

Calculation Policy: Y4

Mathematical Manipulatives | Key Representations
Progression in Procedures



Avonwood Primary School

The best in everyone™

Part of United Learning

YEAR 4: Vocabulary



Key vocabulary

Place value: ones, tens, hundreds, thousands, column, tenth, hundredth, decimal, numeral

Addition: sum, addend, add

Subtraction: difference, subtrahend, subtract, partition

Multiplication: product, multiplicand, multiplier, multiply, multiple, repeated addition

Division: quotient, dividend, divisor, divide, repeated subtraction

Fractions: denominator, numerator, equal part, whole, equivalent, ascending, descending, unit fraction, non-unit fraction, tenth, hundredth

Manipulatives: place value counters, Dienes

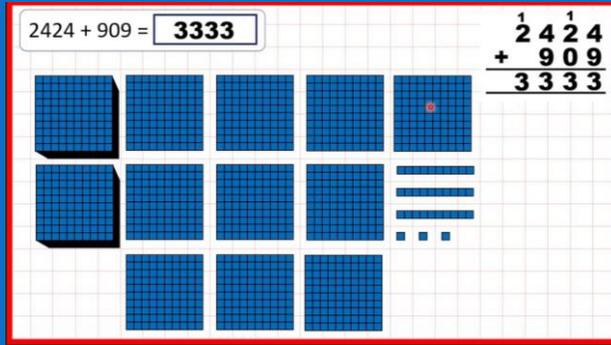
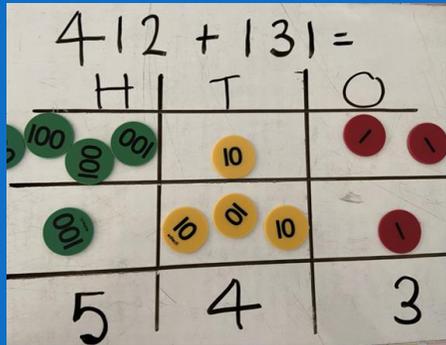
Representations: represent, representation, numberline, array, row/column, Part-Part-Whole diagram, bar model



YEAR 4: Addition

Manipulatives

The recommended manipulatives (physical resources) for adding numbers with up to 4-digits are **place value counters** and **Dienes**.

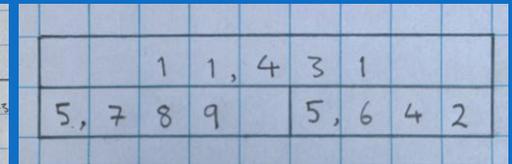
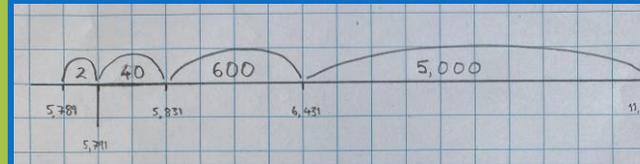


Representations

The key representations used are **place value grids**, **blank number lines** and **bar models**.

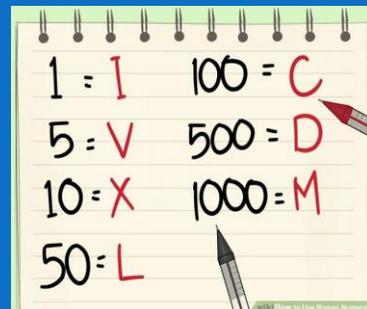
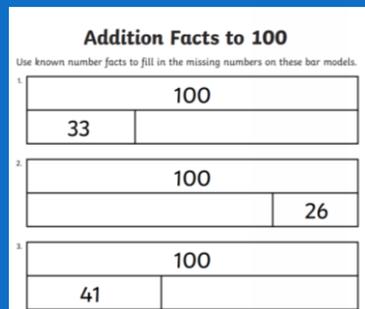
My Place Value Grid

Th	H	T	U	.	$\frac{1}{10}$	$\frac{1}{100}$
Thousands	Hundreds	Tens	Units		Tenths	Hundredths



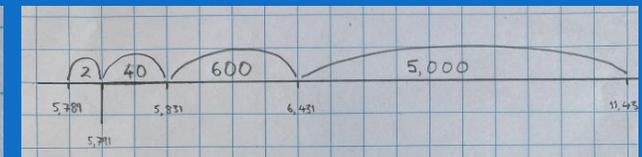
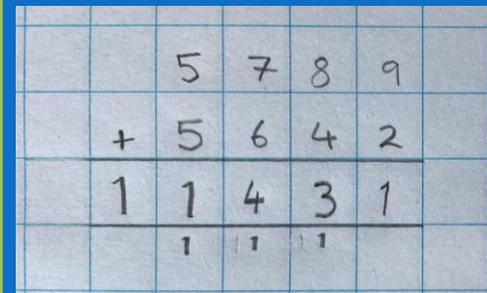
Factual knowledge

The key factual knowledge includes recall of addition/subtraction facts to 100, doubling/halving facts to 50 and all Roman numerals I-C.



