

Describing a rule in words

CURRICULUM ALIGNMENT

ALG.PRR.4b

represent mathematical structures in multiple ways, including verbal expressions, diagrams and symbolic representations.

ALG.PRR.4a

identify, explain and apply generalisations, including properties of operations, mathematical models and patterns.

INTERACTIVES [Function Machine · challenge, 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 4, 7, 10, 13 on the board and gather three or four different wordings of the rule without picking a winner. Show four sequences with rules written underneath, pivoting on the verb that every rule carries. Bring up the function-machine interactive at +3, then switch to $\times 2$ so pupils see the verb has to change. Pupils write each sequence and its rule in copybook. Class Challenge hides the rule — pupils predict outputs from the wording alone.

TEACHING MOVES

- Getting Started.** Write 4, 7, 10, 13 and take three or four wordings on hands-up — don't crown a winner yet. Note on the board the verbs pupils reach for: 'add', 'plus', 'goes up by'. That's the seed for the lesson — same rule, different words.
- Watch and Notice.** Write each sequence first, then add its rule underneath in a second colour. After the third sequence, ask 'could your little sister read this and keep going?' On the alternating-add sequence, revoice the long version into 'alternate add-2 then add-3' so pupils meet the tighter wording.
- Try It Together.** Open the function-machine interactive with +3 already showing. Send 4, 7, 10 through and take two or three wordings — revoice that they all describe the same rule. Then switch the operation to $\times 2$ and ask 'could the same words still work? Why not?' The verb has to change — that's the beat.
- Write each rule in your copy.** Walk the room as pupils write. Glance that the rule sits directly under its sequence and the doing-word is underlined. Don't mark — just check that the verb landed on every line. If a pupil wrote 'goes up by 3', the underline goes under 'goes up' — same job, different word.
- Class Challenge.** Set each rule from the teacher-notes list on the machine before the round starts. After the class proposes a wording, take one more input from a different pupil and have the class predict the output from the words alone before tapping Show rule. For Core 5 and the two-step extensions, if a pupil names only one step, ask 'the machine does two things — what's the other one?' Direct fast finishers to the extension bank on their device.
- What Did We Notice?.** Take the doing-words pupils name first — add, take, multiply, double, halve. Revoice: every rule has a doing-word. Then push: 'what does the number after the verb tell you?' Land on 'add' alone isn't enough; 'add three' is. Two-step rules need two doing-words and the word 'then'.

COMMON MISCONCEPTIONS

⚠ Pupils give a rule that fits the first pair but breaks on the next — e.g. for the $\times 2$ machine, they see $3 \rightarrow 6$ and say 'add 3'.

Don't correct it directly. Send the next input through the machine (5) and ask the pupil 'would your rule still work here?' When 5 'add 3' gives 8 but the machine shows 10, they sharpen the wording themselves. The machine is the test, not you.

⚠ On a two-step rule like $\times 2$ then $+1$, pupils name only the first step — they say 'multiply by 2' and stop because it works for one input by coincidence or near-miss.

Push back with 'the machine does two things to the number — what's the other one?' Send a third input and write the output beside the predicted output so the gap is visible. Then ask what the missing step would have to be to close that gap.

⚠ Pupils write the rule as just a verb — 'add' or 'multiply' — without the number that goes with it.

In the maths-talk close, point at 'add' on its own and ask 'add what?' Land that the verb names what to do; the number names how much. Both have to be in the wording or the next person can't continue the sequence.

DIFFERENTIATION

EMERGING

- Stay with the $+3$ and -5 machines from the worked examples; let these pupils read those rules back in their own words before the hidden-rule round.
- In the copybook step, pre-write the sequences and ask only for the rule line underneath — less to copy, full focus on the verb.

DEVELOPING

- After Core 3, ask 'could you write that rule using a different verb that means the same thing?' (multiply by 2 / double).
- On the two-step Core 5, ask what changes in the wording if the order swaps — first add 1 then multiply by 2. Does the machine give the same answer? Try it.

PROFICIENT

- Direct fast finishers to the extension bank on their device while you circulate — Extensions 1 and 3 are two-step rules that stretch the wording.
- Pose: write a rule that gives 7 when you put in 3, and 11 when you put in 5. Can you write it in two different ways?

• **Cross-curricular:** Tie to English — a clear rule is like a clear instruction: every word earns its place, and you test it by giving it to someone who hasn't seen the sequence.

ANSWER KEY

a) $\times 3$ then $+ 1$ (or ' $3 \times \text{input} + 1$ ').

Q2: 63

b) $\text{input} \times \text{input} + 1$ (or 'square it then add 1').

Q3: -6

c) $\div 2$.

Q4: $\times 3 + 6$

Q1: + 13

EXTENSION SHEET · STRETCH ANSWERS

S1: $\times 6 + 4$

S4: $\times 3 + 8$

S2: 14

S5: 53

S3: 2