

Lesson 25 **NUMBER**

Square numbers and number patterns

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 **Area Model · challenge, display, explore**

WHAT THIS LESSON TEACHES

A square number is made when a whole number is multiplied by itself, forming a perfect square array of dots.

→ $5 \times 5 = 25$, so 25 is a square number.

→ 7 squared means $7 \times 7 = 49$.

MODEL THIS ON THE BOARD

FINDING A SQUARE NUMBER

- 1 Count the side length of the square array of dots.
- 2 Multiply that side length by itself to get the total dots.
- 3 Write it as $n \text{ squared} = n \times n = \text{total}$.

LESSON ARC

Open with a 5×5 dot array on the IWB and link side length to total dots. Model 4^2 , 5^2 and 6^2 as area builds, pausing so pupils see each new L-shaped layer adds the next odd number — especially the shared-corner add on 6^2 . Class builds 7^2 to 9^2 together, predicting totals and gaps, then records the first ten squares and their odd-number gaps in copybooks. Class Challenge stretches the builds to 13^2 ; maths-talk closes on why the gap is always odd.

TEACHING MOVES

1. **Getting Started.** Display the 5×5 dot array as pupils settle. Give five seconds of quiet think-time, then take three hands-up answers to side length and total before revealing $5 \times 5 = 25$. Hold the phrase 'square number' until after they see it fills a perfect square.
2. **Watch and Notice.** Build 4^2 then 5^2 with thumbs-up predictions only — no calling out. On 6^2 , point slowly to the new bottom row of six, the new side column of five, and the shared corner so they see $6 + 5 = 11$, not twelve. Write the gaps 9 then 11 beside the squares and leave them up.
3. **Try It Together.** One pupil drives each board build for 7^2 , 8^2 and 9^2 while the class predicts the total aloud from the side length. After each reveal, ask for the gap from the previous square and stack 13, 15, 17 under the 9 and 11 already on the board.
4. **Write the Squares in Your Copy.** Pupils write each square two ways (n^2 and $n \times n = \text{product}$), list the first ten, then the odd gaps underneath. Walk the room checking layout — leave the last board build on screen as a layout model, not as answers to copy.
5. **Class Challenge.** Keep 10^2 through 13^2 brisk: one driver per build, class predicts, confirm and move on. If a pupil names the gap cleanly, revoice it to the room in their words. For the optional stretch, guide toward $9 + 16 = 25$ and let a pupil test the pair on the board before you confirm.

6. What Did We Notice?. Ask why growing by one on each side always adds an odd number. Listen for ‘new row plus new column, corner counted once’. Revoice: ‘old side plus new side — always odd.’ Head off any claim that the gap doubles; it rises by two.

COMMON MISCONCEPTIONS

⚠ When the side grows from 5 to 6, pupils say we add twelve — six on the bottom and six on the side — and miss that the corner dot is shared.

Freeze the area model mid-build. Circle the corner once and count aloud: new bottom row of six, then five more up the side. Write $6 + 5 = 11$ beside the L-shape.

⚠ Pupils say the gap doubles each time (9, then 18) instead of rising by two (9, 11, 13).

Point back at the gap list already on the board. Ask ‘what was added to 9 to get 11?’ then ‘what do we add to 11?’ — two, not a double.

⚠ Pupils read 7^2 as $7 \times 2 = 14$, treating the raised 2 like ordinary multiplication by two.

Write 7^2 and 7×2 side by side. Build the 7-by-7 array under the first and a 7-by-2 under the second so the class sees two very different totals.

DIFFERENTIATION

EMERGING

- Keep the first few squares (1^2 to 6^2) written in both forms in a board corner so pupils can match the copybook layout without inventing the structure.
- On Class Challenge, let them predict totals for 10^2 and 11^2 only; you name the gap while they watch the L-shape build.

DEVELOPING

- After the copybook list, cover the gap row and ask them to rebuild just the next three gaps from the odd-number pattern before checking.
- Give a missing-square prompt: $8^2 = 64$, next gap is 17, so what is 9^2 ? — before the later Class Challenge builds.

PROFICIENT

- During Class Challenge, after 13^2 , pose the board stretch: find two square numbers that add to a third (start them at $9 + 16$) and ask them to test one more pair on the area model.
- Ask in copybook: if the gaps keep rising by two, what is 15^2 without building every square in between — justify from the pattern.

✍ **Cross-curricular:** Link to Visual Arts — pupils tile a square patchwork from 1×1 up to 5×5 and label each as a square number.

ANSWER KEY

c) 36

Q1: 49

Q2: 64

Q3: 25

Q4: 225

Q5: 484

Q6: 169

a) **Always** : By definition, square numbers form exact n-by-n grids.

b) **Always** : Five squared is 25 and six squared is 36.

c) **Sometimes** : True for 16 from 4×4 ; false for 25 from 5×5 .

d) **Never** : Square numbers end in 0, 1, 4, 5, 6 or 9, never in 7.

EXTENSION SHEET · STRETCH ANSWERS

S1: 144

S3: 49

S2: 100