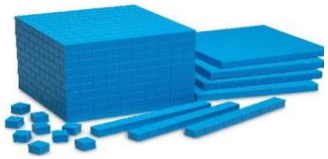
This policy demonstrates the methods that we use for teaching calculations throughout Embsay Primary School.



Maths for young children should be meaningful. Where possible, concepts should be taught in the context of real life situations.

Vocabulary for the four rules of number

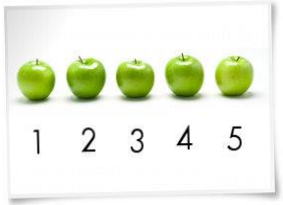
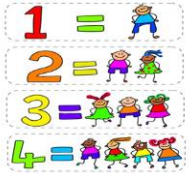
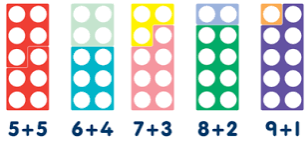
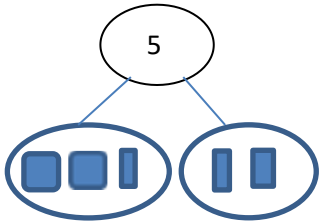
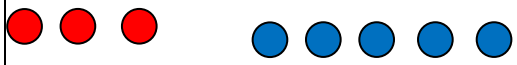
Addition	Subtraction
Add	Less
Addition	Subtract
Plus	Subtraction
Make	Take away
Altogether	Minus
Increase	Difference between
More	Count on
And	Count back
Sum	Take from
Total	Fewer
Inverse	Decrease
Count on	Reduce
Repeated	What is left?
	The change
	Inverse

Multiplication	Division
Multiply	Divide
Times	Divided by
Lots of	Divisible by
Groups of	Share
Sets of	Share equally
Repeated addition	Group
Array	Factor
Product	Inverse
Inverse	Quotient
Squared ($_2$) Cubed ($_3$)	
Double (x2)	
Triple (x3) Quadruple (x4)	

ADDITION

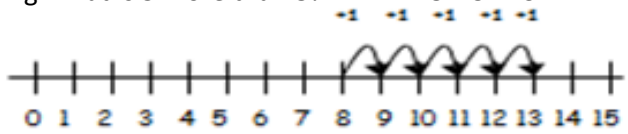
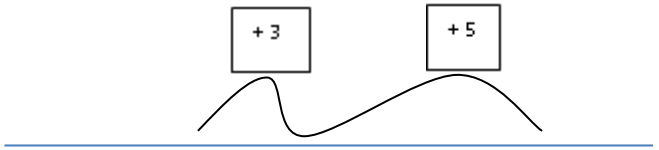
Stage 1

- Children will be introduced to the vocabulary of addition and the + symbol
- Lots of practical work, informal jottings, whole-part models and counting on fingers will be used to help children understand that addition is the combination of 2 or more sets of objects.

Counting sets of objects.	Eg Practical counting activities in meaningful contexts. Vocabulary to include count on, altogether, one more.  
Combining 2 sets of objects into 1 group. Finding number bonds Practical Counting 	Eg Combining numbers and objects.  **5 stars**   Whole-part models.  
Drawing pictures/ dots. Informal jottings.	Eg 3 + 5 =8 

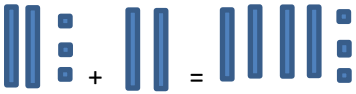
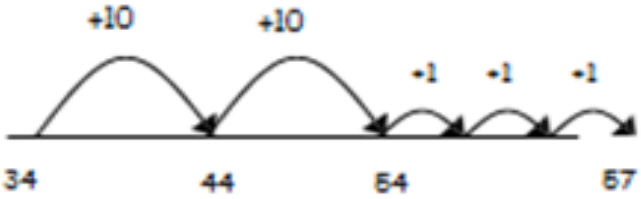
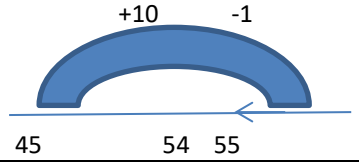
Stage 2

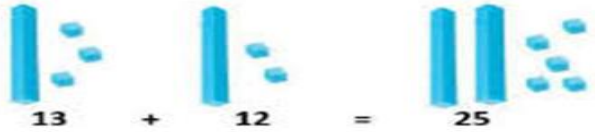
- **The children will use a range of filled number lines to help them add small numbers together.**
- **They will learn to partition numbers into tens and units and then recombine them.**

Counting on using a number line	Eg What is 5 more than 8? 8 + 5= 13  8 + 7 = 15 
Counting on using a number line and putting the biggest number first. Also counting on by putting the biggest number in your head.	Eg 3 + 5 = 8 
Counting on using a number line including bridging through 10	Eg 7 + 8 = 15 
Partition and recombine	Eg Partition… 53 = 50 + 3 or recombine …50 + 3 = 53  Partitioning into tens and ones.

