Progression

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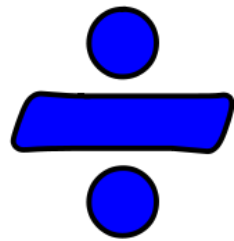
Calculation

Booklet

Introduction

At Tower Bridge, we are committed to ensuring progression and consistency in the teaching of the four operations (+ - ÷ x). This booklet shows the steps we take in school when teaching methods of calculation.

It is important to work through the steps at the suitable rate for every child. Without a good knowledge and understanding of numbers bonds and facts and an ability to use mental strategies, children will struggle when introduced to formal methods. Written methods are based on and not a replacement for mental methods.

No child should omit steps, children will move at different rates through some the steps.

Notes

In class, children are encouraged to progress through the steps at their own rate. The aim is for all children to be using formal written methods for all four operations by year six.

We encourage flexibility in methods and children are encouraged to think "Can I work this out in my head?" and continue to look out for and recognise special cases.
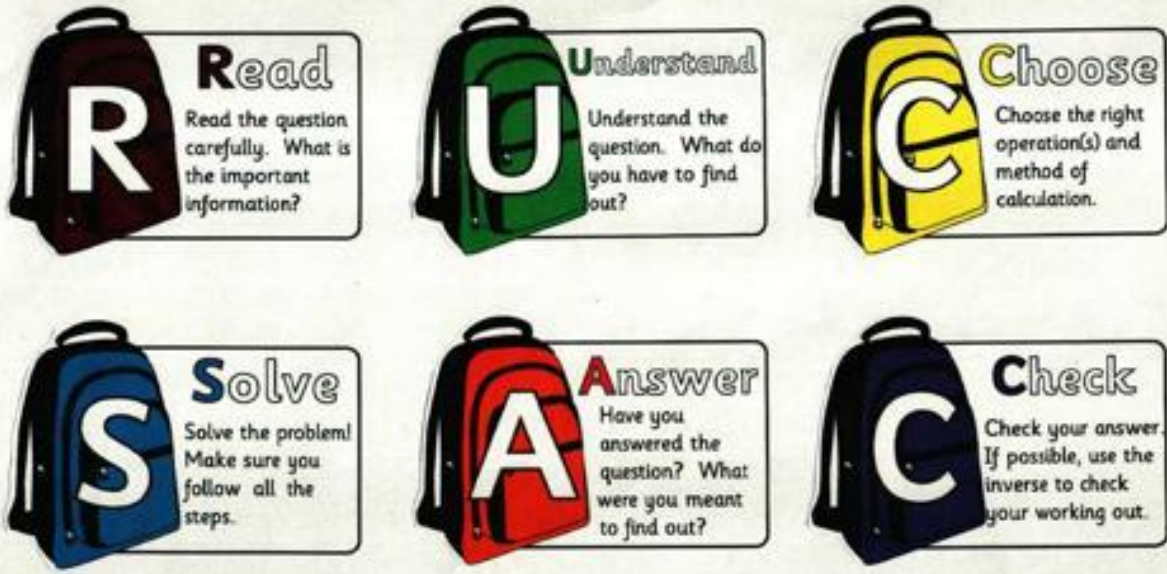
If at any stage, a child is making a significant number of errors, they should return to the step they understand before moving on.

Word Problems

When answering word problems children are encouraged to follow the following 'RUCSAC' steps;

1) Read the question
2) Understand - underline the key information (in order to understand the question they might need to picture what is happening or draw what is happening).
3) Choose – what calculation do they need? Does the problem have more than one step?
4) Solve – Choose a method to solve the problem.
5) Answer – Go back to the question. Have they actually solved what has been asked?
6) Check.

Remember 'RUCSAC' when solving word problems!

Read — Read the question carefully. What is the important information?

Understand — Understand the question. What do you have to find out?

Choose — Choose the right operation(s) and method of calculation.

Solve — Solve the problem! Make sure you follow all the steps.

Answer — Have you answered the question? What were you meant to find out?

Check — Check your answer. If possible, use the inverse to check your working out.