Procedural knowledge

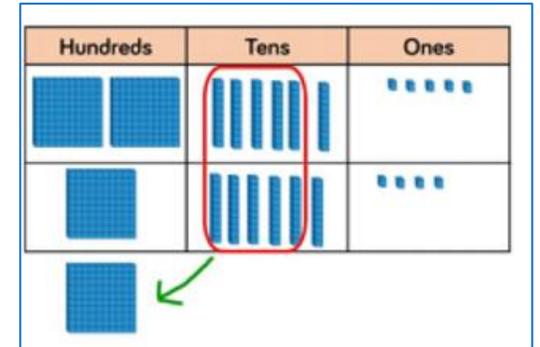
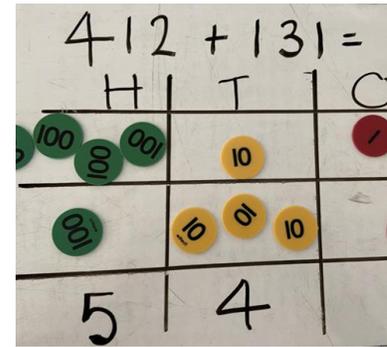
The key method is **formal column addition**. Use numberlines alongside the formal algorithm to promote flexibility, estimation and decision making (number sense).



Addition in Year 4

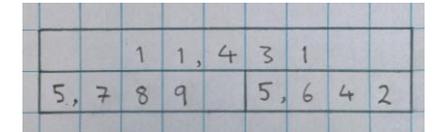
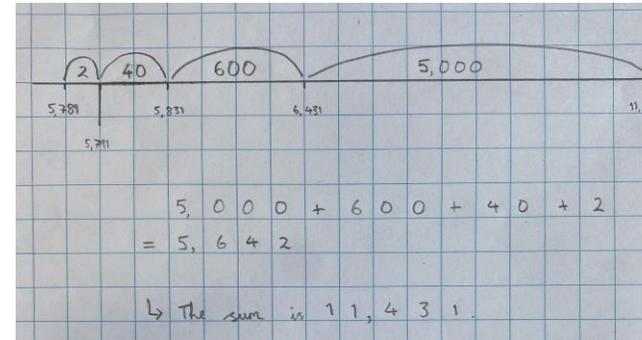
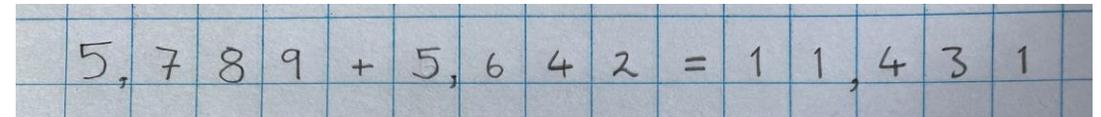
1. The recommended manipulatives (physical resources) for adding numbers with up to 4-digits are **place value counters** and **Dienes**.

1



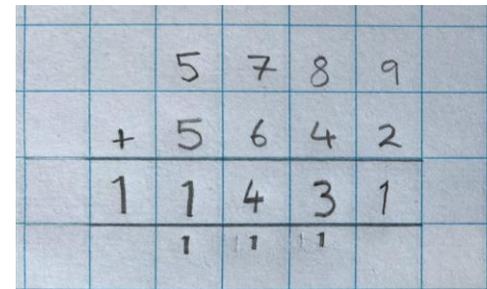
2. The key representations used are **place value grids**, **blank number lines** and **bar models**.

2



3. The key method (procedural knowledge) is **formal column addition** for numbers with up to 4 digits. It is suggested that the children write the calculation alongside representing the calculation on a numberline.

3



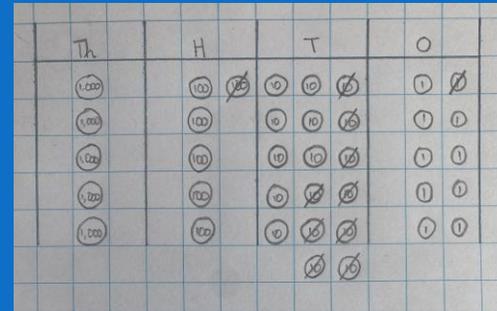


YEAR 4: Subtraction

Manipulatives

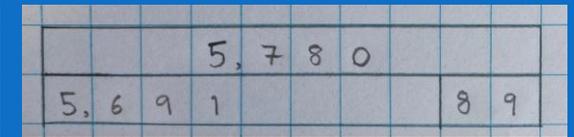
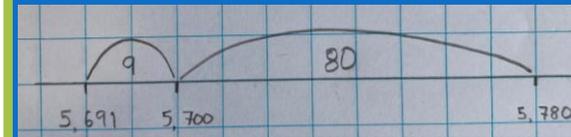
The recommended manipulatives (physical resources) for subtracting numbers with up to 4-digits are **place value counters and Dienes**.

