



THIRD SPACE
LEARNING

Diagnostic Questions

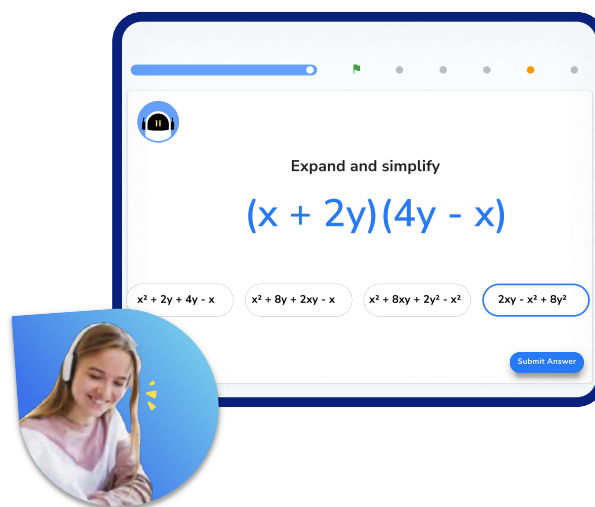
Simultaneous Equations | Algebra

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 **Simultaneous Equations** 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 **simultaneous equations**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions, including: **Calculations with negative numbers**, **Multiplying throughout by a constant**, **Eliminating variables** and **Substitution**.

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: Simultaneous Equations

1. Solve:

$$x + y = 3$$

$$x + 2y = 5$$

A) $x = 2, y = 1$	B) $x = 1, y = 2$
C) $x = 3, y = 1$	D) $x = 1.5, y = 1.5$

2. Solve:

$$x + 4y = 10$$

$$x + 2y = 6$$

A) $x = -6, y = 4$	B) $x = 6, y = 1$
C) $x = 2, y = 2$	D) $x = 4, y = 1$

3. Solve:

$$2a + b = 11$$

$$5a + b = 20$$

A) $a = 3, b = 5$	B) $a = 5, b = 3$
C) $a = 4, b = 3$	D) $a = 5, b = -5$

Diagnostic Questions: Simultaneous Equations

4. Solve:

$$2x + y = 7$$

$$x - y = 2$$

A) $x = 1, y = 3$	B) $x = 5, y = 3$
C) $x = 5, y = -3$	D) $x = 3, y = 1$

5. Solve:

$$4m + 3n = 13$$

$$m - 3n = 7$$

A) $m = 2, n = \frac{5}{3}$	B) $m = -1, n = 4$
C) $m = 4, n = -1$	D) $m = 4, n = 1$

6. Solve:

$$2p + 3q = 13$$

$$2p - q = -7$$

A) $p = -1, q = 5$	B) $p = 2, q = 3$
C) $p = 5, q = -1$	D) $p = 1, q = 5$

Diagnostic Questions: Simultaneous Equations

7. Solve:

$$8x + 4y = 22$$

$$3x + 2y = 9$$

A) $x = 6.5, y = -7.5$	B) $x = 2, y = 1.5$
C) $x = 1.5, y = 2$	D) $x = 4, y = -1.5$

8. Solve:

$$2x + 5y = -19$$

$$3x - y = -3$$

A) $x = \frac{4}{13}, y = \frac{51}{13}$	B) $x = 2, y = -3$
C) $x = -3, y = -2$	D) $x = -2, y = -3$

9. Solve:

$$y = 2x + 7$$

$$5x + 7y = 58.5$$

A) $x = 9.77, y = -16.77$	B) $x = 0.5, y = 8$
C) $x = 1, y = 9$	D) $x = 8, y = 0.5$

Diagnostic Questions: Simultaneous Equations

10. Solve:

$$5x - 2y = 12$$

$$3x + 5y = 1$$

A) $x = 3.05, y = 3.25$	B) $x = 3.25, y = -3.05$
C) $x = 2, y = -1$	D) $x = -1, y = 2$

