



THIRD SPACE
LEARNING

Diagnostic Questions

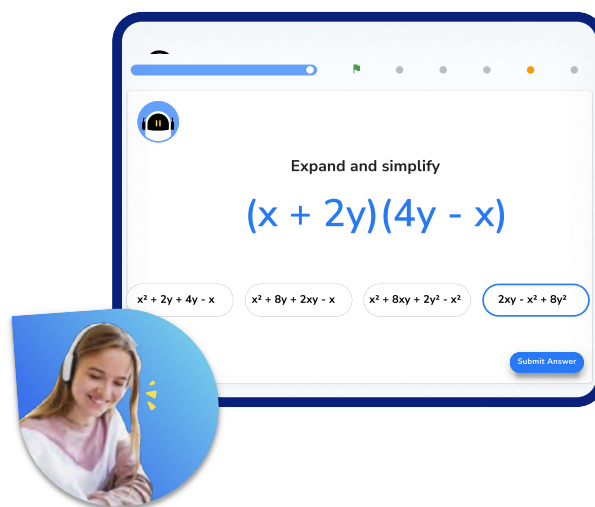
Laws of Indices | Algebra

This resource in a nutshell

Diagnostic questions are a quick and easy way of assessing your students' knowledge and understanding of a particular topic.

Students may be struggling with **laws of indices** for a number of different reasons. Diagnostic questions can help to identify the particular misconception that the student has and help to determine the specific support they will need in order to improve.

They are low stakes and support students developing metacognition around how their learning is progressing and what they need to do to improve further.



At Third Space Learning, we use diagnostic questions before and after online tutoring sessions to identify gaps and track progress, an example of this is shown above.

How to use the questions in this resource

There are 23 multiple choice questions, each designed to assess each of the key skills required to master **laws of indices**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions.

Each question has one correct answer and three carefully chosen incorrect answers that are designed to identify and highlight fundamental misconceptions, including: **Types of number**, **Collecting like terms**, **Simplifying expressions**, **Simplifying fractions**, **Negative indices**, and **Fractional indices**.

When answering these questions, students should be **encouraged to explain why they have chosen a particular answer**, and why the other three answers are incorrect. This can be done verbally in small groups, or written down on the worksheet or in their books.

This resource has been designed to be as **flexible** as possible with questions that can be easily chopped up and reordered, and come with a separate answer sheet that details all of the misconceptions highlighted in the answers.

Diagnostic Questions: Laws of Indices

1. Simplify:

$$x^5 \times x^3$$

A) x^{15}	B) $8x$
C) x^8	D) x^2

2. Simplify:

$$y^2 \times y^{-5}$$

A) y^3	B) y^7
C) y^{-10}	D) y^{-3}

3. Simplify:

$$a^{-3} \times a^{-2}$$

A) a^6	B) a^{-1}
C) a^{-5}	D) a^5

Diagnostic Questions: Laws of Indices

4. Simplify:

$$p^7 \div p^3$$

A) p^4	B) p^{10}
C) p^{-4}	D) $p^{\frac{7}{3}}$

5. Simplify:

$$k^{-2} \div k^3$$

A) k^{-6}	B) k^5
C) k^{-1}	D) k^{-5}

6. Simplify:

$$t^{-2} \div t^{-5}$$

A) t^{10}	B) t^{-7}
C) t^3	D) t^{-3}

Diagnostic Questions: Laws of Indices

7. Simplify:

$$3x^2 \times 4x^5$$

A) $7x^7$	B) $12x^7$
C) $12x^{10}$	D) $34x^{25}$

8. Simplify:

$$20y^6 \div 5y^3$$

A) $4y^2$	B) $15y^3$
C) $15y^2$	D) $4y^3$

9. Simplify:

$$(k^2)^5$$

A) k^7	B) $5k^2$
C) k^{10}	D) $10k$

Diagnostic Questions: Laws of Indices

10. Simplify:

$$(4e^3)^2$$

A) $8e^6$	B) $16e^5$
C) $16e^6$	D) $8e^3$

11. Simplify:

$$5(2t^3)^4$$

A) $80t^{12}$	B) $10000t^{12}$
C) $10t^{12}$	D) $10t^7$

12. Simplify:

$$15a^0$$

A) $15a$	B) 0
C) 15	D) 1

Diagnostic Questions: Laws of Indices

13. Write as a fraction in its simplest form:

$$y^{-3}$$

A) $\frac{3}{y}$	B) $\frac{1}{y^3}$
C) $\frac{y}{3}$	D) $-\frac{3}{y}$

14. Write as a fraction in its simplest form:

$$(3w^4)^{-2}$$

A) $\frac{3}{w^8}$	B) $\frac{9}{w^8}$
C) $\frac{1}{w^2}$	D) $\frac{1}{9w^8}$

15. Write as a fraction in its simplest form:

$$4(2n^5)^{-3}$$

A) $\frac{1}{32n^5}$	B) $\frac{4}{8n^{15}}$
C) $\frac{1}{2n^{15}}$	D) $\frac{1}{8n^{15}}$

