

GRADE 6 · EXPRESSIONS & EQUATIONS · ANSWER KEY

WHOLE-NUMBER EXPONENTS

Today's goal: I can write numerical expressions involving whole-number exponents in the form a^b , where a and b are non-zero whole numbers and evaluate numerical expressions involving whole-number exponents, including fractions and decimals raised to whole-number exponents.



How to use this key. Problem numbers match the student sheets. Each answer shows the steps and the slip Mr DJ sees most, so a wrong answer tells you what to reteach. Pepper levels: **Mild** warm-up, **Medium** stretch, **Spicy** challenge, **Extra Spicy** big brain.

Practice

8 problems + Mr DJ's worked example

Use: During the lesson after the mini-lesson/deck. Items 4–6 show that a base less than 1 SHRINKS under a power — a genuine surprise worth naming. **Timing:** 15–25 min · pairs or independent · circulate on 7–9. Items 1–3 fluency, 4–6 application, 7–9 reasoning. Item 8 is a fast diagnostic: answering 9 means the core misconception is still there.

1 25 2 16 3 64 4 $4/9$ 5 0.04 6 $3^2 = 9$ is greater than $2^3 = 8$ 7 $7^3 = 343$

8 1 — because multiplying 1 by itself any number of times is still 1

1 **◀ MILD** $5^2?$

25

1. $5 \times 5 = 25$.

Watch for: Answered 10 (5×2).

2 **◀ MILD** $2^4?$

16

1. $2 \times 2 \times 2 \times 2 = 16$.

Watch for: Answered 8 (2×4).

3 **◀◀ MEDIUM** $4^3?$

64

1. $4 \times 4 \times 4$.

2. $4 \times 4 = 16$; $16 \times 4 = 64$.

Watch for: Answered 12 (4×3).

4 **◀◀ MEDIUM** $(2/3)^2?$

$4/9$

1. $2/3 \times 2/3$.

2. Numerators $2 \times 2 = 4$; denominators $3 \times 3 = 9$. So $4/9$.

Watch for: Squared only the numerator ($4/3$) or multiplied by 2 ($4/6$).

5 MEDIUM $0.2^2?$

0.04

- 0.2×0.2 .
- $2 \times 2 = 4$, and two decimal places $\rightarrow 0.04$.

Watch for: Answered 0.4 — miscounted decimal places, which happens because the result is SMALLER than the base.

7 SPICY $7 \times 7 \times 7$ as a power?

$7^3 = 343$

- The factor 7 appears three times, so the base is 7 and the exponent is 3.
- $7^3 = 49 \times 7 = 343$.

Watch for: Wrote 3^7 — reversed base and exponent. The repeated FACTOR is the base.

6 SPICY Greater: 3^2 or 2^3 ?

$3^2 = 9$ is greater than $2^3 = 8$

- $3^2 = 3 \times 3 = 9$.
- $2^3 = 2 \times 2 \times 2 = 8$.
- Swapping base and exponent changed the value — they are close here, but not equal.

Watch for: Said they are equal, or compared only the exponents.

8 EXTRA SPICY 1^9 , and why?

1 — because multiplying 1 by itself any number of times is still 1

- $1^9 = 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1 = 1$.
- Every multiplication by 1 leaves the value unchanged.
- So 1 raised to ANY whole-number power is 1.

Watch for: Answered 9 — multiplied base by exponent, which is exactly the error this item is designed to expose.

Homework

7 problems + Mr DJ's worked example

Use: Parallels the practice sheet. Item 6 is deliberately a case where a^b DOES equal b^a — students who over-generalise from it get caught by the follow-up question. **Timing:** ~15 min at home · independent · review item 6 as the next-day warm-up; ask for a counterexample.

1 36

2 64

3 27

4 $9/16$

5 0.125

6 Both equal 16 here, but swapping usually DOES change the value

7 $5^4 = 625$

1 MILD $6^2?$

36

- $6 \times 6 = 36$.

Watch for: Answered 12 (6×2).

2 MILD $2^6?$

64

- 2 six times: 2, 4, 8, 16, 32, 64.

Watch for: Answered 12 (2×6).

3 MEDIUM $3^3?$

27

- $3 \times 3 \times 3 = 27$.

Watch for: Answered 9 — used the base only twice, or computed 3×3 .