$$5,780 - 5,691 = 89$$



Representations

The key representations used are **blank number lines, place value grids, bar models and part-part-whole diagrams**.



$$5,780 - 5,691 = 89$$

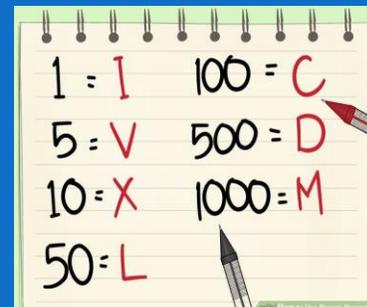
Factual knowledge

The key factual knowledge includes recall of addition/subtraction facts to 100, doubling/halving facts to 50 and all Roman numerals I-C.



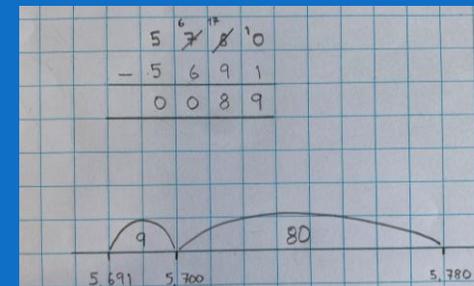
Addition Facts to 100
Use known number facts to fill in the missing numbers on these bar models.

1.	100	
	33	
2.	100	26
3.	100	
	41	



Procedural knowledge

The key methods is **formal column subtraction**. Use numberlines alongside the formal algorithm to promote flexibility, estimation and decision making (number sense).

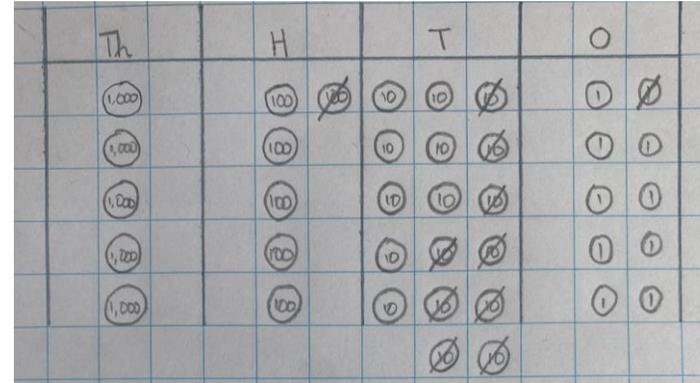


Key vocabulary: difference, minuend, subtrahend, subtract

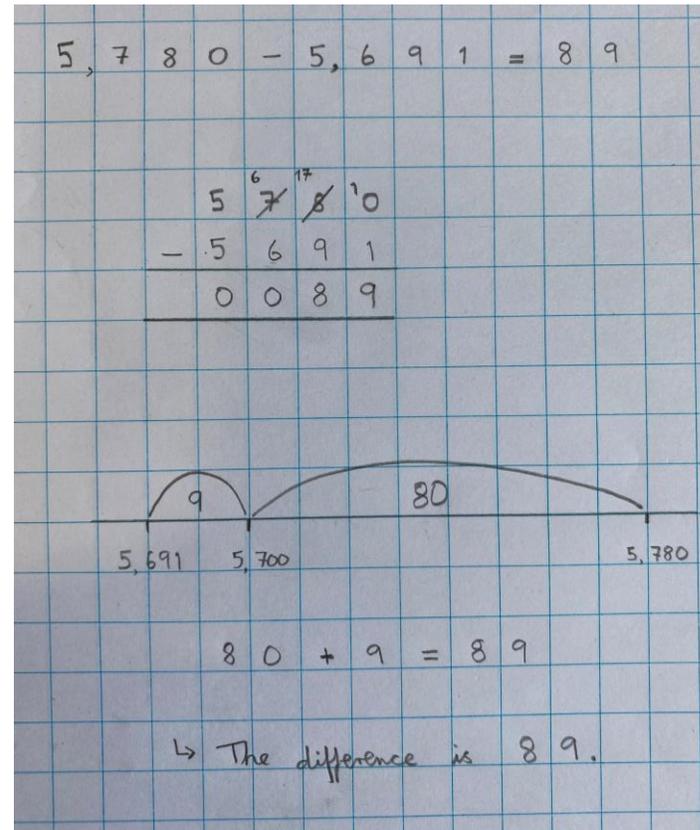
Subtraction in Year 4

- The recommended manipulatives (physical resources) for subtracting numbers with up to 4-digits are **place value counters** and **Dienes**.
- The key representations used are **blank number lines**, **place value grids**, **bar models** and **part-part-whole** diagrams (to develop flexible 'non-standard partitioning').
- The key method (procedural knowledge) is **formal column subtraction** for numbers with up to 4 digits. It is suggested that the children write the calculation alongside representing the calculation on a numberline to promote mental flexibility and active decision making (the numbers involved need to be carefully chosen to promote this).

