Bordon Infant School

Mental and Written Calculation Policy

Updated September 2016

This policy aims to

1. Provide clear mental recall benchmarks for each year group.

2. Provide a clear and consistent progression of written calculation in each year group to ensure consistency throughout the school.

3. Ensure that the teachings of mental and written calculations at Bordon Infants is firmly based within a problem solving context.

4. Emphasise the correct use of mathematical vocabulary, setting out a clear progression of vocabulary use throughout the school.

This policy has been updated to take into account The Primary Framework and the changes in progression that are found in the New Primary Curriculum (2014). It outlines the standards that we expect to be taught in each year group. During their time at our school children will be encouraged to see mathematics as both a written and spoken language.

Early Years Foundation Stage (EYFS)

Whilst EYFS works developmentally to support the children to play and explore, actively learn, create and think critically the expectation is that children will meet the Early Learning Goals (ELGs) in Mathematics by the end of EYFS. In acknowledging this we realise, that if children are not ready to meet these requirements, further provision at this level is needed to ensure a smooth transition.

Key Stage One

Jottings to support Mental Methods

Although the focus of the policy is on developing written methods it is important to recognise that the ability to calculate mentally is developed in conjunction with these. In every written method there is an element of mental processing. Teachers will support and guide children through the following important stages:

• developing the use of pictures (diagrams) and a mixture of words and symbols to represent numerical activities;

• use of jottings (including a number line) to aid a mental strategy;

• using written methods.

Using Written Methods

Sharing written methods with the teacher encourages children to think about the mental strategies that underpin them and to develop new ideas. Therefore written recording helps the children to clarify their thinking whilst supporting and extending the development of more fluent and sophisticated mental strategies. It is good practice when first introducing a method for the range of numbers to be within what the pupil can calculate mentally so that they can self-assess their success at using a method. Once pupils are able to perform a written method successfully they should be encouraged to complete calculations independently choosing the most appropriate way of doing so.

Progression of Written Methods

Taking account of a range of different learning approaches including visual, auditory and kinaesthetic, the written methods for each of the four operations demonstrate progression by building upon skills and knowledge learnt in each year at school.

A pupil should not be targeted at achieving an age-expected method if they are not able to successfully use the method for a previous age-group.

As a school we are taking an approach which ensures consistency across the school using the same few methods across both EY and KS1.   With this in mind, it should be easier for pupils to work on calculations using the method for their appropriate ability.

Reviewed September 2016 KC

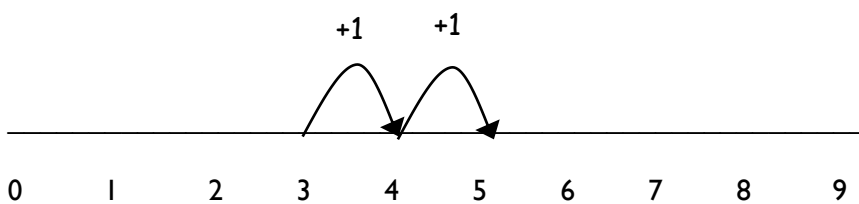| **Counting** |
|---|
| Children use meaningful concepts to help them count reliably with numbers from 1 to 20, place them in order and say which number is one more or one less than a given number. They start using number tracks to develop a mental number line. |

Addition

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation.

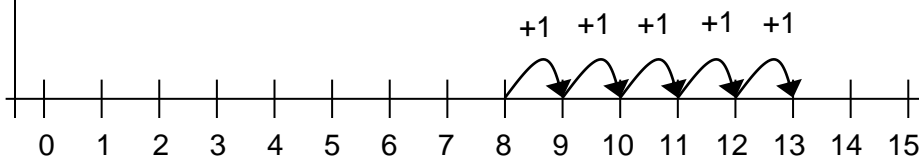They develop ways of recording calculations using pictures, etc.

They use number lines and practical resources such as Numicon to support calculation and teachers *demonstrate* the use of the number line.

