The Glebe Primary School

'We can and we will'

KS1 Calculation Policy March 2022

Mental and Written calculations

Mission Statement:

At Glebe Primary School, we believe in an ethos that values the whole child. We strive to enable all children to achieve their full potential academically, socially and emotionally.

Introduction:

At Glebe Primary School, children are introduced to the process of calculation through practical, oral, and mental activities. As children begin to understand the underlying ideas, they develop ways of recording to support their thinking. Over time, children learn how to use models and images (such as empty number lines) to support the mental and informal written calculations. As children's mental methods are strengthened and refined, so too are their informal written methods. These methods become more efficient and succinct and lead to efficient written methods that can be used more generally.

The range of methods taught are designed to enable children to:

- Become confident, independent and efficient in their calculations;
- Choose the appropriate operation and methods (from a variety of mental and written methods) rather than rely on formal written methods for all calculations;
- To solve a particular calculation;
- Develop strategies for checking accuracy i.e using the inverse to check their answers.

At whatever stage in their learning, and whatever method is being used, it must still be underpinned by a secure and appropriate knowledge of number facts, along with the mental skills that are needed to carry out the process and judge if was successful.

CPA Approach (Concrete, Pictorial, Abstract)

Concepts should follow the CPA approach where possible. At Glebe Primary School, we initiate the teaching of new concepts through the CPA approach from the Early Years and this is continued throughout the school to support and stretch pupils where appropriate. We aim to allow children as much time as is needed on each of the aspects of the CPA approach and it is understood that children must not be moved on from one aspect to another without a full grasp of the previous one.

INTENT

The overall aim is that when children leave primary school they:

- Have a secure knowledge of number facts and a good understanding of the four operations;
- Are able to use this knowledge and understanding to carry out calculations mentally and apply general strategies to special cases involving bigger numbers;
- Make use of diagrams and informal notes to help record steps and multi-step answers; when using mental methods that generate more information than can be kept in their heads.
- Have an efficient, reliable, compact written method, for each operation, that children can apply with confidence when undertaking calculations that they cannot carry out mentally.

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- Become confident, independent and efficient in their calculations;
- Choose the appropriate operation and methods (from a variety of mental and written methods) rather than rely on formal written methods for all calculations;
- To solve a particular calculation;
- Develop strategies for checking accuracy i.e using the inverse to check their answers.

IMPLEMENTATION

At Glebe Primary School, we do not follow a specific mathematics scheme or framework. Instead, we use resources from well-known mathematical leaders, such as White Rose Maths, to support our teaching. Our teachers use their judgement and skills to source resources that have been matched carefully to the abilities of the children, as well as resources designed to stretch and challenge all abilities.

To add successfully by the end of KS1, children need to be able to:

- Know the vocabulary which indicates addition: sum, total, greater, more etc.
- Recall addition pairs to 10 & 100 (such as 2 + 8 = 10 & 20 + 80 = 100);
- To add three one-digit numbers together, mentally or otherwise;
- Add multiples of 10 (such as 60 +20) using related addition facts (6 + 2) and their knowledge of place value;
- Partition two-digit & three-digit numbers, into multiples of 1, 10 and 100 in different ways, e.g. 45 can be partitioned into 40 + 5; 30 + 15; etc.

To subtract successfully by the end of KS1, children must be able to:

- Know the vocabulary which indicates subtraction: less, fewer, difference etc.
- Recall all addition and subtraction facts to 20 (such as 12 + 8 = 20; 20 – 8 = 12);
- Subtract multiples of 10 (such as 50 -30) using related subtraction facts (5 - 3) and their knowledge of place value;
- Partition two-digit and three-digit numbers into 1s, 10s and 100s, in a number of different ways (such as partition 74 into 70 + 4 or 60 + 14)

To multiply successfully by the end of KS1, children need to:

- Recall all multiplication facts from the 2, 5 and 10 times tables;
- Know the vocabulary which indicates multiplication: multiple, multiply, lots of, double, triple etc;
- Partition numbers into multiples of 1s, 10s and 100s;
- Work out products (such as 70 x 5, 70 x 50, 700 x 5) using the related fact (7 x 5) and their knowledge of place value;
- Add two or more single digits mentally;
- Recognise the multiplication is repeated addition;
- Add multiples of 10 or of 100 using related addition facts and their knowledge of place value;

To divide successfully by the end of KS1, children need to be able to:

- Understand the vocabulary which indicates division: share, groups, half, quarter etc;
- Partition two-digit and three-digit numbers into multiples of 1s, 10s and 100s.
- Recall multiplication and division facts from the 2, 5 and 10 times tables;
- Recognise multiples of 2, 5 and 10, and divide these by a single number using their knowledge of multiplication and division facts;
- Know how to find a remainder, working mentally for example to find the remainder when 48 is divided by 5.
- Understand that multiplication and division are inverse operations.
- Understand division as repeated subtraction

