



THIRD SPACE  
LEARNING

# Diagnostic Questions

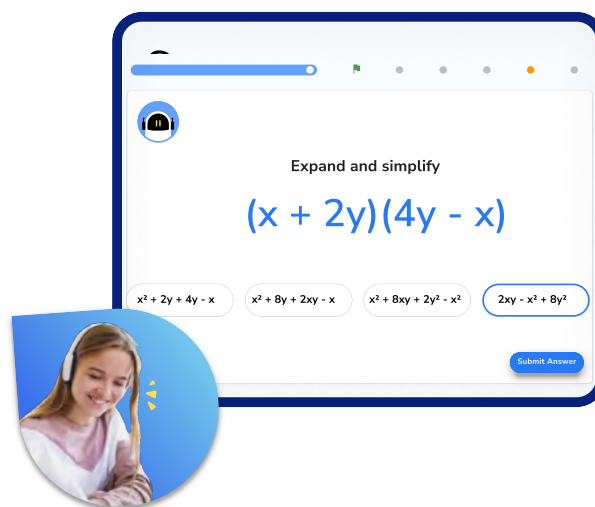
Rearranging Formulae | Algebra

## 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 **rearranging formulae** 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 **rearranging formulae**. 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**, **Expanding single brackets**, **Calculations with fractions** and **Inverse trigonometric functions**.

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: Rearranging Formulae

1. Rearrange to make  $x$  the subject:

$$a = x + b$$

|                |                      |
|----------------|----------------------|
| A) $x = b - a$ | B) $x = a - b$       |
| C) $x = a + b$ | D) $x = \frac{a}{b}$ |

2. Rearrange to make  $y$  the subject:

$$y - e = f$$

|                 |                |
|-----------------|----------------|
| A) $y = f + e$  | B) $y = f - e$ |
| C) $y = -e - f$ | D) $y = ef$    |

3. Rearrange to make  $a$  the subject:

$$F = ma$$

|                      |                      |
|----------------------|----------------------|
| A) $a = \frac{m}{F}$ | B) $m = \frac{F}{a}$ |
| C) $a = \frac{F}{m}$ | D) $a = F - m$       |

## Diagnostic Questions: Rearranging Formulae

4. Rearrange to make  $D$  the subject:

$$S = \frac{D}{T}$$

|                      |                      |
|----------------------|----------------------|
| A) $D = ST$          | B) $D = \frac{T}{S}$ |
| C) $D = \frac{S}{T}$ | D) $D = S + T$       |

5. Rearrange to make  $t$  the subject:

$$v = u + at$$

|                          |                          |
|--------------------------|--------------------------|
| A) $t = \frac{v - u}{a}$ | B) $t = \frac{v - u}{a}$ |
| C) $t = \frac{v + u}{a}$ | D) $t = \frac{a}{v - u}$ |

6. Rearrange to make  $r$  the subject:

$$C = 2\pi r$$

|                         |                         |
|-------------------------|-------------------------|
| A) $r = C - 2\pi$       | B) $r = \frac{2\pi}{C}$ |
| C) $r = \frac{C}{2\pi}$ | D) $r = 2\pi C$         |

## Diagnostic Questions: Rearranging Formulae

7. Rearrange to make  $x$  the subject:

$$\frac{x + m}{f} = G$$

|                        |                   |
|------------------------|-------------------|
| A) $x = Gf - m$        | B) $x = Gf + m$   |
| C) $x = \frac{G+m}{f}$ | D) $x = f(G - m)$ |

8. Rearrange to make  $C$  the subject:

$$\frac{9C}{5} + 32 = F$$

|                            |                              |
|----------------------------|------------------------------|
| A) $C = \frac{9}{5}F - 32$ | B) $C = \frac{5}{9}(F - 32)$ |
| C) $C = \frac{5}{9}F - 32$ | D) $C = \frac{5}{9}(F + 32)$ |

9. Rearrange to make  $a$  the subject:

$$s = ut + \frac{1}{2}at^2$$

|                              |                                |
|------------------------------|--------------------------------|
| A) $a = \frac{2s - ut}{t^2}$ | B) $a = 2t^2(s - ut)$          |
| C) $a = \frac{sut}{2t^2}$    | D) $a = \frac{2(s - ut)}{t^2}$ |

## Diagnostic Questions: Rearranging Formulae

10. Make  $d$  the subject:

$$r = \sqrt{\frac{Ad}{C}}$$

|                           |                     |
|---------------------------|---------------------|
| A) $d = \frac{(rC)^2}{A}$ | B) $d = Ar^2C$      |
| C) $d = \frac{r^2C}{A}$   | D) $d = AC\sqrt{r}$ |