3 + 2 = 5
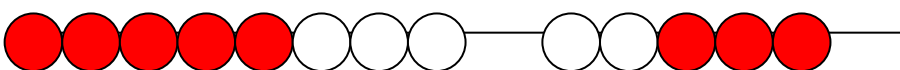

Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13

Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.
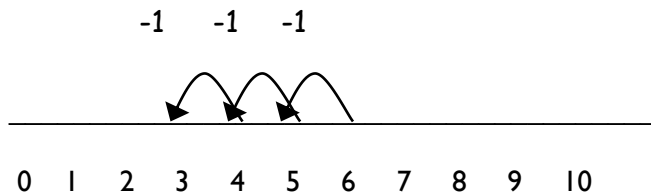
Subtraction

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.
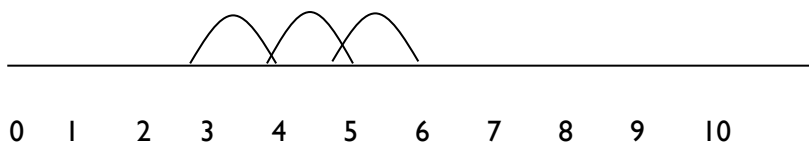

They use number lines and practical resources such as Numicon to support calculation. Teachers *demonstrate* the use of the number line.
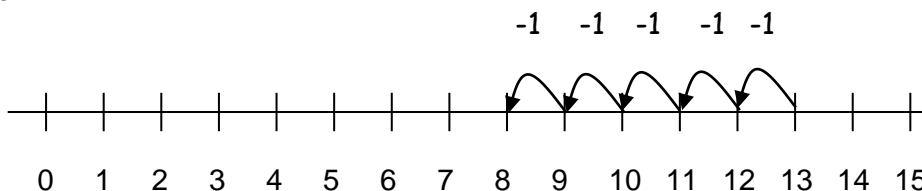
$6 - 3 = 3$

The number line should also be used to show that 6 - 3 means the 'difference between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.
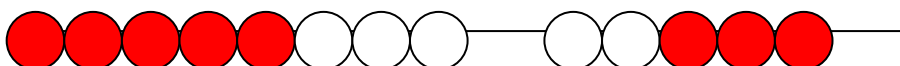

Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

$13 - 5 = 8$

Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.

$13 - 5 = 8$

Reviewed September 2016 KC

Multiplication

Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups.

Division

Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

Children will engage in a wide variety of songs and rhymes, games and activities. In practical activities and through discussion they will begin to solve problems involving halving and sharing. For instance share the apples between two people. 'Half of the apples for you and half of the apples for me.'
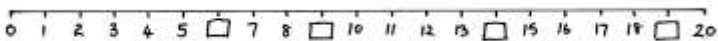
Number fact benchmarks Children in Year 1 should be able to:	Working mentally with jottings children in Year 1 should be able to:	Useful resources and websites
- Number bonds to 20, e.g. 3 + 7 (and 13+7) or what to add to a single-digit number to make 20, e.g. 3 + □ = 10 - Addition facts for totals to at least 5, e.g. 2 + 3, 4 + 3 - Addition doubles for all numbers to at least 10, e.g. 8 + 8 - Count in 2s, 5s, and 10s.	- Add or subtract a pair of single-digit numbers, e.g. 4 + 5, 8 – 3 - Add or subtract a single-digit number to or from a teens number, e.g. 13 + 5, 17 – 3 - Add or subtract a single-digit to or from 10, and add a multiple of 10 to a single-digit number, e.g. 10 + 7, 7 + 30 - Add near doubles, e.g. 6 + 7, 5 + 6 - Solve problems and missing number calculations using pictures and objects	**Click on the hyperlink** Counting on and back ITP Numbergrid ITP Interactive 100 square Counting on and back ITP Interactive bead string A great number line to practise counting in 1s, 2s, 3s up to tens. Children can watch how the frog jumps to each new number.

Using a number line to support counting in Year 1

Continue to use number tracks, but gradually introduce and make links with the number line, initially from 1-20, then 1-50.
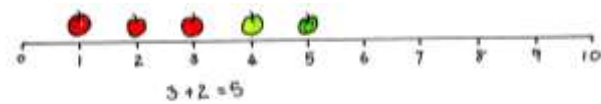
Continue to use meaningful contexts to model counting and calculating using the number track and then the number line.