Stage 3

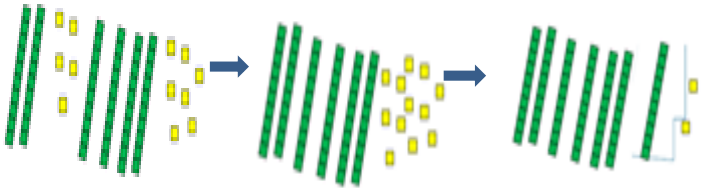
- **Children will consolidate partitioning.**
- **They will add a multiple of 10 to a number.**
- **A range of practical apparatus (eg. place value cards, Dienes apparatus, place value counters) will be used to complete TU + TU. They partition the number into tens and ones before adding the numbers together, finding the total.**

Adding a multiple of 10 to a number.	E.g.23+10 = 20 + 10 = 30 + 3 =33 Or 23+20 = 43 
Partitioning smaller numbers into tens and units	Eg 53 + 32 =85 50+ 3 + 30 + 2 = 85 (Also done through jottings) Or 12 +13 = 12 + 10 + 3 = 22 + 3 = 25 Eg 50 + 30 = 80 3 + 2 = 5 80 + 5 = 85
Adding the multiples of 10 first, then the units	e.g. 34+23=  45 + 9 = 

	add 9 by adjusting Dienes' Apparatus 

Stage 4

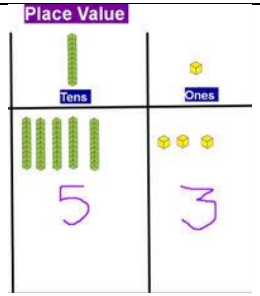
- Children will use partitioning to add two, 2-digit numbers together that cross the tens boundary.
- Practical methods will lead to more formal written methods.
- Then larger numbers will be used (3 digit + 3 digit and 4 digit + 4 digit)

Using practical apparatus and /or a number line to help,	 25 + 47 = 60 + 12 = 60+ 10 = 70 +2=72
Partitioning, but using a more formal written method.	25 + 47 20 + 40 = 60 5 + 7 = 12 60 + 12 = 72 Numbers are written beside each other but adding the tens first, then the units.
Partitioning with numbers written underneath each other	52 = 50 + 2 +62 = 60 + 2 110 + 4 = 114 or 25 = 20 + 5 + 47 = 40 + 7 60 + 12 =
Then adding larger numbers by partitioning.	two 3-digit numbers Eg 145 + 236 two 4-digit numbers eg 2364 + 1423

	145 = 100 + 40 + 5 or 2364 = 2000 + 300 + 60 + 4 + 236 = 200 + 30 + 6 1423 = 1000 + 400 + 20 + 3 300 + 70 + 11 =381 3000 + 700 + 80 + 7 =3787

Stage 5

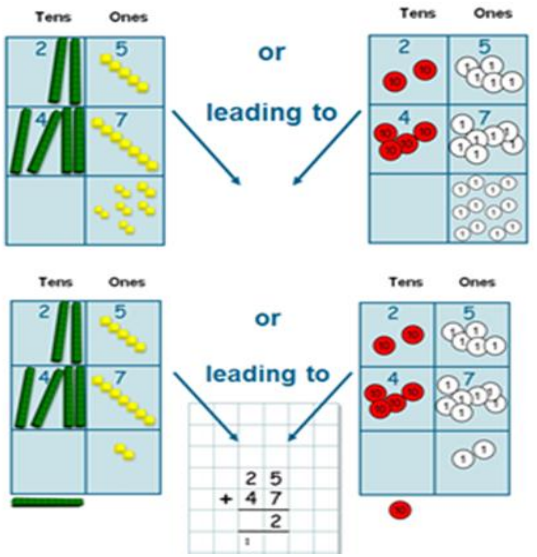
- Supported by practical equipment, children will begin to use the formal long written method.
- Once confident, practical equipment will be taken away.
- Children will then work with larger numbers and decimal numbers.

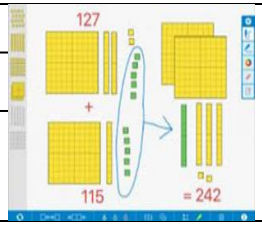
As children first experience the practical version of column addition they record the written method alongside. Units digits are added first.	 Eg. 11 + 53 4 60 64 6 4
Partitioning, using vertical columns, adding the units column first.	62 + 36 = 8, 90, 98 52 + 62 = 4, 110, 114

Working with larger numbers and decimals, adding the units digit first	123 +345 8 60 400 468	435 +356 11 80 700 791	20 . 3 + 82 . 4 0 . 7 2 . 0 100 . 0 102 .7

Stage 6

- Supported by practical equipment, children will begin to use the formal short written method, initially with and then without carrying digits.
- Once confident, practical equipment will be taken away.
- Children will extend the method to work with progressively larger whole numbers and decimal numbers. They will learn that decimal points should line up under each other.