11. Make  $x$  the subject of the formula:

$$y = 6(x + 8)$$

|                          |                          |
|--------------------------|--------------------------|
| A) $x = \frac{y}{6} + 8$ | B) $x = 6y - 8$          |
| C) $x = 6y + 8$          | D) $x = \frac{y}{6} - 8$ |

12. Make  $x$  the subject of the formula:

$$3p = x^2 - 4b$$

|                            |                            |
|----------------------------|----------------------------|
| A) $x = \pm\sqrt{3p + 4b}$ | B) $x = \pm\sqrt{4b - 3p}$ |
| C) $x = (4b + 3p)^2$       | D) $x = \sqrt{3p + 4b}$    |

## Diagnostic Questions: Rearranging Formulae

13. Rearrange to make  $r$  the subject:

$$G = T - \frac{1}{r}$$

|                        |                        |
|------------------------|------------------------|
| A) $r = \frac{1}{T-G}$ | B) $r = \frac{T-1}{G}$ |
| C) $r = \frac{1}{T+G}$ | D) $r = \frac{1}{G-T}$ |

14. Rearrange to make  $R$  the subject:

$$\frac{1}{P} = \frac{1}{Q} + \frac{1}{R}$$

|                         |                         |
|-------------------------|-------------------------|
| A) $R = \frac{PQ}{Q+P}$ | B) $R = \frac{P-Q}{QP}$ |
| C) $R = \frac{PQ}{Q-P}$ | D) $R = \frac{PQ}{P-Q}$ |

15. Make  $x$  the subject of the formula:

$$y(x + 3) = 3(6 - 2x)$$

|                            |                            |
|----------------------------|----------------------------|
| A) $x = \frac{18+3y}{y-6}$ | B) $x = \frac{18+3y}{y+6}$ |
| C) $x = \frac{18-3y}{y-6}$ | D) $x = \frac{18-3y}{y+6}$ |

## Diagnostic Questions: Rearranging Formulae

16. Make  $x$  the subject of the formula:

$$y = \frac{4x - f}{5x}$$

|                            |                           |
|----------------------------|---------------------------|
| A) $x = \frac{f}{5y - 4}$  | B) $x = \frac{f}{4 - 5y}$ |
| C) $x = \frac{-f}{5y + 4}$ | D) $x = \frac{f}{5y + 4}$ |

17. Make  $e$  the subject of the formula:

$$\frac{q}{3} = \frac{6 - 2e}{e + 1}$$

|                               |                               |
|-------------------------------|-------------------------------|
| A) $e = \frac{18 - q}{q - 6}$ | B) $e = \frac{18 - q}{q + 6}$ |
| C) $e = \frac{18 + q}{q + 6}$ | D) $e = \frac{18 - q}{6}$     |

18. Make  $C$  the subject of the formula:

$$A = \frac{1}{2} ab \sin C$$

|  |  |
|--|--|
| A) $C = \sin\left(\frac{2A}{ab}\right)$      | B) $C = \sin^{-1}\left(\frac{ab}{2A}\right)$ |
| C) $C = \sin^{-1}\left(\frac{2A}{ab}\right)$ | D) $C = \sin^{-1}\left(\frac{A}{2ab}\right)$ |



## Diagnostic Questions: Rearranging Formulae

19. Make  $\cos A$  the subject of the formula:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

|   |   |
|---|---|
| A) $\cos A = b^2 + c^2 - 2bc - a^2$       | B) $\cos A = 2bc(b^2 + c^2 - a^2)$        |
| C) $\cos A = \frac{a^2 - b^2 - c^2}{2bc}$ | D) $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ |

20. Make  $x$  the subject:

$$y = x^2 + 2x + 1$$

|                          |                          |
|--------------------------|--------------------------|
| A) $x = \pm\sqrt{y-1}$   | B) $x = \pm\sqrt{y+1}$   |
| C) $x = \pm\sqrt{y} - 1$ | D) $x = \pm\sqrt{y} + 1$ |

