Glebe Primary School

'We can and we will'

Calculation Policy

LKS2

Mental and Written calculations

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Mission Statement:

At Glebe 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.

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.

To add successfully, 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 mentally a series of numbers (such as 5 + 8 + 4);
- Add multiples of 10 (such as 60 +70) or of 100 (600+ 700) using related addition facts (6 + 7) and their knowledge of place value;
- Partition two-digit & three-digit numbers, into multiples of 1, 10 and 100 in different ways.

To subtract successfully, 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);
- Subtract multiples of 10 (such as 160 -70) using related subtraction facts (16 - 7) 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, children need to:

- Recall all multiplication facts to 12 x 12;
- 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 that multiplication is repeated addition;
- Add multiples of 10 or of 100 using related addition facts and their knowledge of place value;
- Add combination of decimal or larger whole numbers using formal written methods (the column method).

To divide successfully, children need to be able to:

- Understand the vocabulary which indicates division: share, groups, quotient, half, quarter etc;
- Understand the vocabulary of division (such as 18 ÷3 = 6 18 is the dividend, the 3 is the divisor & the 6 is quotient;
- Partition two-digit and three-digit numbers into multiples of 1s, 10s and 100s.
- Recall multiplication and division facts 12 x 12;
- Recognise multiples of one-digit numbers and divide multiples of 10 or 100 by a single numbers using their knowledge of 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: January 2022

To be reviewed: January 2024

CALCULATION PROGRESSION CHART Appendix 1

	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.
Children continue to learn using concrete resources and models and images in Lower and Upper KS2 to help develop conceptual understanding				
Year 3	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification). • Expanded column addition for **TU + TU, HTU + TU and HTU + HTU** where necessary.	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification). • **Expanded column subtraction** with decomposition for HTU – TU and HTU – HTU where necessary.	• Using **concrete objects** and other models and images including **arrays and number lines** to multiply and its relation to **scaling**. • **Consolidation of mental methods** including using knowledge of number facts to derive related facts of TU x U : If 2 x 3 = 6 then 2 x 30 = 60.	• **Consolidation of mental** methods including using **knowledge of number facts to derive related facts** of TU ÷ U: For example, using 3 × 2 = 6 for 30 × 2 = 60 and 6 ÷ 3 = 2, and 60 ÷ 3 = 20. • **Use number lines** to calculate **TU ÷ U** where appropriate (including remainders) by **chunking** on in groups of U.
Year 4	• **Consolidation of mental methods (see mental calculation** in the policy for further exemplification). • **Formal- Compact column addition up to 4 digits.**	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification). • **Expanded column subtraction with decomposition up to 4 digits.**	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification). • **Grid multiplication** (using arrays as starting point) for HTU x U and TU x U. • **Formal- Short multiplication for multiplying numbers up to 4 digits with U.**	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification) • **Use number lines to calculate TU÷U or HTU ÷U using chunks of 10** *(chunking on **using repeated addition**).*

Year 5	• **Consolidation of mental methods (see mental calculation** in the policy for further exemplification).
	• **Formal- Compact column addition including:**
	  • **Numbers up to 5 digits**
	  • **Same number of decimal places**
	  • **Different number of decimal places.**
		• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification).
		• **Formal- Compact column subtraction with decomposition for subtracting whole numbers and numbers with the same decimal places.**
			• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification).
			• Consolidate **grid method.**
			• **Consolidate formal short multiplication.**
				• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification).
				• **Consolidate using number lines** to chunk groups on a number line for TU÷U & now for **HTU÷TU- chunking as repeated subtraction**.
				Formal - Short division for TU ÷ U (Bus stop method)
				• **Calculations with no "carrying" (e.g. 96 ÷ 3)**
				• **Calculations with "carrying" (e.g. 72 ÷ 3)**
				• **Calculations with "carrying" and remainders (e.g. 5309 ÷ 8)**
				• **Remainders as fractions.**

Year 6	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification). • **Formal- Compact column addition to add several numbers of increasing complexity including numbers with different number of decimal places.**	**Consolidation of mental methods** (see mental calculation in the policy for further exemplification). **Formal- Compact column subtraction with decomposition to subtract numbers of increasing complexity including numbers with different number of decimal places.**	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification). • **Formal- Short multiplication to multiply numbers with up to 2 decimal places by U.** • **Long multiplication for multiplying numbers up to 4 digits and numbers up to 2 decimal places by TU.**	• **Consolidation of mental methods** (see mental calculation in the policy for further exemplification) • **Formal method- Consolidate short division bus stop method, with and without remainders as whole numbers, fractions, decimals.** • **Formal Long division with TU as divisors.**

Progression of Challenge- in Calculations Appendix 2

Addition	Subtraction	Multiplication	Division
Choice of method could be mental or written (column addition) based on the calculation.	Choice of method could be mental or written (decomposition) based on the calculation.	Mental methods to be used where applicable.	Mental methods to be used where applicable.
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 tens boundary (134 + 25) HTU + TU – crossing tens boundary (235 + 68) HTU + TU – crossing hundreds boundary (483 + 35) HTU + TU – crossing tens and hundreds boundary (488 +47) HTU + HTU – crossing tens boundary (368 + 123) HTU + HTU - crossing tens and hundreds boundary (387 +477)	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 tens boundary (265 - 58) HTU - TU crossing hundreds and tens boundary (265 – 78) HTU - HTU not crossing tens boundary (365 - 123) HTU - HTU crossing tens and hundreds boundary (414 -126) Continue as above with numbers that are 4 digits or over.	<u>Short Multiplication</u> Numbers that are 2 digits or over multiplied by U (34 x 7; 237 x 6; 5673 x 8 etc.) Numbers that have up to 2 decimal places multiplied by U (34.7 x 6; 65.24 x 8 etc.) <u>Long Multiplication</u> Numbers over 2 digits multiplied by TU (34 x 45; 456 x 23; 5643 x 34 etc.) Numbers that have up to 2 decimal places (4.7 x 16; 15.24 x 28 etc.)	<u>Short Division</u> Numbers that are 2 digits, or over, divided by U with or without remainders (78 ÷ 6; 126 ÷ 7; 674 ÷ 8; 5642 ÷ 3 etc.) Numbers that have up to 2 decimal places divided by U (34.2 ÷ 6; 65.28 ÷ 8 etc.) <u>Long Division</u> Numbers that are 3 digits or over divided by TU with or without remainders (245 ÷ 21; 3654 ÷ 35 etc.)
Introduce decimal numbers where appropriate (see policy). • Add numbers with same decimal places • Add numbers with different decimal places	Introduce decimal numbers where appropriate (see policy). • Subtract numbers with same decimal places • Subtract numbers with different decimal places		

ADDITION AND SUBTRACTION Appendix 3

Year 2

Number Bonds

- **recall** and **use addition and subtraction facts to 20 fluently**, and **derive** and use **related facts** up to 100.

Counting

- **count in steps of 2, 3, 5 and 10** from 0, from any number, forward or backward.

Mental Calculations

- add and subtract numbers using **concrete objects, pictorial representations, and mentally**, including:
  - TU + 1; TU + 10; TU – 1; TU -10
  - TU + U; TU -U
  - TU + TU (begin with largest number first e.g. change 23 + 36 to 36 + 23 and then calculate)
  - 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:
  - **number pairs to 100** (If 3 + 7 = 10 then 30 + 70 = 100)
  - If 7 + 5 = 12 then 37 + 5 = 42
  - If 15 + 10 = 25 then 15 + 9 = 24
  - If 35 – 10 = 25 then 35 – 9 = 26
- Use knowledge of **inverse** to find missing numbers
  - E.g. □ - 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).

