Safa British School
مدرسة الصفا البريطانية

Unlocking the Potential of Every Child

Calculation Guide

Revised: June 2021
Review Date: June 2022

Aligned to the 2014 English National Curriculum for Mathematics, the Safa British School Calculation Policy aims to provide a clear progression for carrying out written calculations.

This policy emphasizes the development of understanding starting with concrete methods of learning, followed by pictorial methods before moving to abstract.

This should allow enough time for children to comprehend methods to a deeper level before they experience mastery level questions. This, along with the Singapore Method of teaching Mathematics, develops pupils' mathematical ability and confidence without having to resort to memorizing procedures - making Mathematics more engaging and interesting.

This policy includes several areas of guidance:

1. A quick reference calculation overview
2. A detailed policy for the progression of addition, subtraction, multiplication and division
3. Mastery in calculation
4. The Singapore Bar Method to support understanding

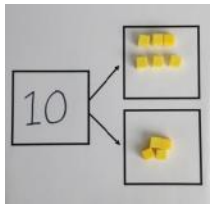
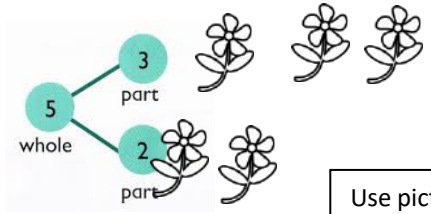
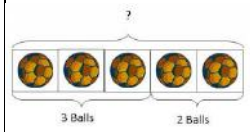
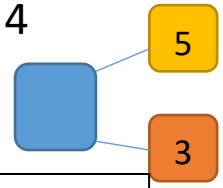
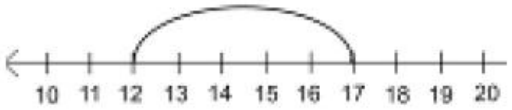
*Policy adapted using ‘Maths No Problem’ and White Rose Maths Hub guidance as well as NCETM/MathsHub ‘Teaching For Mastery resources.

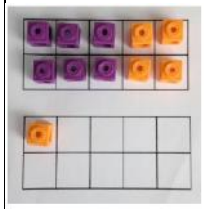
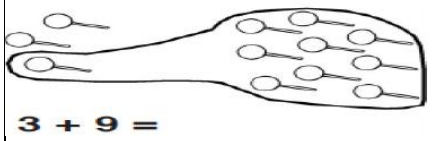
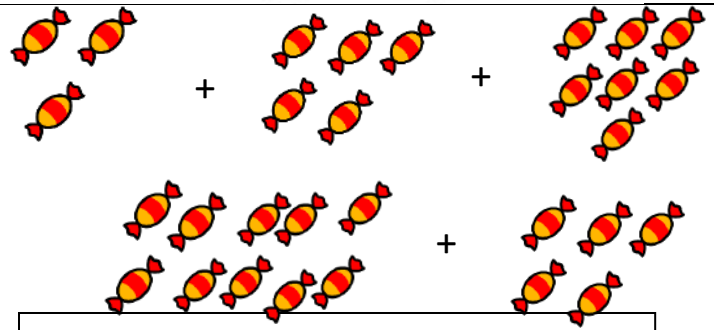
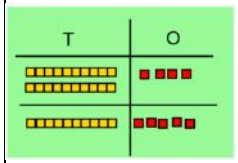
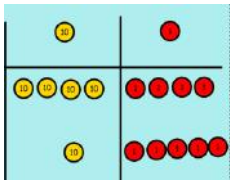
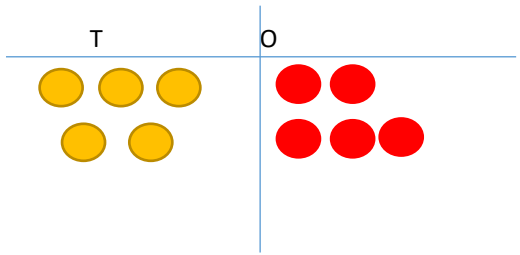
Calculation Overview