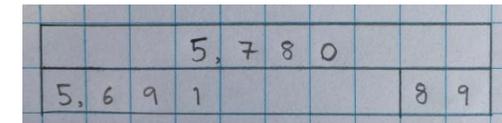
1



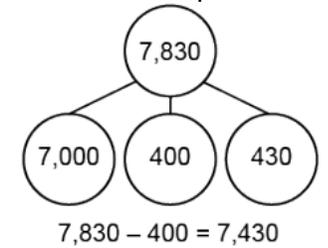
2



3



Non-standard partitioning:

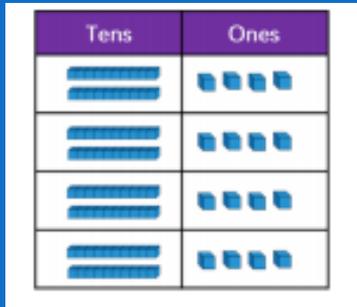




YEAR 4: Multiplication

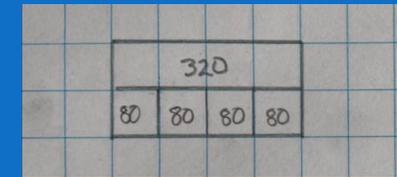
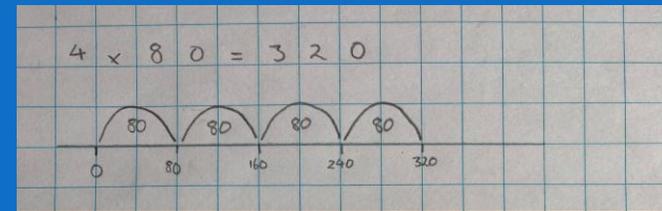
Manipulatives

The recommended manipulatives (physical resources) for multiplying numbers with up are **place value counters and Dienes**.



Representations

The key representations used are **blank number lines** and **bar models**.



Factual knowledge

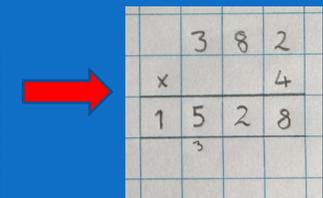
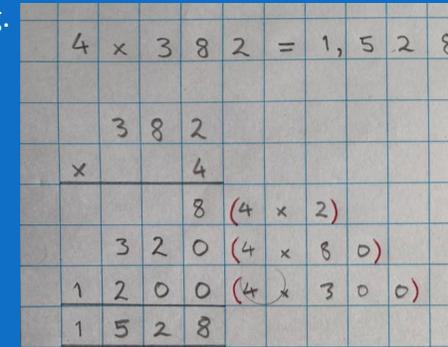
The key factual knowledge includes recall of **all** multiplication tables and count in multiples of 25 and 1,000.

TIMES TABLES					
1x	2x	3x	4x	5x	6x
1 x 1 = 1	1 x 2 = 2	1 x 3 = 3	1 x 4 = 4	1 x 5 = 5	1 x 6 = 6
2 x 1 = 2	2 x 2 = 4	2 x 3 = 6	2 x 4 = 8	2 x 5 = 10	2 x 6 = 12
3 x 1 = 3	3 x 2 = 6	3 x 3 = 9	3 x 4 = 12	3 x 5 = 15	3 x 6 = 18
4 x 1 = 4	4 x 2 = 8	4 x 3 = 12	4 x 4 = 16	4 x 5 = 20	4 x 6 = 24
5 x 1 = 5	5 x 2 = 10	5 x 3 = 15	5 x 4 = 20	5 x 5 = 25	5 x 6 = 30
6 x 1 = 6	6 x 2 = 12	6 x 3 = 18	6 x 4 = 24	6 x 5 = 30	6 x 6 = 36
7 x 1 = 7	7 x 2 = 14	7 x 3 = 21	7 x 4 = 28	7 x 5 = 35	7 x 6 = 42
8 x 1 = 8	8 x 2 = 16	8 x 3 = 24	8 x 4 = 32	8 x 5 = 40	8 x 6 = 48
9 x 1 = 9	9 x 2 = 18	9 x 3 = 27	9 x 4 = 36	9 x 5 = 45	9 x 6 = 54
10 x 1 = 10	10 x 2 = 20	10 x 3 = 30	10 x 4 = 40	10 x 5 = 50	10 x 6 = 60
11 x 1 = 11	11 x 2 = 22	11 x 3 = 33	11 x 4 = 44	11 x 5 = 55	11 x 6 = 66
12 x 1 = 12	12 x 2 = 24	12 x 3 = 36	12 x 4 = 48	12 x 5 = 60	12 x 6 = 72
7 x 7 = 49	8 x 8 = 64	9 x 9 = 81	10 x 10 = 100	11 x 11 = 121	12 x 12 = 144