Comparing Numbers

- compare and order numbers from 0 up to 100; **use <, > and = signs**

Written Calculations

- **read, write and interpret mathematical statements** involving addition (+), subtraction (-) and equals (=) signs (appears also in Mental Calculation)

Identifying, Representing and Estimating Numbers

- **identify, represent and estimate** numbers using different representations, including the number line.

Inverse Operations, Estimating and Checking

- recognise and use the **inverse** relationship between addition and subtraction and use this to **check calculations** and **solve missing number problems**.

Reading and Writing Numbers

- **read and write numbers** to at least 100 in numerals and in words.

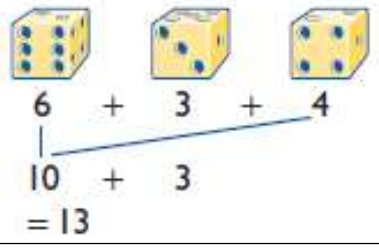
Problem Solving

- **solve problems** with addition and subtraction:
  - using **concrete objects** and pictorial representations, including those involving numbers, quantities and measures.
  - **applying** their increasing knowledge of mental and written methods.
  - solve simple **problems** in a practical context involving **addition/subtraction of money** of the same unit, including giving change (copied from Measurement).

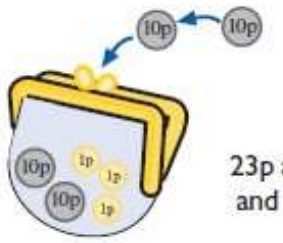
Understanding Place Value

- **recognise** the **place value** of each digit in a two-digit number (tens, ones).

Addition Year 2



Imagine one **more** spot



23p
33p, 43p...

23p and 10p **more** is 33p
and 10p **more** makes 43p

Use of Hundred square for adding in tens and ones.

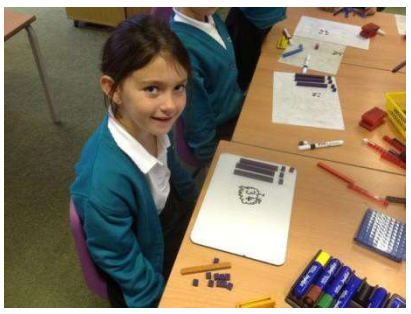
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

36...46,
56, 66

6 + 10 = 16
16 + 10 = 26
26 + 10 = 36
36 + 10 = 46

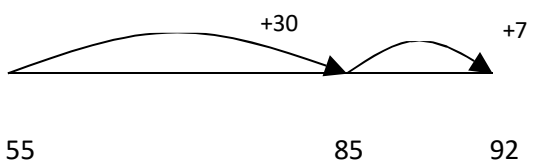
36 + 20 = 56

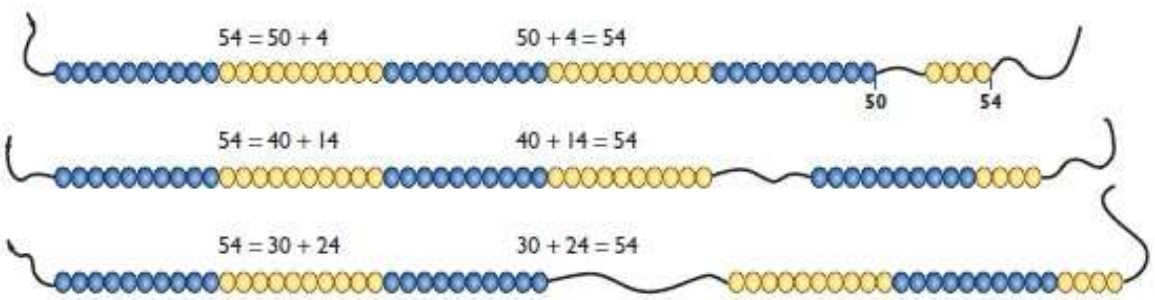
Extensive use of **Dienes apparatus** (Base 10 apparatus) for understanding of place value.



Swap shop – exchanging 10 units for a Ten bar

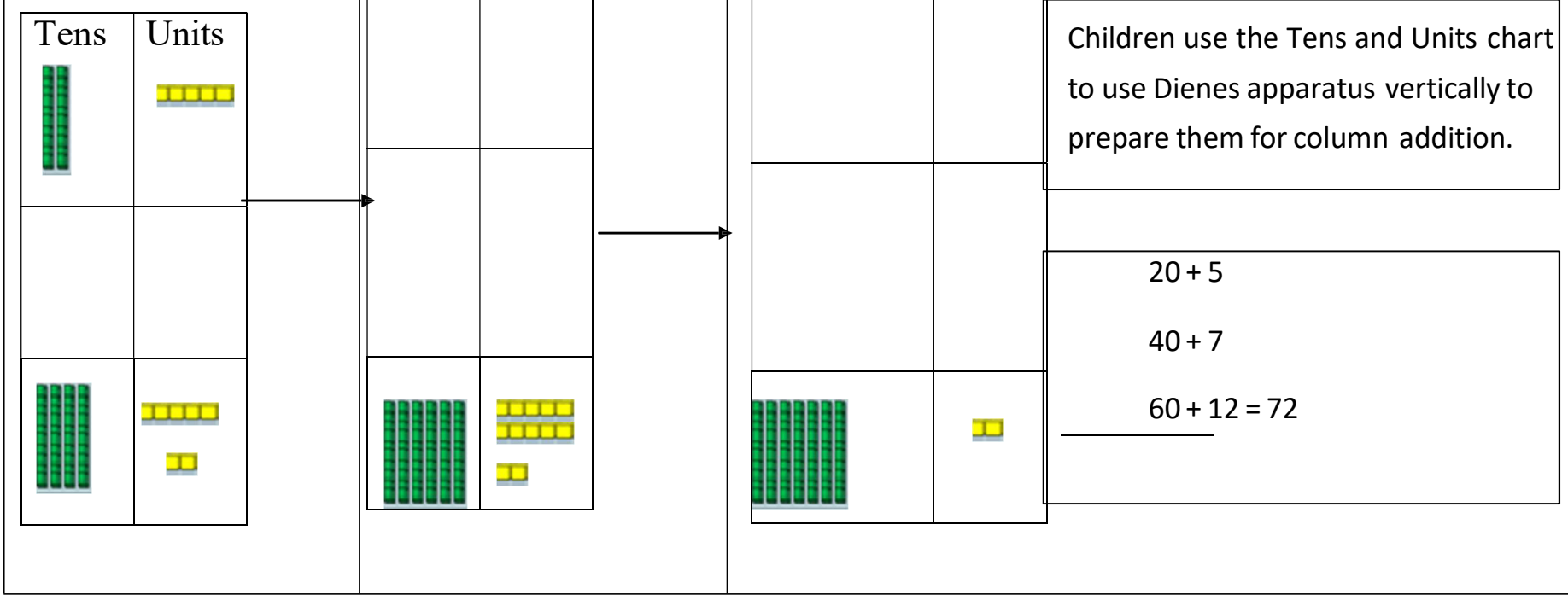
55 + 37 = 92
Estimate: 60 + 40 = 100





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

25 + 47 =



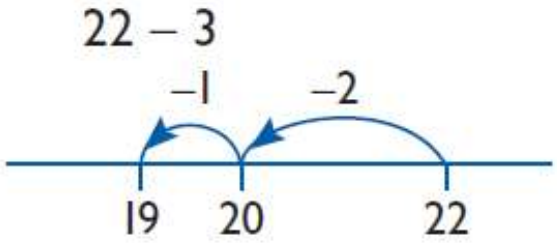
Children use the Tens and Units chart to use Dienes apparatus vertically to prepare them for column addition.