## Diagnostic Questions: Rearranging Formulae Answers

1. Rearrange to make  $x$  the subject:

$$a = x + b$$

A)  $x = b - a$  Student used incorrect inverse operation but inverted the terms

B)  $x = a - b$  Correct answer

C)  $x = a + b$  Student used incorrect inverse operation

D)  $x = \frac{a}{b}$  Student used incorrect inverse operation

2. Rearrange to make  $y$  the subject:

$$y - e = f$$

A)  $y = f + e$  Correct answer

B)  $y = f - e$  Student used incorrect inverse operation

C)  $y = -e - f$  Student may have attempted to subtract  $f$  from both sides

D)  $y = ef$  Student used incorrect inverse operation

3. Rearrange to make  $a$  the subject:

$$F = ma$$

A)  $a = \frac{m}{f}$  Student inverted the fraction

B)  $m = \frac{F}{a}$  Student made  $m$  the subject

C)  $a = \frac{F}{m}$  Correct answer

D)  $a = F - m$  Student used incorrect inverse operation

## Diagnostic Questions: Rearranging Formulae Answers

4. Rearrange to make  $D$  the subject:

$$S = \frac{D}{T}$$

A)  $D = ST$  Correct answer

B)  $D = \frac{T}{S}$  Student incorrectly used an inverse operation

C)  $D = \frac{S}{T}$  Student did not use the inverse operation

D)  $D = S + T$  Student used incorrect inverse operation

5. Rearrange to make  $t$  the subject:

$$v = u + at$$

A)  $t = \frac{u - v}{a}$  Student performed incorrect first step

B)  $t = \frac{v - u}{a}$  Correct answer

C)  $t = \frac{v + u}{a}$  Student used incorrect inverse for first step

D)  $t = \frac{a}{v - u}$  Student has inverted the fraction

6. Rearrange to make  $r$  the subject:

$$C = 2\pi r$$

A)  $r = C - 2\pi$  Student used incorrect inverse operation

B)  $r = \frac{2\pi}{C}$  Student has inverted the fraction

C)  $r = \frac{C}{2\pi}$  Correct Answer

D)  $r = 2\pi C$  Student used incorrect inverse operation

## Diagnostic Questions: Rearranging Formulae Answers

7. Rearrange to make  $x$  the subject:

$$\frac{x + m}{f} = G$$

A)  $x = Gf - m$  Correct answer

B)  $x = Gf + m$  Student used incorrect inverse for second step

C)  $x = \frac{G + m}{f}$  Student has just swapped the  $x$  and  $G$

D)  $x = f(G - m)$  Student has used correct inverses but in the wrong order.

8. Rearrange to make  $C$  the subject:

$$\frac{9C}{5} + 32 = F$$

A)  $C = \frac{9}{5}F - 32$  Student has performed incorrect inverses

B)  $C = \frac{5}{9}(F - 32)$  Correct answer

C)  $C = \frac{5}{9}F - 32$  Student performed incorrect first step

D)  $C = \frac{5}{9}(F + 32)$  Student used incorrect inverse for first step

9. Rearrange to make  $a$  the subject:

$$s = ut + \frac{1}{2}at^2$$

A)  $a = \frac{2s - ut}{t^2}$  Student multiplied by 2 but not every term

B)  $a = 2t^2(s - ut)$  Student used incorrect inverse for  $t^2$

C)  $a = \frac{sut}{2t^2}$  Student performed multiple incorrect steps

D)  $a = \frac{2(s - ut)}{t^2}$  Correct answer

## Diagnostic Questions: Rearranging Formulae Answers

10. Make  $d$  the subject:

$$r = \sqrt{\frac{Ad}{C}}$$

A)  $d = \frac{(rC)^2}{A}$  Student multiplied by  $C$  first, before squaring

B)  $d = Ar^2C$  Student incorrectly multiplied by  $A$

C)  $d = \frac{r^2C}{A}$  Correct answer

D)  $d = AC\sqrt{r}$  Student used incorrect inverse operations

11. Make  $x$  the subject of the formula:

$$y = 6(x + 8)$$

A)  $x = \frac{y}{6} + 8$  Student has performed second step incorrectly

B)  $x = 6y - 8$  Student has used incorrect inverse for first step

C)  $x = 6y + 8$  Student has used incorrect inverse for both steps

D)  $x = \frac{y}{6} - 8$  Correct answer

12. Make  $x$  the subject of the formula:

$$3p = x^2 - 4b$$

A)  $x = \pm\sqrt{3p + 4b}$  Correct answer

B)  $x = \pm\sqrt{4b - 3p}$  Student used incorrect inverse for first step

C)  $x = (4b + 3p)^2$  Student did not use inverse operation for second step

D)  $x = \sqrt{3p + 4b}$  Student forgot to include both roots

## Diagnostic Questions: Rearranging Formulae Answers

13. Rearrange to make  $r$  the subject:

$$G = T - \frac{1}{r}$$

A)  $r = \frac{1}{T-G}$  Correct answer

B)  $r = \frac{T-1}{G}$  Student multiplied by  $r$  but not every term

C)  $r = \frac{1}{T+G}$  Student has incorrect sign in the denominator

D)  $r = \frac{1}{G-T}$  Student inverted the order of the denominator

14. Rearrange to make  $R$  the subject:

$$\frac{1}{P} = \frac{1}{Q} + \frac{1}{R}$$

A)  $R = \frac{PQ}{Q+P}$  Student used incorrect inverse operation for first step