Times tables: the 21 facts*					
1 x 1 = 1	2 x 2 = 4	3 x 3 = 9	4 x 4 = 16	5 x 5 = 25	6 x 6 = 36
1 x 2 = 2	2 x 3 = 6	3 x 4 = 12	4 x 5 = 20	5 x 6 = 30	6 x 7 = 42
1 x 3 = 3	2 x 4 = 8	3 x 5 = 15	4 x 6 = 24	5 x 7 = 35	6 x 8 = 48
1 x 4 = 4	2 x 5 = 10	3 x 6 = 18	4 x 7 = 28	5 x 8 = 40	6 x 9 = 54
1 x 5 = 5	2 x 6 = 12	3 x 7 = 21	4 x 8 = 32	5 x 9 = 45	6 x 10 = 60
1 x 6 = 6	2 x 7 = 14	3 x 8 = 24	4 x 9 = 36	5 x 10 = 50	6 x 11 = 66
1 x 7 = 7	2 x 8 = 16	3 x 9 = 27	4 x 10 = 40	5 x 11 = 55	6 x 12 = 72
1 x 8 = 8	2 x 9 = 18	3 x 10 = 30	4 x 11 = 44	5 x 12 = 60	6 x 13 = 78
1 x 9 = 9	2 x 10 = 20	3 x 11 = 33	4 x 12 = 48	5 x 13 = 65	6 x 14 = 84
1 x 10 = 10	2 x 11 = 22	3 x 12 = 36	4 x 13 = 52	5 x 14 = 70	6 x 15 = 90
1 x 11 = 11	2 x 12 = 24	3 x 13 = 39	4 x 14 = 56	5 x 15 = 75	6 x 16 = 96
1 x 12 = 12	2 x 13 = 26	3 x 14 = 42	4 x 15 = 60	5 x 16 = 80	6 x 17 = 102
2 x 13 = 26	2 x 14 = 28	2 x 15 = 30	2 x 16 = 32	2 x 17 = 34	2 x 18 = 36
3 x 13 = 39	3 x 14 = 42	3 x 15 = 45	3 x 16 = 48	3 x 17 = 51	3 x 18 = 54
4 x 13 = 52	4 x 14 = 56	4 x 15 = 60	4 x 16 = 64	4 x 17 = 68	4 x 18 = 72
5 x 13 = 65	5 x 14 = 70	5 x 15 = 75	5 x 16 = 80	5 x 17 = 85	5 x 18 = 90
6 x 13 = 78	6 x 14 = 84	6 x 15 = 90	6 x 16 = 96	6 x 17 = 102	6 x 18 = 108
7 x 13 = 91	7 x 14 = 98	7 x 15 = 105	7 x 16 = 112	7 x 17 = 119	7 x 18 = 126
8 x 13 = 104	8 x 14 = 112	8 x 15 = 120	8 x 16 = 128	8 x 17 = 136	8 x 18 = 144

Procedural knowledge

The key method is the **expanded method** and **formal column multiplication**. It is suggested that the children write the calculation alongside the numberline to secure conceptual understanding.



Key vocabulary: product, multiplicand, multiplier, multiply, multiple, repeated addition

Multiplication in Year 4

- The recommended manipulatives (physical resources) for multiplying 2/3-digit numbers by 1-digit numbers are **place value counters** and **Dienes**.
- The key representations used are: **blank number lines** (to show the link with repeated addition) and **bar models**.
- The key methods (procedural knowledge) are the **expanded** written method and **formal column** method for multiplying 2/3-digit numbers by 1-digit numbers. It is suggested that the children write the calculation alongside the numberline to secure conceptual understanding.

