



THIRD SPACE  
LEARNING

# Diagnostic Questions

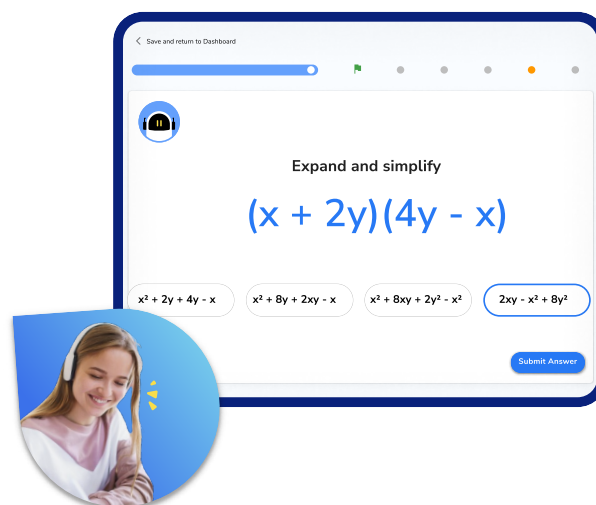
Directed Numbers | Number

## 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 **Directed Numbers** 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 **directed numbers**. Each question has **one correct answer** and **three carefully chosen incorrect answers** that are designed to identify and highlight fundamental misconceptions, including: **Calculating with negative numbers**, **Powers**, **Substitution**, and **Order of operations including 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: Directed Numbers

1. Calculate:

$$-4 + 7$$

|        |       |
|--------|-------|
| A) -11 | B) -3 |
| C) 3   | D) 4  |

2. Calculate:

$$-6 - 9$$

|       |        |
|-------|--------|
| A) 15 | B) 3   |
| C) -3 | D) -15 |

3. Calculate:

$$14 - (-9)$$

|         |       |
|---------|-------|
| A) 5    | B) 23 |
| C) -126 | D) -5 |

## Diagnostic Questions: Directed Numbers

4. Calculate:

$$8 + (-7)$$

|       |        |
|-------|--------|
| A) 1  | B) 15  |
| C) -1 | D) -56 |

5. Calculate:

$$-5 - (-8)$$

|        |       |
|--------|-------|
| A) -13 | B) 13 |
| C) -3  | D) 3  |

6. Calculate:

$$9 - (-7) - 4$$

|       |       |
|-------|-------|
| A) -2 | B) 12 |
| C) 20 | D) 6  |

## Diagnostic Questions: Directed Numbers

7. Calculate:

$$-13 + (-6) - 8$$

|        |        |
|--------|--------|
| A) -1  | B) -15 |
| C) -27 | D) 1   |

8. Calculate:

$$-5 \times 3$$

|       |        |
|-------|--------|
| A) 15 | B) -2  |
| C) -8 | D) -15 |

9. Calculate:

$$4 \times (-3) \times (-2)$$

|       |        |
|-------|--------|
| A) 24 | B) -24 |
| C) -1 | D) 10  |

## Diagnostic Questions: Directed Numbers

10. Calculate:

$$(-2)^3$$

|       |      |
|-------|------|
| A) -6 | B) 8 |
| C) -8 | D) 4 |

11. Calculate:

$$24 \div (-6)$$

|       |       |
|-------|-------|
| A) 18 | B) -4 |
| C) 4  | D) -3 |

12. Calculate:

$$\frac{9 - 15}{4 - 7}$$

|                   |         |
|-------------------|---------|
| A) $\frac{3}{28}$ | B) -2   |
| C) 2              | D) -8.5 |

## Diagnostic Questions: Directed Numbers

13. Calculate:

$$15 - 3(7 - 9)$$

|        |        |
|--------|--------|
| A) 21  | B) -24 |
| C) -15 | D) 75  |

14. Calculate:

$$(-4)^2 \times 3 \div (-6)$$

|      |        |
|------|--------|
| A) 4 | B) -24 |
| C) 8 | D) -8  |

15. Calculate:

$$-7 \times 8 - (-4)$$

|        |        |
|--------|--------|
| A) -60 | B) 5   |
| C) -52 | D) -50 |

## Diagnostic Questions: Directed Numbers

16. The temperature in Calgary is recorded as  $-7.4^{\circ}\text{C}$ , and the temperature in Doha is recorded as  $28.3^{\circ}\text{C}$ . The difference between the temperatures in Doha and Calgary is:

|                           |                           |
|---------------------------|---------------------------|
| A) $25.7^{\circ}\text{C}$ | B) $20.9^{\circ}\text{C}$ |
| C) $45.7^{\circ}\text{C}$ | D) $35.7^{\circ}\text{C}$ |

