

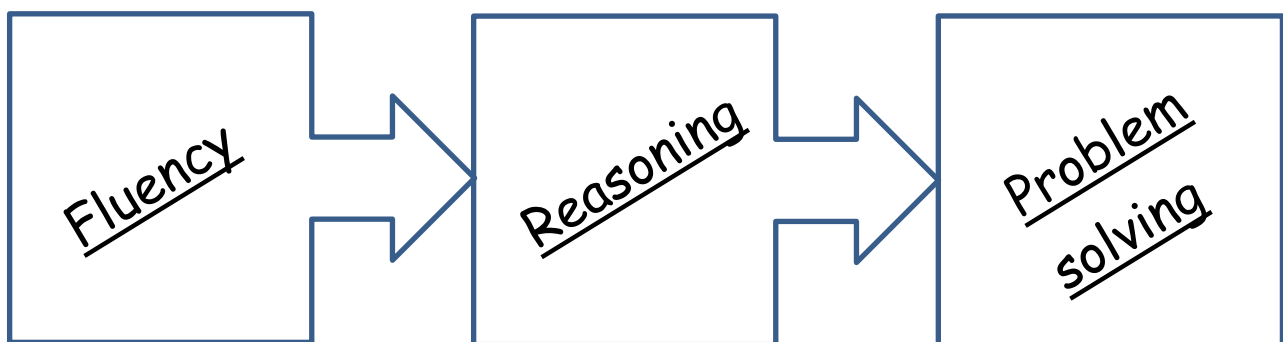


Sharpening the focus on the teaching of word-based problems

The national curriculum for mathematics aims to ensure that all pupils:

1. become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
2. reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
3. can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

The process...



Supported by...



Year 1

In year 1, children should begin to become familiar with Reasoning Ralf as a character, and as someone who can help them to answer questions when the calculation is not laid out for them (non-arithmetic types of questions). Children should be exposed to Reasoning Ralf more regularly as the year progresses, and they should become more confident in checking their answers (at the STOP stage) towards the end of the year.

Steps:

1. **R**ead the question twice.
2. **A**lways underline the numbers and key words.
3. **L**abel the question with the correct number symbol - the one which you need to use to solve the calculation (+ - $\times$ $\div$).
4. **F**inally, use the correct written method to answer the question.



Check that your answer is correct. Have you used the correct method?

Is your answer too big or too small? Can you use another method to check it?

Example:



Miriam has this many cubes in one hand:



Step 3

Step 2

She has fewer cubes in the other hand.

How many cubes could she have in her other hand?

$$5 - 1 = 4 \text{ cubes}$$

$$5 - 2 = 3 \text{ cubes}$$

$$5 - 3 = 2 \text{ cubes}$$

$$5 - 4 = 1 \text{ cube}$$

Step 4

Check it: Inverse method to add the numbers to make a total of 5 cubes.

Year 2

In year 2, children should be familiar with Reasoning Ralf. Children should be exposed to more regular opportunities to 'reason' and solve problems which are not presented as 'straight arithmetic' calculations (fluency presented differently). As the year progresses, the children should be able to confidently recite Ralf's steps and apply them more independently and without being prompted. After step 4, the children should be able to communicate that they must STOP and choose a suitable method to check their answer (re-calculation or using the inverse if it works). Explicit teaching of this step will take place.

Steps:

1. **Read** the question twice.
2. **Always** underline the numbers and key words (**relevant ones**).
3. **Label** the question with the correct number symbol - the one which you need to use to solve the calculation ($+$ $-$ $\times$ $\div$). **You may need to make jottings/drawings at this stage to help you with your final calculation (more suited for use with smaller numbers/amounts).**
4. **Finally**, use the correct written method to answer the question.



Check that your answer is correct. Have you used the correct method?

Is your answer too big or too small? Can you use another method to check it?

Example:

21

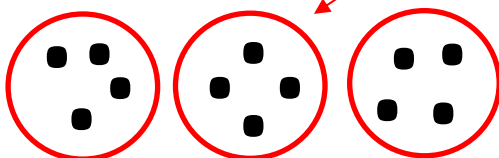
Ajay, Sam and Kemi have 4 conkers each.