Reviewed: March 2022

To be reviewed: March 2024

CALCULATION PROGRESSION CHART

	Addition	Subtraction	Multiplication	Division
Year 1	• Using **concrete objects and other models** and images to understand addition.	• Using **concrete objects and other models** and images to understand subtraction.	• Using **concrete objects** to understand **multiplication** as “**lots of**” and as arrays (with teacher support).	• Using **concrete objects to understand division** as **sharing** and grouping.
Year 2	• Using concrete objects and models and **images including number lines** for **U+1s, TU+10s, U+U, TU+U** (see mental calculation for further exemplification). • Using **Base 10 apparatus** for **TU + TU** (beginning to set out in columns and recorded as expanded column addition).	• Using **concrete objects** and other models and images including number lines for **U-U, TU-U, TU - 10s** (see mental calculation in the policy for further exemplification)	• Using **concrete objects** and other models and images including **arrays** and number lines to **multiply U x** U and understand its relation to scaling including **doubling**.	• Using **concrete objects** and other models and images **including arrays** and **number lines** to embed understanding of division as “**grouping**” and “**sharing**” and relate **halving** to dividing by 2.

Progression of Challenge- in Calculations

Addition	Subtraction	Multiplication	Division
Choice of method could be mental or written (number line, partitioning etc) based on the calculation.	Choice of method could be mental or written (number line, partitioning etc) based on the calculation.	Mental methods to be used where applicable. Arrays, number lines etc to be used as written methods)	Mental methods to be used where applicable. Sharing, grouping etc to be used as written methods.
U + U - below 10 (5 + 4) U + U - crossing tens boundary (5 + 7) TU + U - below 20 (15 + 4) TU + U – crossing tens boundary (35 + 8) TU + TU – within tens boundary (23 + 34) TU + TU – crossing tens boundary (26 + 48) TU + TU – crossing hundreds boundary (78 + 34) HTU + TU – within	U - U below 10 (5 - 4) TU – U below 20; not crossing tens boundary (15 - 4) TU - U crossing tens boundary (15 – 8; 35 - 8) TU - TU within tens boundary (37 - 14) TU - TU crossing tens boundary (46 – 28) TU - TU crossing hundreds boundary (105 - 17) HTU - TU within tens boundary (138 - 25) HTU - TU crossing	Multiplication of 2, 5 and 10 U x U TU x U (up to 12) Related to 2, 5 and 10 division facts	Division where 2,, 3 5 or 10 is the dividend U ÷ U TU ÷ U Related to 2, 5 and 10 division facts

ADDITION AND SUBTRACTION Year 1	
Number Bonds	**Counting**
• represent and use number bonds and related subtraction facts within 20 (Focus on **number bonds to 10**).	• **count to and across 100**; forwards and backwards- beginning with 0 or 1 or from any given number. • **count**, read and write **numbers to 100** in numerals. • **count** in multiples of **twos, fives and tens** given a number, identify **one more** and **one less**.
Mental Calculations	**Comparing Numbers**

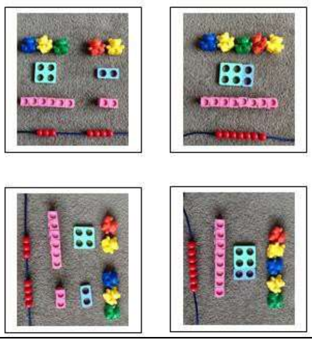
• add and subtract **one-digit & two-digit numbers to 20**, including zero.
  ○ U+U; TU +U, U-U, TU-U **(including +/-0)**
  ○ Begin to apply number bonds to 10 to **derive number bonds to 20**
    ▪ e.g. 8 + 5 = 8 +2 + 3 = 13 (bridging through 10)
    ▪ e.g. If 5 +5 = 10, 5 +6 = 11
    ▪ e.g. 8 + □ = 13
• read, write and interpret mathematical statements involving **addition (+), subtraction (-) and equals (=) signs** (appears also in Written Calculation).
	• use the language of: equal to, more than, less than (fewer), most, least.

Written Calculations	**Identifying, Representing and Estimating Numbers**
• read, write and interpret mathematical statements involving **addition (+), subtraction (-) and equals (=) signs** (appears also in Mental Calculation).	• identify and represent numbers using **objects and pictorial** representations- **including the number line.**
Inverse Operations, Estimating and Checking Answers	**Reading and Writing Numbers**
• NA	• **read and write** numbers **from 1 to 20** in numerals and words.
Problem Solving	**Understanding Place Value**
• solve one-step problems that involve addition and subtraction, using **concrete objects and pictorial representations**, and missing number problems such as: • 7 = 9 - □ or 7 = □ -9	• begin to recognise the **place value** of each digit in a **two-digit** number

ADDITION – Year 1

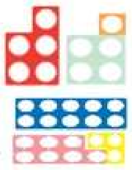
1.

2.



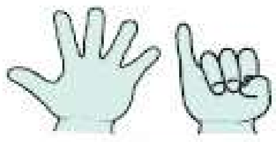
Combining 2 sets of objects into one group and counting practically.
Children combine objects both in the horizontal and vertical position.

5 = 4 + 1

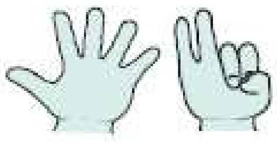


10 = 7 + 3

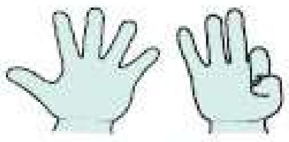
How can I count these shells most easily?