• Use the number line to develop a strong mental image of numbers when **counting** to 20, then beyond, forward and backwards in ones
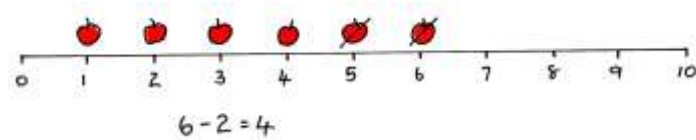

• Make links with the practical activity of counting how many objects there are altogether (addition) or taking away objects from a group (subtraction), to jumps on a number line

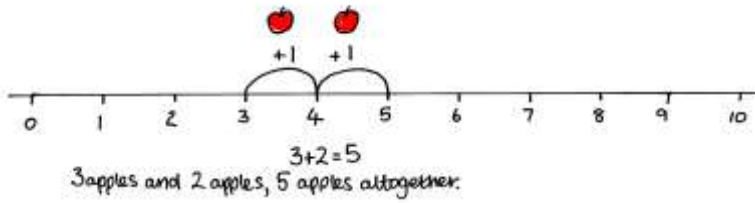If I have 3 apples and 2 apples, I have 5 apples altogether.

3 + 2 = 5

If I have 6 apples and I eat 2, I have 4 apples left.
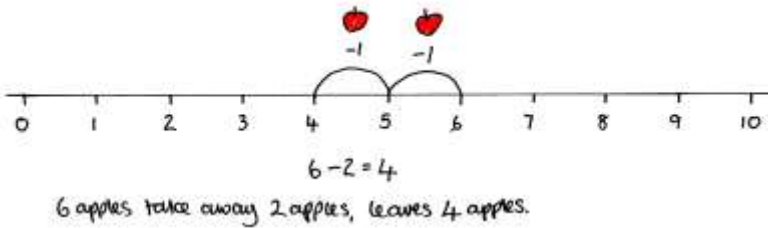

6 – 2 = 4

Using a number line in Year 1 to support calculation

Link the practical activity of counting on or back to recording using a structured number line

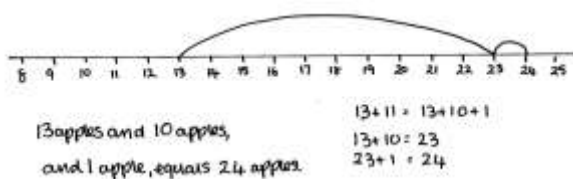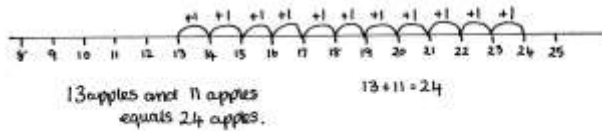*If I have 3 apples and 2 apples, I have 5 apples altogether*

$3+2=5$

3apples and 2 apples, 5 apples altogether.

If I have 6 apples and I eat 2, I have 4 apples left.

$6-2=4$

6 apples take away 2 apples, leaves 4 apples.

Children begin to use the structured number line independently as a tool to support mental calculation. Alongside this they use number sentences to record the calculation.
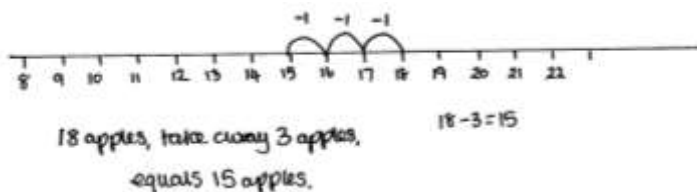
Use the structured number line to support early place value knowledge i.e. addition of 2 'teen numbers' by partitioning one number and counting on in tens and ones.

If a farmer has 13 apples on one tree and 11 apples on another. How many apples does he have altogether?

13apples and 11 apples
equals 24 apples.