17. If  $x = -3$ ,  $y = 5$  and  $z = -0.4$ , find the value of:

$$x - yz$$

|       |       |
|-------|-------|
| A) -5 | B) 1  |
| C) 6  | D) -1 |

18. If  $(x_1, y_1) = (-2, 3)$  and  $(x_2, y_2) = (6, -3)$ , find the distance  $d$  between these points using the formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

|       |        |
|-------|--------|
| A) 4  | B) 8   |
| C) 10 | D) 100 |



## Diagnostic Questions: Directed Numbers

19. If  $(x_1, y_1) = (-4, 3)$  and  $(x_2, y_2) = (4, -1)$ , find the gradient  $m$  of the slope joining these points using the formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

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

20. Given the table of values for the graph of  $y = 2 + x - x^2$  find the value A:

|     |    |    |   |    |     |
|-----|----|----|---|----|-----|
| $x$ | -5 | -3 | 0 | 3  | 5   |
| $y$ |    | A  |   | -4 | -18 |

|       |        |
|-------|--------|
| A) -4 | B) 8   |
| C) 14 | D) -10 |

## Diagnostic Questions: Directed Numbers Answers

1. Calculate:

$$-4 + 7$$

- A) -11 Student subtracted 7 rather than adding
- B) -3 Student attributed the wrong sign to the answer
- C) 3 Correct answer
- D) 4 Student did not include zero when counting on

2. Calculate:

$$-6 - 9$$

- A) 15 Student forgot to include the sign of the number
- B) 3 Student found the difference between -6 and -9
- C) -3 Student subtracted 9 from 6
- D) -15 Correct answer

3. Calculate:

$$14 - (-9)$$

- A) 5 Student subtracted 9, rather than subtracting -9
- B) 23 Correct answer
- C) -126 Student interpreted brackets as multiplication ( $14 \times -9$ )
- D) -5 Student calculated in wrong order

## Diagnostic Questions: Directed Numbers Answers

4. Calculate:

$$8 + (-7)$$

A) 1 Correct answer

B) 15 Student added 7, rather than -7

C) -1 Student attributed wrong sign to the answer

D) -56 Student interpreted brackets as multiplication ( $8 \times -7$ )

5. Calculate:

$$-5 - (-8)$$

A) -13 Student subtracted 8, rather than -8

B) 13 Student ignored the sign of the 5

C) -3 Student subtracted 8 from 5, missing some elements of the calculation

D) 3 Correct answer

6. Calculate:

$$9 - (-7) - 4$$

A) -2 Student subtracted 7, rather than -7

B) 12 Correct answer

C) 20 Student performed first operation correctly but then added 4

D) 6 Student subtracted 4 from 7, then subtracted the result from 9

## Diagnostic Questions: Directed Numbers Answers

7. Calculate:

$$-13 + (-6) - 8$$

- A) -1 Student forgot to include the sign in front of 13
- B) -15 Student added 6, rather than subtracting 6
- C) -27 Correct answer
- D) 1 Student added 6 and 8 to 13

8. Calculate:

$$-5 \times 3$$

- A) 15 Student didn't recognise negative multiplied by positive as negative
- B) -2 Student added 3 to -5
- C) -8 Student subtracted 3 from -5
- D) -15 Correct answer

9. Calculate:

$$4 \times (-3) \times (-2)$$

- A) 24 Correct answer
- B) -24 Student did not correctly apply the rule for multiplying negative numbers
- C) -1 Student attempted addition rather than multiplication
- D) 10 Student added  $(-3 \times -2)$  to 4