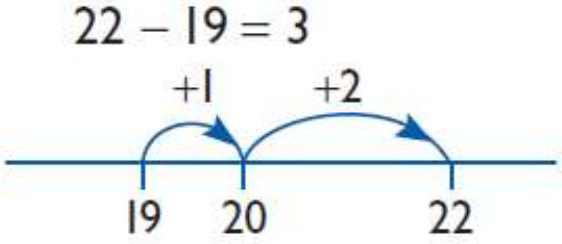
20 + 5

40 + 7

60 + 12 = 72

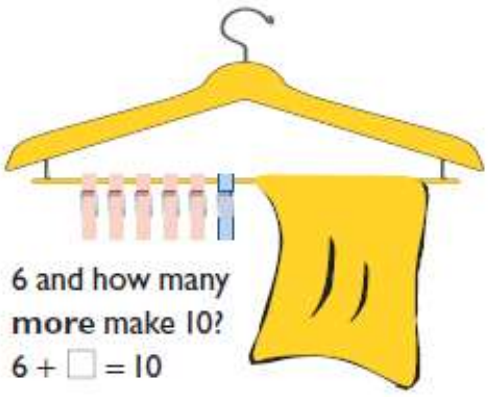
SUBTRACTION – Year 2



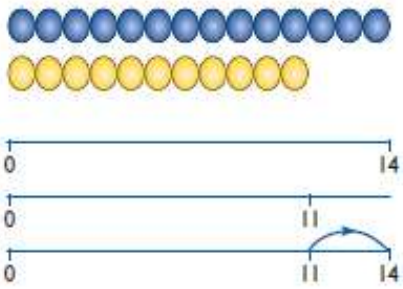


Imagine one **less** spot

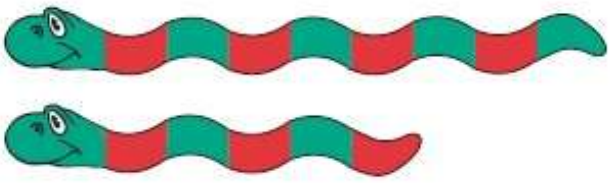
Which line has **most** money?
How much **more**?



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

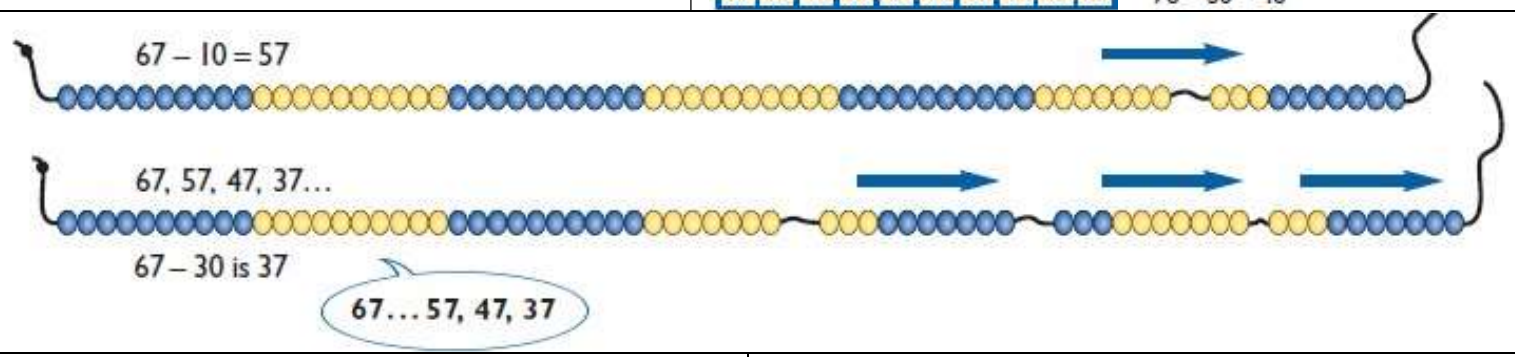
54p
44p, 34p…

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

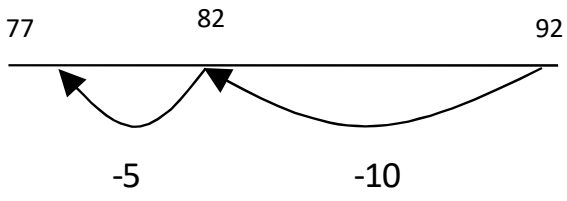
76…66, 56, 46

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

76 – 30 = 46

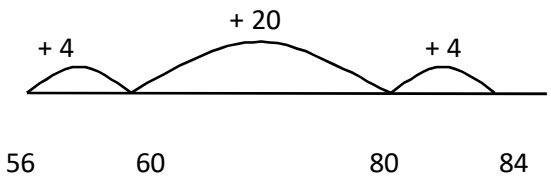


Counting back (empty number line):
92-15 =



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

56 + □ = 84



ADDITION AND SUBTRACTION Appendix 3

Year 3

Number Facts

- **recall** addition and subtraction **facts to 20** fluently.
- **recall number pairs** that total **100**.
- **recall** number pairs that total **1000** (multiples of 100).

Counting

- count from 0 in **multiples** of **4, 8, 50 and 100.**
- find **10 or 100 more or less** than a given number.

Mental Calculations

- add and subtract numbers **mentally**, including:
  - HTU + 1; HTU + 10; HTU + 100; HTU – 1; HTU -10; HTU - 100

Consolidate:

- Use **known facts to and derive related facts up to 1000** including:
  - If 7 + 5 = 12, then 397 + 5 = 402 (crossing 100's boundary)
  - If 95 + 10 = 105, then 95 + 9 = 104 (crossing 100's boundary)
  - If 205 – 10 = 195, then 205 – 9 = 196 (crossing 100's boundary)
- **Use knowledge of doubles** to derive related facts.
  - 15 + 16 = 31 because 15 + 15 = 30 and 30 + 1= 31
- **Number pairs** that total **1000** (**multiples** of **10**)
  - 180 + 50 = 230 because 18 + 5 = 23
  - 180 – 50 = 130 because 18 – 5 = 13
- **Find the difference** between two numbers, that are close to each other, **by counting** on using knowledge of inverse:
  67 -58 = 9 because 58 + 9 = 67
- use knowledge of **inverse** to find missing numbers
- **round to nearest pound** and **compensate**:
  - 99p + 99p = £1 + £1 – 2p = £1.98
- add & subtract **fractions** with the **same denominator**.

Comparing Numbers

- **compare** and order numbers up to **1000**.

Written Calculations

- add and subtract numbers with up to **three** digits, **using expanded column** addition and subtraction.

Identifying, Representing and Estimating Numbers

- **identify**, **represent** and **estimate** numbers using different representations.

Inverse Operations, Estimating and Checking Answers

- **estimate** the answer to a calculation and use **inverse operations** to **check answers**.

Reading and Writing Numbers

- **read and write** numbers **up to 1000** in numerals and in words.
- tell and write the time from an **analogue clock**, including **using Roman numerals from I to XII**, and 12-hour and 24-hour clocks.

Problem Solving

- **solve problems, including missing number problems,** using number facts, place value, and more complex addition and subtraction.

