Chapelford Village Primary School

Learn · Achieve · Respect

Maths

Calculation Policy

Algebra

2024

Year Six → page 3

Year Six

- I can understand that a value can be replaced by a number or symbol

Eg) When you go to the Post Office, they add on 20g to the weight of the parcel to account for packaging.

x can represent the weight of a given parcel
We can represent this using the formula → x + 20g = total weight

- I can solve missing box calculations by using the inverse

Eg) $\square$ + 23 = 844

1) Bar model

844	
23	

844 – 23 = 821

2) Replacing with a symbol

X + 23 = 844
844 – 23 = x

- I can substitute values into a formula to find an answer

Using formulae → could link to known formulae such as area etc

- I understand that the equals sign is a balancing symbol
- I can create a number sequence given a rule to follow
- I understand a linear equation can be recursive

One number in the sequence is generated from the preceding number eg) adding 3 to the preceding number

- I understand a linear equation can be ordinal

The position of the number in the sequence generates the number Eg) by multiplying the position by 3 and then subtracting 2

I can use symbols to express missing number problems

1. 179 = 153 + ?
   179 = 153 + y
   179 – 153 = y
   Y = 26

I can find values that satisfy the equation and make it a true statement

I understand the associative law and apply it to missing number problems

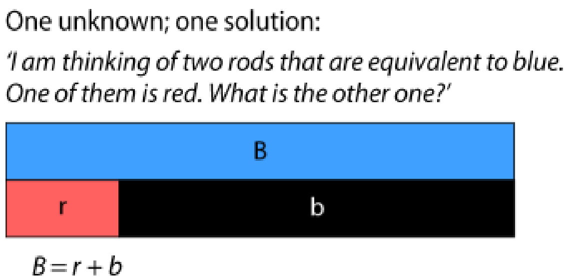
Associative law → (5 + 3) + 4 means 'add 3 to 5 and then add 4 to the result' to give an overall total of 12. Note that 5 + (3 + 4) means 'add the result of adding 4 to 3 to 5' and that the total is again 12. The brackets indicate a priority of sub-calculation, and it is always true that (a + b) + c gives the same result as a + (b + c) for any three numbers a, b and c. You can add in any order and have the same answer.

I understand the distributive law and can apply it to missing number problems

Distributive law → when multiplying a number by a sum, it is the same as multiplying each addend separately and then adding the products. It can be expressed symbolically as a (b + c) = ab + ac or 3 x (2 + 4) = 3x2 + 3x4.

I can compare the structure of problems with one or two unknowns

1. Cuisenaire Rods
2. Bar model



- Take out the blue rod.
- Place the red and black rods underneath.
- Write an addition equation to show that the length of the blue rod is equal to the length of the red and black rod.
- For the problem shown is there:
  - an infinite number of solutions;
  - more than one solution;
  - only one solution?

There is more than one solution to the problem.
Emphasise that when there is one unknown, there is only one solution to the problem while in the case of two unknowns, there is more than one solution.

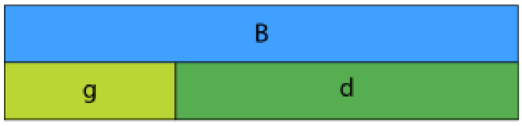
Vocabulary → The combined length of the two rods is equal to the length of the blue rod.

I can compare the structure of problems with two unknowns

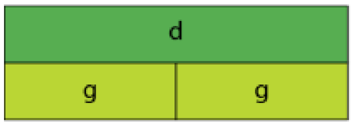
1. Cuisenaire Rods
2. Bar model

Two unknowns; one solution (multiplicative relationship between the unknowns):

'I am thinking of two rods that together are equivalent to blue. Once is twice as long as the other. What are they?'



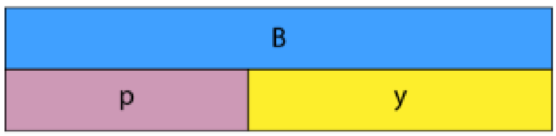
$B = g + d$



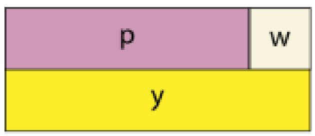
$d = 2 \times g$

Two unknowns; one solution (additive relationship between the unknowns):

'I am thinking of two rods that together are equivalent to blue. There is a difference of white between the two rods. What are they?'