11. Solve:

$$2y - 3x = 24$$

$$4x - 3y = -33$$

A) $x = -6, y = 3$	B) $x = -28.5, y = -27$
C) $x = 6, y = 3$	D) $x = -6, y = -3$

12. Solve:

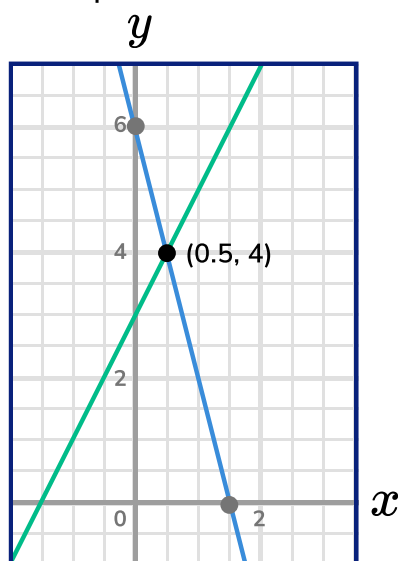
$$\frac{1}{2}x - \frac{1}{3}y = 0$$

$$x + \frac{1}{2}y = 21$$

A) $x = 9, y = 6$	B) $x = 84, y = -126$
C) $x = 18, y = 12$	D) $x = 12, y = 18$

Diagnostic Questions: Simultaneous Equations

13. For which pair of simultaneous equations is this the solution?



A) $x - 2y = -3, x + 4y = 6$	B) $2x - y = 3, 4x + y = 6$
C) $x - 2y = 3, x + 4y = 6$	D) $2x - y = -3, 4x + y = 6$

14. Two families visit a waterpark. Mr Smith takes his three children and pays a total of £49.25. Mr and Mrs Jones take their 5 children and pay a total of £88. Find the total entrance fee for one adult and one child.

A) £28.25	B) £38.75
C) £35.50	D) £21

Diagnostic Questions: Simultaneous Equations

15. Solve, giving your answers as coordinates:

$$y = x^2 - 2x + 7$$

$$y = x + 5$$

A) (1, 4), (-2, 3)	B) (1, 6), (-2, 3)
C) (1, 6), (2, 7)	D) (-1, 4), (2, 7)

16. Solve, giving your answers as coordinates:

$$y = x^2 + 3x - 15$$

$$4x - y = 3$$

A) (3, 9), (-4, -19)	B) (-3, -15), (4, 13)
C) (2, 5), (-9, -39)	D) (-3, -15), (-4, -19)

17. Solve:

$$x^2 + y^2 = 25$$

$$y = x + 1$$

A) $x = -3, y = -2$ or $x = 4, y = 5$	B) $x = 4, y = 5$ or $x = -6, y = -5$
C) $x = 3, y = 4$ or $x = -4, y = -3$	D) $x = 3, y = 4$ or $x = 4, y = 5$

Diagnostic Questions: Simultaneous Equations

18. Solve:

$$2x + y^2 = 7$$

$$x - y = 2$$

A) $x = 3, y = 1$ or $x = -1, y = -3$	B) $x = -3, y = -5$ or $x = 1, y = -1$
C) $x = 3, y = 1$ or $x = 1, y = -1$	D) $x = -3, y = -5$ or $x = -1, y = -3$

19. Solve:

$$2x^2 - y^2 = 17$$

$$y = x - 2$$

A) $x = 7, y = 5$ or $x = -3, y = -5$	B) $x = 2 + \sqrt{17}, y = \sqrt{17}$ or $x = 2 - \sqrt{17}, y = -\sqrt{17}$
C) $x = 3, y = 1$ or $x = -7, y = -9$	D) $x = -3, y = -5$ or $x = -7, y = -9$

20. Solve:

$$x^2 - y^2 = 1$$

$$2x - 3y = 2$$

A) $x = 0, y = -\frac{2}{3}$ or $x = -2.4, y = -\frac{34}{15}$	B) $x = 1, y = 0$ or $x = 4.6, y = 2.4$
C) $x = 1, y = 0$ or $x = -1.25, y = -1.5$	D) $x = 1, y = 0$ or $x = -2.6, y = -2.4$

Diagnostic Questions: Simultaneous Equations Answers

1. Solve:

$$x + y = 3$$

$$x + 2y = 5$$

- A) $x = 2, y = 1$ Student solved the first equation only
B) $x = 1, y = 2$ Correct answer
C) $x = 3, y = 1$ Student solved the second equation only
D) $x = 1.5, y = 1.5$ Student solved the first equation only

2. Solve:

$$x + 4y = 10$$

$$x + 2y = 6$$

- A) $x = -6, y = 4$ Student solved the first equation only
B) $x = 6, y = 1$ Student solved the first equation only
C) $x = 2, y = 2$ Correct answer
D) $x = 4, y = 1$ Student solved the second equation only

