



THIRD SPACE
LEARNING

Diagnostic Questions

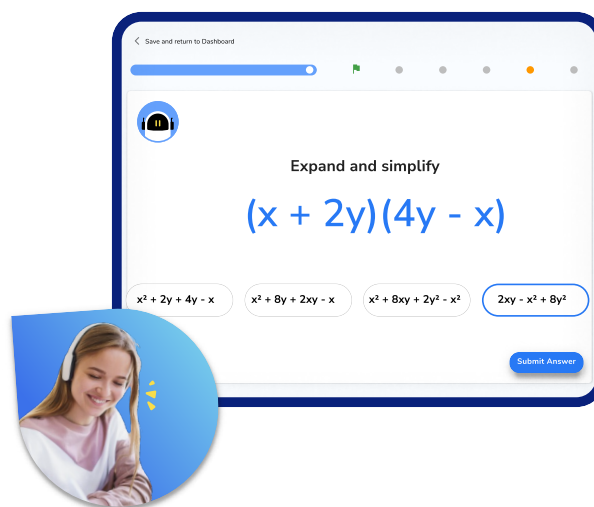
Powers & Roots | Number

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 **Powers & Roots** 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 20 multiple choice questions, each designed to assess each of the key skills required to master **powers & roots**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions, including: **Laws of indices**, **Changing the base**, **Fractional indices**, and **Reciprocals**.

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: Powers & Roots

1. Evaluate:

$$7^2$$

A) 14	B) 49
C) 9	D) 47

2. Evaluate:

$$2^5$$

A) 10	B) 32
C) 16	D) 25

3. Express as a single integer raised to a power:

$$3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

A) 7^3	B) 3^7
C) 21	D) 3^6

Diagnostic Questions: Powers & Roots

4. Express in the form n^k , where n and k are integers with $k \neq 1$:

$$4 \times 2 \times 16$$

A) 2^8	B) 128^1
C) 64^2	D) 2^7

5. Write as a product of primes without using indices:

$$5^3$$

A) $5 + 5 + 5$	B) 5×3
C) $3 \times 3 \times 3 \times 3 \times 3$	D) $5 \times 5 \times 5$

6. Evaluate:

$$16^{\frac{1}{2}}$$

A) 8	B) $\frac{1}{4}$
C) 4	D) 256

Diagnostic Questions: Powers & Roots

7. Evaluate:

$$27^{\frac{2}{3}}$$

A) 9	B) 18
C) 3	D) $\frac{1}{9}$

8. Evaluate:

$$(-8)^{\frac{4}{3}}$$

A) -2	B) $\frac{1}{16}$
C) -16	D) 16

9. Determine the principal value:

$$\sqrt{64}$$

A) 32	B) 8
C) 4	D) 9

Diagnostic Questions: Powers & Roots

10. Evaluate:

$$\sqrt[3]{125}$$

A) 25	B) $41\frac{2}{3}$
C) 5	D) 375

11. Evaluate:

$$\sqrt[3]{-64}$$

A) 4	B) -8
C) $\frac{1}{4}$	D) -4

12. Evaluate:

$$4(3)^2$$

A) 36	B) 144
C) 24	D) 48

Diagnostic Questions: Powers & Roots

13. Evaluate:

$$\left(\frac{3}{4}\right)^2$$

A) $\frac{9}{4}$	B) $\frac{6}{4}$
C) $\frac{9}{16}$	D) $\frac{3}{16}$

14. Evaluate:

$$\sqrt[3]{\frac{8}{27}}$$

A) $\frac{8}{9}$	B) $\frac{8}{81}$
C) $\frac{2}{27}$	D) $\frac{2}{3}$

15. Evaluate:

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

A) $\frac{1}{3}$	B) 3
C) $-\frac{1}{18}$	D) 4.5

Diagnostic Questions: Powers & Roots

16. Evaluate:

$$\left(\frac{1}{8}\right)^{-\frac{2}{3}}$$

A) 4	B) $-\frac{1}{12}$
C) $\frac{1}{4}$	D) 2

17. Given that $3^9 = 19683$, find:

$$3^8$$

A) 19682	B) 59049
C) 2187	D) 6561

18. Express as a fraction in its simplest form:

$$\sqrt[3]{\frac{64}{216}}$$

A) $\frac{8}{27}$	B) $\frac{8}{81}$
C) $\frac{2}{3}$	D) $\frac{8}{9}$

Diagnostic Questions: Powers & Roots

19. Which composite number has a prime factor decomposition given by:

$$2^3 \times 3^2$$

A) 36	B) 72
C) 736	D) 7776

20. Which composite number has a prime factor decomposition given by:

$$2^3 \times 5 \times 11$$

A) 110	B) 330
C) 440	D) 1265

Diagnostic Questions: Powers & Roots Answers

1. Evaluate:

$$7^2$$

- A) 14 Student doubled instead of squared
- B) 49 Correct answer
- C) 9 Student added 2 to 7
- D) 47 Student multiplied incorrectly

2. Evaluate:

$$2^5$$

- A) 10 Student multiplied 2 by 5
- B) 32 Correct answer
- C) 16 Student found 2^4
- D) 25 Student raised 5 to the power 2

3. Express as a single integer raised to a power:

$$3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

- A) 7^3 Student mixed up base number and index number
- B) 3^7 Correct answer
- C) 21 Student multiplied 3 by 7
- D) 3^6 Student did not accurately find the index number