B)  $R = \frac{P-Q}{QP}$  Student inverted the subtraction and did not find the reciprocal for last step

C)  $R = \frac{PQ}{Q-P}$  Correct answer

D)  $R = \frac{PQ}{P-Q}$  Student inverted the subtraction for first step

15. Make  $x$  the subject of the formula:

$$y(x + 3) = 3(6 - 2x)$$

A)  $x = \frac{18+3y}{y-6}$  Student collected terms incorrectly before factorising and dividing

B)  $x = \frac{18+3y}{y+6}$  Student collected terms incorrectly before factorising and dividing

C)  $x = \frac{18-3y}{y-6}$  Student collected terms incorrectly before factorising and dividing

D)  $x = \frac{18-3y}{y+6}$  Correct answer

## Diagnostic Questions: Rearranging Formulae Answers

16. Make  $x$  the subject of the formula:

$$y = \frac{4x - f}{5x}$$

A)  $x = \frac{f}{5y-4}$  Student has used an incorrect inverse operation when collecting terms before factorising and dividing

B)  $x = \frac{f}{4-5y}$  **Correct answer**

C)  $x = \frac{-f}{5y+4}$  Student has used an incorrect inverse operation when collecting terms before factorising and dividing

D)  $x = \frac{f}{5y+4}$  Student has used an incorrect inverse operation when collecting terms before factorising and dividing

17. Make  $e$  the subject of the formula:

$$\frac{q}{3} = \frac{6 - 2e}{e + 1}$$

A)  $e = \frac{18-q}{q-6}$  Student has used an incorrect inverse operation when collecting terms before factorising and dividing

B)  $e = \frac{18-q}{q+6}$  **Correct answer**

C)  $e = \frac{18+q}{q+6}$  Student has used an incorrect inverse operation when collecting terms before factorising and dividing

D)  $e = \frac{18-q}{6}$  Student has not multiplied  $e$  by  $q$  in the first step

18. Make  $C$  the subject of the formula:

$$A = \frac{1}{2}ab \sin(C)$$

A)  $C = \sin\left(\frac{2A}{ab}\right)$  Student has not use the inverse of sine

B)  $C = \sin^{-1}\left(\frac{ab}{2A}\right)$  Student has inverted the fraction

C)  $C = \sin^{-1}\left(\frac{2A}{ab}\right)$  **Correct answer**

D)  $C = \sin^{-1}\left(\frac{A}{2ab}\right)$  Student has not used the inverse function for the 12

## Diagnostic Questions: Rearranging Formulae Answers

19. Make  $\cos(A)$  the subject of the formula::

A)  $\cos(A) = b^2 + c^2 - 2bc - a^2$  Student has used incorrect inverse for  $2bc$

B)  $\cos(A) = 2bc(b^2 + c^2 - a^2)$  Student has used incorrect inverse for  $2bc$

C)  $\cos(A) = \frac{a^2 - b^2 - c^2}{2bc}$  Student should have divided by  $-2bc$

D)  $\cos(A) = \frac{b^2 + c^2 - a^2}{2bc}$  Correct answer

20. Make  $x$  the subject:

$$y = x^2 + 2x + 1$$

A)  $x = \pm\sqrt{y} - 1$  Correct answer

B)  $x = \pm\sqrt{y} + 1$  Student used incorrect inverse for the  $+1$

C)  $x = \pm\sqrt{y-1}$  Student performed inverses in the wrong order

D)  $x = \sqrt{y} - 1$  Student forgot to find both roots

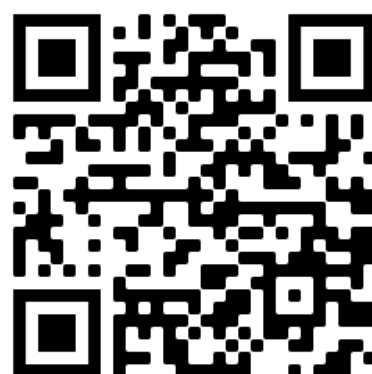


# Where to go next?

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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