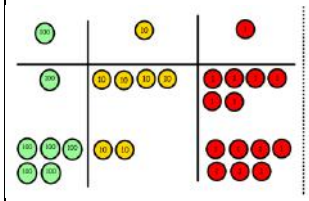
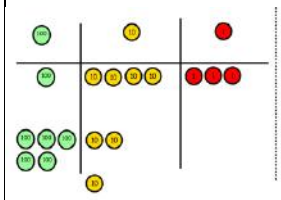
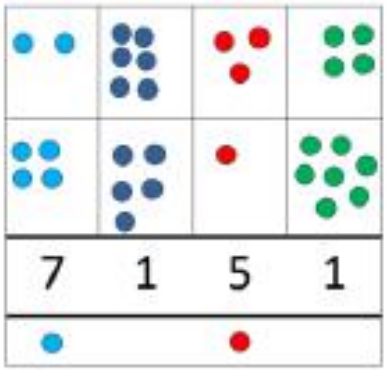
	FS/ Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Combining two parts to make a whole: part whole model. Starting at the bigger number and counting on- using cubes. Regrouping to make 10 using ten frame.	Adding three single digits. Use of base 10 to combine two numbers	Column method- regrouping. Using place value counters (up to 3 digits).	Column method- regrouping. (up to 4 digits)	Column method- regrouping. Use of place value counters for adding decimals.	Column method- regrouping. Abstract methods. Place value counters to be used for adding decimal numbers.
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10 using the ten frame	Counting back Find the difference Part whole model Make 10 Use of base 10	Column method with regrouping. (up to 3 digits using place value counters)	Column method with regrouping. (up to 4 digits)	Column method with regrouping. Abstract for whole numbers. Start with place value counters for decimals- with the same amount of decimal places.	Column method with regrouping. Abstract methods. Place value counters for decimals- with different amounts of decimal places.
Multiplication	Recognizing and making equal groups. Doubling Counting in multiples Use cubes, Numicon and other objects in the classroom	Arrays- showing commutative multiplication	Arrays 2d × 1d using base 10	Column multiplication- introduced with place value counters. (2 and 3 digit multiplied by 1 digit)	Column multiplication Abstract only but might need a repeat of year 4 first(up to 4 digit numbers multiplied by 1 or 2 digits)	Column multiplication Abstract methods (multi-digit up to 4 digits by a 2 digit number)
Division	Sharing objects into groups Division as grouping e.g. I have 12 sweets and put them in groups of 3, how many groups? Use cubes and draw round 3 cubes at a time.	Division as grouping Division within arrays- linking to multiplication Repeated subtraction	Division with a remainder- using lollipop sticks, times tables facts and repeated subtraction. 2d divided by 1d using base 10 or place value counters	Division with a remainder Short division (up to 3 digits by 1 digit- concrete and pictorial)	Short division (up to 4 digits by a 1 digit number including remainders)	Short division Long division with place value counters (up to 4 digits by a 2 digit number) Children should exchange into the tenths and hundredths column too

Calculation Progression

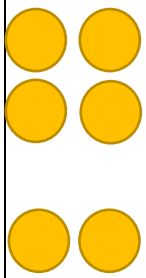
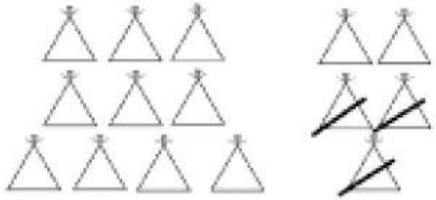
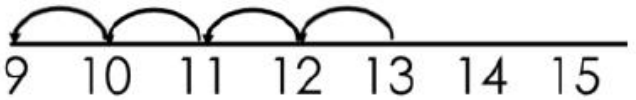
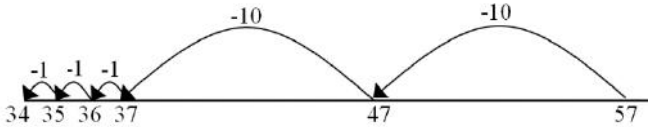
Addition

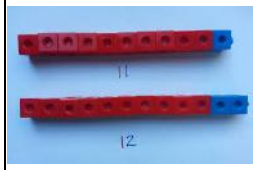
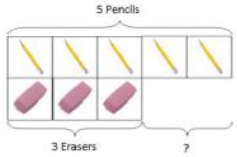
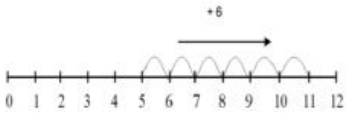
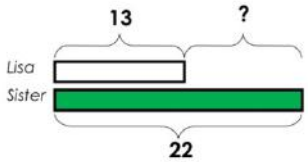
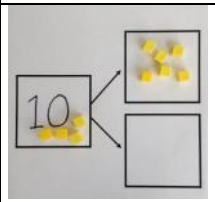
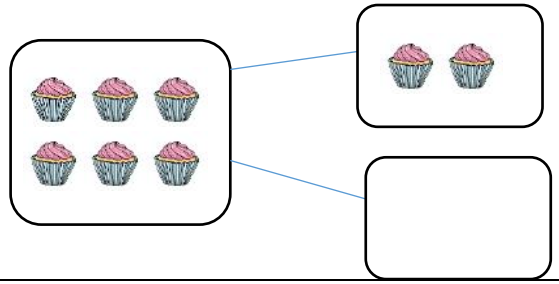
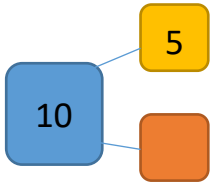
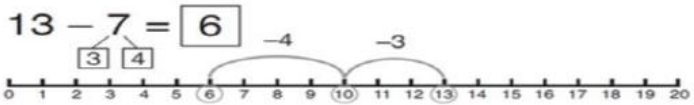
Objective and Strategies	Concrete	Pictorial	Abstract
Combining two parts to make a whole: part-whole model	   Use cubes to add two numbers together as a group or in a bar. 	  Use pictures to add two numbers together as a group or in a bar. 	4 + 3 = 7 10= 6 + 4  Use the part-part whole diagram as shown above to move into the abstract.
Starting at the bigger number and counting on	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	12 + 5 = 17  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer.