$13+11=24$

13apples and 10 apples,
and 1 apple, equals 24 apples

$13+11 = 13+10+1$
$13+10 = 23$
$23+1 = 24$

- Support subtraction of a single digit by counting back from a larger number

If a farmer has 18 apples on a tree and he picks 3. How many apples will be left?
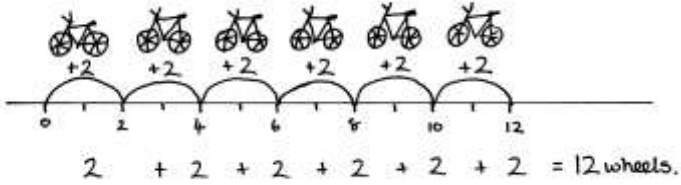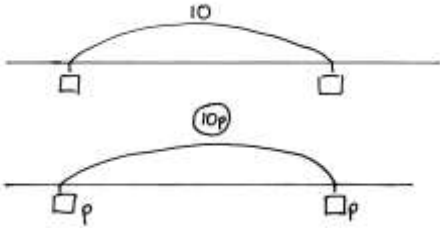

18 apples, take away 3 apples,
equals 15 apples.

$18-3=15$

Using the numberline and arrays to support other concepts in Year 1

Support counting forwards or backwards in 2's, 5's and 10's

If I have 6 bicycles, how many wheels would there be?
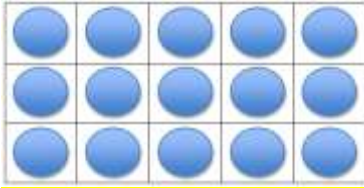

$$2 + 2 + 2 + 2 + 2 + 2 = 12 \text{ wheels.}$$

What could the numbers be?

Children are taught to make connections between arrays, number patterns, and counting in twos, fives and tens.

3 lots of 5
3 groups of 5

If I have 6 bicycles, how many wheels would there be?

YEAR 2

Calculating with numbers to **100** Learning about numbers to **300**

Number fact benchmarks Children in Year 2 should be able to:	Working mentally with jottings children in Year 2 should be able to:	Useful resources and websites
• Recall addition and subtraction facts for all numbers up to 20, e.g 11 + 9, 20 – 7 • Be able to count forwards and backwards from any number in 2s, 3s, 5s form 0 and in 10s from any number • All pairs of multiples of 10 with totals up to 100, e.g. 30 + 70, or 60 + □ = 100 • Know what must be added to any two-digit number to make the next multiple of 10, e.g. 52 + □ = 60 • Addition doubles for all numbers to 20, e.g. 17 + 17 and multiples of 10 to 50, e.g. 40 + 40	• Add or subtract a pair of single-digit numbers, including crossing 10, e.g. 5 + 8, 12 – 7 • Add any single-digit number to or from a multiple of 10, e.g. 60 + 5 • Subtract any single-digit number from a multiple of 10, e.g. 80 – 7 • Add or subtract a single-digit number to or from a two-digit number, including crossing the tens boundary, e.g. 23 + 5, 57 – 3, then 28 + 5, 52 – 7 • Add or subtract a multiple of 10 to or from any two-digit number, e.g. 27 + 60, 72 – 50 • Add 9, 19, 29, … or 11, 21, 31, … • Add near doubles, e.g. 13 + 14, 39 + 40	A great number line to practise counting in 1s, 2s, 3s up to tens. Children can watch how the frog jumps to each new number. Counting on and back ITP Interactive bead string Place value ITP Partition numbers Numbergrid ITP Interactive 100 square – greats for learning about primes, factors, multiples

USING A NUMBER LINE IN YEAR 2
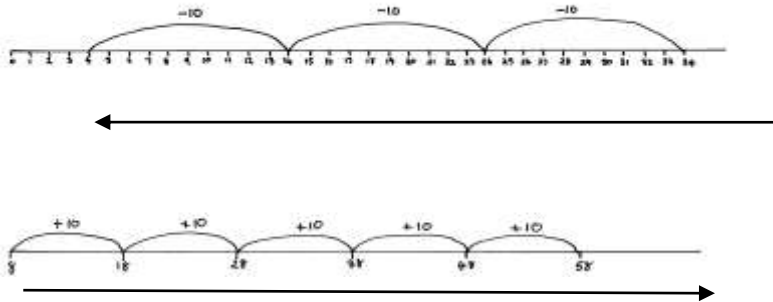
Calculating with numbers to **100**   Learning about numbers to **500**

