



THIRD SPACE
LEARNING

Diagnostic Questions

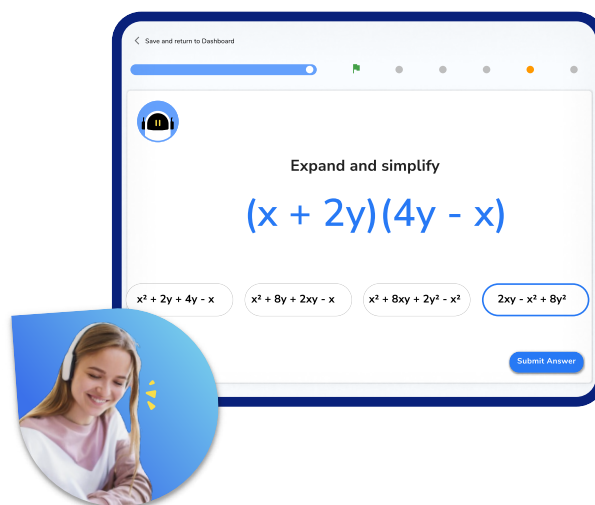
Surds | Number

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 **Surds** 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 **Surds**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions, including: **Calculating roots**, **Prime factorisation**, **Notation**, **Collecting like surds**, and **Calculating with fractions**.

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: Surds

1. Write as a single surd in simplest form:

$$\sqrt{6} \times \sqrt{8}$$

A) $4\sqrt{3}$	B) $\sqrt{48}$
C) $3\sqrt{4}$	D) 48

2. Write in the form $a\sqrt{b}$ where a is an integer and b is prime:

$$\sqrt{80}$$

A) $16\sqrt{5}$	B) $40\sqrt{2}$
C) $8\sqrt{5}$	D) $4\sqrt{5}$

3. Write as a single surd in simplest form:

$$\sqrt{48} + \sqrt{12}$$

A) 24	B) $2\sqrt{15}$
C) $6\sqrt{3}$	D) $\sqrt{60}$

Diagnostic Questions: Surds

4. Write the product as a single term in its simplest form:

$$\sqrt{2} \times \sqrt{6} \times \sqrt{27}$$

A) $\sqrt{324}$	B) 18
C) $\sqrt{18}$	D) $6\sqrt{9}$

5. Write as a single surd in its simplest form:

$$\frac{\sqrt{54}}{\sqrt{3}}$$

A) $\sqrt{18}$	B) $2\sqrt{3}$
C) $3\sqrt{2}$	D) $9\sqrt{2}$

6. Write in the form $a\sqrt{5}$ where a is an integer:

$$\sqrt{45}$$

A) $a = 9$	B) $a = 3$
C) $a = 81$	D) $a = 40$

Diagnostic Questions: Surds

7. Write in the form $a\sqrt{b}$ where a and b are integers with no square factors:

$$\sqrt{150}$$

A) $6\sqrt{5}$	B) $5\sqrt{6}$
C) $25\sqrt{6}$	D) $15\sqrt{10}$

8. Write the surd in its simplest form:

$$\sqrt{243}$$

A) $9\sqrt{3}$	B) $81\sqrt{3}$
C) $3\sqrt{9}$	D) $3\sqrt{27}$

9. Rationalise the denominator and simplify fully:

$$\frac{7}{\sqrt{7}}$$

A) $7\sqrt{7}$	B) $\frac{\sqrt{7}}{7}$
C) $\frac{7\sqrt{7}}{7}$	D) $\sqrt{7}$

Diagnostic Questions: Surds

10. Rationalise the denominator and simplify fully:

$$\frac{6}{\sqrt{3}}$$

A) $3\sqrt{3}$	B) $2\sqrt{3}$
C) $\frac{2\sqrt{3}}{3}$	D) $\frac{6\sqrt{3}}{3}$

11. Rationalise the denominator and simplify fully:

$$\frac{10}{\sqrt{15}}$$

A) $\frac{10\sqrt{15}}{15}$	B) $\frac{\sqrt{6}}{3}$
C) $\frac{2\sqrt{15}}{3}$	D) $\frac{2}{\sqrt{3}}$

12. Rationalise the denominator and simplify fully:

$$\frac{1}{3 - \sqrt{5}}$$

A) $3 + \sqrt{5}$	B) $\frac{3 + \sqrt{5}}{4}$
C) $\frac{3 - \sqrt{5}}{4}$	D) $3 - \sqrt{5}$

Diagnostic Questions: Surds

13. Rationalise the denominator and simplify fully:

$$\frac{8}{\sqrt{2} + \sqrt{6}}$$

A) $2\sqrt{2} - \sqrt{6}$	B) $\frac{\sqrt{2} + \sqrt{6}}{8}$
C) $2\sqrt{6} + 2\sqrt{2}$	D) $2\sqrt{6} - 2\sqrt{2}$

14. Rationalise the denominator and simplify fully:

$$\frac{1}{\sqrt{6} + 9}$$

A) $\frac{\sqrt{6} - 9}{75}$	B) $\frac{9 - \sqrt{6}}{45}$
C) $\frac{9 - \sqrt{6}}{75}$	D) $\sqrt{6} - 9$

15. Expand and simplify fully:

$$\sqrt{2}(5 + \sqrt{6})$$

A) $2\sqrt{3} + 5\sqrt{2}$	B) $5\sqrt{2} + \sqrt{12}$
C) $7\sqrt{6}$	D) $\sqrt{10} + \sqrt{12}$

Diagnostic Questions: Surds

16. Expand and simplify fully:

$$\sqrt{14}(3 - \sqrt{2})$$

A) $3\sqrt{14} - \sqrt{28}$	B) $3\sqrt{14} - 2\sqrt{7}$
C) $\sqrt{7}$	D) $\sqrt{42} - \sqrt{28}$

17. Expand and simplify fully:

$$\sqrt{10}(\sqrt{6} - \sqrt{5})$$

A) $\sqrt{10}$	B) $10\sqrt{6} - 10\sqrt{5}$
C) $2\sqrt{15} - 5\sqrt{2}$	D) $\sqrt{60} - \sqrt{50}$

18. Expand and simplify fully:

$$(1 + \sqrt{7})(1 - \sqrt{7})$$

A) $8 + 2\sqrt{7}$	B) -6
C) -48	D) $1 - 2\sqrt{7}$

Diagnostic Questions: Surds

19. Expand and simplify fully:

$$(2 + \sqrt{3})^2$$

A) $4 + 2\sqrt{3}$	B) $7 + 4\sqrt{3}$
C) 7	D) $13 + 2\sqrt{3}$

20. Expand and simplify fully:

$$(1 + \sqrt{3})(\sqrt{2} + \sqrt{6})$$

A) $\sqrt{2} + 2\sqrt{6} + \sqrt{18}$	B) $\sqrt{2} + 2\sqrt{6}$
C) $2\sqrt{6} + 4\sqrt{2}$	D) $6\sqrt{10}$

Diagnostic Questions: Surds Answers

1. Write as a single surd in simplest form:

$$\sqrt{6} \times \sqrt{8}$$

A) $4\sqrt{3}$ Correct answer

B) $\sqrt{48}$ Student forgot to write in simplest form

C) $3\sqrt{4}$ Student made mistakes simplifying the surd

D) 48 Student forgot to include the radical

2. Write in the form $a\sqrt{b}$ where a is an integer and b is prime:

$$\sqrt{80}$$

A) $16\sqrt{5}$ Student forgot to square root 16

B) $40\sqrt{2}$ Student lacks understanding of how to simplify surds

C) $8\sqrt{5}$ Student found half of 16 instead of the square root

D) $4\sqrt{5}$ Correct answer

3. Write as a single surd in simplest form:

$$\sqrt{48} + \sqrt{12}$$

A) 24 Student found the product of the terms

B) $2\sqrt{15}$ Student added 48 and 12 under the radical then simplified

C) $6\sqrt{3}$ Correct answer

D) $\sqrt{60}$ Student found sum of 48 and 12 under the radical

Diagnostic Questions: Surds Answers

4. Write the product as a single term in its simplest form:

$$\sqrt{2} \times \sqrt{6} \times \sqrt{27}$$

A) $\sqrt{324}$ Student found correct product but did not simplify

B) 18 Correct answer

C) $\sqrt{18}$ Student unnecessarily included radical in answer

D) $6\sqrt{9}$ Student did not fully simplify their answer

5. Write as a single surd in its simplest form:

$$\frac{\sqrt{54}}{\sqrt{3}}$$

A) $\sqrt{18}$ Student forgot to simplify the surd after dividing

B) $2\sqrt{3}$ Student made mistakes simplifying the surd

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

D) $9\sqrt{2}$ Student multiplied surds instead of dividing

6. Write in the form $a\sqrt{5}$ where a is an integer:

$$\sqrt{45}$$

A) $a = 9$ Student forgot to square root 9

B) $a = 3$ Correct answer

C) $a = 81$ Student found the square of 9 instead of square root

D) $a = 40$ Student subtracted 5 from 45

Diagnostic Questions: Surds Answers

7. Write in the form $a\sqrt{b}$ where a and b are integers with no square factors:

$$\sqrt{150}$$

A) $6\sqrt{5}$ Student used surd notation incorrectly

B) $5\sqrt{6}$ Correct answer

C) $25\sqrt{6}$ Student forgot to square root 25

D) $15\sqrt{10}$ Student lacks understanding of surds

8. Write the surd in its simplest form:

$$\sqrt{243}$$

A) $9\sqrt{3}$ Correct answer

B) $81\sqrt{3}$ Student forgot to square root 81

C) $3\sqrt{9}$ Student used surd notation incorrectly

D) $3\sqrt{27}$ Student simplified, but not fully

9. Rationalise the denominator and simplify fully:

$$\frac{7}{\sqrt{7}}$$

A) $7\sqrt{7}$ Student forgot to include the denominator before simplifying

B) $\frac{\sqrt{7}}{7}$ Student miscalculated the square of $\sqrt{7}$ in the denominator

C) $\frac{7\sqrt{7}}{7}$ Student did not fully simplify

D) $\sqrt{7}$ Correct answer

Diagnostic Questions: Surds Answers

10. Rationalise the denominator and simplify fully:

$$\frac{6}{\sqrt{3}}$$

A) $3\sqrt{3}$ Student multiplied numerator and denominator correctly but simplified incorrectly

B) $2\sqrt{3}$ Correct answer

C) $\frac{2\sqrt{3}}{3}$ Student miscalculated the square of $\sqrt{3}$ in the denominator

D) $\frac{6\sqrt{3}}{3}$ Student did not fully simplify their answer

11. Rationalise the denominator and simplify fully:

$$\frac{10}{\sqrt{15}}$$

A) $\frac{10\sqrt{15}}{15}$ Student forgot to simplify the fraction fully

B) $\frac{\sqrt{6}}{3}$ Student multiplied 10 and 15 under the radical in the numerator before simplifying

C) $\frac{2\sqrt{15}}{3}$ Correct answer

D) $\frac{2}{\sqrt{3}}$ Student does not understand how to rationalise the denominator

12. Rationalise the denominator and simplify fully:

$$\frac{1}{3 - \sqrt{5}}$$

A) $3 + \sqrt{5}$ Student did not deal with the denominator correctly

B) $\frac{3 + \sqrt{5}}{4}$ Correct answer

C) $\frac{3 - \sqrt{5}}{4}$ Student made errors with signs

D) $3 - \sqrt{5}$ Student found the reciprocal of the given fraction

Diagnostic Questions: Surds Answers

13. Rationalise the denominator and simplify fully:

$$\frac{8}{\sqrt{2} + \sqrt{6}}$$

A) $2\sqrt{2} - \sqrt{6}$ Student made errors with negative numbers

B) $\frac{\sqrt{2} + \sqrt{6}}{8}$ Student inverted the given fraction

C) $2\sqrt{6} + 2\sqrt{2}$ Student made sign errors when simplifying

D) $2\sqrt{6} - 2\sqrt{2}$ Correct answer

14. Rationalise the denominator and simplify fully:

$$\frac{1}{\sqrt{6} + 9}$$

A) $\frac{\sqrt{6} - 9}{75}$ Student made sign errors when simplifying

B) $\frac{9 - \sqrt{6}}{45}$ Student found $(\sqrt{6})^2$ to be 36 instead of 6

C) $\frac{9 - \sqrt{6}}{75}$ Correct answer

D) $\sqrt{6} - 9$ Student forgot to include workings with the denominator

15. Expand and simplify fully:

$$\sqrt{2}(5 + \sqrt{6})$$

A) $2\sqrt{3} + 5\sqrt{2}$ Correct answer

B) $5\sqrt{2} + \sqrt{12}$ Student expanded correctly, but did not simplify

C) $7\sqrt{6}$ Student incorrectly attempted to combine components of the surd

D) $\sqrt{10} + \sqrt{12}$ Student found the first term in the expansion incorrectly

Diagnostic Questions: Surds Answers

16. Expand and simplify fully:

$$\sqrt{14}(3 - \sqrt{2})$$

A) $3\sqrt{14} - \sqrt{28}$ Student expanded correctly but did not simplify

B) $3\sqrt{14} - 2\sqrt{7}$ Correct answer

C) $\sqrt{7}$ Student simplified incorrectly

D) $\sqrt{42} - \sqrt{28}$ Student found the first term in the expansion incorrectly

17. Expand and simplify fully:

$$\sqrt{10}(\sqrt{6} - \sqrt{5})$$

A) $\sqrt{10}$ Student expanded correctly but then subtracted under the radical

B) $10\sqrt{6} - 10\sqrt{5}$ Student found products of surds incorrectly

C) $2\sqrt{15} - 5\sqrt{2}$ Correct answer

D) $\sqrt{60} - \sqrt{50}$ Student expanded correctly but did not simplify

18. Expand and simplify fully:

$$(1 + \sqrt{7})(1 - \sqrt{7})$$

A) $8 + 2\sqrt{7}$ Student ignored the sign in the second bracket

B) -6 Correct answer

C) -48 Student found $(\sqrt{7})^2$ to be 49 instead of 7

D) $1 - 2\sqrt{7}$ Student lacks understanding of how to expand a product of binomials including surds

Diagnostic Questions: Surds Answers

19. Expand and simplify fully:

$$(2 + \sqrt{3})^2$$

A) $4 + 2\sqrt{3}$ Student doubled the bracket, rather than squaring

B) $7 + 4\sqrt{3}$ Correct answer

C) 7 Student squared each term then added them together

D) $13 + 2\sqrt{3}$ Student made arithmetic errors when expanding

20. Expand and simplify fully:

$$(1 + \sqrt{3})(\sqrt{2} + \sqrt{6})$$

A) $\sqrt{2} + 2\sqrt{6} + \sqrt{18}$ Student did not fully simplify after expanding

B) $\sqrt{2} + 2\sqrt{6}$ Student accidentally dropped a term

C) $2\sqrt{6} + 4\sqrt{2}$ Correct answer

D) $6\sqrt{10}$ Student attempted to combine all terms into one surd

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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