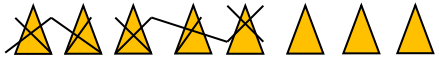
As children first experience short addition methods, practical apparatus is used to support them and they record the written method alongside. Units digits are added first.	 25 + 47 72 1
Short written method initially	67 57 278

without and then with carrying digits. Units digits are added first.	+ 32 → 99 ; + 28 → 85 (1) ; + 165 → 443 (11) 
Using progressively larger digits and decimals	Eg £3.59 + 78p £3.59 + £0.78 £4.37 1 1

SUBTRACTION

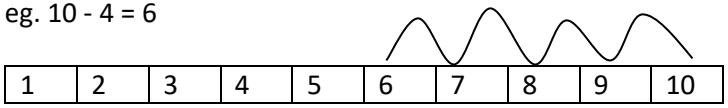
Stage 1

- **Children will be introduced to the vocabulary of subtraction and the – symbol.**
- **Lots of practical work, informal jottings (eg rubbing out / crossing out) and counting back on fingers will be used to help children understand subtraction as the process of taking away.**
- **Children will also be taught to find the diffference between two numbers.**

Practical counting activities	Vocabulary to include : How many are left? 5 take away 1 One less than 5 
Finding the difference	
Jottings. Getting a set of objects and taking some away.	8 – 5 =3 

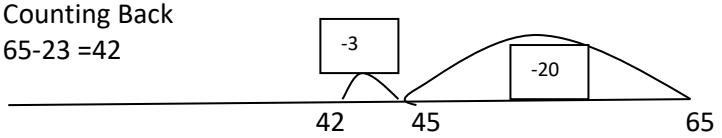
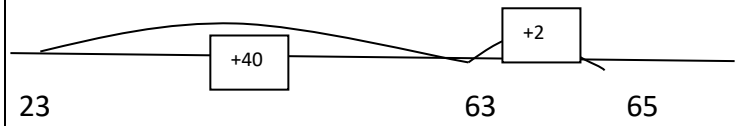
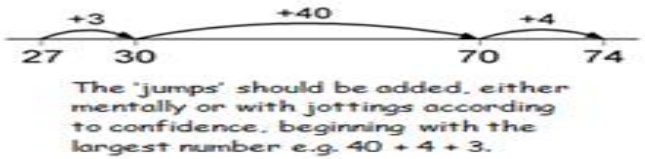
Stage 2

Children will use a filled number line to help them count backwards and forwards in small steps.

Practical activities	Counting back from a larger number Counting back using a complete filled number line and number squares eg. 10 - 4 = 6 

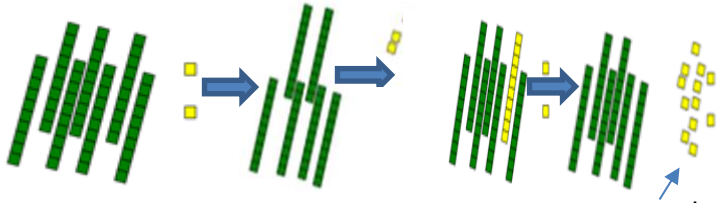
Stage 3

- **Children will count backwards in larger steps**
- **They will find the difference by counting on.**

Using a number-line to count back in larger steps.	Counting Back 65-23 =42  Plus jottings 60 – 20 = 40 5 - 3 = 2 40 + 2 = 42
Finding the difference by counting on.	 74 – 27 =  The 'jumps' should be added, either mentally or with jottings according to confidence, beginning with the largest number e.g. 40 + 4 + 3.