$B = p + y$



$y - p = w$

or

$p + w = y$

I can represent the structure of contextual problems with two unknowns

Mastery materials writing frame – page 10

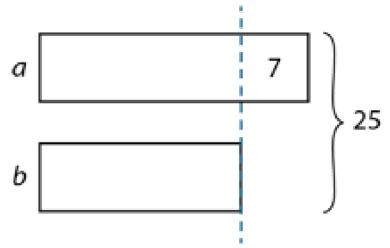
I can represent a problem with two unknowns using a bar model

Mastery materials writing frame – page 13 onwards

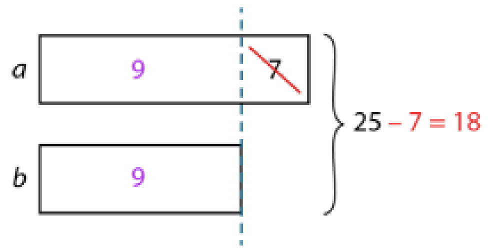
I can explain why sometimes there is only one solution to a sum and difference problem

'The sum of two numbers, a and b, is 25, and the difference between them is 7. What are the two numbers?

Step 1 – representing the information given:



Step 2 – deducing the value of *b*:



This can also be expressed as:

$25 - 7 = 18$ this is double the smaller amount (b)

$b = 18 \div 2 = 9$

$a = 9 + 7 = 16$

'The two numbers are "9" and "16".'

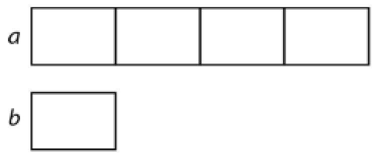
Step 3 – check:

$9 + 16 = 25$

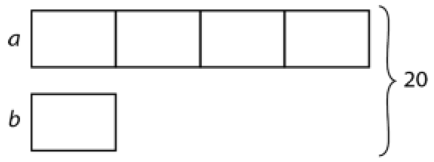
I can explain why sometimes there is only one solution to a sum and multiple problem

'The sum of two numbers is 20. One number is four times the other number. What are the two numbers?'

- *'I know that one number (a) is four times the other number (b).'*



- *'I also know that the two numbers sum to twenty.'*



- *'There are five equal parts that sum to twenty.'*

  one part $= 20 \div 5 = 4$

  $b = 4$

  $a = 4 \times 4 = 16$

- *'The two numbers are "16" and "4".'*

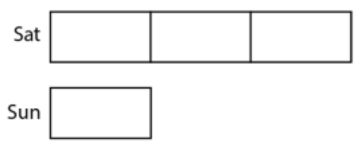
- Check: $16 + 4 = 20$

I can explain the values a part-whole model could represent

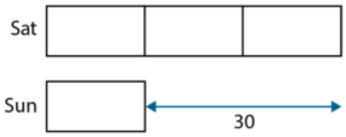
Modelling your thinking:

'Bill earnt some money doing odd-jobs one weekend. He earnt three times as much on Saturday as he did on Sunday. He earnt £30 more on Saturday than on Sunday. How much did Bill earn in total?'

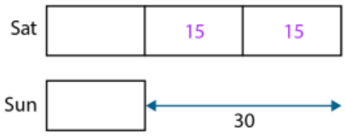
- *'I'll start by representing the information in the question:*
  - *The question compares the amounts earnt on Saturday and Sunday, so I'll draw two bars side by side.*
  - *Bill earnt three times as much on Saturday as on Sunday, so the bar for Saturday must be made up of three parts each equal in size to the "Sunday" bar.'*



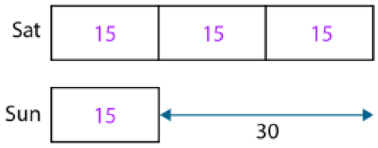
- *'The question also tells us that Bill earns £30 more on Saturday than on Sunday, so I'll add this difference to my model.'*



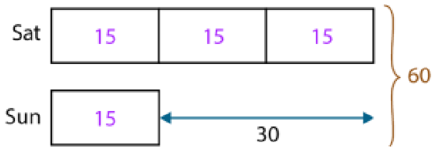
- *'I can see that the difference of 30 corresponds to two equal parts of the "Saturday" bar. So each of those two parts must be 15.'*