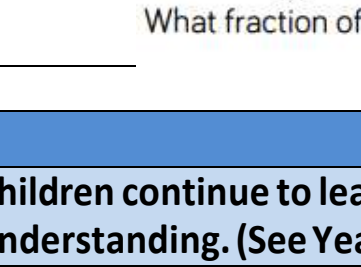
Understanding Place Value

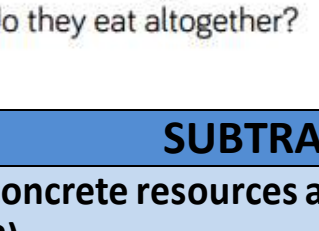
- recognise the place value of each digit in a **three-digit number** (hundreds, tens, ones).

ADDITION - Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)

HTU + 1	HTU + 10	HTU + 100
345 + 1 = 346	345 + 10 = 355	345 + 100 = 445





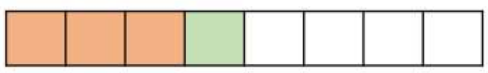
Continue with **expanded** method with **three-digit** numbers:
HTU + HTU **using partitioning and Dienes apparatus**

347 + 122 =

300 + 40 + 7
+ 100 + 20 + 2
400 + 60 + 9 = 469

Then, **cross the tens and the hundreds boundary:** 264 + 159 =

100 + 50 + 9
+ 200 + 60 + 4
300 + 110 + 13 = 423



We can use this model to calculate $\frac{3}{8}+\frac{1}{8}=\frac{4}{8}$
Draw your own models to calculate

$\frac{1}{5}+\frac{2}{5}=\frac{\square}{5}$ $\frac{2}{7}+\frac{3}{7}+\frac{1}{7}=\frac{\square}{\square}$ $\frac{7}{10}+\frac{\square}{\square}=\frac{9}{10}$

Eva eats $\frac{5}{12}$ of a pizza and Annie eats $\frac{1}{12}$ of a pizza.
What fraction of the pizza do they eat altogether?

Rosie and Whitney are solving:

$\frac{4}{7}+\frac{2}{7}$

Rosie says, The answer is $\frac{6}{7}$

Whitney says, The answer is $\frac{6}{14}$

Who do you agree with?
Explain why.

Mo and Teddy share these chocolates.

They both eat an odd number of chocolates.
Complete this number sentence to show what fraction of the chocolates they each could have eaten.

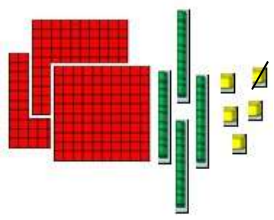
$\frac{\square}{\square}+\frac{\square}{\square}=\frac{12}{12}$

SUBTRACTION – Year 3

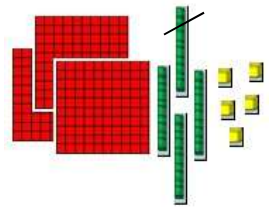
Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)

Recap calculating **using number lines** (as Year 2) – **counting on and counting back.**

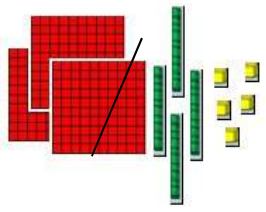
HTU - 1
345 - 1 = 344



HTU - 10
345 - 10 = 335



HTU - 100
345 - 100 = 245



Introduce expanded method with three digit

HTU - HTU

398 – 136 =

300 + 90 + 8
- 100 + 30 + 6
200 + 60 + 2
= 262

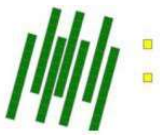
THEN, EXCHANGE from numbers: other column

374 – 146 =

60 1
300 + 70 + 4
- 100 + 40 + 6
200 + 20 + 8
= 228

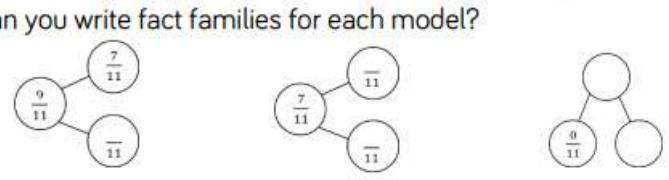
Expanded method using partitioning & Diennes.

72 - 47

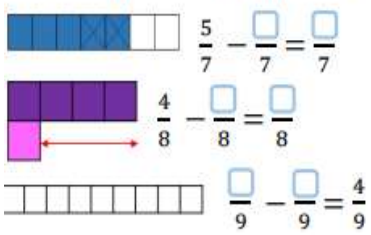


60 1
70 + 2
- 40 + 7
20 + 5 = **25**

Complete the part whole models. Use equipment if needed.
Can you write fact families for each model?



Use the models to help you subtract the fractions.



$\frac{5}{7}-\frac{\square}{7}=\frac{\square}{7}$

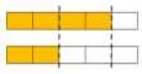
$\frac{4}{8}-\frac{\square}{8}=\frac{\square}{8}$

$\frac{\square}{9}-\frac{\square}{9}=\frac{4}{9}$

Jack and Annie are solving $\frac{4}{5}-\frac{2}{5}$

Jack's method:

Annie's method:



They both say the answer is two fifths.
Can you explain how they have found their answers?

ADDITION AND SUBTRACTION Appendix 4

Year 4

Number Facts

- **recall** addition and subtraction facts to 20 fluently (Year 1).
- **recall** number pairs that **total 100** (Year 2).
- **Recall number pairs** that **total 1000** (multiples of 100) (Year3).

Counting

- **count** backwards through zero to **include negative numbers**.
- **count in multiples** of 6, 7, 9, 25 and 1 000.
- **find 1000 more or less** than a given number

Mental Calculations

- **Consolidate**:
  HTU + 1; HTU + 10; HTU + 100; HTU – 1; HTU -10; HTU - 100
- **Use known facts to and derive related facts up to 1000** including:
  - If 7 + 5 = 12 then 397 + 5 = 402 (crossing 100s boundary)
  - If 95 + 10 = 105 then 95 + 9 = 104 (crossing 100s boundary)
  - If 205 – 10 = 195 then 205 – 9 = 196 (crossing 100s boundary)
- **Use knowledge of doubles** to derive related facts:
  - 23 + 24 = 47 because 23 + 23 = 46 and 46 + 1= 47
- **Find the difference** between two numbers that are close to each other by counting on/ using knowledge of **inverse**:
  E.g. What is 67 -58?
  67 – 58 = 9 because 58 + 9 = 67
- Use **knowledge of inverse** to find **missing numbers**.
- **Round** to **nearest pound** and **compensate**:
  £3.99 + £3.99 = £4 + £4 – 2p = £7.98
- **Add fractions**, of the **same denominator**, when the answer will be greater than 1 (a mixed number).
- **fraction from 1**
- **Subtract** a .

Comparing Numbers

- **order and compare numbers** beyond 1000.
- compare numbers with the same number of **decimal places up to two decimal places** (copied from Fractions).
- Use strips of paper to **show equivalent fractions**.

Written Calculations

- add and subtract numbers **with up to 4 digits** using the **formal written methods of columnar addition and expanded column subtraction where appropriate.**

Identifying, Representing and Estimating Numbers

- **identify**, **represent** and **estimate** numbers using different representations.
- **Investigate fractions greater than 1.**

Inverse Operations, Estimating and Checking Answers

- **estimate** and use **inverse** operations to **check answers** to a calculation.

Reading and Writing Numbers

- **read Roman numerals to 100** (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.