1

Tens	Ones
10 10	1 1
10 10	1 1
10 10	1 1
10 10	1 1

$$\square + \square + \square + \square = \square$$

$$\square \times \square = \square$$

Tens	Ones
4 bars	4 dots

	T	O
	2	4
x		4
	9	6
	1	

2

$$4 \times 80 = 320$$

3

$$4 \times 382 = 1,528$$

	3	8	2	
x			4	
		8	(4 x 2)	
	3	2	0	(4 x 80)
1	2	0	0	(4 x 300)
1	5	2	8	



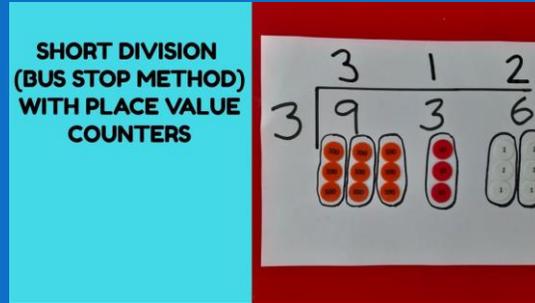
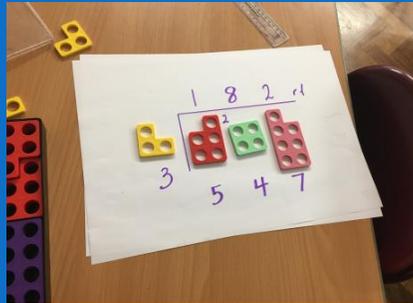
	3	8	2
x			4
	1	5	2
		8	
		3	



YEAR 4: Division

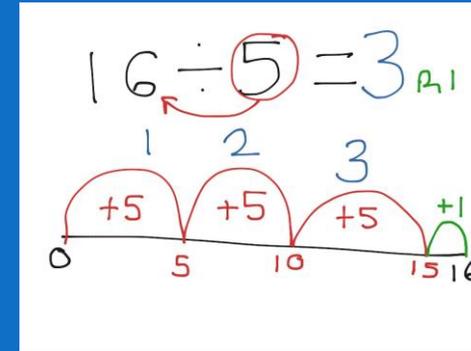
Manipulatives

The recommended manipulatives (physical resources) for Division Numicon and are place value counters.



Representations

The key representations used are blank number lines and place value grids.



Factual knowledge

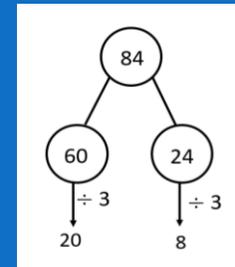
The key factual knowledge includes recall of **all** multiplication tables and count in multiples of 25 and 1,000.

	+1	+2	+3	+4	+5	+6	+7	+8	+9	+10	+11	+12
=1	1	2	3	4	5	6	7	8	9	10	11	12
=2	2	4	6	8	10	12	14	16	18	20	22	24
=3	3	6	9	12	15	18	21	24	27	30	33	36
=4	4	8	12	16	20	24	28	32	36	40	44	48
=5	5	10	15	20	25	30	35	40	45	50	55	60
=6	6	12	18	24	30	36	42	48	54	60	66	72
=7	7	14	21	28	35	42	49	56	63	70	77	84
=8	8	16	24	32	40	48	56	64	72	80	88	96
=9	9	18	27	36	45	54	63	72	81	90	99	108
=10	10	20	30	40	50	60	70	80	90	100	110	120
=11	11	22	33	44	55	66	77	88	99	110	121	132
=12	12	24	36	48	60	72	84	96	108	120	132	144

1	2	3	4	5
1×1=1	2×2=4	3×3=9	4×4=16	5×5=25
1×2=2	2×3=6	3×4=12	4×5=20	5×6=30
1×3=3	2×4=8	3×5=15	4×6=24	5×7=35
1×4=4	2×5=10	3×6=18	4×7=28	5×8=40
1×5=5	2×6=12	3×7=21	4×8=32	5×9=45
1×6=6	2×7=14	3×8=24	4×9=36	
1×7=7	2×8=16	3×9=27		
1×8=8	2×9=18			
1×9=9				
6	7	8	9	
6×6=36	7×7=49	8×8=64	9×9=81	
6×7=42	7×8=56	8×9=72		
6×8=48	7×9=63			
6×9=54				

Procedural knowledge

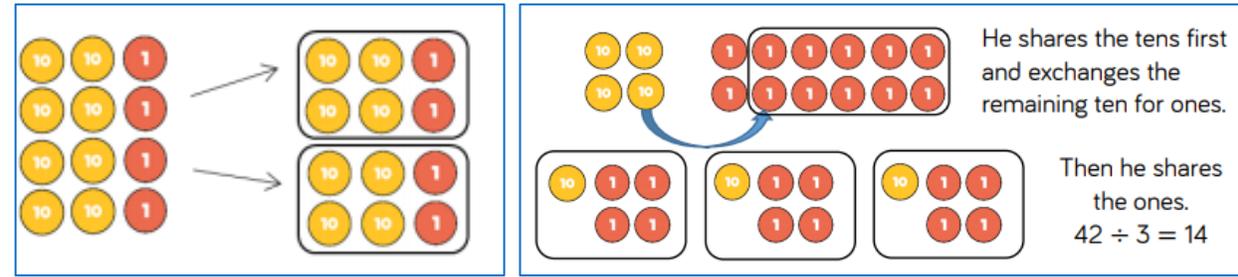
The key method is short division.