Read, Understand, Choose, Solve, Answer, Check

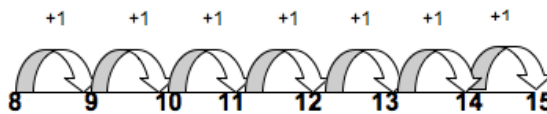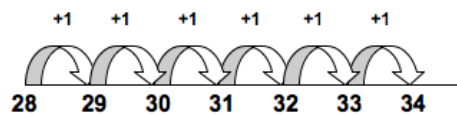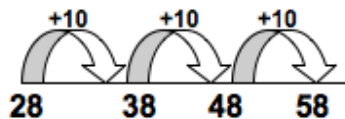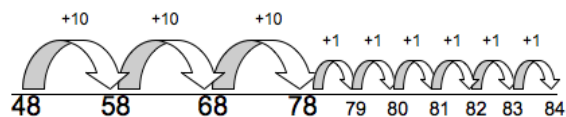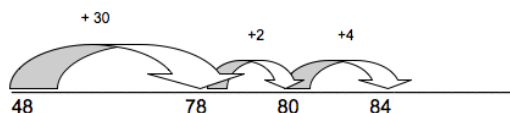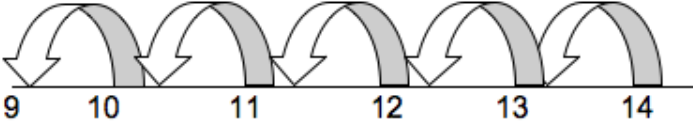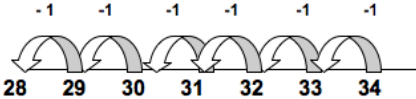| Addition	+
Use a wide variety of songs and rhymes, games and activities. Relate addition to **combining two groups of objects**, first by **counting all** and then by **counting on** from the largest number. They will find one more than a given number.	In practical activities and through discussion they will begin to use the vocabulary involved in addition. 'You have five apples and I have three apples. How many apples altogether?'
Count on from any number Count on from the largest number for numbers within 20, including 0.	First using a number track **5 + 4 = 9** 'Put your finger on number five. Count on (count forwards) four.' Then onto a marked number line **8 + 7 = 15** 'Put your finger on number eight and count on seven.'
Add a two-digit number and units Add two-digit number and tens Add two two-digit numbers	Start using a blank number line starting with the bigger number and jumping in ones, tens and then choosing suitable jumps. 28 + 6 = 34 28 + 30 = 58 48 + 36 = 84 If confident, use more efficient jumps
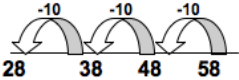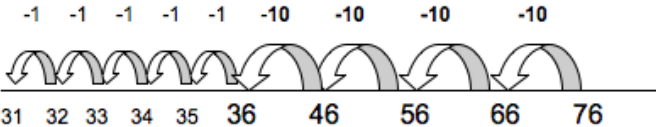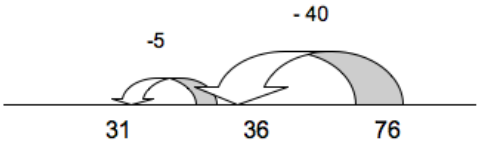
Use partitioning to add two two-digit numbers	$43 + 25 = 68$ 40 3 20 5 $40 + 20 = 60$ $3 + 5 = 8$ $60 + 8 = 68$
Add numbers up to three digits using the written column method	First expanded **63 + 32 = 95** $\quad 60 + 3$ $+\ \ 30 + 2$ $\quad 90 + 5 = 95$ | Which will lead to the formal written method 'Partition the numbers into tens and ones/units. Add units together then add the tens together. Recombine to give the answer.' 6 3 $+\ $ 3 2 9 5 ...lue to ensure understanding: 'Three add two equals five. Write five in the units column. 60 add 30 equals 90. Write 9 (90) in the tens column.
Introduce number where you bridge one hundred and are required to 'carry'.	First expanded **68 + 24 = 92** $\quad 60 + 8$ $+\ \ 20 + 4$ $\quad 90 + 2 = 92$ $\quad 10$ Which will lead to the formal written method 'Partition the numbers into tens and ones/units. Add the units together, where the answer is 10 or greater 'carry' over to the tens column. Add the tens together remembering not to forget the ten underneath. 6 8 $+\ $ 2 4 9 2 $_1$ ...to ensure understanding: 'Eight add four equals 12. Write two in the units column and 'carry' one (10) across into the tens column. 60 add 20 and the ten that we 'carried' equals 90. Write 9 (90) in the tens column. 92 is the answer.
Use the same method for different numbers. Three-digit numbers and two- digit numbers	$546 + 67$
A pair of three-digit numbers	$452 + 543$
Four-digit and five-digit numbers	$63424 + 5384$
Decimal numbers	£34.12 + £8.19