Problem Solving

- solve addition and subtraction **two-step problems in contexts,** deciding which operations and methods to use and why

Understanding Place Value

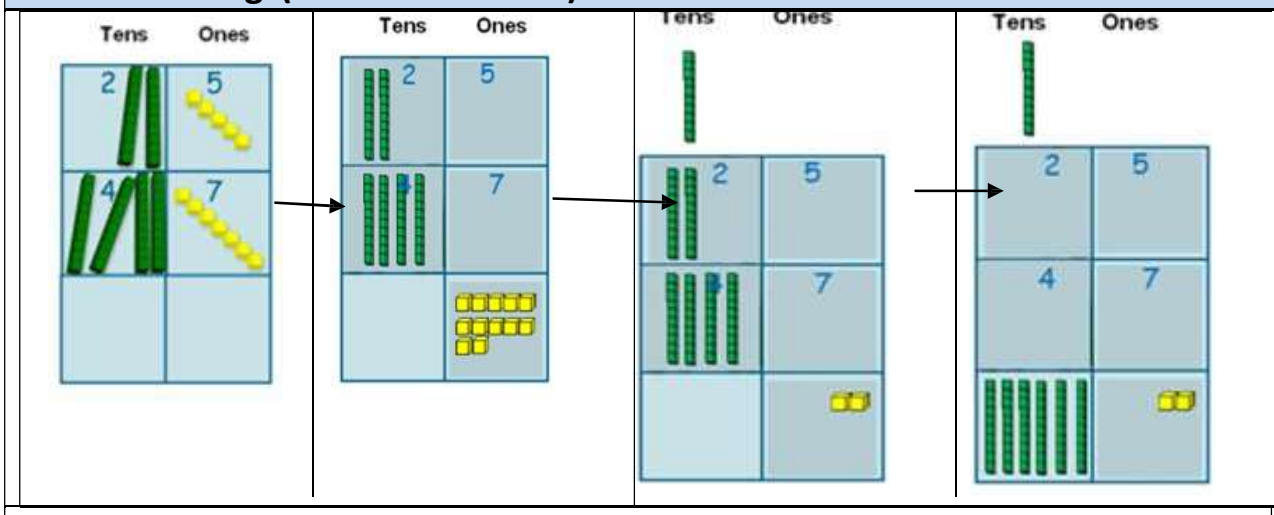
- **recognise** the place value of each digit in a **four-digit** number (thousands, hundreds, tens, and ones)
- find the effect of **dividing a one- or two-digit number by 10 and 100**, identifying the value of the digits in the answer as units, tenths and hundredths (copied from Fractions).

Rounding

- **round** any number to the **nearest 10, 100 or 1000**.
- **round decimals** with one decimal place to the **nearest whole number** (copied from Fractions).

ADDITION – Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)



Children use Diennes in a vertical format, to prepare them for column addition.

Column Addition with up to 4 digit numbers:

347 + 122

Estimation: 350 + 100 = 450

$$\begin{array}{r} 347 \\ +122 \\ \hline 469 \end{array}$$

THEN, with "carrying":

159 + 264 =

Estimation: 150 + 300 = 450

$$\begin{array}{r} {\scriptstyle 1} \\ 159 \\ +\ 264 \\ \hline 423 \end{array}$$

3517 + 396 =

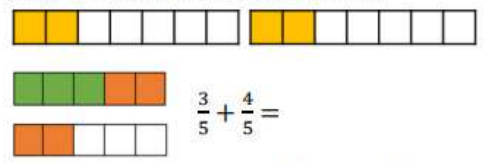
Estimation: 3500 + 400 = 3900

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 3517 \\ +\ 396 \\ \hline 3913 \end{array}$$

Use and apply this method in the context of money and measures as well.

Fractions:

Use the models to add the fractions:



$\frac{2}{7}+\frac{2}{7}=$

$\frac{3}{5}+\frac{4}{5}=$

Choose your preferred model to add:

$\frac{2}{5}+\frac{1}{5}$ $\frac{3}{7}+\frac{6}{7}$ $\frac{7}{9}+\frac{4}{9}$

Alex is adding fractions.

$\frac{3}{9}+\frac{2}{9}=\frac{5}{18}$

Is she correct? Explain why.

How many different ways can you find to solve the calculation?

$\frac{\square}{\square}+\frac{\square}{\square}=\frac{11}{9}$

SUBTRACTION - Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)

Continue **expanded** subtraction method with up to 4 digit numbers:

Children begin to estimate their answers: 2754 – 1562 =

Estimation - 2800 – 1500 = 1300

2754 − 1562 = 1192

2000 + 600 + 150 + 4

− 1000 + 500 + 60 + 2

1000 + 100 + 90 + 2

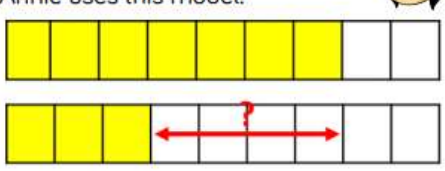
Use and apply this method in the context of money and measures as well.

Fractions:

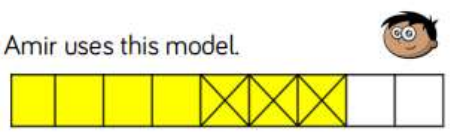
Annie and Amir are working out the answer to this problem.

$\frac{7}{9}-\frac{3}{9}$

Annie uses this model.



Amir uses this model.



Which model is correct? Explain why.

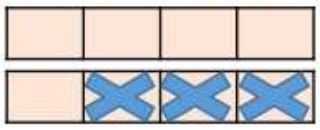
Can you write a number story for each model?

How many different ways can you find to solve the calculation?

$\frac{\square}{7}-\frac{3}{7}=\frac{\square}{7}+\frac{\square}{7}$

$\frac{\square}{7}-\frac{3}{7}=\frac{\square}{7}-\frac{\square}{7}$

Jack uses a bar model to subtract fractions.

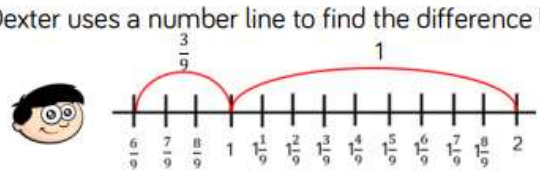


$2-\frac{3}{4}=\frac{8}{4}-\frac{3}{4}=\frac{5}{4}=1\frac{1}{4}$

Use Jack's method to calculate.

$3-\frac{3}{4}=$ $3-\frac{3}{8}=$ $3-\frac{7}{8}=$ $3-\frac{15}{8}=$

Dexter uses a number line to find the difference between 2 and $\frac{6}{9}$



$2-\frac{6}{9}=1\frac{3}{9}$

Use a number line to find the difference between:

2 and $\frac{2}{3}$ 2 and $\frac{2}{5}$ $\frac{2}{5}$ and 4

Dora is subtracting a fraction from a whole.

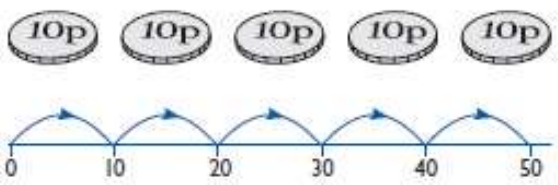
$5-\frac{3}{7}=\frac{2}{7}$

Can you spot her mistake?

What should the answer be?

MULTIPLICATION AND DIVISION Appendix 5
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.