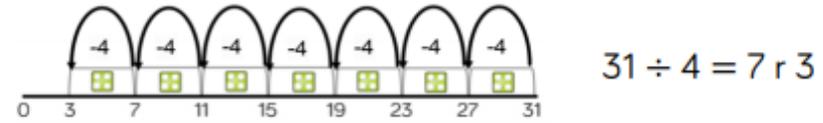
Division in Year 4

- The recommended manipulatives (physical resources) for dividing 2-digit numbers by 1-digit numbers are **place value counters** and **Dienes**.
- The key representations used are: **blank number lines** (to show the link with repeated subtraction), **bar models**, **part-part-whole diagrams** and **place value grids**.
- The key method (procedural knowledge) for dividing a 3-digit number by and 1-digit number is **short division**. It is suggested that the children begin by exploring this method using manipulatives (place value counters, Dienes or Numicon).

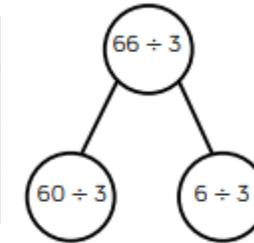
1



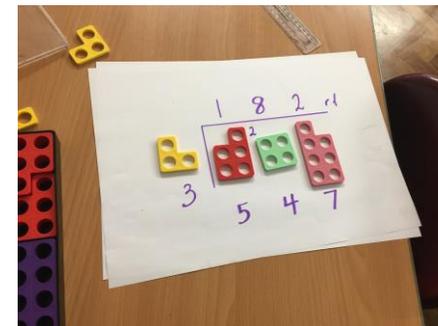
2



Tens	Ones
10 10	1 1
10 10	1 1
10 10	1 1



3



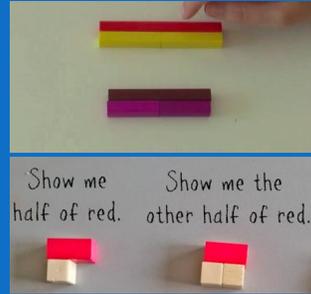
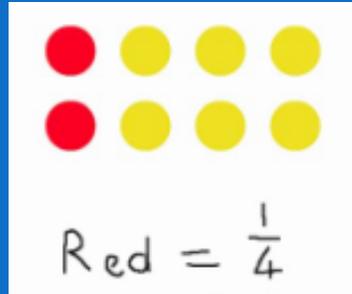
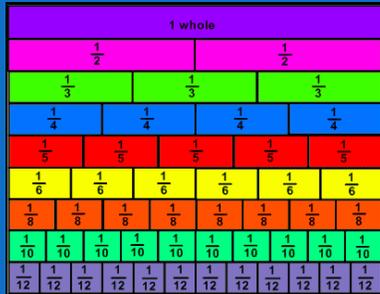
$$\begin{array}{r}
 \text{H} \quad \text{T} \quad \text{U} \\
 1 \quad 3 \quad 4 \quad \text{r} \quad 4 \\
 6 \overline{) 8208}
 \end{array}$$



YEAR 4: Fractions

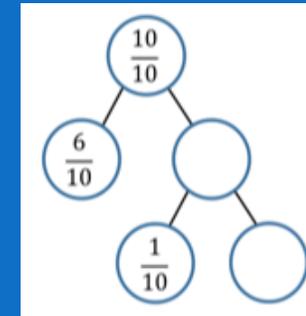
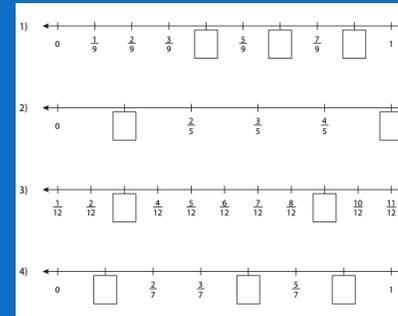
Manipulatives

The recommended manipulatives (physical resources) for Fractions are **fraction walls**, **two-colour counters** and **Cuisenaire rods**.



Representations

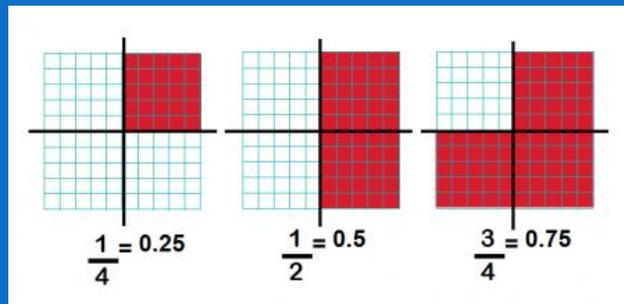
The key representations are **number lines**, **PPW diagrams** and **bar models**.