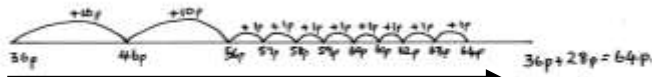| To support counting |
| --- |
| Counting on and back in 1's, 10's and 100's from any two digit number.
Counting on and back in 2's, 3's and 5's from 0.
Explore patterns using jumps of a constant size, forwards and backwards, starting from any number. |

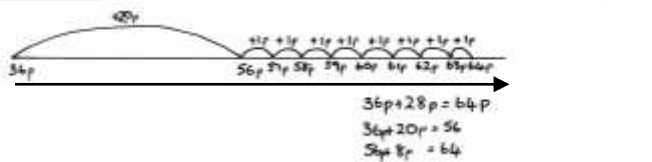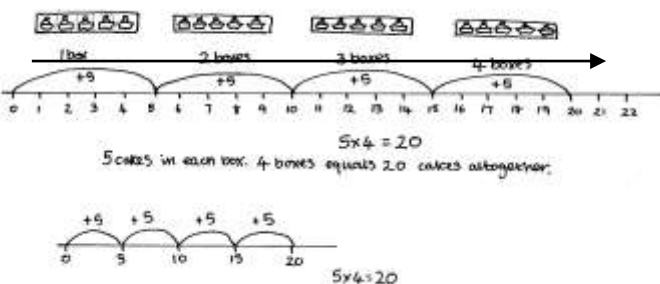| Adding pairs of numbers in Year 2	Subtracting pairs of numbers in Year 2

Adding two, two digit numbers by partitioning one number and counting on in tens and ones then multiples of ten and ones
 	
I have 36p and my mum gives me 28p pocket money. How much money do I have altogether?
 	
FIRST
 	
THEN
 	
When secure moving to 2 digit column addition without carrying *(this is not a substitute for working mentally but should be explained to the children as.. 'the beginnings of a method that will help you to tackle larger and trickier numbers')*
 	
   85
+ 12
Use place value and number facts to solve problems.
	Subtracting two, two digit numbers by partitioning the second number and counting back in tens and ones then multiples of ten and ones
	
	I have 36p, I spend 28p. How much do I have left?
	
	FIRST
	
	THEN
	
	When secure moving to 2 digit column subtraction without borrowing
	   85
	- 12

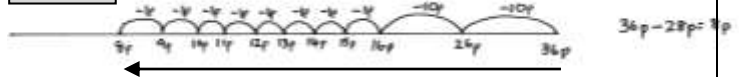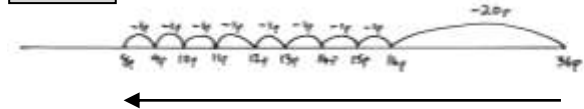| Multiplication on a number line in Year 2	Multiplication on a number line in Year 2
Multiplying through making links to counting on in steps of equal size. (multiples of 2's, 5's and 10's, then other numbers). *There are 5 cakes in one box. How many cakes in 4 boxes?* 5x4 = 20 5 cakes in each box. 4 boxes equals 20 cakes altogether. 5x4=20	Dividing through making links to counting back in steps of equal size. (multiples of 2's, 5's and 10's) *I have 20 cakes, I can fit 5 cakes in a box. How many boxes will I need?* 20 cakes divided into boxes of 5, I need 4 boxes. There are 4 groups of 5 in 20. 20÷5 = 4 boxes

Multiplication and division using arrays in Year 2	
Use arrays to help teach children to understand the commutative law of multiplication, and give examples such as **3 x __ = 6.**	