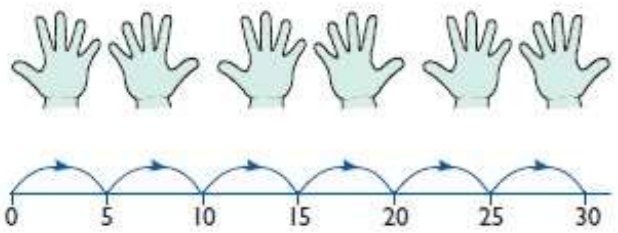
MULTIPLICATION - Year 2

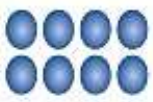


10p + 10p + 10p + 10p + 10p = 50p

10p × 5 = 50p

5 hops of 10



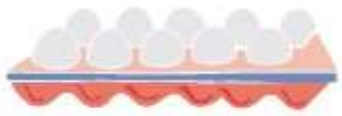


4 × 2 = 8

2 × 4 = 8

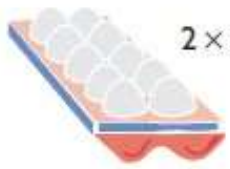
2 × 4 = 8

4 × 2 = 8



5 × 2 = 10

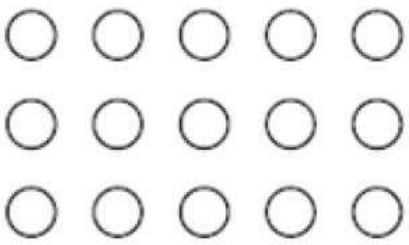
2 × 5 = 10



2 × 5 = 10

5 × 2 = 10

Use arrays to show commutative property of multiplication



5 x 3 = 15

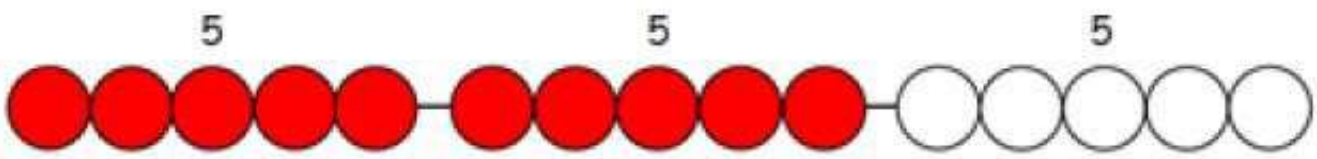
3 x 5 = 15

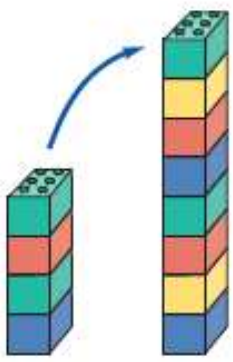
5 x 3 = 15

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

3 x 5 = 5 + 5 + 5 = 15

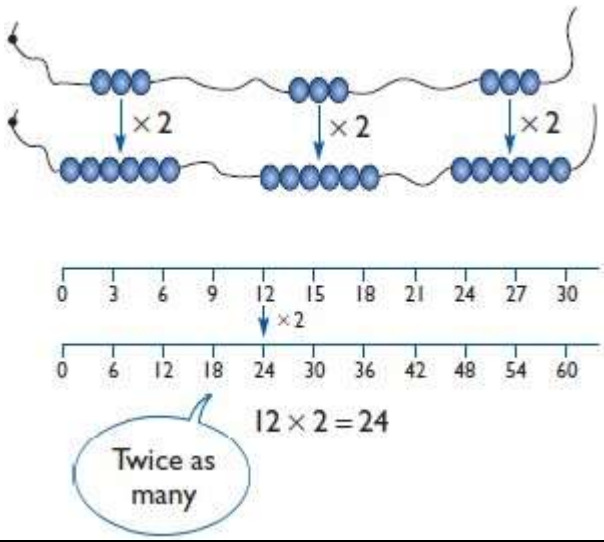
5 x 3 = 5 + 5 + 5





double 4 is 8

4 × 2 = 8



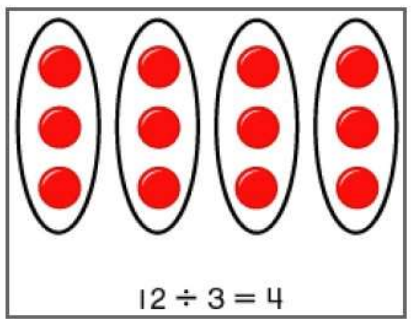
12 × 2 = 24

Relate multiplication to scaling

DIVISION – Year 2

How many 10ps are in 50p?

Arrays:



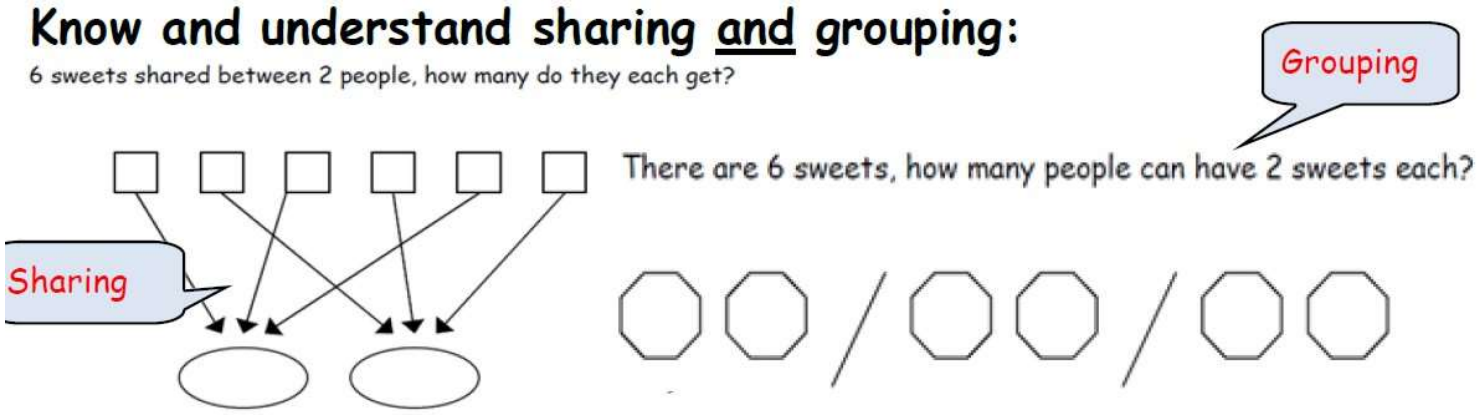
This represents **12 ÷ 3, posed as** how many groups of 3 are in 12?

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

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

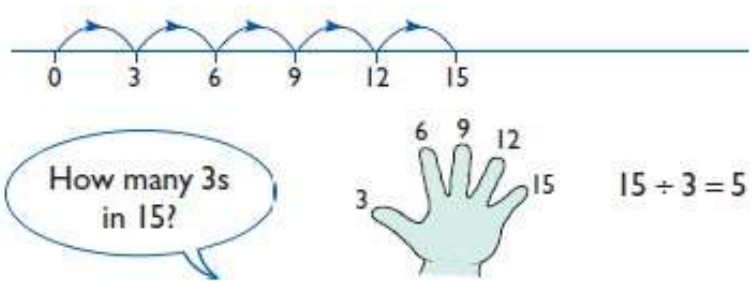
Know and understand sharing and grouping:

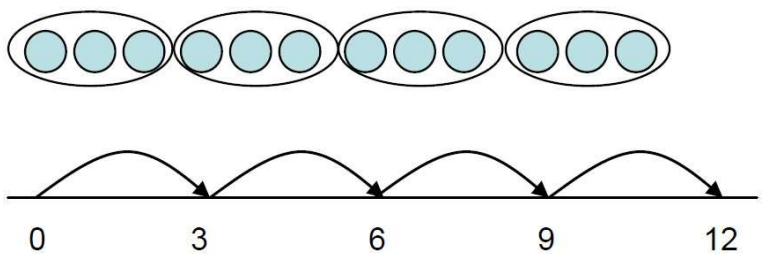
6 sweets shared between 2 people, how many do they each get?



