Spot Them, Write Them, Use Them: Squares and Cubes

Teacher		**Class**	Year 5
Subject	Maths	**Topic**	Square and cube numbers
Date		**Room**	
Lesson length	60 minutes	**Country**	United Kingdom

Pupils learn what square numbers and cube numbers mean and how ² and ³ work. They match notation to multiplications in a paper domino chain.

Curriculum links

- recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³) [1]
- solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes [1]

Learning objectives

- Students will recognise square numbers to 10^2 and write them using ².
- Students will recognise cube numbers to 5^3 and write them using ³.
- Students will match ² and ³ notation to multiplications and explain answers.

Success criteria

- I can write square facts like $7^2 = 49$ correctly.
- I can write cube facts like $3^3 = 27$ correctly.
- I can explain why 5^2 is 25 and not 10.

What students already know

Quick 2-minute times-table check: ask 4 x 4, 5 x 5, 3 x 3 and 2 x 2 x 2 on mini whiteboards to see recall before squares and cubes.

Key words

squared	little 2 that tells you to multiply a value by itself [3]
cubed	little 3 that tells you to multiply a value by itself and then again [3]
square number	result when a whole value is multiplied by itself [3]
cube number	result when a whole value is multiplied by itself twice [3]
product	answer you get when you multiply two or more values together [9]

Materials

- sets of paper domino cards covering 1^2 to 10^2 and 1^3 to 5^3
- pencils
- exercise books
- interactive whiteboard for slides
- mini whiteboards and pens
- printed copies of Worksheet Task B (page 2)

Before the lesson

- Print and cut one set of paper domino cards per pair, including links where 3^2 joins to 3 x 3 joins to 9, and 4^3 joins to 4 x 4 x 4 joins to 64
- Print copies of Worksheet Task B (page 2) for Task B practice
- Load Slides 1-5, 7, 9-10, 12 and check display
- Set out pencils, exercise books and mini whiteboards

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Lesson outline

0–8 min **Starter** 8 min · Whole class

To recall times-table facts and hook pupils into seeing even arrays as squares.

YOU DO

1. Show Slide 1: Square and Cube Numbers [title]: Spot them, write them and use them and read the title together.
2. Show Slide 2 photo and point out: Floor tiles make equal rows across and down. That even shape helps us see square numbers.
3. Do a fast times-table recall: 3 x 3, 4 x 4, 5 x 5, then ask what 7 counters would look like in equal rows.
4. Introduce the main challenge for later in the lesson.

STUDENTS DO

1. Look at the floor-tile photo and describe the equal rows.
2. Answer times-table facts on mini whiteboards.
3. Discuss with a partner whether 7 counters can make an even square.

Say: No tablets, no board today — just you, your partner and a chain of dominoes! That is our main challenge later. First we warm up our multiplications. Floor tiles make equal rows across and down. That even shape helps us see square numbers.

Worked example: 3 rows of 3 tiles: step 1 count rows = 3, step 2 count columns = 3, step 3 multiply 3 x 3 = 9, so 9 can make an even square.

Ask: How many tiles in 4 rows of 4? (16, because 4 x 4 = 16) · Can 7 counters make equal rows across and down? (No, 7 leaves gaps; 9 makes 3 rows of 3)

Check understanding: Hold up mini whiteboards for 4 x 4. If many miss 16, redo 3 x 3 and 4 x 4 with fingers or grid before moving on.

Support: Give a multiplication grid and focus on 2 x 2, 3 x 3 and 4 x 4 only. **Stretch:** Ask what size even square 16 tiles would make and what multiplication shows it.

Use: Slides 1–2

8–23 min **Teaching** 15 min · Whole class

To explain what ² and ³ tell us to do and model square and cube calculations.

YOU DO

1. Show Slide 3 steps and model: Pick a whole number, like 4 · For squared: do 4 x 4 = 16 · For cubed: do 4 x 4 x 4 = 64 · Say 4 squared and 4 cubed.
2. Show Slide 4 and stress: ² means times a number by itself [3]. Model that $3^2 = 3 \times 3 = 9$ and that 9 dots make a 3 by 3 square.
3. Show Slide 5 mystery: I stacked 27 tiny blocks into a big cube. Which cubed number am I? Agree that 27 is 3 cubed: $3^3 = 3 \times 3 \times 3$. Explain that a cube number is a number multiplied by itself twice [3] and the symbol for cubed is ³ [3].
4. Show Slide 7 to compare: Squared ² · number x itself · e.g. $5^2 = 25$ · makes a flat square · Cubed ³ · number x itself x itself · e.g. $2^3 = 8$ · makes a solid cube.