YEAR 3

Calculating with numbers to **1000**   Learning about numbers to **2000**

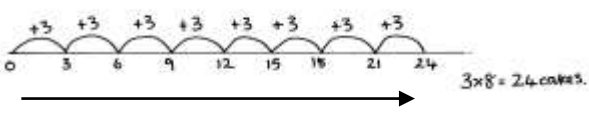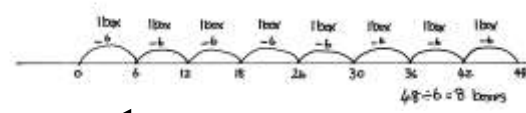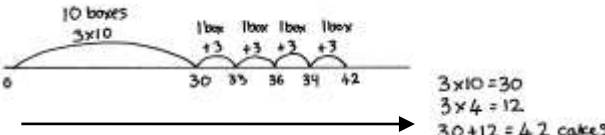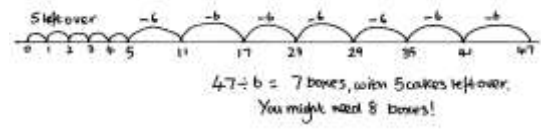| Number fact benchmarks **Children in Year 3 should be able to:**	Working mentally with jottings children in **Year 3** should be able to:	Useful resources and websites
• To know multiplication and division facts for 2, 3, 4, 5, 8, & 10 x times tables. (Recall forwards, backwards, any order and division facts) • To recognise multiples of 2, 5 & 10 upto 1000 • To know all number bonds for each number to 20 e.g 8 +9, 17 -9 • To know sums and differences of multiples of 10 to 100. • To know number pairs of multiples of 10 to 100. • To know pairs of numbers to 100 e.g 34 + ? = 100, 100 – 19 = 81 • To know addition doubles for multiples of 10 to 100 e.g 90 + 90 = 180 • Know pairs of multiples of 100 to 1000 • Count on and back from any given number in 10s and 100s • Recall doubles and corresponding halves to 15 + 15 / half of 30 • Add and subtract fractions with the same denominator within one whole.	• Add and subtract groups of small numbers, e.g. 5 – 3 + 2 • Add or subtract a two-digit number to or from a multiple of 10, e.g. 50 + 38, 90 – 27 • Add and subtract two-digit numbers e.g. 34 + 65, 68 – 35 • Add near doubles, e.g. 18 + 16, 60 + 70 • Partition 2 & 3 digit nos and know what each digit represents • Add & subtract multiple of 10 from 2 digit number • Add & subtract multiple of 10 from 3 digit number • add/subtract 9 or 11 by adding/subtracting 10 then adjusting • add/subtract 19 or 21 by adding 20 and the adjusting • Add and subtract mentally and using the written methods, including; a three digit number and ones a three digit number and tens a three digit number and hundreds	**Click on hyperlink** Multifacts ITP – Times table practice Difference ITP – Showing difference visually Grouping ITP - Division Numberdials – Times tables Speedgrid challenge Times table practise Numbergrid ITP Interactive 100 square

ADDITION & SUBTRACTION ON A NUMBERLINE IN YEAR 3

Calculating with numbers to **1000**   Learning about numbers to **2000**

Stage 1 Column addition without carrying	Stage 1 Column addition without exchanging
There are 38 fiction books and 51 non-fiction books in the library. How many books are there in the library? 38 +51 89 • Start with units column • Move to tens column • Encourage children to line columns up accurately Once confident move to carrying stage	*There were 72 books in the library. Children borrowed 21 of them. How many books were left in the library?* 72 -21 51 • Start with units column • Move to tens column • Encourage children to line columns up accurately Once confident move to borrowing stage
Stage 2 Column addition with carrying	**Stage 2 Column subtraction with exchanging (used to be called borrowing)**
59 girls went to the disco and 33 boys. How many children were there at the disco? $\quad$ 5 $\quad$ 9 + $\quad$ 3 $\quad$ 3 $\quad$ 9 $\quad$ 2 $\quad$ 1 • Start with units column • Carry ten below the line • Add tens column remembering ten **carried below the line (exchange)** • Encourage children to line up column s accurately **Progress to calculations involving larger 3 digit numbers up to 1000.**	*There were 134 children at the disco. 19 went home. How many children were left?* $\quad$ 1 $\quad$ 3^2 $\quad$ ^{14} - $\quad$ $\quad$ 1 $\quad$ 9 $\quad$ 1 $\quad$ 1 $\quad$ 5 • Start with units column • 4 – 9 you can't do. • Exchange a 10 from tens column. • 3 becomes 2 in tens column (reinforce this is actually 30 – 20) • Ten moves to the units column and 4 becomes 14. • Encourage children to line up column accurately **Progress to calculations involving larger 3 digit numbers up to 1000.**
	Stage 3 Subtraction as difference
	Sam has 28 pencils and Sarah has 35 pencils. How many more pencils does Sam need to have the same number of pencils as Sarah?