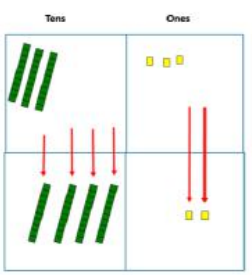
Regrouping to make 10.	 6 + 5 = 11  Start with the bigger number and use the smaller number to make 10.	 3 + 9 = Use pictures or a number line. Regroup or partition the smaller number to make 10. 9 + 5 = 14 1 4 +1 +4 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	7 + 4= 11 If I am at seven, how many more do I need to make 10. How many more do I add on now?
Adding three single digits	4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.  Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.	 Add together three groups of objects. Draw a picture to recombine the groups to make 10.	4 + 7 + 6 = 10 + 7 10 = 17 Combine the two numbers that make 10 and then add on the remainder.
Column method- no regrouping	24 + 15= Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.  	After physically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.  	Calculations 21 + 42 = 21 + 42

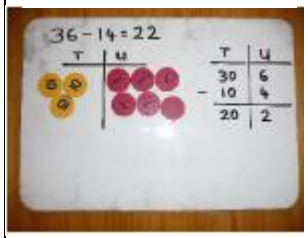
Column method- regrouping	Make both numbers on a place value grid.  146 + 527 Add up the units and exchange 10 ones for one 10.  146 + 527 Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added. Base 10 can help children clearly see that 10 ones equal 1 ten and 10 tens equal 100. As children move on to decimals, money and decimal place value counters can be used to support learning.	Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.  	Start by partitioning the numbers before moving on to clearly show the exchange below the addition. 20 + 5 40 + 8 60 + 13 = 73 536 + 85 621 1 1 As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here. 72.8 + 54.6 127.4 1 1 £23.59 + £7.55 £31.14 1 1 1

Subtraction

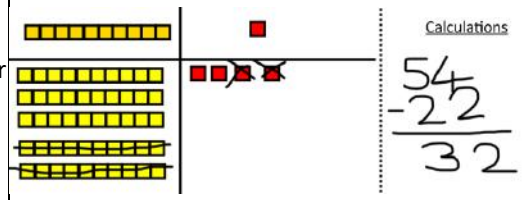
Objective and Strategies	Concrete	Pictorial	Abstract
Taking away ones	Use physical objects, counters, cubes etc to show how objects can be taken away.  6 – 2 = 4 	Cross out drawn objects to show what has been taken away.  15 – 3 = 12	18 -3= 15 8 – 2 = 6
Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones. 13 – 4  Use counters and move them away from the group as you take them away counting backwards as you go. 	Count back on a number line or number track  Start at the bigger number and count back the smaller number showing the jumps on the number line.  This can progress all the way to counting back using two 2 digit numbers.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.

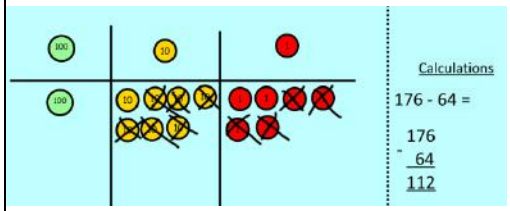
Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference Use basic bar models with items to find the difference 	 **Comparison Bar Models** *Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.* 	Count on to find the difference. Draw bars to find the difference between 2 numbers.	Hannah has 23 sandwiches; Helen has 15 sandwiches. Find the difference between the number of sandwiches.
Part- Whole Model	 Link to addition- use the part-whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? 10 - 6 =	Use a pictorial representation of objects to show the part-whole model. 	 Move to using numbers within the part whole model.
Make 10	14 – 9 =  Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.	 Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.	16 – 8= How many do we take off to reach the next 10? How many do we have left to take off?

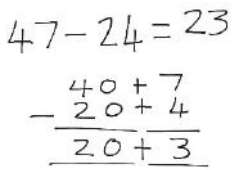
<table>
<tr>
<td>Column method without regrouping</td>
<td> 



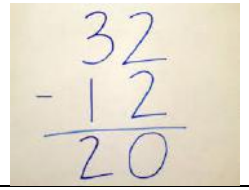
Use Base 10 to make the bigger number then take the smaller number away.

Show how you partition numbers to subtract. Again make the larger number first.</td>
<td> 

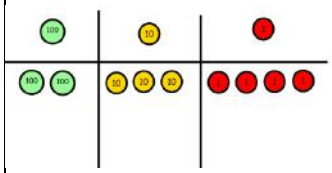


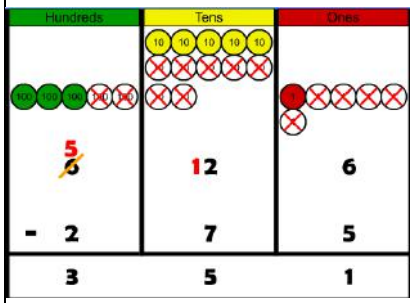
Draw the Base 10 or place value counters alongside the written calculation to help to show working.</td>
<td> 

This will lead to a clear written column subtraction.


</td>
</tr>
<tr>
<td>Column method with regrouping</td>
<td>Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

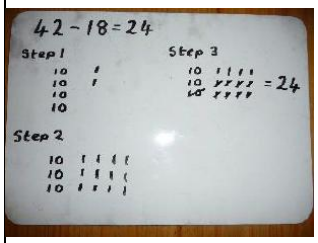
Make the larger number with the place value counters

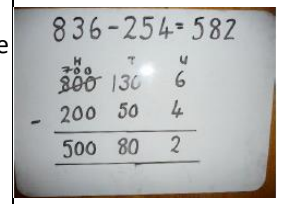


Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.</td>
<td> 

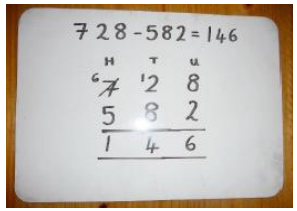
Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

When confident, children can find their own way to record the exchange/regrouping.



Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.</td>
<td> 

Children can start their formal written method by partitioning the number into clear place value columns.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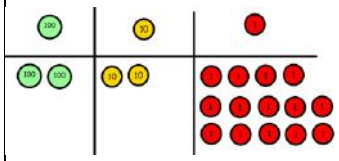
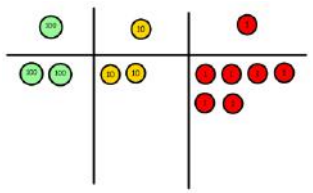
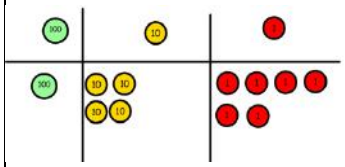
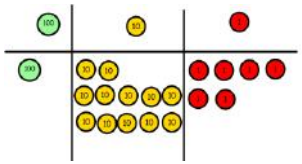
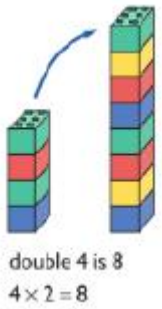
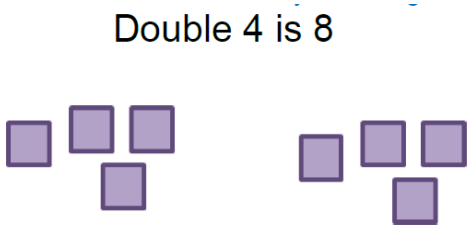
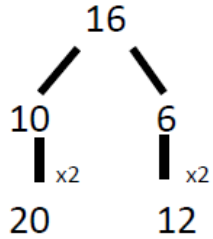
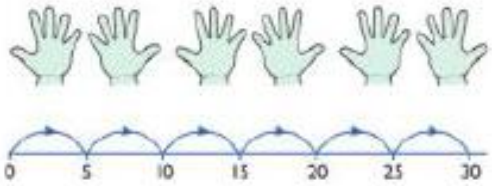
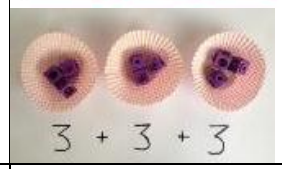
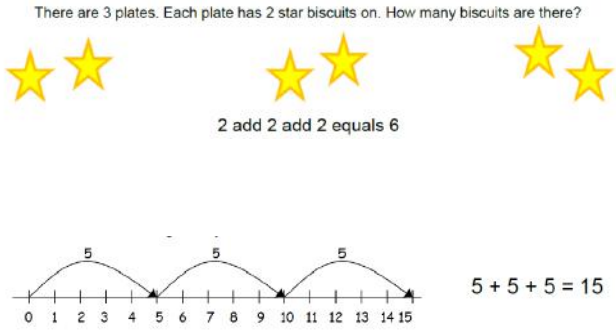
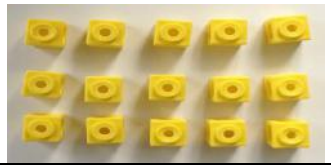
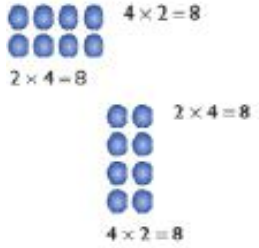
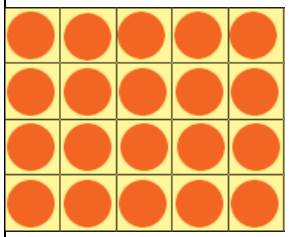
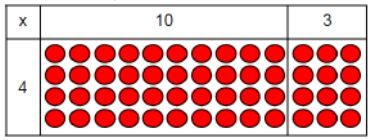
</table>

	 Calculations 234 - 88 Now I can subtract my ones.  Calculations 234 - 88 Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens. Now I can take away eight tens and complete my subtraction  Calculations 234 - 88 146  Calculations 234 - 88 Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.		Moving forward the children use a more compact method. This will lead to an understanding of subtracting any number including decimals. 5 12 1 2 ~~6~~ ~~3~~ . 0 - 2 6 . 5 2 3 6 . 5

Multiplication **Note * In line with the NCfE, children are expected to have rapid recall of tables up to 12x12 by the end of Year 4 – TTRS supports and tracks this.**

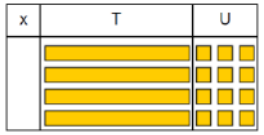
Objective and Strategies	Concrete	Pictorial	Abstract
Doubling	Use practical activities to show how to double a number.  	Draw pictures to show how to double a number.  	Partition a number and then double each part before recombining it back together. 
Counting in multiples	  Count in multiples supported by concrete objects in equal groups.	 Use a number line or pictures to continue support in counting in multiples.	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25 , 30

Repeated addition	   Use different objects to add equal groups.	 	Write addition sentences to describe objects and pictures. 
Arrays- showing commutative multiplication	Create arrays using counters/ cubes to show multiplication sentences.  	Draw arrays in different rotations to find **commutative** multiplication sentences.   Link arrays to area of rectangles.	Use an array to write multiplication sentences and reinforce repeated addition.  5 + 5 + 5 = 15 3 + 3 + 3 + 3 + 3 = 15 5 x 3 = 15 3 x 5 = 15
Grid Method	Show the link with arrays to first introduce the grid method.	Children can represent the work they have done with place value counters in a way that they understand.	Start with multiplying by one digit numbers and showing the clear addition alongside the grid.



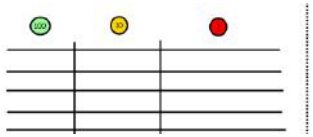
4 rows of 10
4 rows of 3

Move on to using Base 10 to move towards a more compact method.

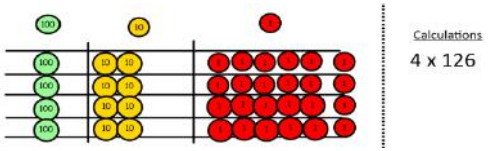


4 rows of 13

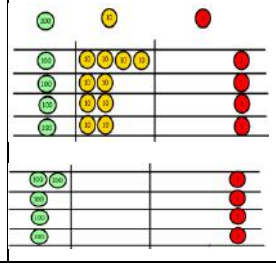
Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.



Fill each row with 126.

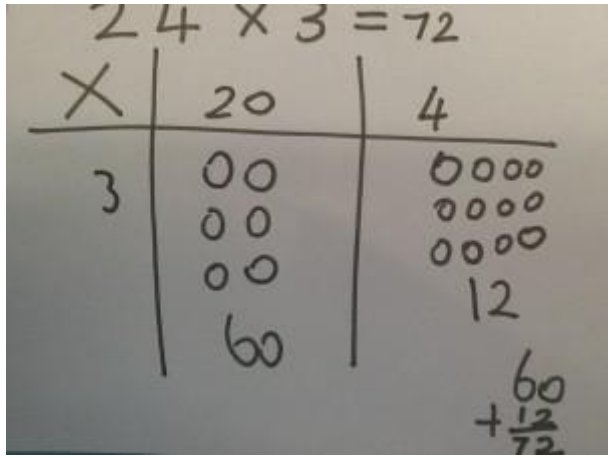


Add up each column, starting with the ones making any exchanges needed.



Then you have your answer.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.



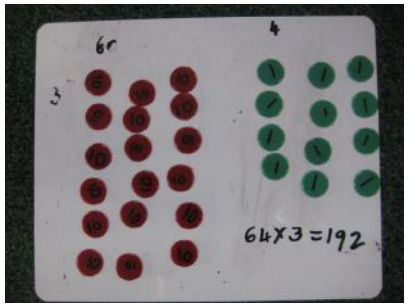
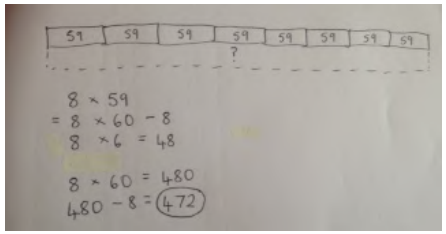
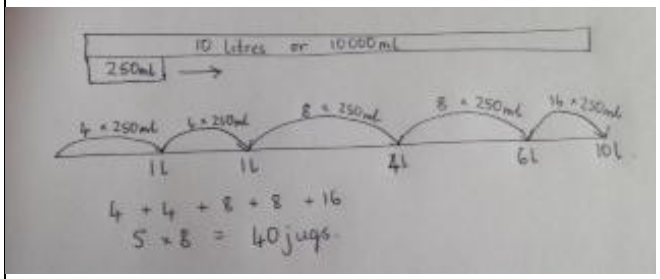
×	30	5
7	210	35

210 + 35 = 245

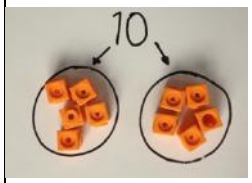
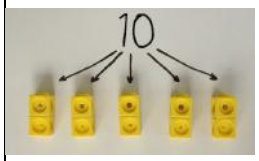
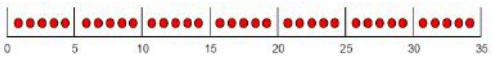
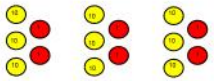
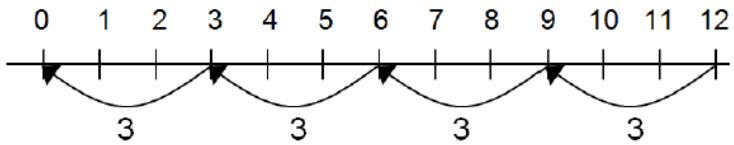
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

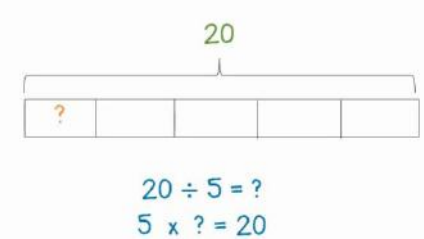
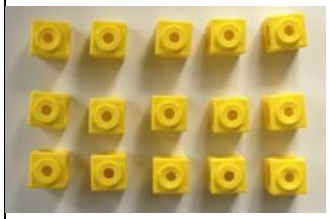
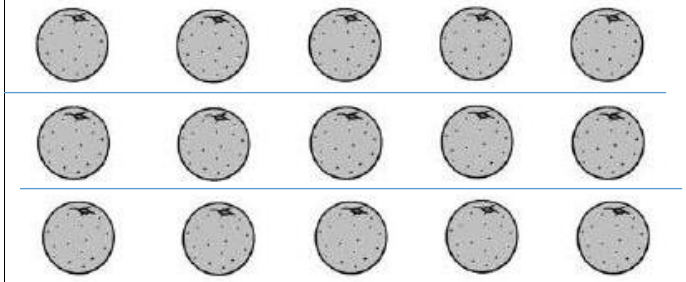
	10	8
10	100	80
3	30	24

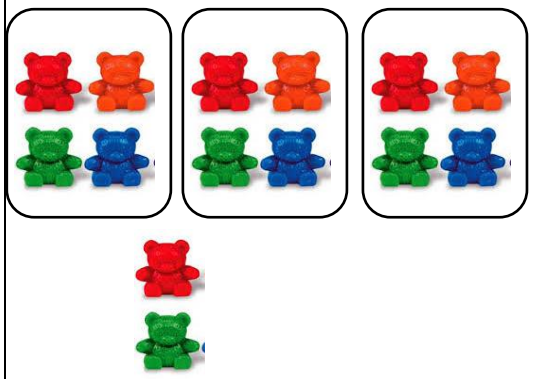
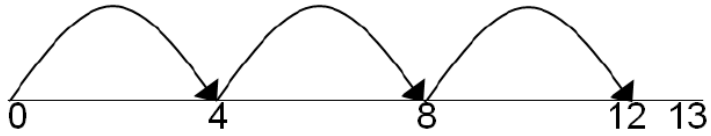
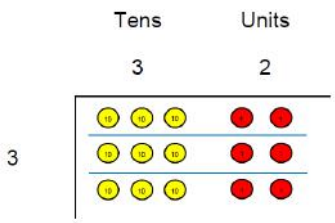
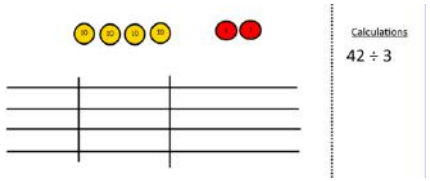
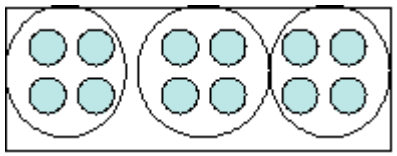
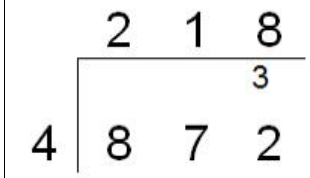
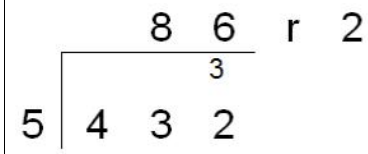
X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

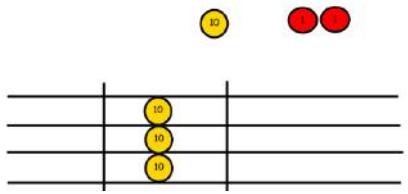
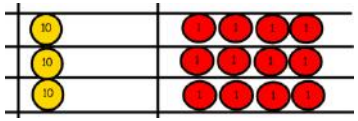
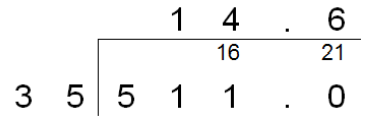
Column multiplication	Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.   	Start with long multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer. 74 × 63 12 210 240 + 4200 4662 1342 × 18 13420 10736 24156 This moves to the more compact method. Decimal numbers should be multiplied as whole numbers but with amount of decimal places recorded (dp) and accounted for in the answer. 3.77 × 2.8 = ? 3.77 (2 decimal places) × 2.8 (1 decimal place) 3016 +754 10.556 (3 decimal places)

Division

Objective and Strategies	Concrete	Pictorial	Abstract
Sharing objects into groups	 I have 10 cubes, can you share them equally in 2 groups? 	Children use pictures or shapes to share quantities.  8 ÷ 2 = 4	Share 9 buns between three people. 9 ÷ 3 = 3
Division as grouping	 Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.   96 ÷ 3 = 32 	Use a number line to show jumps in groups. The number of jumps equals the number of groups. 	28 ÷ 7 = 4 Divide 28 into 7 groups. How many are in each group?

		Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.  	
Division within arrays	 Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7

Division with a remainder	14 ÷ 3 = Divide objects between groups and see how much is left over 	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder.  	Complete written divisions and show the remainder using r. 
Short division	 Use place value counters to divide using the bus stop method alongside  42 ÷ 3=	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder. 

	Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.  We exchange this ten for ten ones and then share the ones equally among the groups.  We look how much in 1 group so the answer is 14.		Finally move into decimal places to divide the total accurately. Children should make notes when dividing by a 2-digit number (35, 70, 105 etc) 

Mastery and Calculation

Mastery questions should be used when children are observed having a deeper understanding of calculation skills. See the examples for addition below. More examples can be found in the 'Teaching for Mastery' booklets for Year 1 to Year 6.

Addition

Find the missing numbers in each addition sentence.
Will the totals always be the same?
Explain your reasoning

□ + □ = □
□ + □ = □
□ + □ = □

Mastery with greater depth:

□ + □ + □ = □
□ + □ + □ = □
□ + □ + □ = □

Fill in the missing numbers and explain what you notice.

23 + □ = 30 33 - □ = 30
43 + □ = 50 53 - 3 = □

Mastery with greater depth:
Find the different possibilities.

□ + □ = 50

50 - □ = □

Can you see these number sentences in the picture below?
3 + 2 = 5
2 + 3 = 5
5 − 3 = 2
5 − 2 = 3

Now write the four number sentences for this picture:

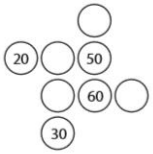
Fill in the empty boxes to make the equations correct.

7 □ 1 + □ 3 □ = 999

7 □ 1 + □ 3 □ = 1000

Mastery with greater depth:

Complete this diagram so that the three numbers in each row and column add up to 140.



Now create your own diagram with a total of 250.

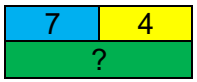
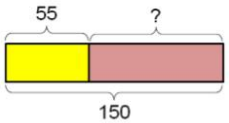
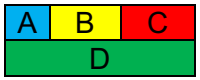
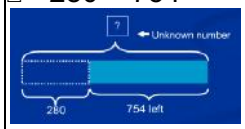
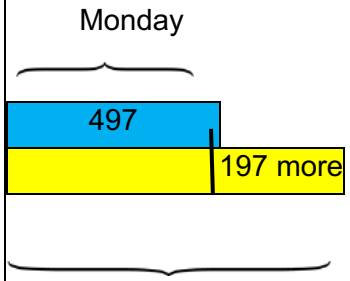
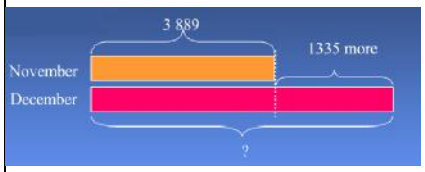
What do you notice?
Is there a relationship between the calculations?
500 + 400 = 523 + 400 =
523 + 28 =
400 + 500 = 423 + 500 =
423 + 28 =
300 + 600 = 323 + 600 =
323 + 28 =
200 + 700 = 223 + 700 =
223 + 28 =

Mastery with greater depth:
For positive integers are the following statements always, sometimes or never true?
The sum of 2 odd numbers is even.
The sum of 3 odd numbers is even.
Adding 5 to a number ending in 6 will sum to a number ending in 1.
Adding 8 to a number ending in 2 will always sum to a multiple of 10.

The Singapore Bar Method

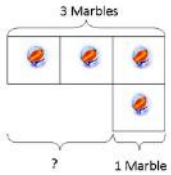
The Singapore Bar Method should be used to help children apply their calculation skills when solving word problems. Children should start applying their calculation skills as soon as their calculation skills are secure. The table below shows examples of how the Bar Method can be used at different stages. For more word problems progressing from Foundation Stage to Year 6, see the Singapore Bar Method assessment questions.

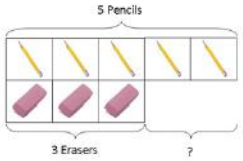
Addition

I had 7 sweets and then somebody gave me 4 more. How many do I have altogether?  Sally had three sweets. Carole gave her two more. How many sweets does she have now?	I had 26 strawberries and my friend had 19. Find the total.  What is the missing value? 	A + B + C = D  On Saturday, __ people went to the concert. On Sunday, __ people went to the concert. How many people went to the concert on both days?	Louise had some stamps. After giving away 280 stamps to her brother, she had 754 stamps left. How many stamps did Louise have at first? □ - 280 = 754 	497 people visited the museum on Monday. On Tuesday 197 more people visited the museum than on Monday. How many people visited on Monday and Tuesday?  497 + 197 = ?	In November, 3889 people visited the water park. In December, 1335 more people visited the water park. How many people visited the waterpark in December? How many people visited the waterpark over both months?  Mary baked some tarts for her party. Her friends ate __ of the tarts during the party. There were __ tarts left over. How many tarts did Mary bake?

Subtraction

I have three marbles. If I take away one marble, how many marbles do I have left?



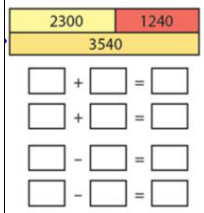


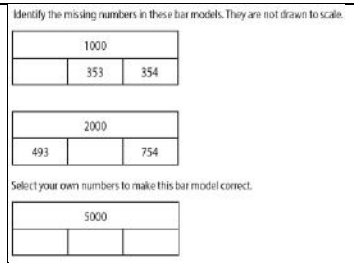
I had 12 apples in my fruit bowl. I ate 4 over the last two days. How many apples do I have left?

I had 8 pencils and 5 rubbers in my pencil case. How many more pencils do I have than rubbers?

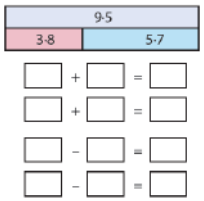
There were __ balloons for sale at the fair. By the end of the day __ balloons were left. How many balloons were sold?

What number sentences can you make?





There were __ stamps in an album. __ were Spanish stamps and __ were Italian stamps. The rest were British stamps. How many British stamps were there?



Mrs M had £ __ (larger number) saved in one bank and £ __ (smaller number) saved in a second bank. How much money must she transfer from the first bank to ensure that the same amount of money is in each bank?

250 000 people visited a theme park in one year.
15% of the people visited in April and **40%** of the people visited in August.
How many people visited the park in the rest of the year?