Step 2

How many conkers do they have altogether?

+

Step 3



Step 4

12 conkers

Check it: Re-calculate the total - repeat the process of adding the conkers.

Year 3 and 4 – lower key stage 2

In year 3 and 4, children should be exposed to a wide range of fluency, reasoning and problem-solving questions which go beyond 'straight arithmetic' calculations. They should be well versed in Ralf's steps and be able to apply them confidently and independently as a means to accurately decode a question. At step 2, children should be taught explicitly how to distinguish between relevant and irrelevant information (numbers and words). Children should become skilled at only underlining the key information. At step 3, children may need to identify a different calculation for 2 or more steps within a problem (e.g. 2/multi step word problems). After step 4, the children should be able to communicate that they must STOP and choose a suitable method to check their answer (re-calculation or using the inverse if it works). Explicit teaching of this step will take place and be reviewed within the lesson.

Steps:

1. **R**ead the question twice.
2. **A**lways underline the numbers and key words (relevant ones).
3. **L**abel the question with the correct number symbol(s) - the one which you need to use to solve the calculation at each step/stage (+ - x ÷). ***You may also add notes and jottings/drawings at this stage to help with your final calculations (e.g. bar models) - where appropriate and if needed.**
4. **F**inally, use the correct written method(s) to answer the question.



Check that your answer is correct. Have you used the correct method?
Is your answer too big or too small? Can you use another method to check it?

Example:

6

Jacob cuts 4 metres of ribbon into three pieces.

Step 2

The length of the first piece is 1.28 metres.

The length of the second piece is 1.65 metres.

+

Step 3

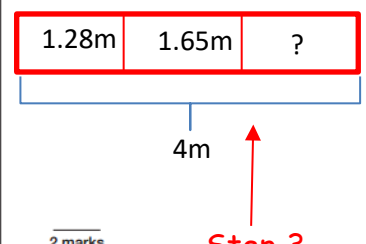
Work out the length of the third piece.

-

***4m - total of first and second piece**

Step 4

Show your method	1.28	4.00
	1.65 +	2.93
	2.93	1.07
		1.07 metres



Step 3

Check it: Add the 3 totals together to make a combined total of 4m.

Year 5 and 6 - upper key stage 2

In years 5 and 6, children should have developed a strong understanding of the steps, and how Ralf can help them to approach problems of varied layout and complexity. There should be extensive teaching of steps 3 and 4 (decision making at step 3 becomes more complex and pertinent as the problems become more in depth). Notes should help to support the calculation stage and help the smooth transition between steps 3 and 4. Regular attention should be paid to checking the answer - children should be exposed to and confident in using a range of strategies effectively to check their answers.



Steps:

1. **R**ead the question twice.
2. **A**lways underline the numbers and key words (relevant ones).
3. **L**abel the question with the correct number symbol(s) - the one which you need to use to solve the calculation at each step/stage (+ - x ÷). ***You could also add annotations at this stage to help with your final calculations.**
4. **F**inally, use the correct written method(s) to answer the question.



Check that your answer is correct. Have you used the correct method?
Is your answer too big or too small? Can you use another method to check it?

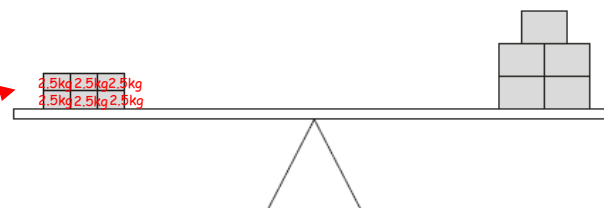
Example:

16

6 small bricks have the same mass as 5 large bricks.

Step 2

*Annotations



1. Total divided by 5 large bricks

Step 3

The mass of one small brick is 2.5kg.

X

2. Total mass of small bricks

Step 4

What is the mass of one large brick?

Show your method	$6 \times 2.5 = 15$
	$15 \div 5 = 3$
	3 kg

Check it: Multiply 3 and 5 to make the mass of 15kg (same as the small bricks total).