The difference between 28 and 35
35 – 28 = 7 |

MULTIPLICATION AND DIVISION ON A NUMBERLINE IN YEAR 3

Stage 1 Multiplication on a number line counting on in equal steps	Stage 1 Division through making links with counting back in steps of equal size
Multiplying through making links to counting on in steps of equal size. (multiples of 2's, 3, 4, 5, 6's and 10's, then other numbers). *There are 3 cakes in one box. How many cakes in 8 boxes?* 3×8 = 24 cakes.	Multiplying through making links to counting on in steps of equal size. (multiples of 2's, 3, 4, 5, 6's and 10's, then other numbers). *I have 48 cakes, I can fit 6 cakes in a box. How many boxes will I need?* 48÷6 = 8 boxes
Stage 2 Using known facts to multiply teens numbers by a single digit number	**Stage 2 Understand that some division calculations have remainders and make decisions about rounding up or down depending on context**
Using known facts to multiply a 'teens number' by a single digit *There are 3 cakes in one box. How many cakes in 14 boxes?* 3×10=30 3×4 =12 30+12 = 42 cakes	*I have 47p and lollipops cost 6p. How many lollipops could I buy? Would I have any money left over?* 47÷6 = 7 boxes, with 5 cakes left over. You might need 8 boxes! Remainder after division ITP

Reviewed September 2016 KC

Work out multiplication facts not known by repeated addition or other taught mental strategies (e.g. by commutative law, working out near multiples and adjusting, using doubling etc.) Strategies to support this are repeated addition using a number line, bead bars and arrays:

9 x 4 = 36

EYFS & KEY STAGE 1 BORDON INFANT SCHOOL VOCABULARY PROGRESSION
(Words in the **bold** are new to the year group)

YEAR	Addition & Subtraction	Multiplication & Division
R	add, more, and make, sum, total altogether score double one more, two more, ten more… how many more to make… ? how many more is… than…? take (away), leave how many are left/left over? how many have gone? one less, two less… ten less… how many fewer is… than…? difference between is the same as	
1	**+,** add, more, **plus** make, sum, total altogether score double, **near double** one more, two more… ten more how many more to make…? how many more is… than…? ***how much more is…?*** **-, subtract,** take (away), **minus** leave how many are left/left over? how many are gone? one less, two less, ten less… how many fewer is… than…? ***how much less is…?*** difference between ***half, halve*** **=, equals, sign,** is the same as	
2	+, add, ***addition***, more, plus make, sum, total altogether score double, near double one more, two more… ten more… **one hundred more** how many more to make…? how many more is… than…? how much more is…? -, subtract, take away, minus leave, how many are left/left over? one less, two less… ten less… **one hundred less** how many less is… than…? how much fewer is…? difference between half, halve =, equals, sign, is the same as ***tens boundary***	*lots of, groups of* *x, times, multiply, multiplied by* *multiple of* *once, twice, three times,* *four times, five times… ten times…* *times as (big, long, wide and so on)* *repeated addition* *array* *row, column* *double, halve* *share, share equally* *one each, two each, three each…* *group in pairs, threes… tens* *equal groups of* *÷, divide, divided by, divided into, left, left over*

Reviewed September 2016 KC