3. Solve

$$2a + b = 11$$

$$5a + b = 20$$

- A) $a = 3, b = 5$ Correct answer
B) $a = 5, b = 3$ Student inverted the solutions
C) $a = 4, b = 3$ Student solved the first equation only
D) $a = 5, b = -5$ Student solved the second equation only

Diagnostic Questions: Simultaneous Equations Answers

4. Solve:

$$2x + y = 7$$

$$x - y = 2$$

- A) $x = 1, y = 3$ Student inverted the solutions
- B) $x = 5, y = 3$ Student solved the second equation only
- C) $x = 5, y = -3$ Student solved the first equation only
- D) $x = 3, y = 1$ Correct answer

5. Solve:

$$4m + 3n = 13$$

$$m - 3n = 7$$

- A) $m = 2, n = \frac{5}{3}$ Student solved the first equation only
- B) $m = -1, n = 4$ Student inverted the solutions
- C) $m = 4, n = -1$ Correct answer
- D) $m = 4, n = 1$ Student solved for m correctly but lost the negative sign for n

6. Solve:

$$2p + 3q = 13$$

$$2p - q = -7$$

- A) $p = -1, q = 5$ Correct answer
- B) $p = 2, q = 3$ Student ignored the negatives when subtracting
- C) $p = 5, q = -1$ Student inverted the answers
- D) $p = 1, q = 5$ Student solved for q correctly but lost the negative sign for p

Diagnostic Questions: Simultaneous Equations Answers

7. Solve:

$$8x + 4y = 22$$

$$3x + 2y = 9$$

A) $x = 6.5, y = -7.5$ Student forgot to double the 9, subtracted and used x value to solve for y

B) $x = 2, y = 1.5$ Correct answer

C) $x = 1.5, y = 2$ Student inverted the answers

D) $x = 4, y = -1.5$ Student solved the second equation only

8. Solve:

$$2x + 5y = -19$$

$$3x - y = -3$$

A) $x = \frac{4}{13}, y = \frac{51}{13}$ incorrectly subtracted the equations to eliminate y

B) $x = 2, y = -3$ Student has incorrect sign for

C) $x = -3, y = -2$ Student inverted the answer

D) $x = -2, y = -3$ Correct answer

9. Solve:

$$y = 2x + 7$$

$$5x + 7y = 58.5$$

A) $x = 9.77, y = -16.77$ Student incorrectly subtracted the equations to eliminate y

B) $x = 0.5, y = 8$ Correct answer

C) $x = 1, y = 9$ Student solved the first equation only

D) $x = 8, y = 0.5$ Student has inverted the answers

Diagnostic Questions: Simultaneous Equations Answers

10. Solve:

$$5x - 2y = 12$$

$$3x + 5y = 1$$

A) $x = 3.05, y = 3.25$ Student incorrectly subtracted the equations to eliminate y

B) $x = 3.25, y = -3.05$ Student incorrectly subtracted the equations to eliminate y and then inverted the answers

C) $x = 2, y = -1$ Correct answer

D) $x = -1, y = 2$ Student has inverted the answers

11. Solve:

$$2y - 3x = 24$$

$$4x - 3y = -33$$

A) $x = -6, y = 3$ Correct answer

B) $x = -28.5, y = -27$ Student has solved with $2x - 3y = 24$

C) $x = 6, y = 3$ Incorrect sign given for x

D) $x = -6, y = -3$ Incorrect sign given for y

12. Solve:

$$\frac{1}{2}x - \frac{1}{3}y = 0$$

$$x + \frac{1}{2}y = 21$$

A) $x = 9, y = 6$ Student solved $2x - 3y = 0, x + 2y = 21$

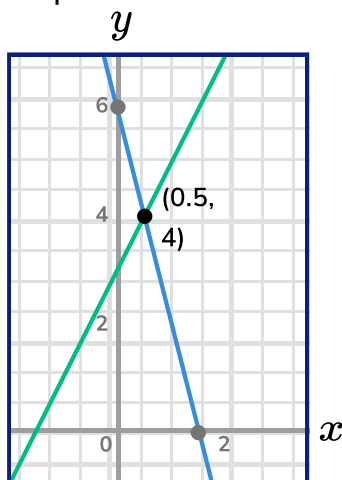
B) $x = 84, y = -126$ Student solved with $\frac{1}{2}x + \frac{1}{3}y = 0$