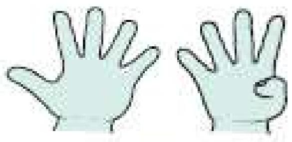
6 is 5 and 1 more
6 = 5 + 1



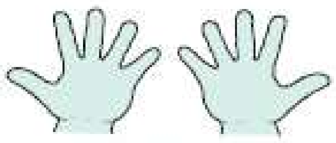
7 is 5 and 2 more
7 = 5 + 2



8 is 5 and 3 more
8 = 5 + 3

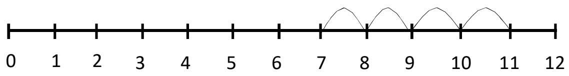


9 is 5 and 4 more
9 = 5 + 4



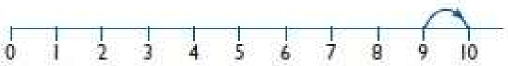
10 is 5 and 5 more
10 = 5 + 5

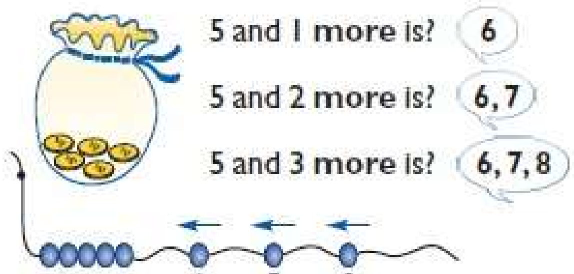
7 + 4



- drawing jumps on prepared lines or constructing own lines

9 and 1 more is 10
9 add 1 equals 10
9 + 1 = 10

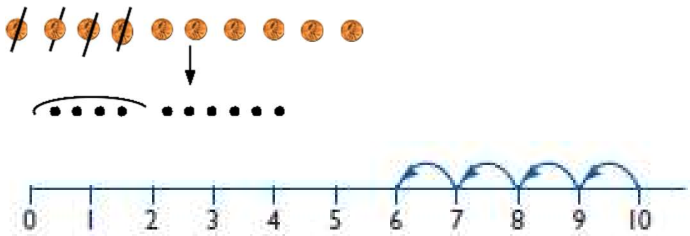


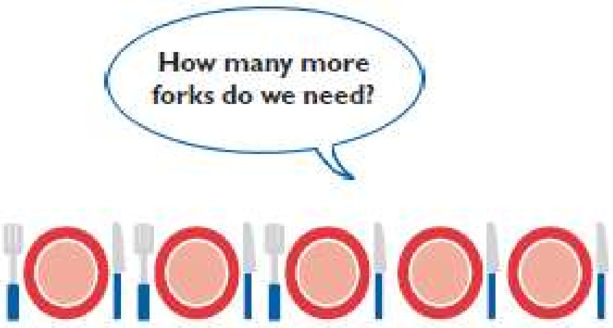


<u>Swap shop (exchanging 10 units for a Ten bar)</u>
Children play in pairs. They roll dice and collect units. When they collect 10, they swap them for a ten bar. The first person to get 5 ten bars wins.