STUDENTS DO

1. Chant back $3^2 = 3 \times 3 = 9$ and $3^3 = 3 \times 3 \times 3 = 27$ with actions for flat square and solid cube.
2. Draw a 3 by 3 dot square and say why 9 is square.
3. Tell a partner in one sentence what the tiny 2 and tiny 3 each tell us to do.

Say: A square number is the result of multiplying a number by itself [3]. A square number is the product of two repeated integers [9]. A cube number is the product of three repeated integers [9]. The little 2 tells us to use two same factors, the little 3 tells us to use three.

Worked example: 4^2: step 1 write 4 x 4, step 2 multiply 4 x 4 = 16, so $4^2 = 16$. 4^3: step 1 write 4 x 4 x 4, step 2 do 4 x 4 = 16, step 3 do 16 x 4 = 64, so $4^3 = 64$ [3].

Ask: What does ² tell us to do? (Times a number by itself, e.g. $3^2 = 3 \times 3 = 9$ [3]) · What does 2^3 mean and what is it? (2 x 2 x 2, so 2^3 equals 8 [3]; 2 x 2 x 2 (or 2^3) = 8 therefore 8 is a cube number [8]) · Why is 25 a square number? (Because 5 x 5 (or 5^2) = 25 therefore 25 is a square number [8])

Check understanding: Thumbs up or down: Is $3^3 = 9$? On down, re-model 3 x 3 x 3 = 27 step by step [3] before moving on.

Support: Use dot arrays for 2^2 and 3^2 and say aloud: to calculate a square number, you times a number by itself, so 3^2 is the same as saying 3 x 3 [3]. **Stretch:** Ask pupils to predict 5^2 and 5^3 without writing all steps, then check by multiplying.

Use: Slides 3–5, 7

23–43 min **Main activity** 20 min · Pairs

To match ² and ³ notation to multiplications and answers in a domino loop.

YOU DO

1. Show Slide 9 instruction: Match 1^2 to 10^2 and 1^3 to 5^3 · Check 5^2 is 25, not 10 · Explain one match to your partner.
2. Hand out domino sets and model one join: 3^2 joins to 3 x 3 joins to 9, and 4^3 joins to 4 x 4 x 4 joins to 64. Stress that this matches the Year 5 expectation to recognise and use square numbers and cube numbers, and the notation for squared (²) and cubed (³) [1].
3. Let pairs lay the full loop using the cube order 1, 8, 27, 64, 125 [10] alongside squares to 100.
4. Stop the class twice to hear pairs read back two matches correctly, e.g. explaining that 8^2 is the same as 8 x 8 and makes 64 [3].

STUDENTS DO

1. In pairs, sort and lay domino cards into a loop from 1^2 to 10^2 and 1^3 to 5^3.
2. Copy two finished domino links into exercise books with full sentences, e.g. 3^3 means 3 x 3 x 3 and makes 27 [3].
3. Explain one match to a partner, saying the multiplication aloud.

Say: Work with your partner to build one long domino chain. Each ² card must join to its two-factor multiplication and answer. Each ³ card must join to its three-factor multiplication and answer. Copy two finished links into your exercise books with full number sentences.

Worked example: Link 1: 3^2 joins to 3 x 3 joins to 9, because 3^2 is the same as saying 3 x 3 [3]. Link 2: 4^3 joins to 4 x 4 x 4 joins to 64, because 4^3 is the same as saying 4 x 4 x 4 [3].

Ask: Your card says 5^2. What two cards must it join to? (5 x 5 and 25, because 5 x 5 (or 5^2) = 25 [8]) · Your card says 2^3. What must it join to? (2 x 2 x 2 and 8, because 2 x 2 x 2 (or 2^3) = 8 [8])

Check understanding: Walk round and ask each pair to read one join with the full multiplication. If joins are random, rebuild the starter chain together before continuing.

Support: Give a starter chain already joined showing that 5 x 5 (or 5^2) = 25 therefore 25 is a square number [8], then ask pupils to continue it. **Stretch:** Pupils make three extra dominoes of their own for another pair to solve.

Use: Slide 9

43–50 min **Consolidation** 7 min · On their own

To practise working out square and cube values on their own.

YOU DO

1. Hand out Worksheet Task B and read the instruction together.
2. Ask pupils to work silently for 5 minutes on the first set of squares and cubes.
3. Remind them to write both the multiplication and the ² or ³ form.
4. Collect in to spot errors for the plenary.

STUDENTS DO

1. Complete Worksheet Task B on their own in exercise books or on the sheet.
2. Write ² and ³ correctly and check answers with inverse multiplication.