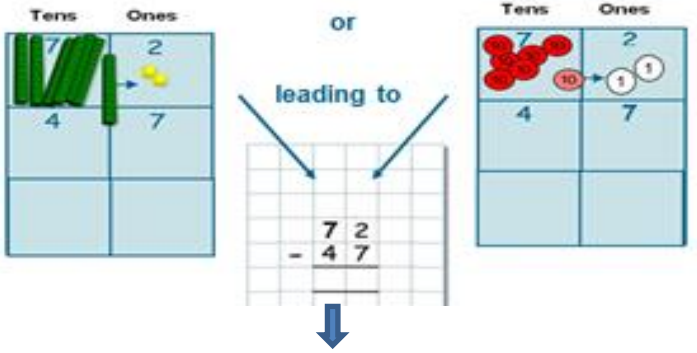
Stage 4

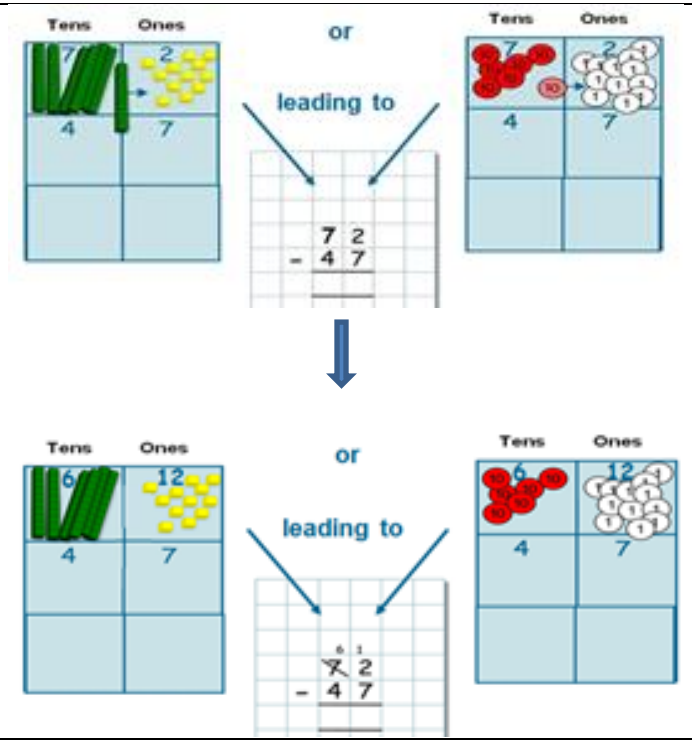
- **Alongside the number line method, children will use practical apparatus to take away the smaller number from the larger number and model exchanging.**

Practical apparatus and drawings are used to model exchanging	Eg 72 – 47 = 25 Take away the 4 tens first Then exchange a ten for 10 ones  Now take away the 7 ones  2 tens and 5 ones are left = 2 5

Stage 5

- **Supported by practical equipment (place value counters and Dienes' apparatus) , children will begin to use the formal short written column method, initially without and then with exchanging.**
- **Once confident, practical equipment will be taken away.**

As children first experience short subtraction written methods, practical apparatus is used to support them and they record the written column method alongside.	Eg 72 - 47 

Exchanging takes places by swapping a ten for 10 ones.	

Stage 6

- **Finally children use the compact column subtraction method as the most efficient form.**
- **The children will learn how to use the method for subtraction of TU – TU numbers and HTU - HTU numbers**
- **They will subtract the most significant digit first (units column).**
- **Once children are confident with HTU – HTU, this should be extended to THTU – THTU.**

Short written column method initially without and then with exchanging. Units digits are subtracted first.	Eg. 76 – 24 = 52 (without exchanging) 76 - 52 24 Eg. 563 – 246 = 317 (with exchanging)

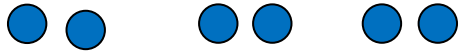
	5 1 5~~6~~3 246 317
Extend the method to numbers with any number of digits and decimal places.	4 15 1 ~~5~~~~6~~7.8 -478.5 89.3 Line decimal points up underneath each other.

MULTIPLICATION

Stage 1

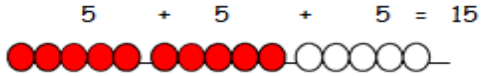
- **Lots of practical work and counting of sets of objects will take place.**
- **Pictorial representations will be used to show groups of objects.**
- **Children will learn that multiplication is a way of grouping.**
- **They will be taught how to multiply by using repeated addition.**
- **Children will begin to be introduced to the vocabulary of multiplication.**

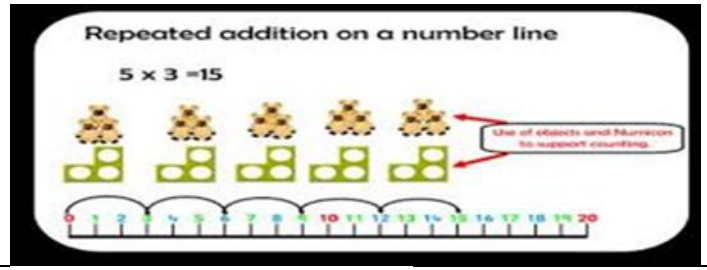
Pictorial representations	
Real life contexts	How many fingers on 2 hands? How many sides on 3 triangles? How many legs on four ducks?
Counting in repeated groups	 How many socks are there?

Making the link with repeated addition.	 How many wheels are there altogether? 2 + 2 + 2 = 6  How many fingers can you see? How much money do I have? 
Grouping / lots of / sets of	3 lots of 2 2 + 2 + 2 

Stage 2.

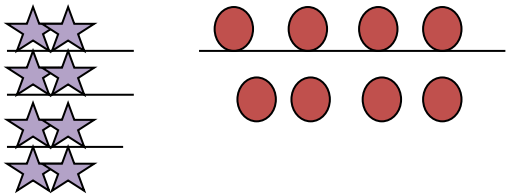
- **Children continue to use repeated addition to carry out multiplication tasks and represent their counting on a bead string or a number line.**
- **Lots of practical work and counting will be used to help children understand that multiplication is a way of grouping and it is the combination of sets of objects or numbers.**
- **Children will be introduced to the symbol X alongside repeated addition.**

Bead strings	 Children count out three lots of 5, then they count the beads altogether.
Number lines	 10p + 10p + 10p + 10p + 10p = 50p 10p × 5 = 50p 5 hops of 10 Children count on in groups of 10.
Linking repeated addition and multiplication	3 x 6 or 6+6+6 or 3 lots of 6