## Diagnostic Questions: Directed Numbers Answers

10. Calculate:

$$(-2)^3$$

- A) -6 Student multiplied -2 by 3
- B) 8 Student forgot that a product of three negative numbers is negative
- C) -8 Correct answer
- D) 4 Student squared rather than cubed

11. Calculate:

$$24 \div (-6)$$

- A) 18 Student divided 24 by 1, then subtracted 6
- B) -4 Correct answer
- C) 4 Student forgot to apply rule when dividing numbers of opposite sign
- D) -3 Student made arithmetic errors dividing 24 by 6

12. Calculate:

$$\frac{9 - 15}{4 - 7}$$

A)  $\frac{3}{28}$  Student calculated  $\frac{9}{4} - \frac{15}{7}$

- B) -2 Student didn't apply rule when dividing numbers of the same sign

C) 2 Correct answer

D) -8.5 Student calculated  $\frac{9 - 15}{4} - 7$  by working sequentially

## Diagnostic Questions: Directed Numbers Answers

13. Calculate:

$$15 - 3(7 - 9)$$

A) 21 Correct answer

B) -24 Student found product of  $(15 - 3) = 12$  and  $(7 - 9) = -2$

C) -15 Student carried out calculation as  $15 - 21 - 9$

D) 75 Student carried out calculation as  $15 - 3 = 12$ , then multiplied by 7, then subtracted 9

14. Calculate:

$$(-4)^2 \times 3 \div (-6)$$

A) 4 Student doubled -4 instead of squaring

B) -24 Student multiplied -4 and 3 then squared, before dividing by -6

C) 8 Student incorrectly found  $(-4)^2$  to be -16

D) -8 Correct answer

15. Calculate:

$$-7 \times 8 - (-4)$$

A) -60 Student subtracted 4 rather than adding 4

B) 5 Student added 8 instead of multiplying by 8

C) -52 Correct answer

D) -50 Student found the product of -7 and 8 to be -54

## Diagnostic Questions: Directed Numbers Answers

16. The temperature in Calgary is recorded as  $-7.4^{\circ}\text{C}$ , and the temperature in Doha is recorded as  $28.3^{\circ}\text{C}$ . The difference between the temperatures in Doha and Calgary is:

- A)  $25.7^{\circ}\text{C}$  Student made an error regrouping
- B)  $20.9^{\circ}\text{C}$  Student subtracted 7.4 (instead of  $-7.4$ ) from 28.3
- C)  $45.7^{\circ}\text{C}$  Student misaligned place value columns
- D)  $35.7^{\circ}\text{C}$  Correct answer

17. If  $x = -3$ ,  $y = 5$  and  $z = -0.4$ , find the value of:

$$x - yz$$

- A) -5 Student made a sign error subtracting  $yz$
- B) 1 Student forgot to include the sign of  $x$
- C) 6 Student found the product  $xyz$
- D) -1 Correct answer

18. If  $(x_1, y_1) = (-2, 3)$  and  $(x_2, y_2) = (6, -3)$ , find the distance  $d$  between these points using the formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

- A) 4 Student forgot to include negative signs from coordinates in calculation
- B) 8 Student calculated horizontal difference correctly, but vertical difference incorrectly
- C) 10 Correct answer
- D) 100 Student forgot to square root

## Diagnostic Questions: Directed Numbers Answers

19. If  $(x_1, y_1) = (-4, 3)$  and  $(x_2, y_2) = (4, -1)$ , find the gradient  $m$  of the slope joining these points using the formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

A) -2 Student interchanged numerator and denominator

B)  $-\frac{1}{2}$  Correct answer

C)  $-\frac{1}{4}$  Student made an error finding the vertical change

D)  $\frac{1}{2}$  Student forgot to include the sign in their answer

20. Given the table of values for the graph of  $y = 2 + x - x^2$  find the value A:

|     |    |    |   |    |     |
|-----|----|----|---|----|-----|
| $x$ | -5 | -3 | 0 | 3  | 5   |
| $y$ |    | A  |   | -4 | -18 |

A) -4 Student assumed symmetry across the  $y$ -axis

B) 8 Student made an error subtracting the square of a negative number

C) 14 Student treated each term in the sum as being positive and found the total

D) -10 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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## Do you have KS4 students who need additional support in maths?



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