- *'Because all of the parts in the model are equal, I know that the other parts must be 15 as well.'*



- *'So the total amount earnt is four multiplied by £15; that's £60.'*

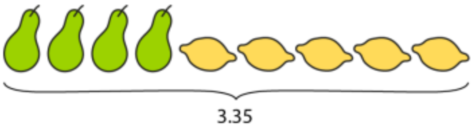


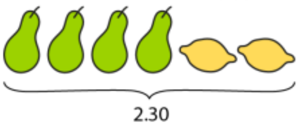
I can use a bar model to visualise how to solve a problem with two unknowns

Representing the original information provided in the problem:

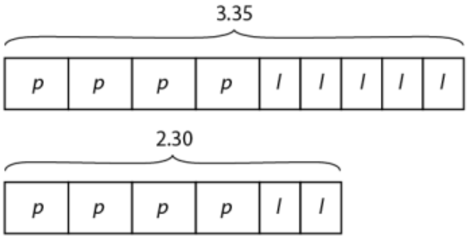
'4 pears and 5 lemons cost £3.35.
4 pears and 2 lemons cost £2.30.'

- Pictorial – one diagram for each piece of information

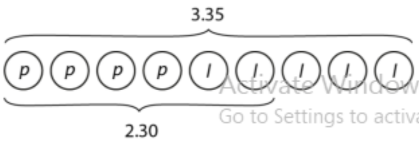




- Bar-type model – one diagram for each piece of information



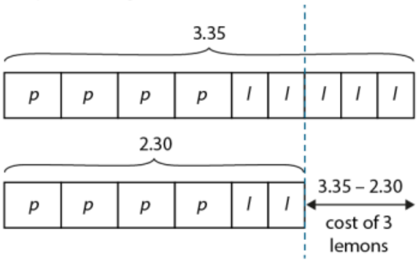
- Circles/shapes – one diagram for both pieces of information



Comparing the information and finding the solution:

'4 pears and 5 lemons cost £3.35.
4 pears and 2 lemons cost £2.30.
How much does one pear cost?
How much does one lemon cost?'

- Step 1 – finding the cost of a lemon



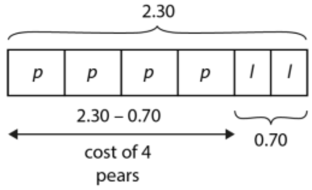
cost of 3 lemons = 3.35 – 2.30 = 1.05

so

cost of 1 lemon = 1.05 ÷ 3 = 0.35

'One lemon costs 35 p.'

- Step 2 – finding the cost of a pear



cost of 2 lemons = 70 p (or £0.70)

cost of 4 pears = 2.30 – 0.70 = 1.60

so

cost of 1 pear = 1.60 ÷ 4 = 0.40

'One pear costs 40 p.'

- Check

'4 pears and 5 lemons cost £3.35.'

cost of 4 pears = 4 × 40p = £1.60

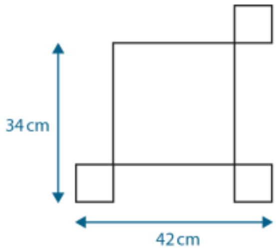
cost of 5 lemons = 5 × 35p = £1.75

£1.60 + £1.75 = £3.35

'The solution must be correct.'

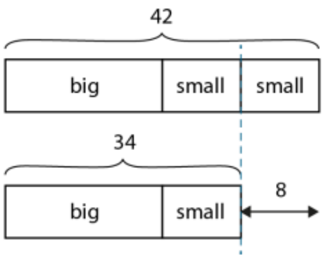
I can use diagrams to explain how to solve a spatial problem

'This pattern is made from two different sized squares. What is the side-length of each type of square?'