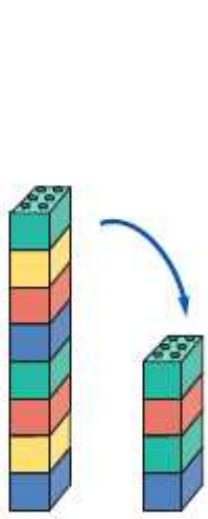
Children should be taught to recognise whether problems require sharing or grouping.

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





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



Complete the stem sentences.

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

□ ÷ □ = □

□ × □ = □

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?

MULTIPLICATION AND DIVISION Appendix 6

Year 3

Multiplication and Division facts

- **count** from 0 in multiples of **4, 8, 50 and 100** (copied from Number and Place Value).
- recall and use multiplication and division facts for the **3, 4 and 8 multiplication tables**.

Mental Calculations

- write and calculate **mathematical statements** for **multiplication** and division using the **multiplication tables** that they know, including for **TU x U**, using mental strategies.
  - Through **doubling & halving**, they connect the **2, 4 and 8** multiplication tables. X 4 = x 2 x 2 or ÷4= ÷2 ÷2 .
  - Pupils develop efficient mental methods, for example, using **commutativity** and **associativity** (for example, 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240)
  - Children use existing knowledge to **find related facts**:
    For example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3 to derive related facts (for example, 30 × 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).
- **relate division** to find **finding fractions** of amounts (for example 1/5 of 30 = 6) through using **diagrams, concrete resources and bar models**.

Written Calculations

- write and calculate **mathematical statements** for multiplication and division using the **multiplication tables** that they know, **including for TU x U**, using mental methods- **using related facts**.
- Use **number lines to calculate TU ÷ U** where appropriate (including remainders) by asking "How many groups of U are in TU?" and **chunking** on in groups of **U** (inverse – repeated addition).

Inverse Operations, Estimating and Checking

- **estimate** the answer to a calculation and **use inverse operations to check** answers.

Problem Solving

- solve problems, including **missing number** problems, involving multiplication and division, including positive **integer scaling problems** and correspondence problems (for example which n objects are connected to m objects?)

MULTIPLICATION - Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)

Children represent calculations as **arrays**, **repeated addition** and use **number lines** to calculate.

Through **doubling**, they connect the 2, 4 and 8 multiplication tables.

Pupils develop **efficient mental methods**, for example, using **commutativity** and associativity (for example, 4 × 12 × 5 = 4 × 5 × 12 = 20 × 12 = 240)

Children use existing knowledge to find **related facts:**

If 3 x 2 = 6 then 3 x 20 = 60

There are 8 children.
Each child has 3 sweets.
How many sweets altogether?

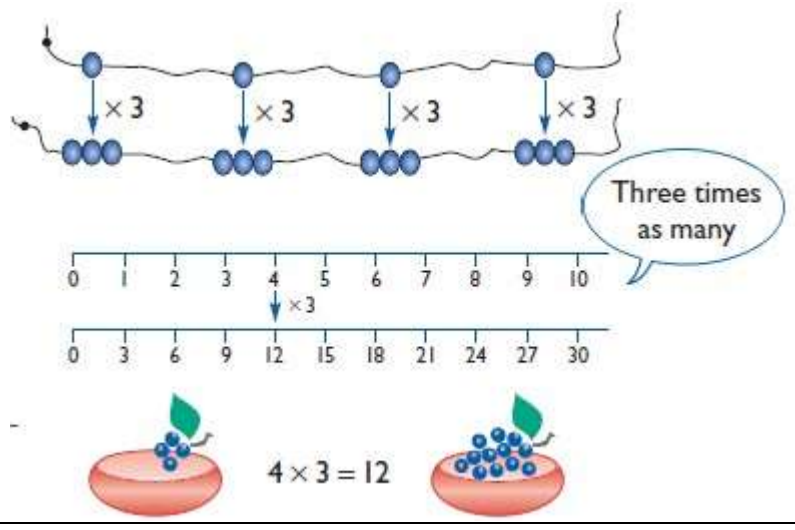
Use concrete or pictorial representations to show this problem.

If 5 × 3 = 15, which number sentences would find the answer to 6 × 3?

- 5 × 3 + 6
- 5 × 3 + 3
- 15 + 3
- 15 + 6
- 3 × 6

lain how you know.

Children continue to relate multiplication to scaling contexts.



DIVISION – Year 3

Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)

Children use existing knowledge to **find related facts:**

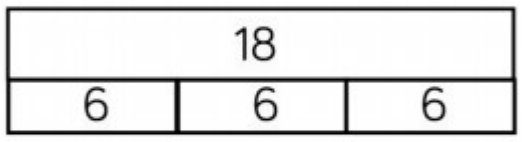
For example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (for example, 30 × 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).

Jack has 18 seeds.

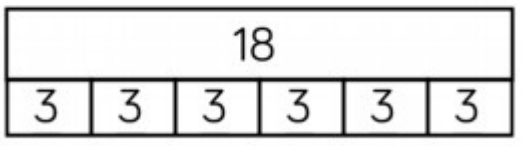
He plants 3 seeds in each pot.

Which bar model matches the problem?

A



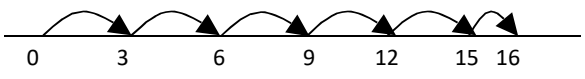
B



Explain your choice.

Children continue to use number lines to find groups of numbers including remainders:

16 ÷ 3 = 5 r1



Children find fractions of amounts and relate to division.

Fractions:

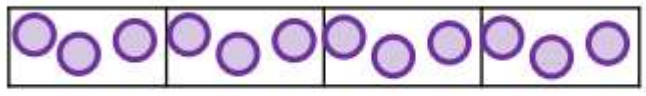
Find $\frac{1}{5}$ of Eva's marbles.

I have divided the marbles into ☐ equal groups.

There are ☐ marbles in each group.

$\frac{1}{5}$ of Eva's marbles is ☐ marbles.

Dexter has used a bar model and counters to find $\frac{1}{4}$ of 12



Use Dexter's method to calculate:

$\frac{1}{6}$ of 12 $\frac{1}{3}$ of 12 $\frac{1}{3}$ of 18 $\frac{1}{9}$ of 18

MULTIPLICATION AND DIVISION Appendix 6

Year 4

Multiplication and Division facts

- **count** in multiples of **6, 7, 9, 25 and 1000** (copied from Number and Place Value).
- recall multiplication and division facts for multiplication tables up to **12 × 12**.
- **Doubles** and **halves** of numbers up to 50.

Mental Calculations

- use place value, known and derived facts to **multiply and divide mentally**, including: **multiplying by 0 and 1; dividing by 1; multiplying together three numbers.**
- Recognise, and use, **factor pairs** and commutativity in mental calculations (appears also in Properties of Numbers).
- Understand the impact on place value when a number is **multiplied or divided by 10 and 100**
- Halve whole numbers **including odd numbers**.
- Consolidate that x 4 is doubling twice and **introduce x8** is **doubling three** times & ÷ 4 is ÷2 twice, ÷8 is ÷2 three times.

Written Calculations

- Multiply TU and HTU by a U **using grid method.**
- Multiply HTU x U using **the grid method** then moving into **formal written methods.**

Properties of Numbers – Multiples, Factors, Primes, Square and Cube numbers

- Recognise and use **factor pairs** and commutativity in mental calculations (repeated).

Inverse Operations, Estimating and Checking

- **Estimate** and use **inverse operations** to check answers to a calculation.

Problem Solving

- solve problems involving **multiplying and adding**, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.
- Solve **area** problems about **rectangles**.