4 MEDIUM $(3/4)^2?$

$9/16$

- $3/4 \times 3/4 = 9/16$.

Watch for: Squared only the numerator ($9/4$) or multiplied by 2 ($6/8$).

5 MEDIUM 0.5^3 ?

0.125

1. $0.5 \times 0.5 = 0.25$; $0.25 \times 0.5 = 0.125$.

Watch for: Answered 1.5 (0.5×3). Note the answer shrinks — that is expected for a base below 1.

6 SPICY 4^2 vs 2^4 — always different?

Both equal 16 here, but swapping usually DOES change the value

1. $4^2 = 16$ and $2^4 = 16$ — equal in this case.
2. But $2^3 = 8$ while $3^2 = 9$, so they are not equal in general.
3. This pair is a coincidence, not a rule.

Watch for: Concluded from this one example that a^b always equals b^a . One matching case does not make a rule — test another pair.

7 SPICY $5 \times 5 \times 5 \times 5$ as a power?

$5^4 = 625$

1. The factor 5 appears four times: base 5, exponent 4.
2. $5^4 = 25 \times 25 = 625$.

Watch for: Wrote 4^5 — reversed base and exponent.

Exit Ticket

4 problems

Use: End of the exponents lesson. 5–8 min, independent. **Timing:** 5–8 min · independent. Item 1 catches the 3×4 error; item 4 catches the $a^b = b^a$ assumption.

1 81

2 32

3 $1/8$

4 Not equal — $2^3 = 8$ and $3^2 = 9$

1 MILD 3^4 ?

81

1. $3^4 = 3 \times 3 \times 3 \times 3$.
2. $3 \times 3 = 9$; $9 \times 3 = 27$; $27 \times 3 = 81$.

Watch for: Answered 12 — multiplied the base by the exponent. The exponent COUNTS the factors; it is not one of them.

2 MEDIUM 2^5 ?

32

1. $2 \times 2 \times 2 \times 2 \times 2$.
2. = 32.

Watch for: Answered 10 (2×5) or 25 (mixed up base and exponent).

3 MEDIUM $(\frac{1}{2})^3$?

$1/8$

1. $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$.
2. Numerators: $1 \times 1 \times 1 = 1$. Denominators: $2 \times 2 \times 2 = 8$. So $1/8$.

Watch for: Answered $3/2$ or 1.5 — multiplied by 3 instead of using $\frac{1}{2}$ three times. Note the result is SMALLER: repeated multiplication by a number less than 1 shrinks it.

4 SPICY 2^3 vs 3^2 ?

Not equal — $2^3 = 8$ and $3^2 = 9$

1. $2^3 = 2 \times 2 \times 2 = 8$.
2. $3^2 = 3 \times 3 = 9$.
3. The BASE is the number being multiplied; the EXPONENT counts how many times. Swapping them changes the meaning, so the order matters.

Watch for: Said they are equal because ‘the same two numbers are used.’ Unlike multiplication, a^b and b^a are usually different.

Lesson slides

teaching notes & timing

Slide	Time	What to do
1	0:00	Frame the skill: exponents as repeated multiplication, read and evaluated correctly.
2	1:00	Hook — poll 12 vs 81. Do NOT resolve. The 12 answer is the single most common exponent error.
3	3:00	Name what each part does: base = the repeated factor, exponent = the count. Resolve the hook here.

4	5:00	WE1 — expand and evaluate. Insist on writing the expansion; it is the habit that fixes this permanently.
5	7:00	WE2 — order matters. Have students compute both before you reveal. 8 vs 9 is memorable because it is so close.
6	11:00	The shrinking surprise. Connect back to multiplying by less than 1 from the decimals skill.
7		Show the problem and the slip. Pairs: what went wrong, and what is the right answer? Take two answers before moving on.
8		Solve it together, one step at a time. It is also the worked example at the top of the practice sheet, so students can look back at it.
9	9:00	CFU — all-student response. Answers 32 and $1\frac{1}{8}$. Watch for 10 and $\frac{3}{2}$. Whiteboards: everyone tries Mild, then climbs. These are #1, #3, #6 on the practice sheet.
10		Fingers up: 3 = got it, 2 = almost, 1 = not yet. Pull the 1s for a quick reteach while everyone else starts the practice sheet.
11	13:00	Launch the in-class practice sheet. Launch the practice sheet. Exit ticket in the last 5–8 minutes.