C) $x = 18, y = 12$ Student inverted the answers

D) $x = 12, y = 18$ Correct answer

Diagnostic Questions: Simultaneous Equations Answers

13. For which pair of simultaneous equations is this the solution?



- A) $x - 2y = -3, x + 4y = 6$ Student mixed up the coefficients of x and y
- B) $2x - y = 3, 4x + y = 6$ Student incorrectly worked out the y -intercept of the first equation
- C) $x - 2y = 3, x + 4y = 6$ Student mixed up the coefficients of x and y and incorrectly worked out the y -intercept of the first equation
- D) $2x - y = -3, 4x + y = 6$ Correct answer

14. Two families visit a waterpark. Mr Smith takes his three children and pays a total of £49.25. Mr and Mrs Jones take their 5 children and pay a total of £88. Find the total entrance fee for one adult and one child.

- A) £28.25 Correct answer
- B) £38.75 Student subtracted the equations, finding the cost of one adult and two children
- C) £35.50 Student found the cost of two adults
- D) £21 Student found the cost of one child

Diagnostic Questions: Simultaneous Equations Answers

15. Solve, giving your answers as coordinates:

$$y = x^2 - 2x + 7$$

$$y = x + 5$$

- A) (1, 4), (-2, 3) Student used incorrect signs when solving their quadratic
B) (1, 6), (-2, 3) Student used incorrect signs when solving their quadratic
C) (1, 6), (2, 7) Correct answer
D) (-1, 4), (2, 7) Student used incorrect signs when solving their quadratic

16. Solve, giving your answers as coordinates:

$$y = x^2 + 3x - 15$$

$$4x - y = 3$$

- A) (3, 9), (-4, -19) Student used incorrect signs when solving their quadratic
B) (-3, -15), (4, 13) Correct answer
C) (2, 5), (-9, -39) Student rearranged second equation to give $y = 3 - 4x$
D) (-3, -15), (-4, -19) Student used an incorrect sign when solving their quadratic

17. Solve:

$$x^2 + y^2 = 25$$

$$y = x + 1$$

- A) $x = -3, y = -2$ or $x = 4, y = 5$ Student used incorrect signs when solving their quadratic
B) $x = 4, y = 5$ or $x = -6, y = -5$ Student forgot the extra x^2 term
C) $x = 3, y = 4$ or $x = -4, y = -3$ Correct answer
D) $x = 3, y = 4$ or $x = 4, y = 5$ Student used an incorrect sign when solving their quadratic

Diagnostic Questions: Simultaneous Equations Answers

18. Solve:

$$2x + y^2 = 7$$

$$x - y = 2$$

A) $x = 3, y = 1$ or $x = -1, y = -3$ Correct answer

B) $x = -3, y = -5$ or $x = 1, y = -1$ Student used incorrect signs when solving their quadratic

C) $x = 3, y = 1$ or $x = 1, y = -1$ Student used an incorrect sign when solving their quadratic

D) $x = -3, y = -5$ or $x = -1, y = -3$ Student forgot the $2x$ term and solved $(x - 2)^2 = 7$

19. Solve:

$$2x^2 - y^2 = 17$$

$$y = x - 2$$

A) $x = 7, y = 5$ or $x = -3, y = -5$ Student had an incorrect sign for their $4x$ term

B) $x = 2 + \sqrt{17}, y = \sqrt{17}$ or $x = 2 - \sqrt{17}, y = -\sqrt{17}$ Student collected the constant terms incorrectly

C) $x = 3, y = 1$ or $x = -7, y = -9$ Correct answer

D) $x = -3, y = -5$ or $x = -7, y = -9$ Student used an incorrect sign when solving their quadratic

20. Solve:

$$x^2 - y^2 = 1$$

$$2x - 3y = 2$$

A) $x = 0, y = -\frac{2}{3}$ or $x = -2.4, y = -\frac{34}{15}$ Student solved a quadratic in terms of x but then used the solutions and values of x

B) $x = 1, y = 0$ or $x = 4.6, y = 2.4$ Student used incorrect sign for non-zero value of y

C) $x = 1, y = 0$ or $x = -1.25, y = -1.5$ Student forgot to multiply their y^2 term by 4 before collecting a quadratic in term of y

D) $x = 1, y = 0$ or $x = -2.6, y = -2.4$ Correct answer

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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