Diagnostic Questions: Powers & Roots Answers

4. Express in the form n^k , where n and k are integers with $k \neq 1$:

$$4 \times 2 \times 16$$

- A) 2^8 Student determined the index number incorrectly
- B) 128^1 Student forgot to apply the criteria for k
- C) 64^2 Student wrote 64×2 incorrectly, without considering the size of their answer
- D) 2^7 Correct answer

5. Write as a product of primes without using indices:

$$5^3$$

- A) $5 + 5 + 5$ Student confused product with sum
- B) 5×3 Student lacks understanding of how to use an exponent to write a product
- C) $3 \times 3 \times 3 \times 3 \times 3$ Student confused the roles of base number and index number
- D) $5 \times 5 \times 5$ Correct answer

6. Evaluate:

$$16^{\frac{1}{2}}$$

- A) 8 Student found half of 16
- B) $\frac{1}{4}$ Student confused rules for fractional indices and negative indices
- C) 4 Correct answer
- D) 256 Student raised 16 to the power 2

Diagnostic Questions: Powers & Roots Answers

7. Evaluate:

$$27^{\frac{2}{3}}$$

A) 9 Correct answer

B) 18 Student found two thirds of 27

C) 3 Student found the cube root, but did not square

D) $\frac{1}{9}$ Student found the reciprocal of the correct answer

8. Evaluate:

$$(-8)^{\frac{4}{3}}$$

A) -2 Student forgot to raise cube root to the power of 4

B) $\frac{1}{16}$ Student found the reciprocal of the correct answer

C) -16 Student did not apply rules for negative numbers consistently

D) 16 Correct answer

9. Determine the principal value:

$$\sqrt{64}$$

A) 32 Student found half of 64, instead of the square root

B) 8 Correct answer

C) 4 Student found the cube root of 64

D) 9 Student made arithmetic errors

Diagnostic Questions: Powers & Roots Answers

10. Evaluate:

$$\sqrt[3]{125}$$

A) 25 Student found $125 = 5 \times 25$, but did not extend to a complete answer

B) $41\frac{2}{3}$ Student found one third of 125

C) 5 Correct answer

D) 375 Student found the product of 3 and 125

11. Evaluate:

$$\sqrt[3]{-64}$$

A) 4 Student found the cube root of 64

B) -8 Student confused finding square root and cube root

C) $\frac{1}{4}$ Student attempted to use rules for negative indices when dealing with a negative base number

D) -4 Correct answer

12. Evaluate:

$$4(3)^2$$

A) 36 Correct answer

B) 144 Student found the product of 4 and 3, then squared

C) 24 Student found the product of 4, 3 and 2

D) 48 Student squared 4 then multiplied by 3

Diagnostic Questions: Powers & Roots Answers

13. Evaluate:

$$\left(\frac{3}{4}\right)^2$$

A) $\frac{9}{4}$ Student forgot to square the denominator

B) $\frac{6}{4}$ Student doubled the numerator

C) $\frac{9}{16}$ Correct answer

D) $\frac{3}{16}$ Student forgot to square the numerator

14. Evaluate:

$$\sqrt[3]{\frac{8}{27}}$$

A) $\frac{8}{9}$ Student multiplied fraction by 3 instead of finding cube root

B) $\frac{8}{81}$ Student found a third of the fraction instead of the cube root

C) $\frac{2}{27}$ Student forgot to cube root the denominator

D) $\frac{2}{3}$ Correct answer

15. Evaluate:

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

A) $\frac{1}{3}$ Student forgot to use negative index to find the reciprocal

B) 3 Correct answer

C) $-\frac{1}{18}$ Student found product of base number and index number

D) 4.5 Student found reciprocal of base number then halved

Diagnostic Questions: Powers & Roots Answers

16. Evaluate:

$$\left(\frac{1}{8}\right)^{-\frac{2}{3}}$$

A) 4 Correct answer

B) $-\frac{1}{12}$ Student found product of base number and index number

C) $\frac{1}{4}$ Student did not use the sign of the index to find the reciprocal

D) 2 Student correctly cube rooted and inverted the fraction, but forgot to square

17. Given that $3^9 = 19683$, find:

$$3^8$$

A) 19682 Student subtracted 1 from the given result

B) 59049 Student multiplied by 3 instead of dividing

C) 2187 Student divided by 9 instead of dividing by 3

D) 6561 Correct answer

18. Express as a fraction in its simplest form:

$$\sqrt[3]{\frac{64}{216}}$$

A) $\frac{8}{27}$ Student simplified the fraction but did not cube root

B) $\frac{8}{81}$ Student found a third, instead of cube rooting

C) $\frac{2}{3}$ Correct answer

D) $\frac{8}{9}$ Student multiplied by 3 instead of cube rooting

Diagnostic Questions: Powers & Roots Answers

19. Which composite number has a prime factor decomposition given by:

$$2^3 \times 3^2$$

A) 36 Student calculated as $(2 \times 3) \times (3 \times 2)$

B) 72 Correct answer

C) 736 Student found the product of 23 and 32

D) 7776 Student misused index rules and calculated 6^5

20. Which composite number has a prime factor decomposition given by:

$$2^3 \times 5 \times 11$$

A) 110 Student forgot to cube the 2

B) 330 Student multiplied 2 by 3, instead of cubing

C) 440 Correct answer

D) 1265 Student found the product of 23, 5 and 11

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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