SUBTRACTION – Year 1

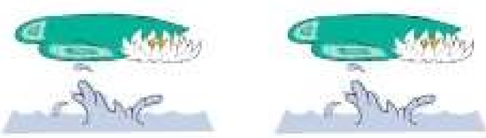
10 - 4 =

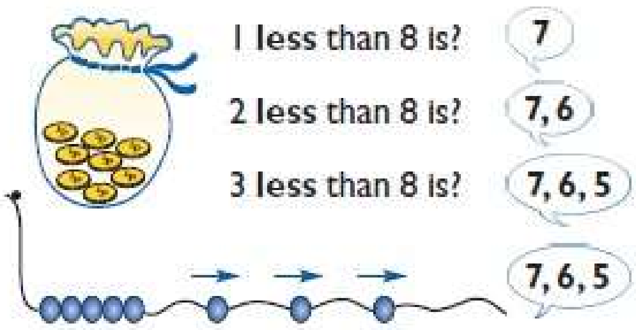




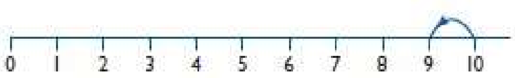
3 + ☐ = 5

5 − ☐ = 3 ☐ − 2 = 3





1 less than 10 is 9
10 subtract 1 equals 9
10 − 1 = 9

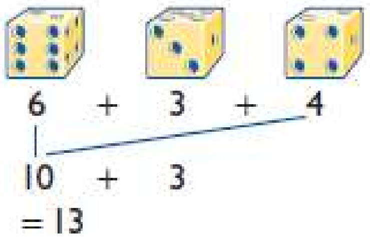


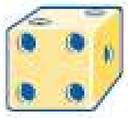
ADDITION AND SUBTRACTION

Year 2

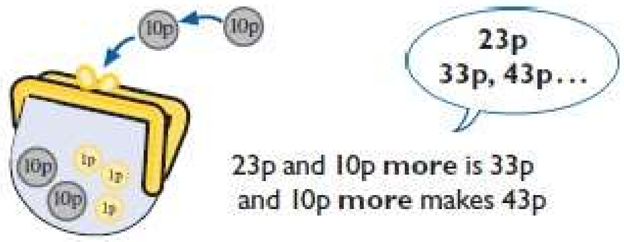
Number Bonds	Counting
• **recall** and **use addition and subtraction facts to 20 fluently**, and **derive** and use **related facts** up to 100.	• **count in steps of 2, 3, 5 and 10** from 0, from any number, forward or backward.
Mental Calculations	**Comparing Numbers**
• add and subtract numbers using **concrete objects, pictorial representations, and mentally**, including: o TU + 1; TU + 10; TU – 1; TU -10 o TU + U; TU -U o TU + TU (begin with largest number first e.g. change 23 + 36 to 36 + 23 and then calculate) o U + U + U (use number bonds to add first e.g. 3 + 5 + 7 = 10 + 5 = 15) • Use known facts to and **derive related facts** up to 100 including: o **number pairs to 100** (If 3 + 7 = 10 then 30 + 70 = 100) o If 7 + 5 = 12 then 37 + 5 = 42 o If 15 + 10 = 25 then 15 + 9 = 24 o If 35 – 10 = 25 then 35 – 9 = 26 • Use knowledge of **inverse** to find missing numbers o E.g. $\boxed{}$ - 7 = 22 • show that **addition** of two numbers can be done in any order (**commutative**) and subtraction of one number from another cannot. • **read, write and interpret mathematical statements** involving addition (+), subtraction (-) and equals (=) signs (appears also in Written Calculation).	• compare and order numbers from 0 up to 100; **use <, > and = signs**
Written Calculations	**Identifying, Representing and Estimating Numbers**
• **read, write and interpret mathematical statements** involving addition (+), subtraction (-) and equals (=) signs (appears also in Mental Calculation)	• **identify, represent and estimate** numbers using different representations, including the number line.
Inverse Operations, Estimating and Checking	Reading and Writing Numbers
• recognise and use the **inverse** relationship between addition and subtraction and use this to **check calculations** and **solve missing number problems**.	• **read and write numbers** to at least 100 in numerals and in words.
Problem Solving	Understanding Place Value
• **solve problems** with addition and subtraction: o using **concrete objects** and pictorial representations, including those involving numbers, quantities and measures. o **applying** their increasing knowledge of mental and written methods. o solve simple **problems** in a practical context involving **addition/subtraction of money** of the same unit, including giving change (copied from Measurement).	• **recognise** the **place value** of each digit in a two-digit number (tens, ones).

Addition Year 2

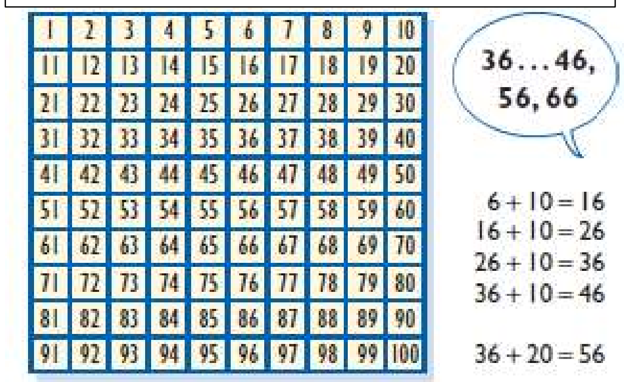




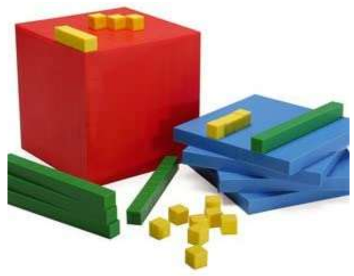
Imagine one more spot



Use of Hundred square for adding in tens and ones.



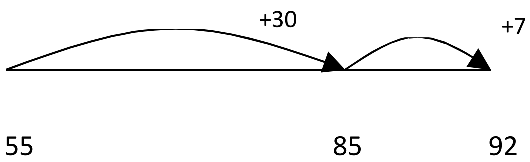
Extensive use of **Dienes apparatus** (Base 10 apparatus) for understanding of place value.



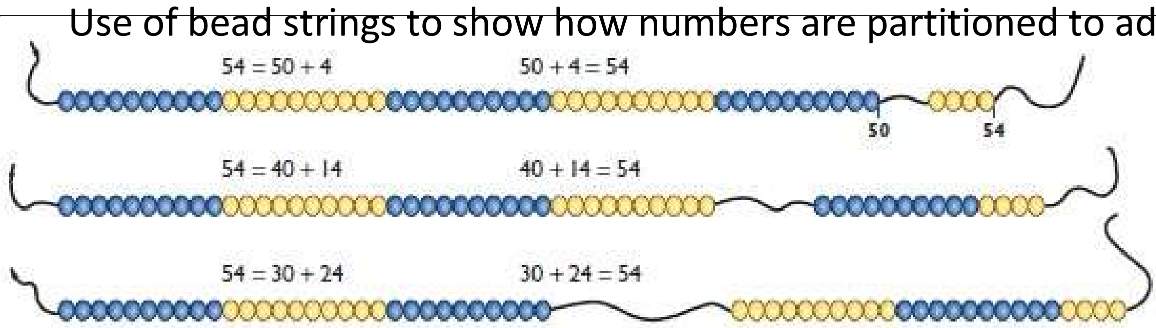
Swap shop – exchanging 10 units for a Ten bar

