



THIRD SPACE
LEARNING

Diagnostic Questions

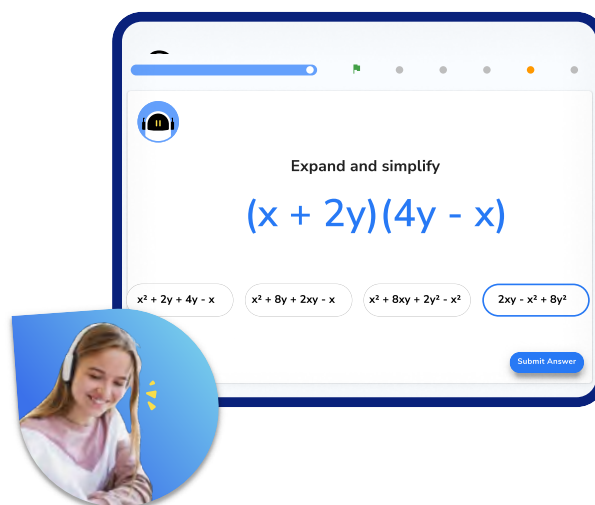
Algebraic Fractions | Algebra

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 **algebraic fractions** 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 **algebraic fractions**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions, including: **Order of operations**, **Negative numbers**, **Calculations with fractions**, **Solving linear equations**, **Laws of indices**, and **Highest common factors**.

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: Algebraic Fractions

1. Simplify fully:

$$\frac{3x^4}{24x^2}$$

A) $\frac{3x^2}{24}$	B) $\frac{x^2}{8}$
C) $\frac{x^4}{8x^2}$	D) $8x^2$

2. Write as a single fraction in its simplest terms:

$$\frac{a}{2b} \times \frac{4b^3}{a^5}$$

A) $\frac{4ab^3}{2a^5b}$	B) $\frac{2ab^3}{a^5b}$
C) $\frac{b^2}{2a^4}$	D) $\frac{2b^2}{a^4}$

3. Write as a single fraction in its simplest terms:

$$\frac{2}{m} + \frac{m}{3}$$

A) $\frac{2}{3}$	B) $\frac{2+m}{3m}$
C) $\frac{6+m^2}{3m}$	D) $\frac{2+m}{3+m}$

Diagnostic Questions: Algebraic Fractions

4. Solve:

$$\frac{21}{x} = 3.5$$

A) $x = 6$	B) $x = 73.5$
C) $x = \frac{1}{6}$	D) $x = 17.5$

5. Solve:

$$\frac{x-3}{5} + x = 9$$

A) $x = 48$	B) $x = 24$
C) $x = 7$	D) $x = 8$

6. Solve:

$$x - \frac{2x+1}{3} = 2$$

A) $x = 5$	B) $x = -7$
C) $x = 7$	D) $x = \frac{5}{2}$

Diagnostic Questions: Topic

7. Expand:

$$\frac{x+2}{3} + \frac{x+6}{2} = 7$$

A) $x = 4$	B) $x = -\frac{1}{2}$
C) $x = 17$	D) $x = 3$

8. Solve:

$$\frac{3x+2}{4} - \frac{9+x}{5} = 2$$

A) $x = -6$	B) $x = 6$
C) $x = 9$	D) $x = 23.5$

9. Solve:

$$8 - \frac{9}{x+2} = 5$$

A) $x = -0.6$	B) $x = -1$
C) $x = 1$	D) $x = -0.25$

Diagnostic Questions: Algebraic Fractions

10. Solve:

$$\frac{6}{x-1} + 7 = 10$$

A) $x = 3$	B) $x = -3$
C) $x = 1$	D) $x = 1.5$

11. Solve:

$$\frac{1}{x} + \frac{2}{3x} = 2$$

A) $x = \frac{3}{8}$	B) $x = \frac{2}{7}$
C) $x = \frac{1}{2}$	D) $x = \frac{5}{6}$

12. Solve:

$$\frac{1}{x} + \frac{2}{3x} + \frac{5}{6x} = 10$$

A) $x = \frac{2}{25}$	B) $x = \frac{4}{5}$
C) $x = \frac{1}{4}$	D) $x = \frac{3}{4}$

Diagnostic Questions: Algebraic Fractions

13. Solve:

$$\frac{1}{x-2} + \frac{1}{x} = 1$$

A) $x = 1$	B) $x = 2 - \sqrt{2}, x = 2 + \sqrt{2}$
C) $x = -\sqrt{2}, x = \sqrt{2}$	D) $x = 1.5$