Diagnostic Questions: Laws of Indices

16. Simplify:

$$\frac{h^8}{h^5}$$

A) h^3	B) $\frac{8}{5}$
C) h^{-3}	D) $\frac{8}{5}h$

17. Simplify:

$$\frac{4m^7}{6m^3}$$

A) $\frac{2}{3}$	B) $-2m^4$
C) $\frac{3}{2}m^{-4}$	D) $\frac{2}{3}m^4$

18. Simplify:

$$\frac{18a^5b^{-3}}{3a^4b^{-7}}$$

A) $18ab^4$	B) $6a^9b^{-10}$
C) $6ab^4$	D) $6ab^{-10}$

Diagnostic Questions: Laws of Indices

19. Evaluate:

$$64^{\frac{1}{2}}$$

A) 32	B) 8
C) 128	D) $64^{\frac{1}{2}}$

20. Evaluate:

$$16^{\frac{3}{2}}$$

A) 64	B) 24
C) $17^{\frac{1}{2}}$	D) 32

21. Evaluate:

$$8^{-\frac{2}{3}}$$

A) -4	B) $-\frac{16}{3}$
C) $\frac{1}{4}$	D) $-\frac{1}{4}$

Diagnostic Questions: Laws of Indices

22. Evaluate:

$$\left(\frac{4}{9}\right)^{-\frac{1}{2}}$$

A) $\frac{2}{3}$	B) $-\frac{2}{9}$
C) $1\frac{1}{2}$	D) $2\frac{1}{4}$

23. Simplify fully:

$$\left(\frac{16x^4y^7}{25x^8y^5}\right)^{\frac{1}{2}}$$

A) $\frac{4y}{5x^2}$	B) $\frac{8x^4y^7}{25x^8y^5}$
C) $\frac{16y}{25x^2}$	D) $\sqrt{\frac{16x^4y^7}{25x^8y}}$

Diagnostic Questions: Laws of Indices Answers

1. Simplify:

$$x^5 \times x^3$$

- A) x^{15} Student multiplied index numbers
- B) $8x$ Student wrote index number as coefficient
- C) x^8 Correct answer
- D) x^2 Student subtracted index numbers

2. Simplify:

$$y^2 \times y^{-5}$$

- A) y^3 Student forgot minus sign on index number
- B) y^7 Student added index numbers ignoring signs
- C) y^{-10} Student multiplied index numbers
- D) y^{-3} Correct answer

3. Simplify:

$$a^{-3} \times a^{-2}$$

- A) a^6 Student multiplied index numbers
- B) a^{-1} Student found sum of index numbers incorrectly
- C) a^{-5} Correct answer
- D) a^5 Student ignored minus signs

Diagnostic Questions: Laws of Indices Answers

4. Simplify:

$$p^7 \div p^3$$

A) p^4 Correct answer

B) p^{10} Student added index numbers

C) p^{-4} Student performed subtraction of index numbers incorrectly

D) $p^{\frac{7}{3}}$ Student wrote index numbers as a fraction

5. Simplify:

$$k^{-2} \div k^3$$

A) k^{-6} Student multiplied index numbers

B) k^5 Student performed subtraction of index numbers incorrectly

C) k^{-1} Student performed subtraction of index numbers incorrectly

D) k^{-5} Correct answer

6. Simplify:

$$t^{-2} \div t^{-5}$$

A) t^{10} Student multiplied index numbers

B) t^{-7} Student performed subtraction of index numbers incorrectly

C) t^3 Correct answer

D) t^{-3} Student performed subtraction of index numbers incorrectly

Diagnostic Questions: Laws of Indices Answers

7. Simplify:

$$3x^2 \times 4x^5$$

- A) $7x^7$ Student added coefficients
- B) $12x^7$ Correct answers
- C) $12x^{10}$ Student multiplied index numbers
- D) $34x^{25}$ Student does not understand index laws

8. Simplify:

$$20y^6 \div 5y^3$$

- A) $4y^2$ Student divided first index number by second index number
- B) $15y^3$ Student subtracted coefficients
- C) $15y^2$ Student subtracted coefficients and divided first index number by second index number
- D) $4y^3$ Correct answer

9. Simplify:

$$(k^2)^5$$

- A) k^7 Student added index numbers when they should have multiplied
- B) $5k^2$ Student multiplied the bracket by the index number
- C) k^{10} Correct answer
- D) $10k$ Student confused multiplication and exponentiation

Diagnostic Questions: Laws of Indices Answers

10. Simplify:

$$(4e^3)^2$$

- A) $8e^6$ Student multiplied index numbers but doubled coefficient
- B) $16e^5$ Student added index numbers
- C) $16e^6$ Correct answer
- D) $8e^3$ Student used index number as a multiplier