55 + 37 = 92

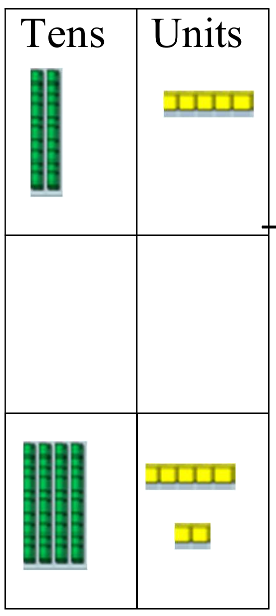
Estimate: 60 + 40 = 100

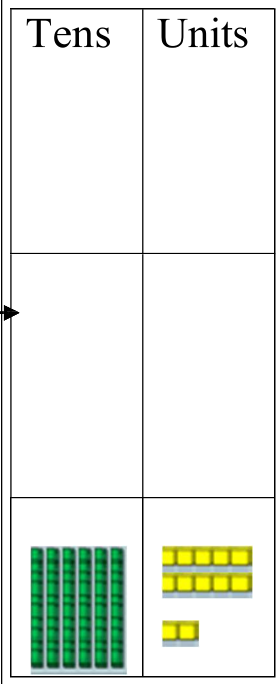


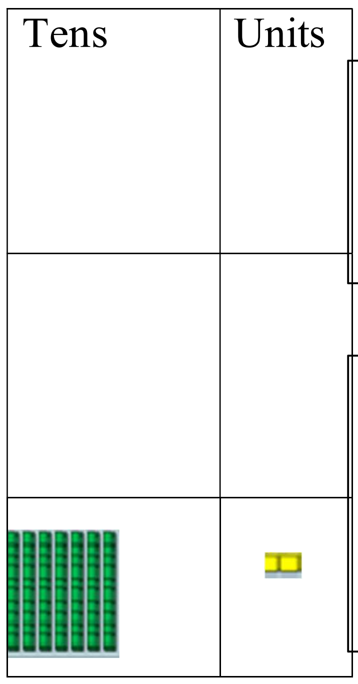
Use of bead strings to show how numbers are partitioned to add together to make the number again.



25 + 47 =







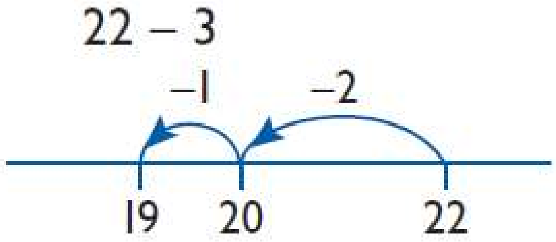
Children use the Tens and Units chart to use Dienes apparatus vertically to prepare them for column addition.

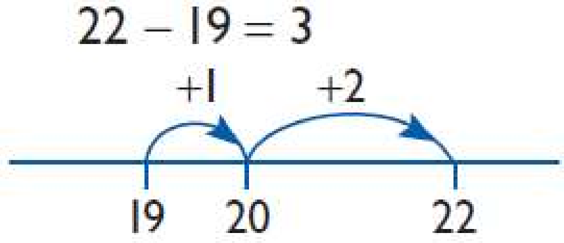
20 + 5

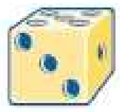
40 + 7

60 + 12 = 72

SUBTRACTION – Year 2



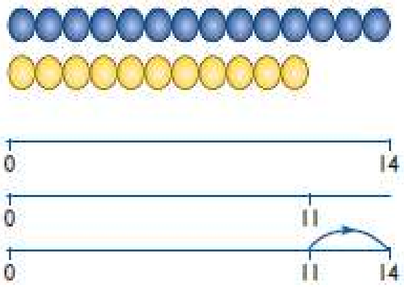




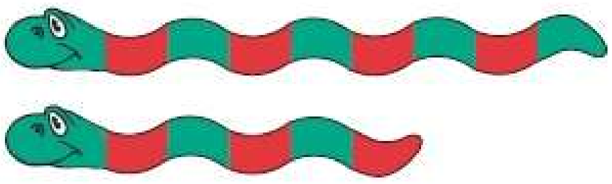
Imagine one less spot

Which line has most money?
How much more?

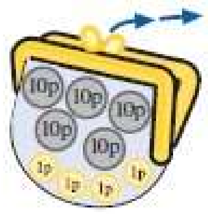
6 and how many more make 10?
6 + □ = 10



The difference between 11 and 14 is 3.
14 – 11 = 3
11 + □ = 14



The difference is?