Say: Now show what you can do on your own. Write each answer with its multiplication so I can see squared or cubed. Remember to check that 5^2 is 25, not 10. If you finish, explain one match in writing.

Worked example: 6^2: write 6 x 6, then 36. 2^3: write 2 x 2 x 2, then 2 x 2 = 4 and 4 x 2 = 8, so 2^3 equals 8 [3].

Ask: How do you work out 7^2? (7 x 7 = 49) · How do you work out 3^3? (3 x 3 x 3 = 27)

Check understanding: Look at books after 5 minutes: if most miss cubes, re-model 2 x 2 x 2 = 8 on the board before the quiz.

Support: Let pupils use the domino loop built in the main activity as a help card. **Stretch:** Ask early finishers to order their answers smallest to largest and spot which are squares, cubes or neither.

Use: Worksheet Task B

50–60 min **Plenary** 10 min · Whole class

To check recall of key squares and cubes and fix the doubling mix-up.

YOU DO

1. Show Slide 10 cards and chant: $4^2 = 16$ · 4 rows of 4 make a square. Then $9^2 = 81$ · 9 times 9 gives 81. Then $2^3 = 8$ · 2 by 2 by 2 makes a cube. Then 64 is special · 64 is 8^2 and also 4^3.
2. Run Slide 12 quiz: What is 4^2? Agree 16, because 4 x 4 = 16. What is 3^3? Agree 27, because 3 x 3 x 3 = 27.
3. Ask: Is 10 a square number? Agree No. $3^2 = 9$ and $4^2 = 16$, so 10 is missed.
4. Return to success criteria and ask pupils to show fingers for each I can.

STUDENTS DO

1. Chant and write answers to the quiz on mini whiteboards.
2. Explain why 10 is missed between 9 and 16.
3. Self-assess against the three I can statements.

Say: Let us lock in the facts to know cold. Say each fact aloud until fast. Remember, confusing squaring with doubling gives the wrong answer, because $5^2 = 25$, not 10 [14]. Squaring and cubing use repeated multiplication, not adding or doubling.

Ask: What is 4^2 and why? (16, because 4 x 4 = 16) · Is $5^2 = 10$ true or false? Why? (False, $5^2 = 25$, not 10) · Which number is both 8^2 and 4^3? (64)

Check understanding: Mini-whiteboard quiz on 4^2, 3^3 and is 10 square? If errors remain, set re-practice of 1^2 to 6^2 and 1^3 to 3^3 for next starter.

Support: Keep the domino loop and Slide 10 cards visible while answering. **Stretch:** Ask pupils to say why 64 can be both square and cube in their own words.

Use: Slides 10, 12

Common mistakes

Mistake	How to spot it	How to fix it
Thinking squaring means doubling, e.g. $5^2 = 10$	Pupil writes $5^2 = 10$ or $4^2 = 8$	Rebuild with dots: 5 rows of 5 is 25, not 10. Stress that $5^2 = 25$, not 10 [14] and to calculate a square number, you times a number by itself [3].
Thinking cubing means adding or multiplying by 3, e.g. $2^3 = 6$	Pupil says three lots of 2 equals 6 for 2 x 2 x 2	Build with blocks and do steps: 2 multiplied by 2 is 4 and this multiplied by 2 is 8 [9]. Emphasise to calculate a cube number, you multiply a number by itself and then by itself again [3].
Mixing up ² and ³, e.g. $3^3 = 9$	Pupil gives square answer for a cube card in dominoes	Count the factors: square is the product of two repeated integers and cube is the product of three repeated integers [9]. Check 3 x 3 = 9 but 3 x 3 x 3 = 27 [3].

Support

- Give a starter domino chain already joined, including 5 x 5 (or 5^2) = 25, then ask pupils to continue it
- Provide a multiplication grid and dot arrays for 1^2 to 5^2 and block layers for 1^3 and 2^3

Stretch

- Pupils make three extra dominoes of their own for another pair to solve
- Challenge pupils to predict the next square without building it, then check

- Use sentence frames: Squared means ___ and Cubed means ___
- Ask whether a number could ever be both a square and a cube and to give reasons

For the LSE or teaching assistant

Stay with the domino pairs who need most help. Point to the starter chain, prompt full multiplication aloud for each join, and check Task B squares first before cubes.

Check for understanding

Question	Answer
What is 7^2?	49, because 7 x 7 = 49
What is 3^3?	27, because 3 x 3 x 3 = 27
Is 10 a square number? Explain.	No, because $3^2 = 9$ and $4^2 = 16$ so 10 is missed

Homework

Write out 1^2 to 10^2 and 1^3 to 5^3 from memory, then check with multiplications.

Sources

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