Subtraction	-
Use a wide variety of songs and rhymes, games and activities. They will relate subtraction to **taking away** using objects to find out how many are left after some have been taken away. Find one less than a number	$6 - 2 = 4$ 🍎🍎🍎🍎🍎🍎 'Take two apples away. How many are left?'
Count back from any number Solve missing number problems 20 - __ = 15	First using a number track 9 – 5 = 4 "Place your finger on 9 and count back 5 spaces" Then progress onto a marked number line. 14 – 5 = 9 9 10 11 12 13 14 'Put your finger on number 14 and count back five.'
Subtract a two-digit number and units subtract two-digit number and tens Subtract two two-digit numbers, using partitioning. If confident, use more efficient methods.	Start using a blank number line starting with the bigger number and jumping **back** in units, tens and then choosing suitable jumps. 34 - 6 = 28 -1 -1 -1 -1 -1 -1 28 29 30 31 32 33 34 …and in tens: 58 - 30 = 28 -10 -10 -10 28 38 48 58 76 – 45 = 31 -1 -1 -1 -1 -1 -10 -10 -10 -10 31 32 33 34 35 36 46 56 66 76 76 – 45 = 31 - 40 -5 31 36 76

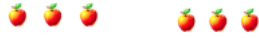|	

Subtract numbers up to three digits using the written column method (where there is no exchange).
 	
Exchange – this term is used instead of "borrow" or "pay back".
	First using an expanded method
	
	78 – 23 = 55
	
	  70 and 8
	−20 and 3
	  50 and 5 = 55
	
	'Partition numbers into tens and ones/units. Subtract the ones, and then subtract the tens. Recombine to give the answer.'
	
	NB In this example decomposition (exchange) is not required.
	
	Which will lead to the formal written method
	
	  7 8
	-2 3
	  5 5
	
	Use the language of place value to ensure understanding:
	'Eight subtract three, seventy subtract twenty.'

Subtract numbers up to three digits using the written column method (where there is exchange).
 	
Exchange – this term is used instead of "borrow" or "pay back".
	Introduce exchange with the expanded method at first
	
	73 − 27 = 46
	
	  70 and 3 becomes 60 +13
	- 20 and 7 - 20 + 7
	                            40 + 6 = 46
	
	73 is partitioned into 60+13 in order to calculate 73-27
	
	Which will lead to the formal written method
	
	73 − 27 = 46
	
	  6 13
	  7 3
	- 2 7
	  4 6
	
	Use the language of place value to ensure understanding.
	'We can't subtract seven from three, so we need to exchange a ten for ten ones to give us 60 + 13.'

Use the same method for different numbers. Three-digit numbers and two- digit numbers	538 - 67
A pair of three-digit numbers	543 - 256
Four-digit and five-digit numbers	63424 - 5827
Decimal numbers	£24.52 - £8.23