54p in the purse. Take 10p out, another 10p and so on

54p
44p, 34p…

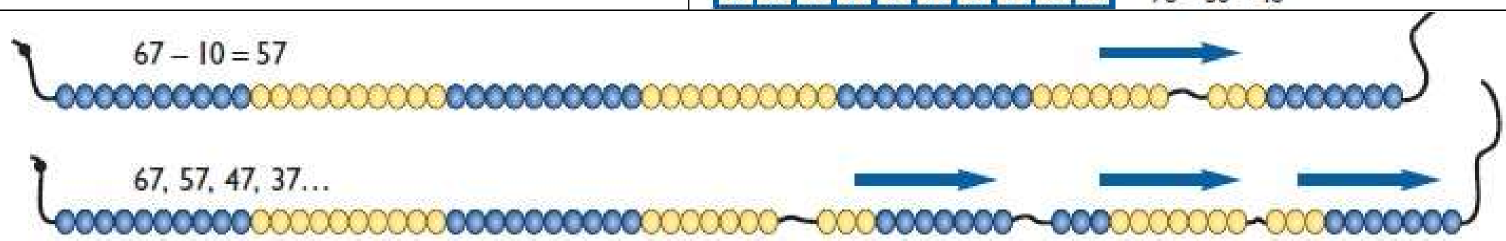
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

76…66, 56, 46

96 – 10 = 86
86 – 10 = 76
76 – 10 = 66
etc.

76 – 30 = 46

67 – 10 = 57

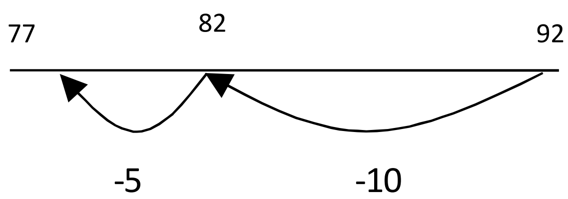


67, 57, 47, 37…

67 – 30 is 37

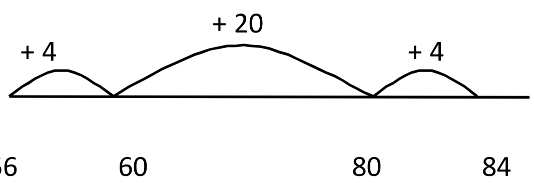
67…57, 47, 37

Counting back (empty number line):
92-15 =



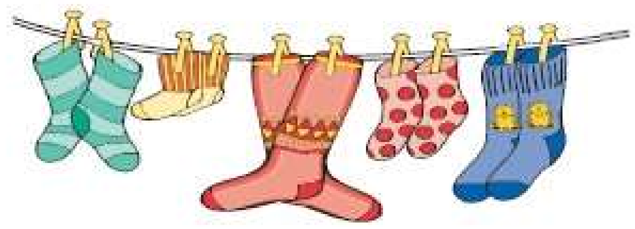
Finding the difference (**counting on** - empty number line)
84 - 56 = □

56 + □ = 84



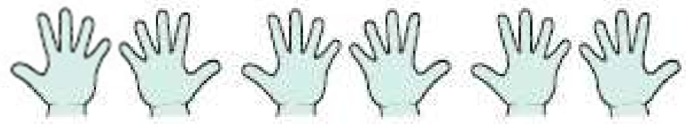
MULTIPLICATION AND DIVISION
Year 1
Multiplication and Division facts
• **count** in **multiples** of **twos, fives and tens** (copied from Number and Place Value).
Mental Calculations
• **count** in **multiples** of **twos, fives and tens** (copied from Number and Place Value).
Problem Solving
• solve **one-step problems** involving multiplication and division, by calculating the answer using **concrete objects, pictorial representations and arrays** with the support of the teacher.

MULTIPLICATION - Year 1



5 groups of 2

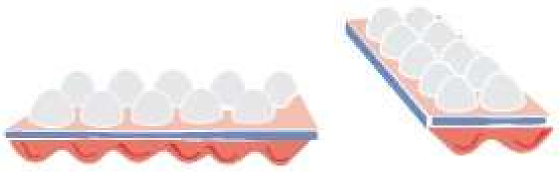
5 pairs



6 lots of 5

4 lots of 2 or

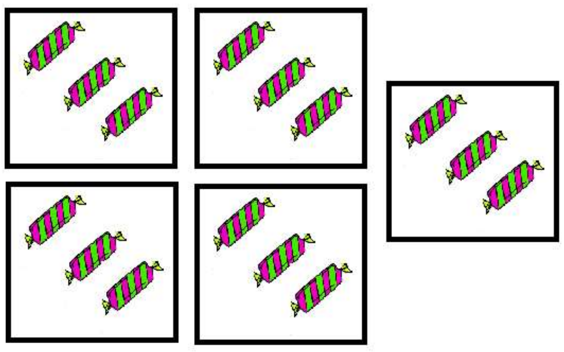
2 lots of 4



5 lots of 2 or

2 lots of 5

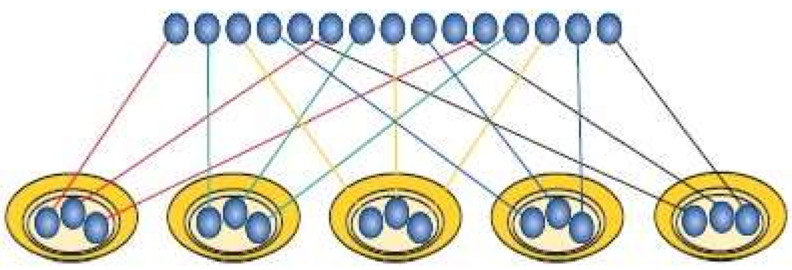
There are 3 sweets in one bag.
How many sweets are in 5 bags altogether?