14. Solve:

$$\frac{x-5}{x-3} + \frac{1}{x+4} = 1$$

A) <i>No solution</i>	B) $x = 11$
C) $x = \pm 2\sqrt{2}$	D) $x = -11$

15. Solve:

$$\frac{x+2}{x-1} - \frac{4-x}{x+2} = 2$$

A) $x = 1, x = -2$	B) $x = 2$
C) $x = 4$	D) $x = -\frac{1}{2}, x = 4$

Diagnostic Questions: Algebraic Fractions

16. Solve:

$$\frac{x}{x+1} + \frac{x+1}{x+3} = 1$$

A) $x = -2, \quad x = 1$	B) $x = 0$
C) $x = -3, \quad x = -1$	D) $x = -2, \quad x = -\frac{1}{2}$

17. Simplify fully:

$$\frac{x+7}{x^2-49}$$

A) $\frac{1}{x+7}$	B) $x+7$
C) $x-7$	D) $\frac{1}{x-7}$

18. Simplify fully:

$$\frac{x^2-36}{x^2+x-30}$$

A) $\frac{x-6}{x-5}$	B) $\frac{x+6}{x-5}$
C) $\frac{(x+6)(x-6)}{(x-5)(x+6)}$	D) $\frac{-36}{x-30}$

Diagnostic Questions: Algebraic Fractions

19. Simplify fully:

$$\frac{x^2 + 5x - 14}{x^2 + 4x - 21}$$

A) $x + 7$	B) $\frac{x - 2}{x - 3}$
C) $\frac{(x - 2)(x + 7)}{(x - 3)(x + 7)}$	D) $\frac{5x - 14}{4x - 21}$

20. Simplify fully:

$$\frac{x^2 + 3x}{x^3 - 9x}$$

A) $\frac{3}{x - 9}$	B) $\frac{x(x + 3)}{x(x + 3)(x - 3)}$
C) $\frac{1}{x - 3}$	D) $\frac{x + 3}{x^2 - 9}$

Diagnostic Questions: Answers

1. Simplify fully:

$$\frac{3x^4}{24x^2}$$

A) $\frac{3x^2}{24}$ Student did not simplify coefficients

B) $\frac{x^2}{8}$ Correct answer

C) $\frac{x^4}{8x^2}$ Student did not simplify variables

D) $8x^2$ Student made mistakes writing the fraction

2. Write as a single fraction in its simplest terms:

$$\frac{a}{2b} \times \frac{4b^3}{a^5}$$

A) $\frac{4ab^3}{2a^5b}$ Student multiplied but did not simplify

B) $\frac{2ab^3}{a^5b}$ Student did not simplify variables after multiplying

C) $\frac{b^2}{2a^4}$ Student simplified coefficients incorrectly

D) $\frac{2b^2}{a^4}$ Correct answer

3. Write as a single fraction in its simplest terms:

$$\frac{2}{m} + \frac{m}{3}$$

A) $\frac{2}{3}$ Student found the product of terms

B) $\frac{2+m}{3m}$ Student added numerators without finding equivalent fractions