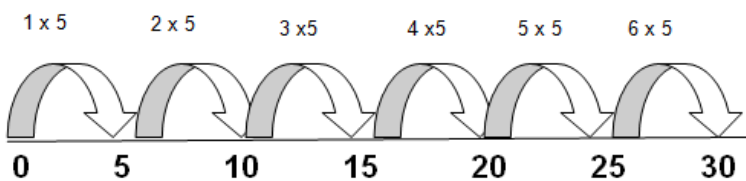| Multiplication	x
Use a wide variety of songs, rhymes and activities.	"Three apples for you and three apples for me. How many apples altogether?"
Use pictorial representations and arrays to solve one-step problems. Count in multiples of 2, 5 and 10. Array – 4 x 2 = 8 Using dots or squares to show multiplication and division using rows and columns	'Six pairs of socks. How many socks altogether? 2, 4, 6, 8, 10, 12' Use arrays to help support early multiplication 2 x 5 = 10 or 5 x 2 = 10 Introduce x sign for "lots of" or "groups of"
Know that multiplication can be done in any order (commutative) e.g. 4x2=8 and 2x4=8 Recall and use 2,5 and 10 times tables Know that multiplication is the same as repeated addition Repeated addition 5 x 3 is the same as 5 + 5 + 5	Using arrays 6 x 5 = 30 '5 + 5 + 5 + 5 + 5 + 5 = 30 ' '6 rows of 5' '6 groups of 5' '5 groups of 6' '5 x 6 = 30' '6 x 5 = 30' Using pictures and diagrams '3 groups of 10 crayons' 'How many crayons altogether?' '10 + 10 + 10 = 30' '3 groups of 10' '3 times ten' '3 x 10 = 30' '10 x 3 = 30' Using an empty number line 6 x 5 = 30 1 x 5 2 x 5 3 x5 4 x5 5 x 5 6 x 5 0 5 10 15 20 25 30

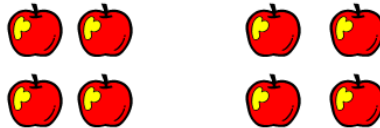|	
Only move on when confident with previous methods. Recall and use multiplication facts for the 3, 4 and 8 times tables Write and calculate multiplication including one-digit and two-digit numbers	*Mental strategy using partitioning* **13 x 5 = 65** (Partition 13 into 10 + 3) 10 x 5 = 50 3 x 5 = 15 50 + 15 = 65 Use partitioning for the written grid method <table><tr><td>X</td><td>10</td><td>3</td></tr><tr><td>8</td><td>80</td><td>24</td></tr></table> 80 + 24 = 104
Formal short multiplication TU x U HTU x U ThHTU x U	Firstly with two-digit number by a single digit Starting with the units (3x8=24) Ensure the digit is 'carried over' and written under the line in the correct column. $$\begin{array}{r} 1\ 3 \\ \times\ 8 \\ \hline 1\ 0\ 4 \\ {\scriptstyle 2} \end{array}$$ Then with a three-digit number and a single digit $$\begin{array}{r} 1\ 2\ 7 \\ \times\ \ 6 \\ \hline 7\ 6\ 2 \\ {\scriptstyle 1\ \ 4} \end{array}$$
Multiplying by a multiple of ten Combine understanding to multiply TU X TU	Remind children about knowledge of place value and how when you multiply by 10 numbers move one place to the left. Use place value to multiply a number by a multiple of 10 21 x 3 = 63 21 x 30 = 630 $$\begin{array}{r} 2\ 1 \\ \times\ 3\ 0 \\ \hline 6\ 3\ 0 \end{array}$$ Use brackets for early examples to help understanding. Encourage children not to use brackets in their own written work. $$\begin{array}{r} 24 \\ \times\ 35 \\ \hline 720 \\ 120 \\ \hline 840 \end{array}$$ (24 × 30) (24 × 5)
Use method for calculating HTU x TU and decimal numbers	Make sure children use knowledge of place value to align column and decimals correctly. $$\begin{array}{r} 5\ 3\cdot2 \\ \times\ 2\ 4\cdot0 \\ \hline 2\ 1^{1}2\cdot8 \\ 1\ 0\ 6\ 4\cdot0 \\ \hline 1\ 2\ 7\ 6\cdot8 \end{array}$$