	The link can also be made using a number-line. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 
Introducing the x symbol	$5+5+5+5+5+5=30$ $5\times6=30$ 

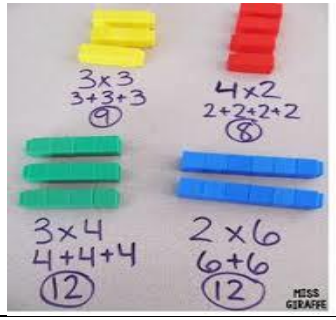
Stage 3

- **It is important to be able to visualise multiplication as a rectangular array. This helps children develop their understanding of the commutative law (ie numbers can be multiplied in any order and you will still get the same answer)**
- **Children will use pictorial representations (eg arrays) and may use rings to show groups.**

Arrays show that multiplication is commutative	4 x 2 or 2 x 4 

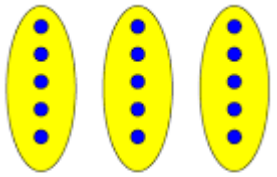
4 lots of 3
4 x 3

2 x 3 = 6 and 3 x 2 = 6



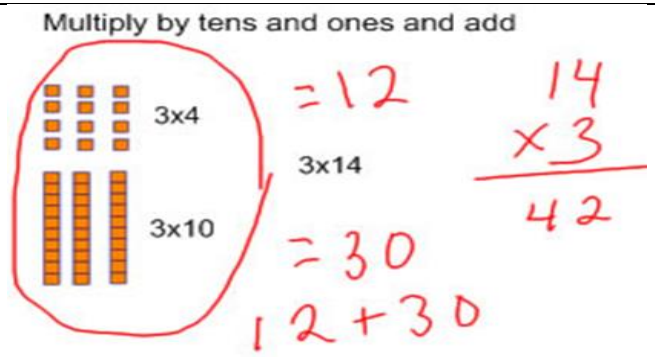
Stage 4

- Children will look at the relationship between division and multiplication.
- They will be introduced to the idea of multiplication as the inverse of division.
- Multiplication cards will be sent home weekly with children from Year 2 onwards

Multiplication is the inverse of division	Eg 15 ÷5=3 and 3x5=15  'How many groups of 5?' '15 shared equally between 3 people is…?' '15 divided by 3 equals 5' '15 divided by 5 equals 3' 15 ÷ 5 = 3 15 ÷ 3 = 5

Stage 5

- **The link between arrays and the multiplication is made clear to children by the use of place value apparatus such as place value counters and Dienes.**
- **Multiplication will take place through partitioning.**
- **This is the children's first exposure to the distributive law of multiplication and children should be given plenty of opportunity to explore this .**

Using practical apparatus to show the distributive law of multiplication	
The distributive law definition	The distributive law means that a number is **partitioned** and then each part of that number is multiplied, before the answers are added back together to form a final total. Eg In the sum 13 x 4 the number 13 is partitioned into Tens and Units. So 13 becomes 10 and 3. Each part of this number is then multiplied by 4. 4 x 13 4 x 10 = 40 4 x 3 = + 12 Total 52
Multiplication through partitioning. The tens column is multiplied first Without, then with carrying digits over when adding the total.	Without carrying digits over for the total. 4 x 14 4 x 10 = 40 4 x 4 = + 16 56 With carrying digits over for the total. 16 x 7 6 x 7 = 42 10 x 7 = + 70 = 112 1

Stage 6

- **Children will be introduced to the expanded short multiplication column method, which still uses partitioning.**
-

Steps in the expanded short multiplication method	**The first step is to represent this method of recording in a column format, but still showing the working down the side.** **Children should be expected to multiply the units first which enables them to move more easily towards the compact method later on.** **Children will describe what they do by referring to the actual values of the digits in the columns. For example, the second step in the sum below (35 × 4) is 'thirty multiplied by four', not 'three times four', although the relationship 3 × 4 should be stressed. (eg If**

	we know that 3 x 4 = 12 then we also know that 30 x 4 = 120)
Expanded short multiplication method TH x U Use with increasingly larger numbers. HTU x U THTU x U	35 X 4 20 (4x 5) + 120 (4 x 30) 140 78 x 9 72 (9 x 8) + 630 (9 x 70) 702 1 345 x 7 35 (7x 5) 280 (7 x 40) 2100 (7 x 300) 2415 1

Stage 7

- **Children will then move onto using the compact short written method for multiplication.**
- **The recording is reduced further, with the carried digits recorded below the line.**

Short Written method TU x U Then use increasingly larger numbers HTU x U THTU x U And with different contexts such as money	35 X 4 140 2 78 x 9 702 7 345 x 7 2,415 33 £3.55 x 9 = £3.55 x 9 £31.95 4 4