DIVISION - Year 1

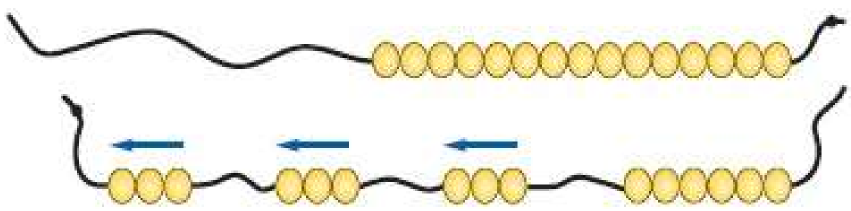
Solve problems involving both sharing and grouping:

15 shared between 5



Sharing 12 cakes equally between 3

How many groups of 3 are in 15?

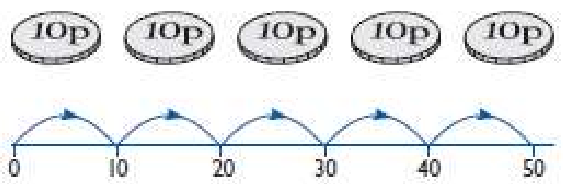


How many groups of 4 can be made with 12 stars?

Grouping:

MULTIPLICATION AND DIVISION
Year 2
Multiplication and Division facts
• **count** in steps of **2, 3, and 5 from 0**, and in tens from any number, forward or backward (copied from Number and Place Value). • recall and use **multiplication and division facts for the 2, 5 and 10 multiplication tables**, including **recognising odd and even numbers.** • Know that **doubling** is **multiplying by 2** and **halving** is **divided by 2**. • I know **significant doubles** (eg 10 + 10, 50+ 50=, 50p+50p=) involving **doubling multiples of 5** up to 50.
Mental Calculations
• show that **multiplication** of two numbers can be **done in any order** (commutative) and **division** of one number by another **cannot**. • Find a **half, a third and a quarter** of an amount.
Written Calculations
• calculate mathematical statements for multiplication and division within the multiplication tables and **write them using** the **multiplication (×), division (÷) and equals (=) signs**
Inverse Operations, Estimating and Checking
• Understand that **division** is the **inverse** of multiplication.
Problem Solving
• solve problems involving multiplication and division, using: **materials**, **arrays**, **repeated addition** and **multiplication and division facts**, including problems in contexts.