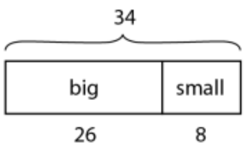


Bar-type model:

- Step 1 – finding the side-length of the small square

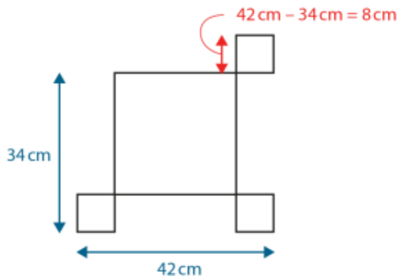


- Step 2 – finding the side-length of the big square

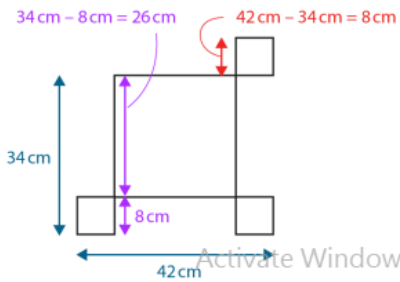


Annotating the spatial diagram:

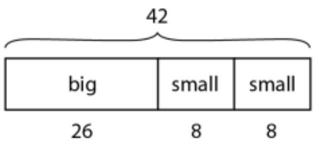
- Step 1 – finding the side-length of the small square



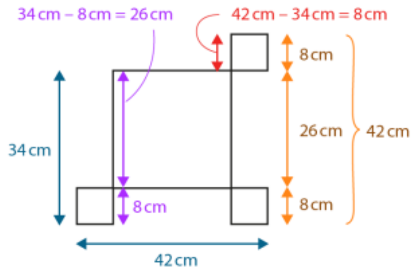
- Step 2 – finding the side-length of the big square



- Step 3 – check



- Step 3 – check

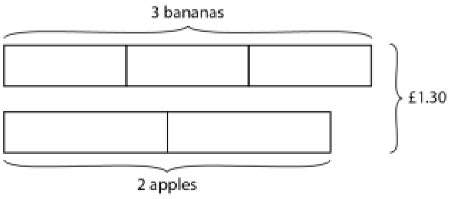


I can explain how to represent an equation with a bar model

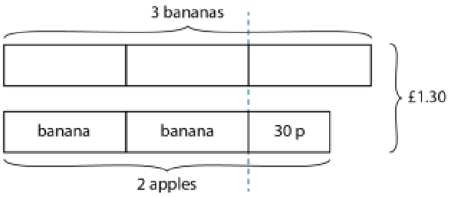
Side-by-side layout of bars:

'An apple costs 15 p more than a banana. 2 apples and 3 bananas cost £1.30. How much do apples and bananas cost each?'

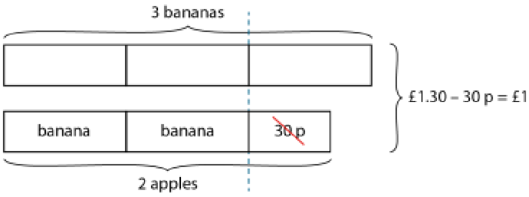
- Step 1 – *'2 apples and 3 bananas cost £1.30.'*



- Step 2 – *'An apple costs 15 p more than a banana. So the cost of two apples is equal to the cost of two bananas plus 30 p.'*



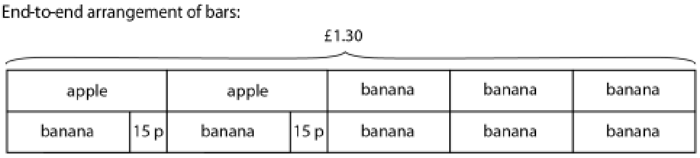
- Step 3 – *'Now we can see that £1.30 minus 30 p is equal to the cost of 5 bananas.'*



cost of 5 bananas = £1
cost of 1 banana = £1 ÷ 5 = 20 p

- Step 4 – *'An apple costs 15 p more than a banana.'*
  cost of 1 apple = 20 p + 15 p = 35 p

End-to-end arrangement of bars:



- Check – *'2 apples and 3 bananas cost £1.30.'*
  cost of 2 apples = 2 × 35 p = 70 p
  cost of 3 bananas = 3 × 20 p = 60 p
  cost of 2 apples and 3 bananas = 70 p + 60 p = £1.30

- I can solve problems with two unknowns in a range of contexts

- I can systematically solve problems with two unknowns using 'trial and improvement'

Mastery materials writing frame – page 38 onwards

- I can explain how I know I have found all possible solutions to problems with two unknowns

Mastery materials writing frame – page 38 onwards

- I can explain how to balance an equation with two unknowns

- I can identify different variable and consider the impact on one when one changes