Factual knowledge

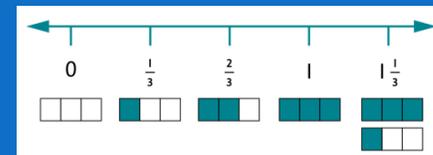
The key factual knowledge includes the recall and recognition of decimal equivalents of $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$ and decimal equivalents of any number of tenths/hundredths.

★ Decimal Equivalents for Tenths and Hundredths			
0.1	$\frac{1}{10}$	0.03	$\frac{3}{100}$
0.5	$\frac{5}{10}$	0.08	$\frac{8}{100}$

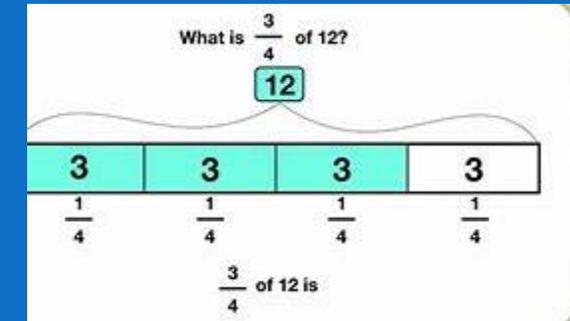


Procedural knowledge

The key procedures are counting up/down in fractions on a numberline, adding/subtracting fractions and finding non-unit fractions of amount.



$$\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$$



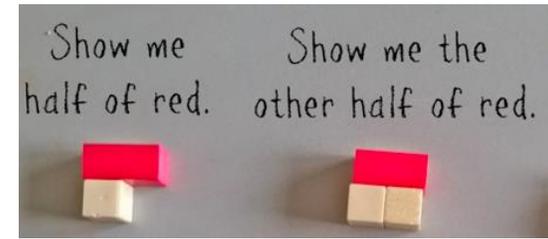
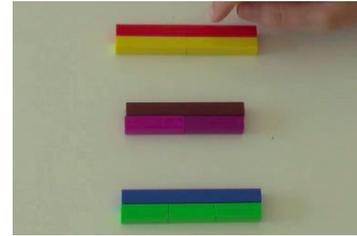
Fractions in Year 4

1. The recommended manipulatives (physical resources) for fractions are **two-colour counters** and **Cuisenaire rods**.

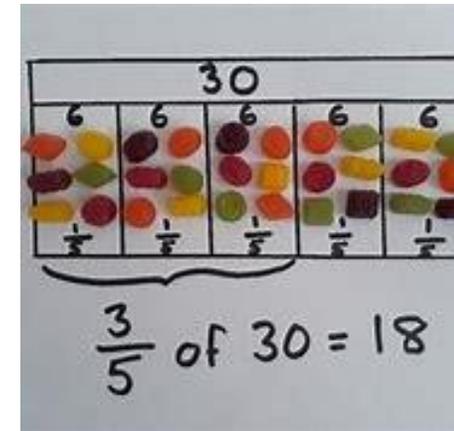
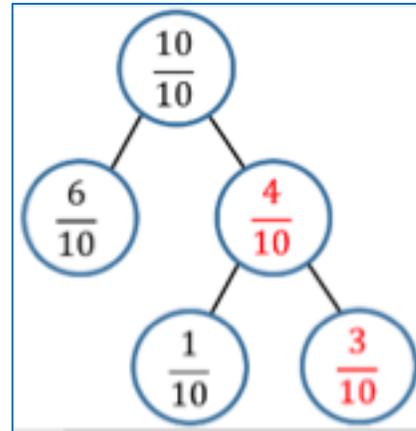
2. The key representations are **blank number lines**, **part-part-whole diagrams** and **bar models**.

3. The key procedural knowledge includes: **counting in fractions on a numberline**, **ordering fractions with the same denominator**, **adding/subtracting fractions with the same denominator**

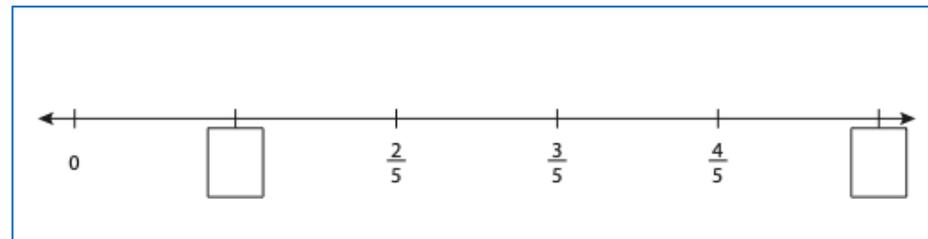
1



2



3



$$\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$$