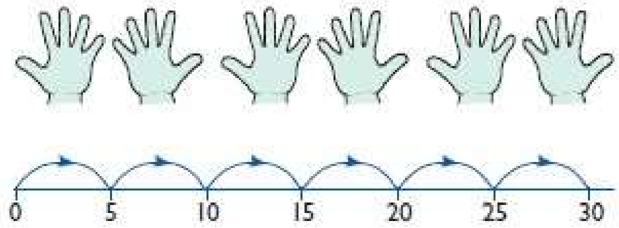
MULTIPLICATION - Year 2

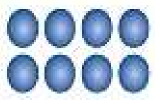


$10p + 10p + 10p + 10p + 10p = 50p$

$10p \times 5 = 50p$

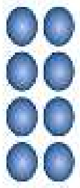
5 hops of 10





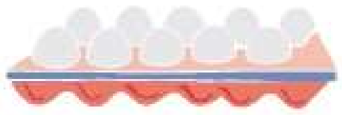
$4 \times 2 = 8$

$2 \times 4 = 8$



$2 \times 4 = 8$

$4 \times 2 = 8$



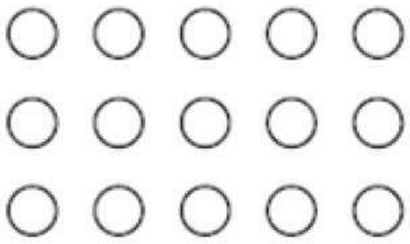
$5 \times 2 = 10$

$2 \times 5 = 10$

$2 \times 5 = 10$

$5 \times 2 = 10$

Use arrays to show commutative property of multiplication



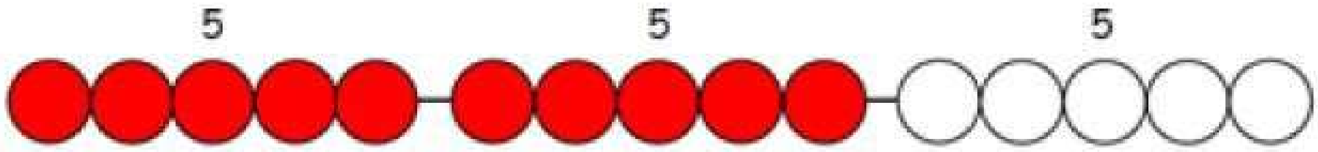
$5 \times 3 = 15$

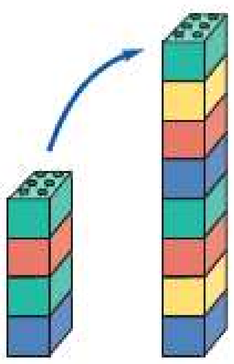
$3 \times 5 = 15$

5 x 3 = 3 + 3 + 3 + 3 = **15**

3 x 5 = 5 + 5 + 5 = **15**

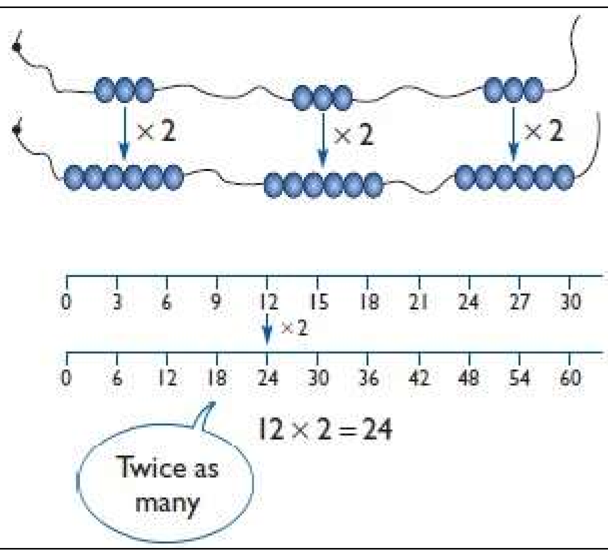
5 x 3 = 5 + 5 + 5





double 4 is 8

$4 \times 2 = 8$



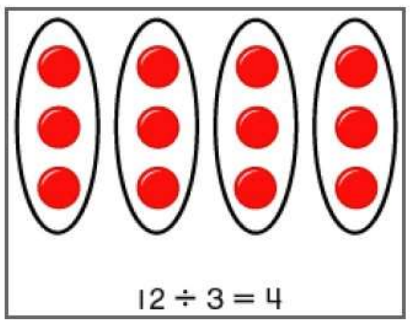
$12 \times 2 = 24$

Relate multiplication to scaling

DIVISION – Year 2

How many 10ps are in 50p?

Arrays:



This represents **12 ÷ 3, posed as** how many groups of 3 are in 12?

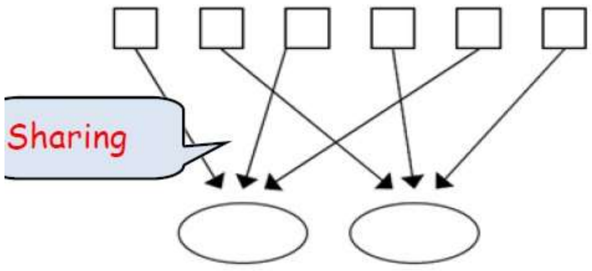
Pupils should also show that the same array can represent **12 ÷ 4 = 3** if grouped horizontally.

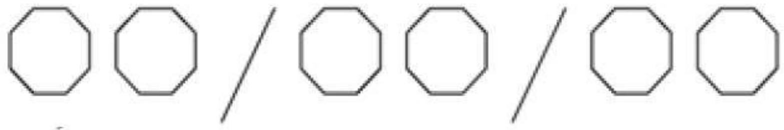
Introducing that division is the **inverse** of multiplication

Know and understand sharing <u>and</u> grouping:

6 sweets shared between 2 people, how many do they each get?

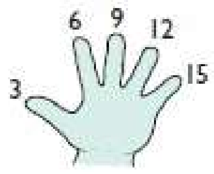
There are 6 sweets, how many people can have 2 sweets each?



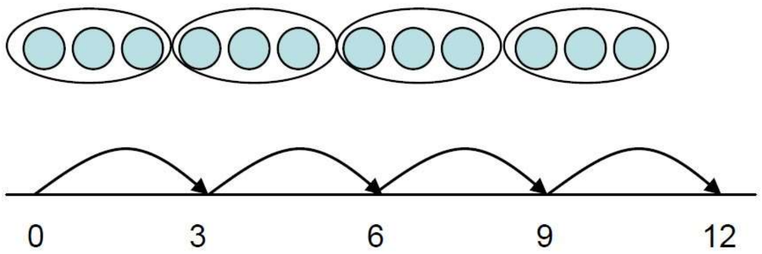


Children should be taught to recognise whether problems require sharing or grouping.

Grouping using a **number line**: Children to see the link between multiplication and division and begin to recall division facts.



15 ÷ 3 = 5



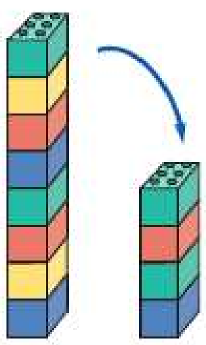
Children understand that **halving means "divided by 2**".

Complete the stem sentences.

I have ___ cubes altogether.
There are ___ in each group.
There are ___ groups.

$\square \div \square = \square$

$\square \times \square = \square$



half of 8 is 4
8 ÷ 2 = 4

I have 24p.
I divide it equally between 2 friends.
How much will they get each?

I have 24p in 2p coins.
How many 2p coins do I have?

Consider the two questions above.
What is the same and what is different?