11. Simplify:

$$5(2t^3)^4$$

- A) $80t^{12}$ Correct answer
- B) $10000t^{12}$ Student multiplied by 5 before simplifying the bracket
- C) $10t^{12}$ Student did not raise 2 to the power 4 before multiplying by 5
- D) $10t^7$ Student does not understand how to use indices with brackets

12. Simplify:

$$15a^0$$

- A) $15a$ Student did not evaluate a^0 correctly
- B) 0 Student does not understand the zeroth power
- C) 15 Correct answer
- D) 1 Student did not multiply by 15 after evaluating a^0

Diagnostic Questions: Laws of Indices Answers

13. Write as a fraction in its simplest form:

$$y^{-3}$$

A) $\frac{3}{y}$ Student wrote positive index number as numerator

B) $\frac{1}{y^3}$ Correct answer

C) $\frac{y}{3}$ Student wrote index number as denominator

D) $-\frac{3}{y}$ Student wrote negative index number as numerator

14. Write as a fraction in its simplest form:

$$(3w^4)^{-2}$$

A) $\frac{3}{w^8}$ Student did not deal with the coefficient correctly

B) $\frac{9}{w^8}$ Student forgot to find the reciprocal of the coefficient

C) $\frac{1}{w^2}$ Student does not understand how to rewrite this

D) $\frac{1}{9w^8}$ Correct answer

15. Write as a fraction in its simplest form:

$$4(2n^5)^{-3}$$

A) $\frac{1}{32n^{15}}$ Student multiplied the denominator (instead of numerator) by 4

B) $\frac{4}{8n^{15}}$ Student forgot to simplify the fraction

C) $\frac{1}{2n^{15}}$ Correct answer

D) $\frac{1}{8n^{15}}$ Student did not multiply by 4

Diagnostic Questions: Laws of Indices Answers

16. Simplify:

$$\frac{h^8}{h^5}$$

A) h^3 Correct answer

B) $\frac{8}{5}$ Student attempted to cancel the variable

C) h^{-3} Student subtracted index numbers in the wrong order

D) $\frac{8}{5}h$ Student does not understand how to use index laws with fractions

17. Simplify:

$$\frac{4m^7}{6m^3}$$

A) $\frac{2}{3}$ Student did not include variables in the answer

B) $-2m^4$ Student subtracted coefficients instead of dividing

C) $\frac{3}{2}m^{-4}$ Student applied rules in the wrong order

D) $\frac{2}{3}m^4$ Correct answer

18. Simplify:

$$\frac{18a^5b^{-3}}{3a^4b^{-7}}$$

A) $18ab^4$ Student did not divide coefficients

B) $6a^9b^{-10}$ Student used wrong index law

C) $6ab^4$ Correct answer

D) $6ab^{-10}$ Student did not apply index laws consistently

Diagnostic Questions: Laws of Indices Answers

19. Evaluate:

$$64^{\frac{1}{2}}$$

A) 32 Student multiplied by one half

B) 8 Correct answer

C) 128 Student divided by one half

D) $64^{\frac{1}{2}}$ Student does not understand fractional indices

20. Evaluate:

$$16^{\frac{3}{2}}$$

A) 64 Correct answer

B) 24 Student multiplied by the index number

C) $17^{\frac{1}{2}}$ Student added index number to base number

D) 32 Student does not understand fractional indices

21. Evaluate:

$$8^{-\frac{2}{3}}$$

A) -4 Student did not find the reciprocal

B) $-\frac{16}{3}$ Student multiplied the base number by the index number

C) $\frac{1}{4}$ Correct Answer

D) $-\frac{1}{4}$ Student found negative reciprocal

Diagnostic Questions: Law of Indices Answers

22. Evaluate:

$$\left(\frac{4}{9}\right)^{-\frac{1}{2}}$$

A) $\frac{2}{3}$ Student found the square root but did not find the reciprocal

B) $-\frac{2}{9}$ Student multiplied base number and index number

C) $1\frac{1}{2}$ **Correct Answer**

D) $2\frac{1}{4}$ Student found the reciprocal but did not square root

23. Simplify fully:

$$\left(\frac{16x^4y^7}{25x^8y^5}\right)^{\frac{1}{2}}$$

A) $\frac{4y}{5x^2}$ **Correct answer**

B) $\frac{8x^4y^7}{25x^8y^5}$ Student used index number to multiply by a half

C) $\frac{16y}{25x^2}$ Student forgot to simplify coefficients

D) $\sqrt{\frac{16x^4y^7}{25x^8y}}$ Student rewrote but did not simplify

Where to go next?

For more diagnostic questions, and GCSE maths revision resources and worksheets to support students in fixing any misconceptions take a look at the free Third Space Learning [GCSE maths revision](#) pages.

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