Can I solve multi-step problems that involve using inverse operations and explain my method?

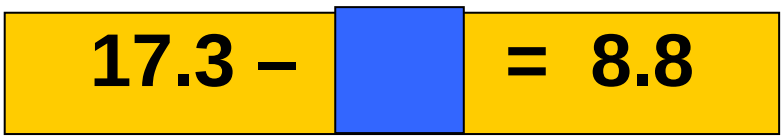
Teaching guidance

Key vocabulary

inverse, operation, function, input, output, equation

Models and images and resources

Slidey box cards

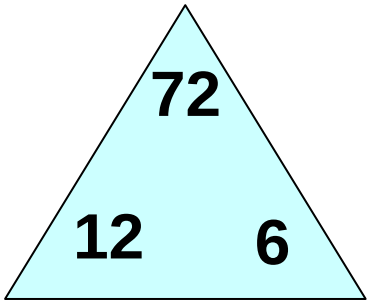


Create slidey box cards by writing calculations onto card and folding a strip of coloured paper to create a slider. Use the slider to cover a number. Ask children to explain what calculation they can do with the visible numbers to find the hidden number.

Number trios

Ensure that children can give four calculations for every family of numbers. For example, for the multiplication and division family shown:

6 × 12 = 72 12 × 6 = 72
72 ÷ 12 = 6 72 ÷ 6 = 12



Calculators

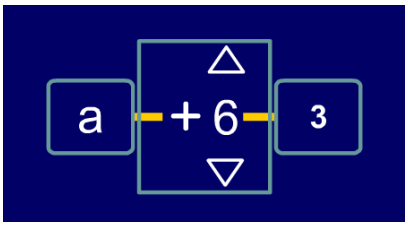
Reinforce understanding of inverse operations by asking children to choose a start number then enter an operation with a number (× 6 for example) and press the equals key. Now ask them to enter the inverse operation with the same number (÷ 6). Point out that they will always return to their chosen start number. This is because the inverse ‘undoes’ the operation.

Function blocks ITP

Give children experience of using the output number and the inverse operation to work out what the input number must have been, for example:

a + 6 = 3

so 3 – 6 = **a** using the inverse operation, that is, **a** = –3



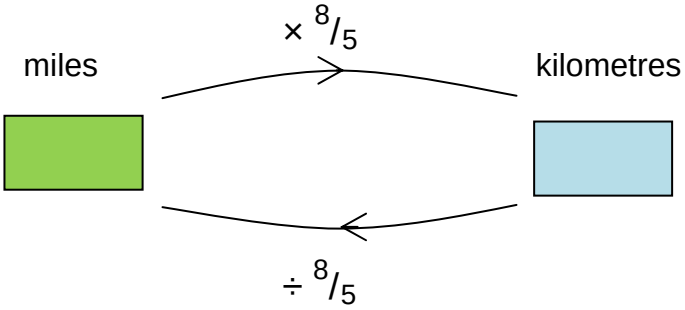
Teaching tips

- Ensure that children fully appreciate the nature of inverse operations:
  - Explore what happens when you carry out an operation followed by its inverse.
  - Understand that if an operation maps an input number to an output number, then the inverse operation will map the output number back to the input number.
  - Use the fact that you can 'undo' an operation by applying its inverse.

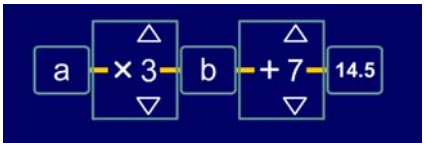
- Make sure that children can write the four equations for a given trio of numbers. Include examples which involve large and decimal numbers:
  - Given the multiplicative trio 1.5, 6 and 9 it is possible to write the four equations:
  - 1.5 × 6 = 9 6 × 1.5 = 9 9 ÷ 6 = 1.5 9 ÷ 1.5 = 6
  - Given the equation 8.8 + 8.5 = 17.3, it is possible to write the three linked equations:
    8.5 + 8.8 = 17.3 17.3 – 8.5 = 8.8 17.3 – 8.8 = 8.5

- Give children regular opportunities to use inverse operations to find missing numbers and to discuss their methods. This kind of activity can be included in mental and oral starters. Include examples where children need to use a calculator to find the missing numbers:
  - To find the missing number in ☐ × 13.5 = 35.1, children can use the inverse operation to give 35.1 ÷ 13.5 = ☐

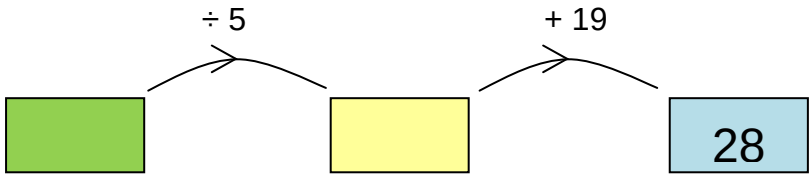
- Teach children how to record operations and their inverses using function diagrams:



- Develop the use of function diagrams to include examples with two functions:
  - In this example from Function blocks ITP, to find **a** children need to use inverse operations to work backwards from the output of 14.5.
  - The number **b** is therefore 14.5 – 7, that is, 7.5.
  - The number **a** is therefore 7.5 ÷ 3, that is, 2.5.
  - Children should check that (2.5 × 3) + 7 equals 14.5.



- Teach children how to use function diagrams to solve 'I think of a number' type problems.
  - *I think of a number, divide it by 5 and then add 19. I get the answer 28. What number did I think of?*
  - This can be represented by the function diagram:



  - Children can then work backwards from 28 using inverse operations to find the input.

- Use multi-step word problems that involve using inverse operations, for example:
  - *Mary buys some packs of gum that cost 39p each. She pays with £5 and gets 32p change. How many packs did she buy?*