Stage 8

- **As children's confidence with the method grows, they will use larger whole numbers, decimals and in a range of contexts eg money.**
- **The long multiplication method will be used to multiply 2 digit numbers.**
- **The method will be used with a wide range of contexts (eg money)**

Long multiplication for multiplying by 2 digit numbers
TU x TU
HTU x TU
THTU x TU

Starting with the expanded method

53
X 16
18 (6 x 3)
300 (6 x 50)
30 (10 x 3)
+500 (10 x 50)
848

Leading to a more compact method

53
x 16
3 1 8 (x6)
+ 5 3 0 (x10)
8 4 8

Finally leading to this compact method with increasingly larger numbers:

			5	3
		x	4	6
			1	
		3	1	8
		1		
+	2	1	2	0
	2	4	3	8

Decimal multiplication X 1dp X 2dp X mixed decimals	**-By counting how many numbers appear after the decimal place** eg- 23.5 x 56.4 235 x 564= 132540 23.5 x 56.4 = 1325.40 **-By x and ÷ by 10/100** Eg 6.04 x 7 Work out 604 x 7 instead (this number is x 100 bigger) 604 x 7 4228 2 → then divide the total by 100 to reach the final answer = 42.28

Key Multiplication Facts-

YR: counting in 2s
Y1: x2,10
Y2: x2, x5,x10
Y3: x2, x3, x4, x5, x8, x10
Y4 All x and ÷ facts up to 12 x 12
Y5 and Y6: All x and ÷ facts up to 12 x 12 plus decimal x and ÷ facts.

Because the National Curriculum for maths is so extensive, there is an expectation that parents will help their children learn their times tables at home.
All Pupils are expected to know their times tables facts up to 12 x 12 by the end of Year 4.
The Multiplication Tables Check (MTC) was officially announced by the Department for Education (DfE) in September 2017. It will be administered for children in Year 4, starting in the 2019-20 academic year. More information onn this can be found at this link: https://www.theschoolrun.com/new-primary-school-times-tables-tests-explained

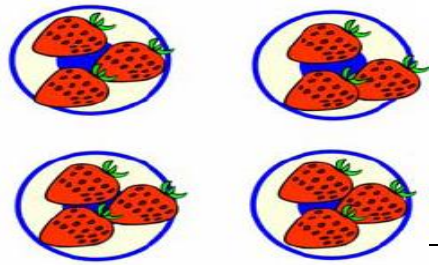
÷ DIVISION ÷

Stage 1

- **Children are encouraged, through practical experiences, to develop physical and mental images of sharing things out equally.**

Practical activities in real life contexts	Eg. Practically sharing food out between people Old Bear's tea party

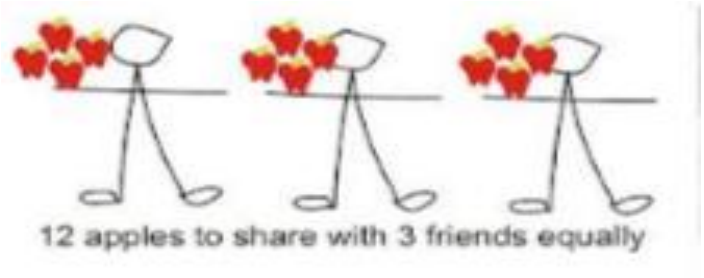
12 strawberries shared between 4 people



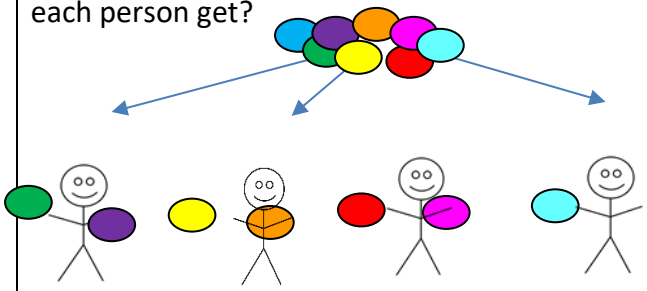
Stage 2

- **Children make recordings of their work as they solve a problem where they share objects out equally.**

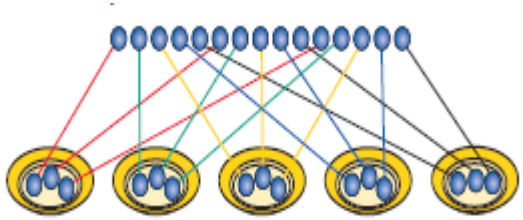
Using jottings	Eg.



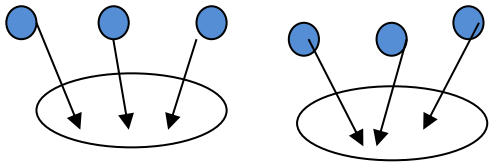
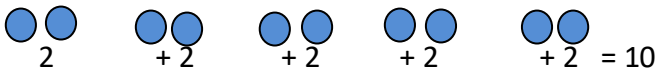
8 sweets are shared between 4 people how many will each person get?

