machine themselves from two start values, then write four sequences in their copy. Class Challenge cycles five hidden-rule machines, landing on a two-step stretch.

TEACHING MOVES

- Getting Started.** Write 2, 5, 8, 11, ___ on the IWB with deliberate space after the last term. Take three hands-up predictions — no open call-outs — and park each one on the board without confirming. The pupil who says 'it goes up by three' is your seed for the next step.
- Watch and Notice.** Say each input-output pair aloud in rhythm — 'two in, five out — five in, eight out' — so the class hears the rule before they see it. Slow right down on the double-then-add-1 machine and narrate both steps: 'one doubled is two, plus one is three'. Before moving on, ask the class to name each rule in one short sentence.
- Try It Together.** Call a pupil to type 2 into the machine and ask the class 'what will come out?' — wait for a chorus before tapping Send through. Feed the output back in and keep going to 17. Then a second pupil starts fresh from 7 with the same rule. Watch for pupils adding the gap ($5-2=3$) to the last term instead of applying the rule to the last output — for +3 the answers happen to match, but revoice each time: 'we take what came out and put it back in', because the difference will matter in Class Challenge.
- Write the sequences in your copy.** Walk the room glancing at the two extra terms and the rule sentence — don't mark, just look. The trickiest one to put into words is double-then-add-1; ' $\times 2 + 1$ ' is fine if pupils write that. If pupils are still on the second sequence at the four-minute mark, call time at two and set the other two for home.
- Class Challenge.** Pupils take turns at the board picking a test input the machine hasn't shown yet — that's the whole point of probing. Always tap Show rule to confirm, even when the class got it. Budget two and a half minutes per challenge; on the stretch, listen for 'it's not just times two, because two should give four, but two gives five' — that's the moment two operations click. Direct fast finishers to the extension bank on their device while you circulate.

6. **What Did We Notice?**. Open with the equivalence — 'go up by three' and 'add three each time' name the same rule. Then steer to checking every gap, not just the first. Take two or three pupil voices and revoice: 'so we don't just check it works once — we check every gap'.

COMMON MISCONCEPTIONS

⚠ Pupils continue the sequence by adding the first gap ($5-2=3$) onto the last term they can see, rather than feeding the output back into the rule. On $+3$ this hides — both methods give 14 — but on $\times 4$ starting at 2 they'll write 2, 8, 14, 20 instead of 2, 8, 32, 128.

Stop the class at the first $\times 4$ machine in Class Challenge. Point to the function machine on screen and revoice: 'we take what came out and put it back in — eight goes back in, not two plus six'. Run the next term together with the pupil's finger tracing output-back-to-input on the IWB.

⚠ On the double-then-add-1 machine, pupils lock onto one operation: they see $1 \rightarrow 3$ and call it $\times 3$, then freeze when $3 \rightarrow 7$ breaks their rule.

Ask 'what would happen if we just tripled — would we get 7 from 3?' The class hears the gap. Then ask them to test ' $\times 2$ only' — also doesn't fit. Now revoice: 'two things happen each time — first one, then the other'. Walk through $1 \rightarrow 2 \rightarrow 3$, then $3 \rightarrow 6 \rightarrow 7$ saying both steps aloud.

DIFFERENTIATION

EMERGING

- During Try It Together, pre-write the running list ($2 \rightarrow 5 \rightarrow 8 \rightarrow _ \rightarrow _ \rightarrow _$) in their copy so they only fill the blanks, not invent the layout.
- On the copybook sequences, stay on the first two ($+3$ and $\times 2$ — both start small) and skip the double-then-add-1 one. Naming one rule cleanly is the win.

DEVELOPING

- After the $+3$ sequence in Try It Together, ask 'if we started at 100 with the same rule, what would the fifth term be?' — pushes them off the chain and onto reasoning about the rule.
- In the copybook step, ask them to write each rule two different ways — words and shorthand (e.g. 'add three each time' and '+3').

PROFICIENT

- Direct fast finishers to the extension bank on their device — the two-step rules ($\times 3$ then -2 ; $\times 2$ then $+3$) are the real stretch.
- Pose: 'invent a two-step rule of your own, write the first four terms in your copy, but hide the rule. We'll try yours after What's Next.' Forces them to think backwards from rule to sequence.

- **Cross-curricular:** Tie to music — clap a rhythm that doubles each bar (1 clap, 2, 4, 8) and ask pupils to name the rule between the bars.

ANSWER KEY

a) $+4$ chain: 3, 7, 11, 15, 19, 23, ...

Q2: 53

b) $\times 2$: 2, 4, 6, 8, 10.

Q3: 14

c) -3 : 7, 10, 13, 16.

Q4: 2

Q1: 43

EXTENSION SHEET · STRETCH ANSWERS

S1: -6

S3: 63

S2: 45