MULTIPLICATION - Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)

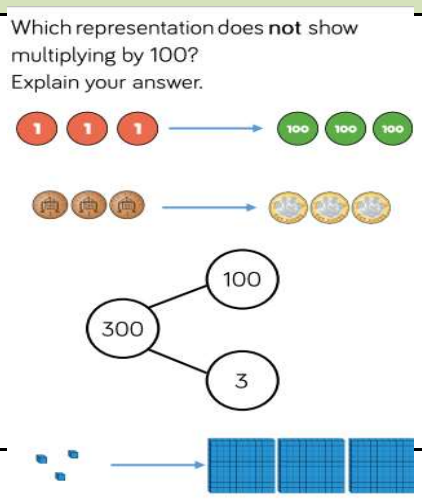
- Children know that the digits move to the left when a number is **multiplied by 10 and 100**

3 × ▪ = ▪▪▪ = 3 ones = 3

Complete:

3 × ▮ = ▮▮▮ = ___ tens = ___

3 × ▦ = ▦▦▦ = ___ hundreds = ___



Children use mental strategies to find **products** and **missing** numbers.

Use your knowledge of the 6 times table to complete the missing values?

6 × 2 = ___	___ × 6 = 12	6 × 2 × 10 = ___
___ × 20 = 120	20 × ___ = 120	6 × 2 × ___ = 1,200
6 × ___ = 1,200	200 × 6 = ___	10 × ___ × 6 = 120

I am thinking of 2 numbers where the sum of the numbers is 15 and the product is 54

What are my numbers?

Think of your own problem for a friend to solve?

Children use mental methods to multiply **three** one-digit numbers together using the "associate law"(it doesn't matter how we group the numbers).

Choose three digit cards.
Arrange them in the calculation.

□ × □ × □ = □

How many different calculations can you make using your three digit cards?
Which order do you find it the most efficient to calculate the product?
How have you grouped the numbers?

Make the target number of 84 using three of the digits below.

7	5	3	4	6	2

□ × □ × □ = 84

Multiply the remaining three digits together, what is the product of the three numbers?

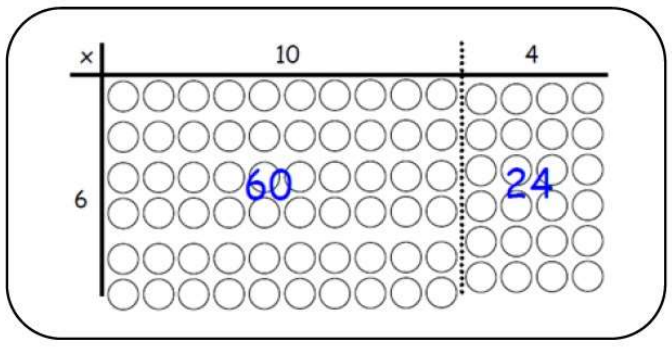
Is the product smaller or larger than 84?

Can you complete this problem in more than one way?

Children then move on to using grid method for multiplying two and three-digit numbers by one

14 x 6=
Estimation: 10 x 6 = 60

Link the layout of the grid to an array initially:



x	10	4
6	60	24

60 + 24 = 84

234 x 6
Estimation: 200 x 6 = 1200

200 + 180 + 24 = 1404 using column addition if necessary

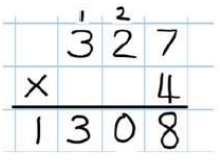
x	200	30	4
6	1200	180	24

1200
180
24
1404

Short multiplication for multiplying by a single digit

x	300	20	7
4	1200	80	28

1
1200
80
28
1308



DIVISION – Year 4

Children continue to learn from concrete resources and other models and images to develop conceptual understanding. (See Years 1 and 2)

Children use mental strategies to find **products** and **missing** numbers.

Children know that the digits move to the **right** when a number is **divided by 10 and 100.**

Eva and Whitney are dividing numbers by 10 and 100
They both start with the same 4-digit number.

They give some clues about their answer.

Eva

My answer has 8 ones and 2 tens.

My answer has 2 hundreds, 8 tens and 0 ones.

Whitney

What number did they both start with?
Who divided by what?

Use <, > or = to make each statement correct.

3,600 ÷ 10	◯	3,600 ÷ 100
2,700 ÷ 100	◯	270 ÷ 10
4,200 ÷ 100	◯	430 ÷ 10

Use the digit cards to fill in the missing digits.

1	2	3	4	5	6	7	8	9

170 ÷ 10 = __

_20 × 10 = 3,_00

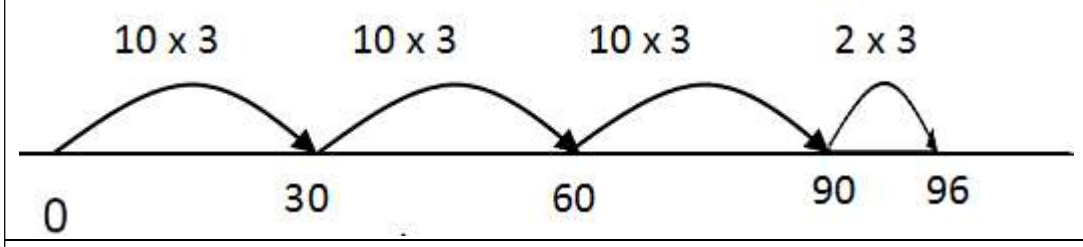
1,8_0 ÷ 10 = 1_6

_9 × 100 = 5,_00

6_ = 6,400 ÷ 100

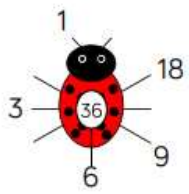
Children begin to **chunk** on a **number line**: (2 or 3 digit number by a 1 digit number)

96 ÷ 3 = 32



Children learn that a **factor** is a number which **divides** into another perfectly and can identify factor pairs which, when multiplied together, make the target number.

Here is an example of a factor bug for 12
Complete the factor bug for 36



Are all the factors in pairs?
Draw your own factor bugs for 16, 48, 56 and 35

Tommy says

The greater the number, the more factors it will have.

Is Tommy correct?

Use arrays to explain your answer.

How many other numbers can you find that are equal to the sum of their factors?
Which numbers are less than the sum of their factors?
Which numbers are greater than the sum of their factors?

Fractions:

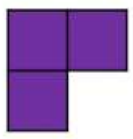
Children **find fractions** of amounts, when the **numerator is greater than 1** and apply this to more complex problems.

The school kitchen needs to buy carrots for lunch.
A large bag has 200 carrots and a medium bag has $\frac{3}{5}$ of a large bag.
Mrs Rose says,

I need 150 carrots so I will have to buy a large bag.

Is Mrs Rose correct?
Explain your reasoning.

These three squares are $\frac{1}{4}$ of a whole shape.



How many different shapes can you draw that could be the complete shape?

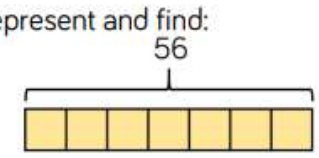
True or False?

To find $\frac{3}{8}$ of a number, divide by 3 and multiply by 8

Convince me.

Use a bar model to help you represent and find:

$\frac{1}{7}$ of 56 = 56 ÷ ☐



$\frac{2}{7}$ of 56 $\frac{3}{7}$ of 56 $\frac{4}{7}$ of 56 $\frac{4}{7}$ of 28 $\frac{7}{7}$ of 28

Jack has a bottle of lemonade.
He has one-fifth left in the bottle.
There are 150 ml left.
How much lemonade was in the bottle when it was full?