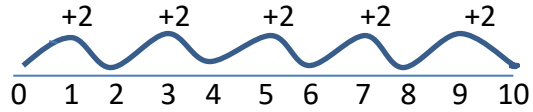
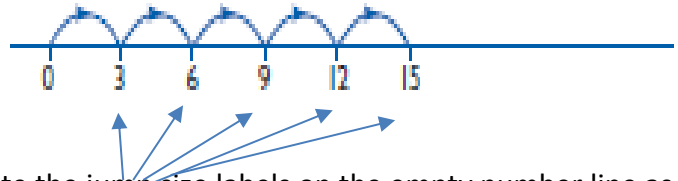
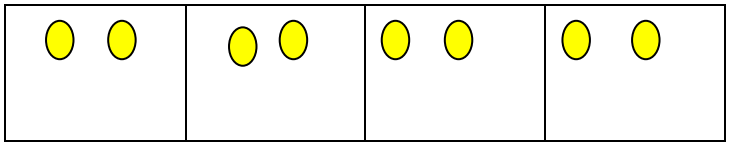


15 peas shared out equally between 5 plates



- **Division is also** **remainders)**
- **Children contin** **contexts and al**
- **The division sign will be introduced and used alongside the recordings**

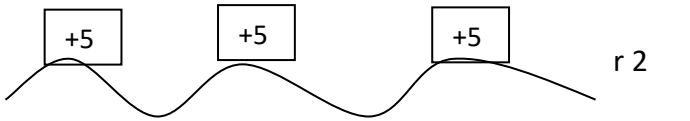
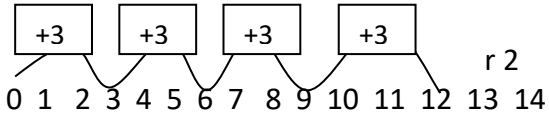
Division as grouping	Eg.  Divide 50 coins into groups of 10 .  There are 10 coins in each group. 50 divided into groups of 10, equals 5 So 50 ÷ 10 = 5 0r 5 groups with 10 in each group, equals 50 So, there are 5 groups of 10 in 50. Or 6 tennis balls grouped into threes  There are 3 in each group so 6 ÷ 3 = 2
Division as repeated addition	How many 2s are there in 10? 

	so there are five 2s in 10 or 10 ÷ 2 = 5
Division as repeated addition on a labelled number line (without remainders)	This can also be shown on a number line How many 2s are there in 10? 10 ÷ 2 = 5 
Counting on labelled and then empty number lines (without remainders)	15 ÷ 3 = 5  Write the jump size labels on the empty number line as you make the jumps.
Division shown as arrays	8 ÷ 4 = 2 

Stage 4

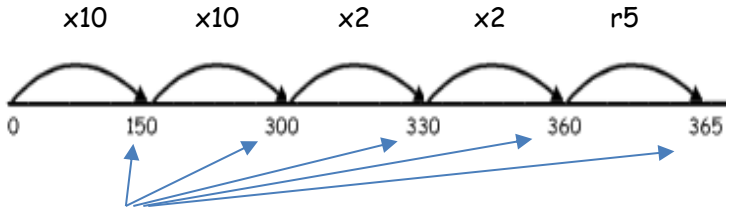
- **Division is also taught as repeated addition on a labelled number line with remainders.**
- **Children will relate division to its inverse, multiplication.**

- **Children will be exposed to different forms of division questions**

Division with remainders through repeated addition and 'How many left over?'	Eg. 17 ÷5= 3 r 2  14 ÷ 3= 4 r 2 
Inverse relationship with multiplication (both with and without remainders)	Eg. (including remainders) What is 17 ÷5 ? Use 17. What is the closest you can get to 15 in 5x table = 15 (3 lots of 5). And how many left over? = 2 So 17 ÷5 = 3 r 2
Types of questioning used	When discussing division, ask: 'How many threes are in 15?' as well as: 'What is 15 divided by 3?' to help children relate division to its inverse multiplication

Stage 5

- **Division on an empty number line will be used with larger numbers**

Using an empty number line but with increasingly larger numbers 2d ÷ 1d 3d ÷ 1d 3d ÷ 2d	Division will be taught as counting on an empty number line E.g 365 ÷ 15=  Write the jump size labels on the empty number line as you make the jumps <u>This number line method explained:</u> The first jump is 10 lots of 15 = 150 The second jump is 10 lots of 15 (=150) = 300 The third jump is 2 lots of 15 (= 30) = 330 The forth jump is 2 lots of 15 (= 30) = 360 The last jump is 5 left over = 365 So 24 lots of 15 r 5 **Final answer is: 365 ÷ 15=24 r 5**

Stage 6

- ***Once children have developed a sound understanding of division, they can move onto the 'formal written method'***

of short division.