C) $\frac{6+m^2}{3m}$ Correct Answer

D) $\frac{2+m}{3+m}$ Student does not understand how to add algebraic fractions

Diagnostic Questions: Answers

4. Solve:

$$\frac{21}{x} = 3.5$$

A) $x = 6$ Correct answer

B) $x = 73.5$ Student used inverse operations incorrectly

C) $x = 16$ Student found reciprocal of solution

D) $x = 17.5$ Student used incorrect operations

5. Solve:

$$\frac{x - 3}{5} + x = 9$$

A) $x = 48$ Student ignored the single x variable

B) $x = 24$ Student did not multiply all terms by 5

C) $x = 7$ Student subtracted the 3, rather than adding it

D) $x = 8$ Correct answer

6. Solve:

$$x - \frac{2x + 1}{3} = 2$$

A) $x = 5$ Student subtracted 1 rather than adding it

B) $x = -7$ Student did not multiply the single x variable by 3

C) $x = 7$ Correct answer

D) $x = \frac{5}{2}$ Student made several errors inverting operations

Diagnostic Questions: Answers

7. Solve:

$$\frac{x+2}{3} + \frac{x+6}{2} = 7$$

A) $x = 4$ Correct answer

B) $x = -\frac{1}{2}$ Student ignored the denominators

C) $x = 17$ Student did not apply the lowest common denominator correctly

D) $x = 3$ Student simplified the left hand side incorrectly

8. Solve:

$$\frac{3x+2}{4} - \frac{9+x}{5} = 2$$

A) $x = -6$ Student simplified the left hand side incorrectly

B) $x = 6$ Correct answer

C) $x = 9$ Student made several errors

D) $x = 23.5$ Student did not apply the lowest common denominator correctly

9. Solve:

$$8 - \frac{9}{x+2} = 5$$

A) $x = -0.6$ Student simplified the left hand side incorrectly

B) $x = -1$ Student made a mistake with a negative number

C) $x = 1$ Correct answer

D) $x = -0.25$ Student only multiplied the left hand side by the denominator

Diagnostic Questions: Answers

10. Solve:

$$\frac{6}{x-1} + 7 = 10$$

A) $x = 3$ Correct answer

B) $x = -3$ Student made a mistake with a negative number

C) $x = 1$ Student treated denominator as $x + 1$

D) $x = 1.5$ Student multiplied the numerator by the denominator, then solved

11. Solve :

$$\frac{1}{x} + \frac{2}{3x} = 2$$

A) $x = \frac{3}{8}$ Student simplified the left hand side incorrectly

B) $x = \frac{2}{7}$ Student multiplied the numerators by the denominators then solved

C) $x = \frac{1}{2}$ Student mistakenly solved $x + 3x = 2$

D) $x = \frac{5}{6}$ Correct answer

12. Solve:

$$\frac{1}{x} + \frac{2}{3x} + \frac{5}{6x} = 10$$

A) $x = \frac{2}{25}$ Student collected the numerators and the denominators then solved

B) $x = \frac{4}{5}$ Student made errors multiplying by the lowest common denominator

C) $x = \frac{1}{4}$ Correct answer

D) $x = \frac{3}{4}$ Student made arithmetic errors

Diagnostic Questions: Answers

13. Solve:

$$\frac{1}{x-2} + \frac{1}{x} = 1$$

A) $x = 1$ Student equated the left hand side to zero

B) $x = 2 - \sqrt{2}, x = 2 + \sqrt{2}$ Correct answer

C) $x = -\sqrt{2}, x = \sqrt{2}$ Student solved quadratic incorrectly

D) $x = 1.5$ Student multiplied the numerators by the denominators then solved

14. Solve:

$$\frac{x-5}{x-3} + \frac{1}{x+4} = 1$$

A) *No solution* Student multiplied the numerators by the denominators then solved

B) $x = 11$ Student made a mistake collecting like terms

C) $x = \pm 2\sqrt{2}$ Student multiplied by the lowest common denominator incorrectly

D) $x = -11$ Correct answer

15. Solve:

$$\frac{x+2}{x-1} - \frac{4-x}{x+2} = 2$$

A) $x = 1, x = -2$ Student solved a quadratic formed from the product of denominators

B) $x = 2$ Student attempted to use trial and error (incorrectly)

C) $x = 4$ Correct answer

D) $x = -\frac{1}{2}, x = 4$ Student found the sum of the left hand side before solving

Diagnostic Questions: Answers

16. Solve:

$$\frac{x}{x+1} + \frac{x+1}{x+3} = 1$$

A) $x = -2, x = 1$ Correct answer

B) $x = 0$ Student solved a linear equation using only the numerators

C) $x = -3, x = -1$ Student solved a linear equation using only the denominators

D) $x = -2, x = -\frac{1}{2}$ Student multiplied the numerators by the denominators then solved the resulting quadratic

17. Simplify fully:

$$\frac{x+7}{x^2-49}$$

A) $\frac{1}{x+7}$ Student simplified the factorised expression incorrectly

B) $x+7$ Student simplified incorrectly

C) $x-7$ Student wrote the reciprocal of the answer

D) $\frac{1}{x-7}$ Correct answer

18. Simplify fully:

$$\frac{x^2-36}{x^2+x-30}$$

A) $\frac{x-6}{x-5}$ Correct answer

B) $\frac{x+6}{x-5}$ Student cancelled terms incorrectly

C) $\frac{(x+6)(x-6)}{(x-5)(x+6)}$ Student factorised but did not simplify

D) $\frac{-36}{x-30}$ Student attempted to cancel the x^2 terms

Diagnostic Questions: Algebraic Fractions Answers

19. Simplify fully:

$$\frac{x^2 + 5x - 14}{x^2 + 4x - 21}$$

A) $x + 7$ Student cancelled terms incorrectly

B) $\frac{x-2}{x-3}$ Correct answer

C) $\frac{(x-2)(x+7)}{(x-3)(x+7)}$ Student factorised but did not simplify

D) $\frac{5x-14}{4x-21}$ Student attempted to cancel the x^2 terms

20. Simplify fully:

$$\frac{x^2 + 3x}{x^3 - 9x}$$

A) $\frac{3}{x-9}$ Student attempted to simplify only the variable

B) $\frac{x(x+3)}{x(x+3)(x-3)}$ Student factorised but did not simplify

C) $\frac{1}{x-3}$ Correct answer

D) $\frac{x+3}{x^2-9}$ Student did not recognise the difference of two squares in the denominator

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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