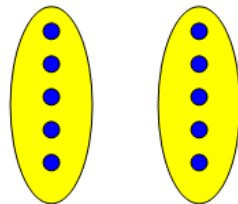| Division	÷
Use a wide variety of songs, rhymes and activities. Begin to solve problems involving sharing and halving.	Share the apples between two people. "Half of the apple for you and half of the apples for me." 🍎🍎🍎 🍎🍎🍎
Use pictorial representations and arrays to solve one-step problems. Count in multiples of 2, 5 and 10. Array – 8 ÷ 2 = 4 Using dots or squares to show division and multiplication using rows and columns	'Share these eight apples equally between two children. How many apples will each child have?' 🍎🍎 🍎🍎 🍎🍎 🍎🍎 Use arrays to help support early division 'How many groups of 5?' '10 shared equally between 2 people' 'Half of ten is five'
Recall and use multiplication and division facts for the 2,5 and 10 times tables. Know the symbol for division Know that division is the same as repeated subtraction Repeated addition 5 x 3 is the same as 5 + 5 + 5	Using arrays $15 ÷ 5 = 3$ $15 ÷ 3 = 5$ ⭐⭐⭐⭐⭐ ⭐⭐⭐⭐⭐ ⭐⭐⭐⭐⭐ How many groups of 3? How many groups of 5? 15 shared between 3 people is…? 15 shared between 5 people is…? 15 divided by 5 = 3 15 divided by 3 = 5 Using pictures and diagrams '30 crayons shared equally between three pots.' (Sharing) 'We have 30 crayons and put ten crayons in each pot. How many pots do we need?' (Grouping) '30 divided by 10 = 3' '30 divided by 3= 10' $30 ÷ 10 = 3$ $30 ÷ 3 = 10$ Using an empty number line 'How many groups of five?' - 5 - 5 - 5 - 5 - 5 - 5 0 5 10 15 20 25 30
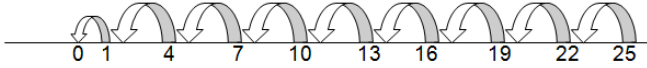
Recall and use multiplication and division facts for the 3, 4 and 8 times tables Write and calculate division including two-digit by one-digit numbers	*Mental strategy using partitioning* *84 ÷6 = 14 (Partition 84 into 60 + 24, using knowledge of multiples of 10)* *60 ÷ 6 = 10* *24 ÷ 6 = 4* Introduce the formal layout for multiplication "Can you count in 3's to see how many are in 24?" $$\begin{array}{r} 8 \\ \hline 3\,\big)\,24 \end{array}$$
Division with remainders	Demonstrate what a remainder is using arrays or a number line **25 ÷ 3 = 8 r1** 0 1 4 7 10 13 16 19 22 25 Continue to record using the formal written layout $$\begin{array}{r} 8\,r\,1 \\ \hline 3\,\big)\,25 \end{array}$$
Move onto using the formal written method. Sometimes called the "bus stop method." TU ÷ U HTU ÷ U Use the formal written layout for questions with remainders.	Remind children of mental methods using partitioning in different ways. 98 = 70 + 28 70 ÷ 7 = 10 28 ÷ 7 = 4 98 ÷ 7 = 14 432 ÷ 5 = 86 r2 $$\begin{array}{r} 1\,4 \\ \hline 7\,\big)\,9\,^2 8 \end{array}$$ When confident move on to HTU ÷ U ThHTU ÷ U $$\begin{array}{r} 8\,6\,r\,2 \\ \hline 5\,\big)\,4\,3\,^3 2 \end{array}$$
Use the "bus stop" method for dividing by a two-digit number	440 + 55 + 1 440 ÷ 11 = 40 55 ÷ 11 = 5 Remainder of 1 Remainder can also be recorded as a fraction $\frac{1}{11}$ **496 ÷ 11 = 45 r1** $$\begin{array}{r} 4\,5\,r\,1 \\ \hline 11\,\big)\,4\,9\,^5 6 \end{array}$$
For more able children some questions will require the use of long division (repeated subtraction of multiples of the divisor)	**144÷ 16 = 9** $$\begin{array}{r} 9 \\ \hline 16\,\big)\,1\,4\,4 \\ -\,6\,4 \\ \hline 8\,0 \\ -\,6\,4 \\ \hline 1\,6 \\ -\,1\,6 \\ \hline 0 \end{array}$$ (4 x 16) Multiples of the divisor (16) have been subtracted from the dividend (144) (4 x 16) '4 (lots of 16) + 4 (lots of 16) + 1 (lot of 16) = 9 (lots of 16) (1 x 16) There is no remainder'