- **The short division method is used both with and without remainders.**
- **Until the summer term of Year 6 (for calculations where numbers with up to 4 digits are divided by a single digit number and also 4 digits divided by a 2 digit number) children are expected to use short division methods.**

Short Division Written Method (without remainders) Increasingly larger numbers will be used TU ÷U HTU ÷U THTU ÷U	Eg Simple Calculations without remainders: **<u>3 digit</u>** 369 ÷3= 1 2 3 3 ⟌ 3 6 9 Final answer is: 369 ÷3=123
Short Division Written Method (with remainders) Increasingly larger numbers will be used HTU ÷ U THTU ÷ U	Eg More complex calculations with remainders 192 ÷ 6 = 3 2 6 ⟌ 1 ^{1}9 ^{1}2 Final answer is: 192 ÷ 6 = 32 Eg 197 ÷ 7 = 2 8 r 1 7 ⟌ 1 9 $_{5}$7 Final answer is: 197 ÷7= 28r1 Eg 3625 ÷ 8 = 4 5 3 r1 8 ⟌ 3 6 $_{4}$2 $_{2}$5 Final answer is: 3625 ÷ 8= 453 r 1

HTU ÷ TU THTU ÷ TU	Eg 7990 ÷ 34 = 2 3 5 34 ⟌ 7 $_{7}$9 $_{11}$9 $_{17}$0 Final answer is: 7990 ÷ 34= 235 Jottings are made down the side for jumps of 34 → 34 68 102 136 170
Use the method in different real-life contexts such as with money or measures	Eg. £7.84 ÷ 7 = £ 1. 1 2 7 ⟌ £ 7. 8 $_{1}$4 Final answer is: £1.12 Eg. 3.92kg ÷ 7 = 0. 5 6 7 ⟌ 3. $_{3}$9$_{4}$2 Final answer is: 0.56kg

Stage 7

- **Children will practise writing remainders as fractions and then decimals**

Short division written method and converting remainders to fractions	Eg 256 ÷5= 51 r1 = r 1 / 5 5 ⟌ 2 25 6 There is 1 left over out of the 5 that you are dividing by Final answer is : 256 ÷5 = 51 1 / 5
Short division written method and converting remainders to decimals	Eg 256 ÷5= 51.2 5 ⟌ 2 25 6 .10 Final answer is: 256 ÷5= 51 .2 Note: The fraction 1/5 in the previous answer is the same as (or equivalent to) the decimal answer 0.2 Eg 247 ÷8= 30.875 8 ⟌ 2 24 7 .70 60 40 Final answer is: 247 ÷8= 30 . 875 Eg 8007 ÷ 34 = 235.5 34 ⟌ 8 80 120 187 . 170 Final answer is: 8007 ÷ 34= 235.5 Jottings are made down the side for jumps of 34 → 34 68 102 136 170

Stage 8

- **In the summer term of Year 6, children will be familiarised with the vertical long division written method for calculations of up to 4 digits divided by a 2 digit number.**
- **Children will be encouraged to use their knowledge of times tables and multiples to speed this method up and will make jottings down the side before they begin the calculation.**
- **Remainders will also be written as fractions and decimals.**
- **The long division written method will be practised in a range of real-life contexts, such as with money and measures.**

Vertical Method
(Chunking)

Eg 364m ÷ 13 =

28
13 ⟌ 3 6 4
- 2 6
1 0 4

Down the side, of the page, pupils use jottings to count on in multiples of the divisor

eg.
13 = x1 lot
26 = x2 lots
52 = x4 lots
104 = x8 lots
130 = x10 lots

Final answer is: 364m ÷ 15 = 28m

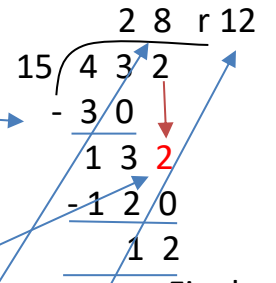
Vertical Method (explained)

Eg. 432 ÷ 15 =

Down the side, pupils use jottings to count on in multiples of the divisor

eg.

15 = x1 lot
30 = x2 lots
60 = x4 lots
120 = x8 lots
135 = x9 lots
150 = x10 lots



Final answer is: 28 r 12
or: 28 12/15 = 28 4/5
or: 28 . 8

<u>The method broken down</u>

Step 1
Say 43 ÷ 15 = 2 lots of 15 which equals 30

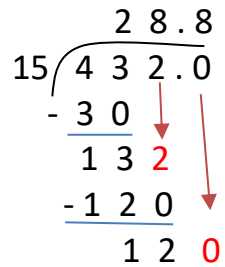
Step 2
Bring down the number 2 from the sum

Step 3
Say 132 ÷ 15 = 8 lots of 15 which is 120

Step 4
There is 12 left over. This is the remainder.

Step 5
The remainder can also be written as a fraction or a decimal

Eg. Answer as a decimal



eg.

15 = x1 lot
30 = x2 lots
60 = x4 lots
120 = x8 lots
135 = x9 lots
150 = x10 lots

K Speak **Policy Date:** Spring 2019 **Review Date:** Spring 2021

Ratified by Governing Body: