

Calculation Policy: Y3

Mathematical Manipulatives | Key Representations
Progression in Procedures



Avonwood Primary School

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Key vocabulary

Place value: ones, tens, hundreds, column, tenth

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

Manipulatives: place value counters, Dienes

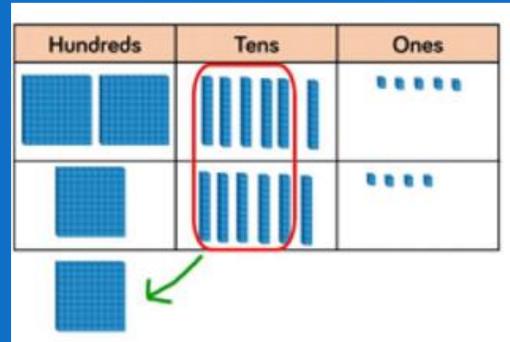
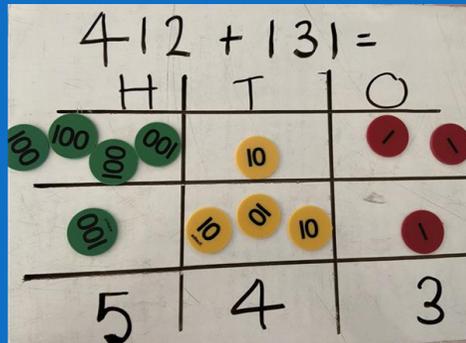
Representations: represent, representation, numberline, array, row/column, Part-Part-Whole diagram, bar model



YEAR 3: Addition

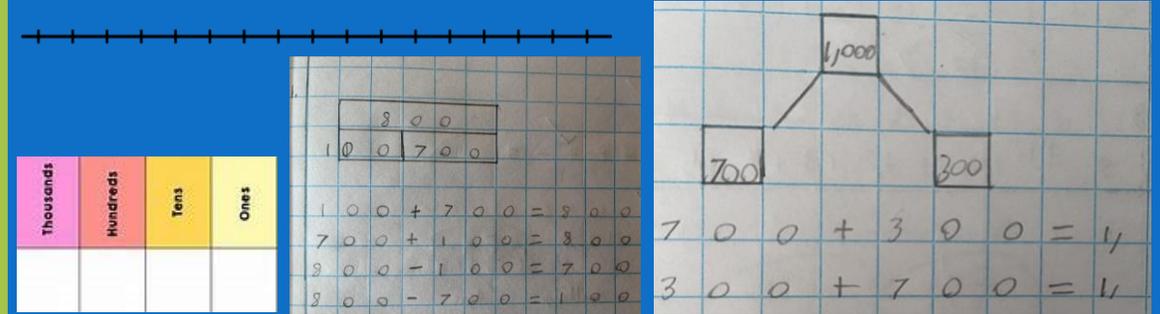
Manipulatives

The recommended manipulatives (physical resources) for adding numbers with up to 3-digits are **place value counters and Dienes**.



Representations

The key representations used are **blank number lines, place value grids, bar models and part-part-whole diagrams** (which encourage children to apply their knowledge of place value).



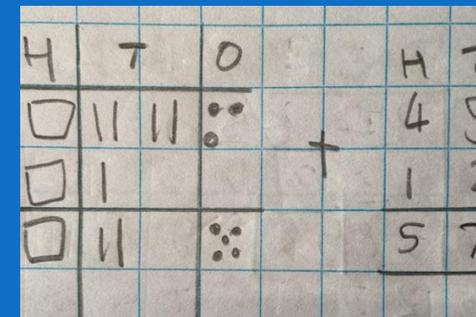
Factual knowledge

The key factual knowledge includes recall of addition/subtraction facts to 20, doubling/halving facts to 20.

Addition Tables						
0	1	2	3	4	5	6
0	0+0	0+1	0+2	0+3	0+4	0+5
1	1+0	1+1	1+2	1+3	1+4	1+5
2	2+0	2+1	2+2	2+3	2+4	2+5
3	3+0	3+1	3+2	3+3	3+4	3+5
4	4+0	4+1	4+2	4+3	4+4	4+5
5	5+0	5+1	5+2	5+3	5+4	5+5
6	6+0	6+1	6+2	6+3	6+4	6+5
7	7+0	7+1	7+2	7+3	7+4	7+5
8	8+0	8+1	8+2	8+3	8+4	8+5
9	9+0	9+1	9+2	9+3	9+4	9+5
10	10+0	10+1	10+2	10+3	10+4	10+5

Procedural knowledge

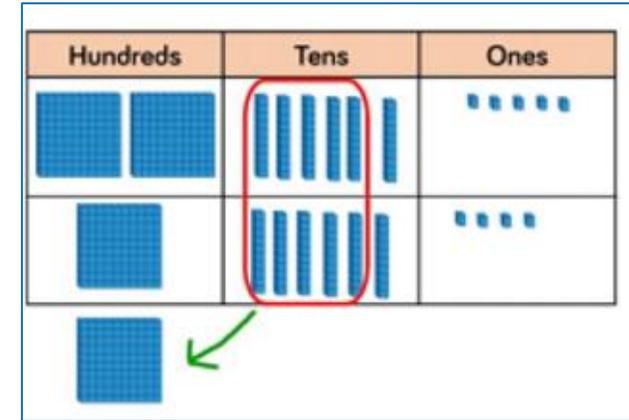
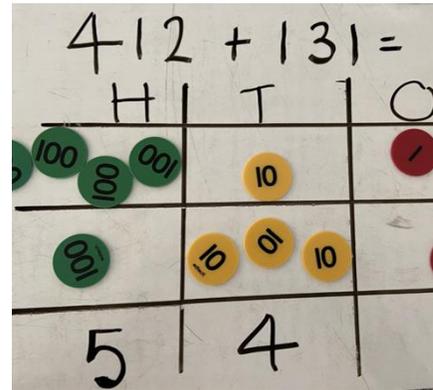
The key methods is **formal column addition**. It is suggested that the children write the calculation alongside the concrete resources to ensure they can see the link between the two.



Addition in Year 3

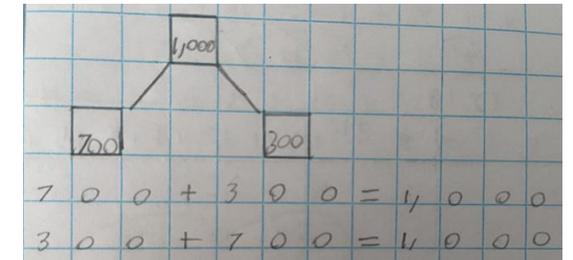
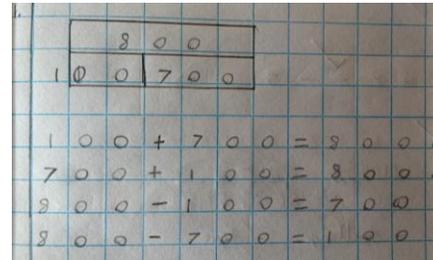
1. The recommended manipulatives (physical resources) for adding numbers with up to 3- digits are **place value counters and Dienes**.

1



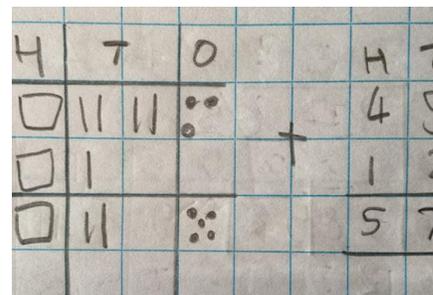
2. The key representations used are: **blank number lines, part-part-whole diagrams and bar models** (which encourage children to apply their knowledge of place value) and **place value grids**.

2



3. The key method (procedural knowledge) is **formal column addition** for numbers with up to 3 digits. It is suggested that the children write the calculation alongside the concrete resources to ensure they can see the link between the two.

3

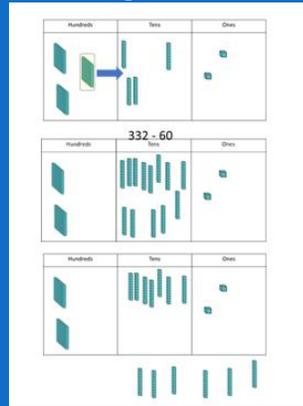
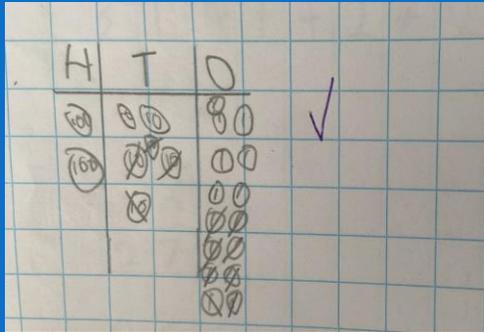




YEAR 3: Subtraction

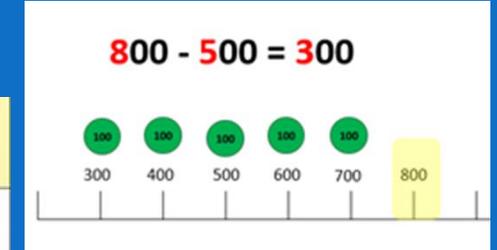
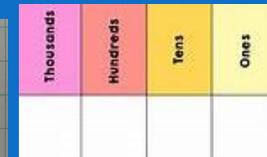
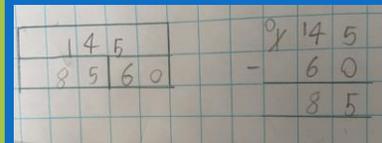
Manipulatives

The recommended manipulatives (physical resources) for subtracting numbers with up to 3- digits are **place value counters and Dienes**.



Representations

The key representations used are **number lines, place value grids, bar models and part-part-whole diagrams** (which encourage children to apply their knowledge of place value).



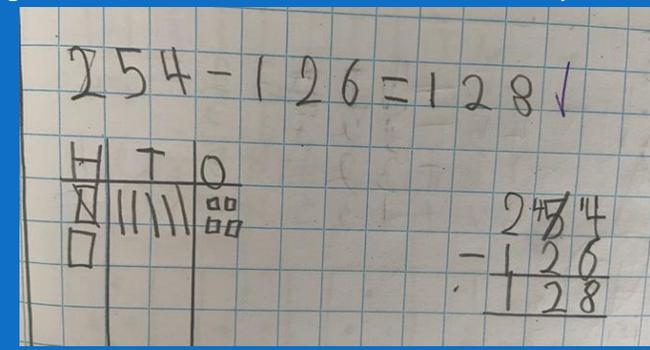
Factual knowledge

The key factual knowledge includes recall of addition/subtraction facts to 20, doubling/halving facts to 20.

Subtraction Tables						
Subtracting 1	Subtracting 2	Subtracting 3	Subtracting 4	Subtracting 5	Subtracting 6	Subtracting 7
10-1	11-2	12-3	13-4	14-5	15-6	16-7
9-1	10-2	11-3	12-4	13-5	14-6	15-7
8-1	9-2	10-3	11-4	12-5	13-6	14-7
7-1	8-2	9-3	10-4	11-5	12-6	13-7
6-1	7-2	8-3	9-4	10-5	11-6	12-7
5-1	6-2	7-3	8-4	9-5	10-6	11-7
4-1	5-2	6-3	7-4	8-5	9-6	10-7
3-1	4-2	5-3	6-4	7-5	8-6	9-7
2-1	3-2	4-3	5-4	6-5	7-6	8-7

Procedural knowledge

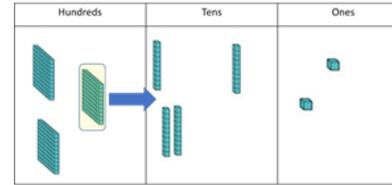
The key methods is **formal column subtraction**. It is suggested that the children write the calculation alongside the concrete resources to ensure they can see the link between the two.



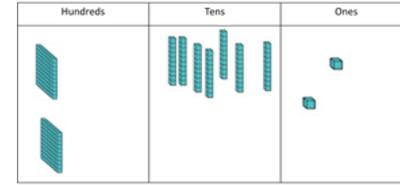
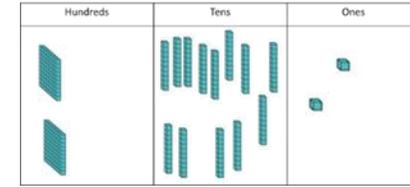
Subtraction in Year 3

1. The recommended manipulatives (physical resources) for subtracting numbers with up to 3-digits are **place value counters** and **Dienes**.

1



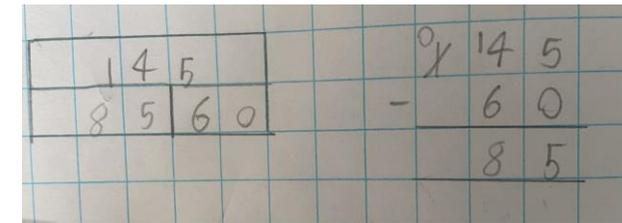
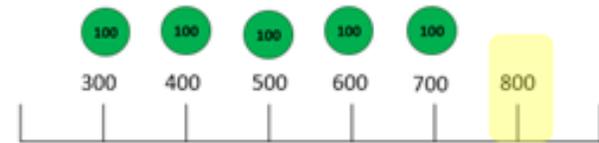
$$332 - 60$$



2. The key representations used are: **number lines**, **bar models** and **part-part-whole diagrams** (which encourage children to apply their knowledge of place value) and **place value grids**.

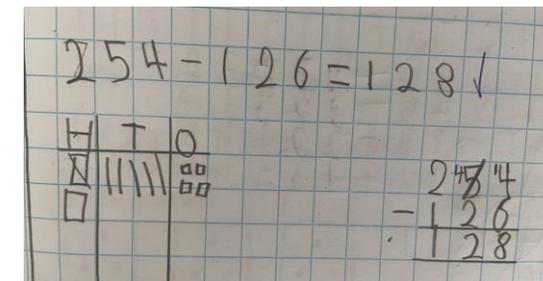
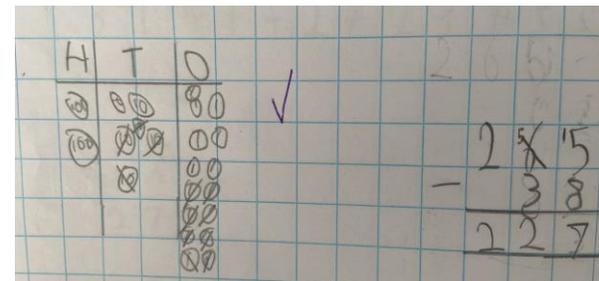
2

$$800 - 500 = 300$$



3. The key method (procedural knowledge) is **formal column subtraction** for numbers with up to 3 digits. It is suggested that the children write the calculation alongside the concrete resources to ensure they can see the link between the two.

3

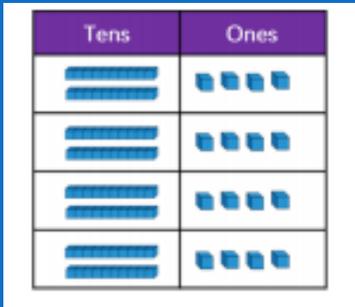




YEAR 3: Multiplication

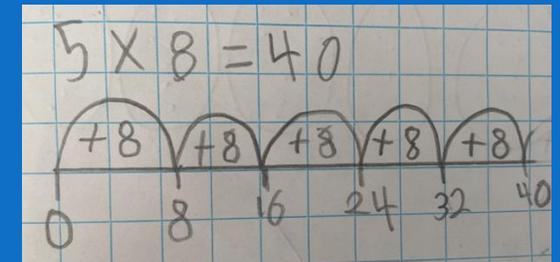
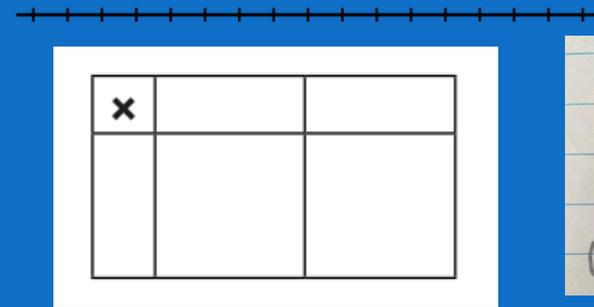
Manipulatives

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 place value grids**.



Factual knowledge

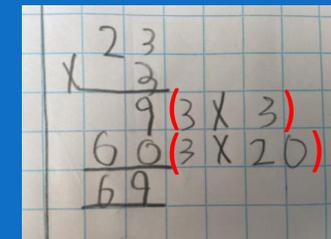
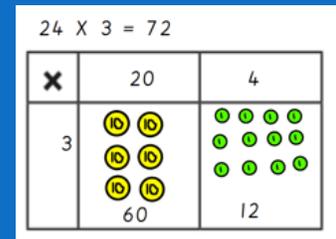
The key factual knowledge includes recall of 2, 3, 4, 5, 8 and 10 multiplication tables and counting in multiples of 50 and 100.

x	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

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

Procedural knowledge

The key methods are grid method, expanded written method and **formal column multiplication**. It is suggested that the children write the calculation alongside the concrete resources to ensure they can see the link between the two.



Hundreds	Tens	Ones	
			T O
			3 4
			x 5
			1 7 0
			1 2

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

Multiplication in Year 3

- The recommended manipulatives (physical resources) for multiplying 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 addition), **bar models** and **place value grids**.
- The key methods (procedural knowledge) are **Grid** method, **Expanded** written method and **formal column** method. It is suggested that the children write the calculation alongside the concrete resources to ensure they can see the link between the two.

1

Tens	Ones
● ●	● ●
● ●	● ●
● ●	● ●
● ●	● ●

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

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

Tens	Ones
■■■■	■■■■
■■■■	■■■■
■■■■	■■■■
■■■■	■■■■

	T	O
	2	4
x		4
	9	6
	1	

2

$5 \times 8 = 40$

3

$24 \times 3 = 72$

x	20	4
3	● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ●
	60	12

$3 \times 20 = 60$ $3 \times 4 = 12$

0 60 72

Tens	Ones
●	● ● ● ● ● ● ● ●
●	● ● ● ● ● ● ● ●
●	● ● ● ● ● ● ● ●
●	● ● ● ● ● ● ● ●

T	O
1	6
x	4
6	4
	2

Hundreds	Tens	Ones
	● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ●
	● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ●
	● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ●
	● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ●
●	● ● ● ● ● ● ● ●	● ● ● ● ● ● ● ●

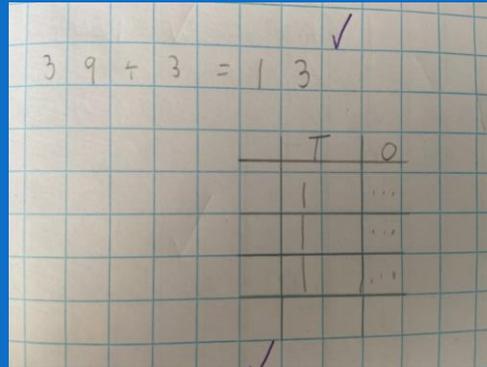
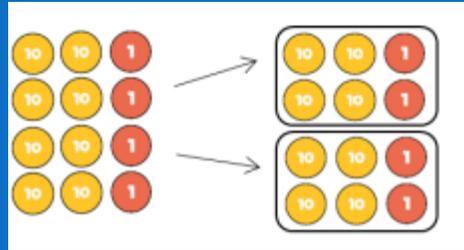
T	O
3	4
x	5
1	7
1	2



YEAR 3: Division

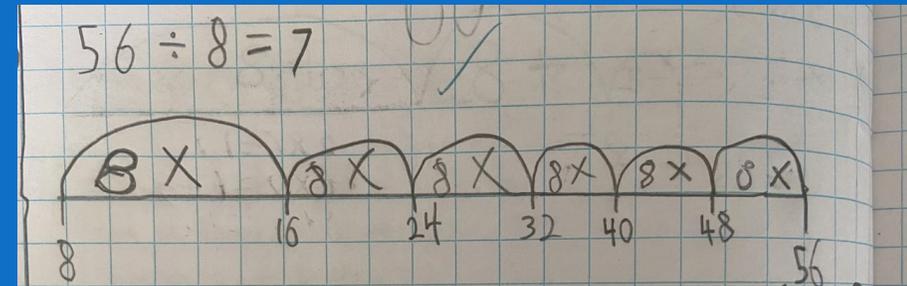
Manipulatives

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



Representations

The key representations used are **blank number lines**.



Factual knowledge

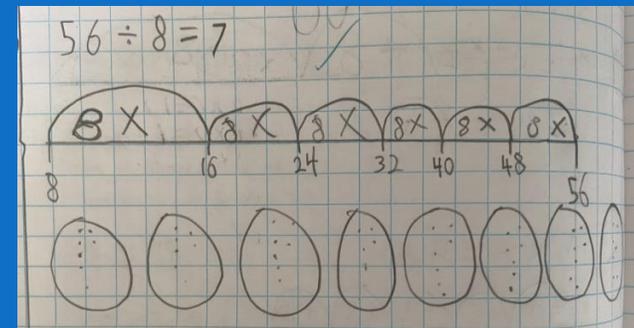
The key factual knowledge includes recall of 2, 3, 4, 5, 8 and 10 multiplication tables and counting in multiples of 50 and 100.

	+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

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
7x	8x	9x	10x	11x	12x
7 x 7 = 49	7 x 8 = 56	7 x 9 = 63	7 x 10 = 70	7 x 11 = 77	7 x 12 = 84
8 x 7 = 56	8 x 8 = 64	8 x 9 = 72	8 x 10 = 80	8 x 11 = 88	8 x 12 = 96
9 x 7 = 63	9 x 8 = 72	9 x 9 = 81	9 x 10 = 90	9 x 11 = 99	9 x 12 = 108
10 x 7 = 70	10 x 8 = 80	10 x 9 = 90	10 x 10 = 100	10 x 11 = 110	10 x 12 = 120
11 x 7 = 77	11 x 8 = 88	11 x 9 = 99	11 x 10 = 110	11 x 11 = 121	11 x 12 = 132
12 x 7 = 84	12 x 8 = 96	12 x 9 = 108	12 x 10 = 120	12 x 11 = 132	12 x 12 = 144

Procedural knowledge

The key method is repeated subtraction on a number line.



Key vocabulary: quotient, divisor, dividend, divide, repeated subtraction

Division in Year 3

- 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 2-digit number by and 1-digit number is **repeated subtraction on a number line**. It is suggested that the children write the calculation alongside the concrete resources to ensure they can see the link between the two.

1

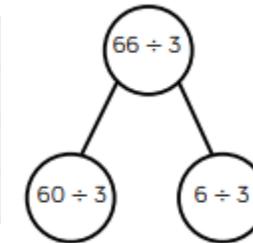
He shares the tens first and exchanges the remaining ten for ones.

Then he shares the ones.
 $42 \div 3 = 14$

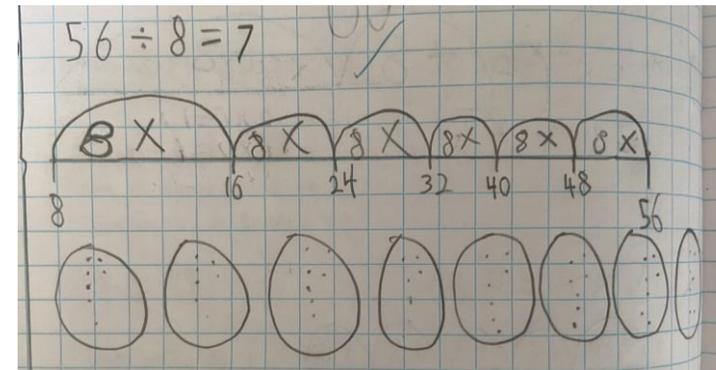
2



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



3

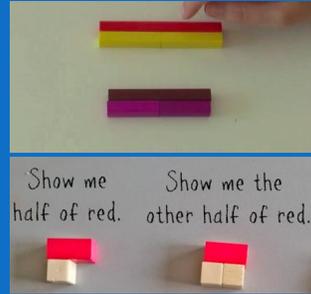
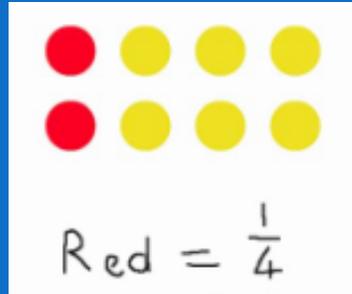
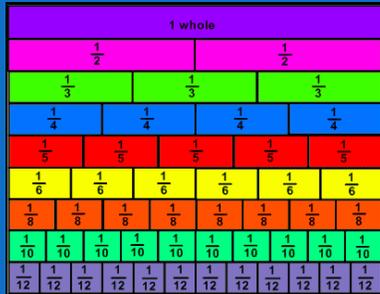




YEAR 3: Fractions

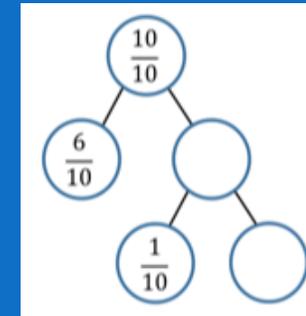
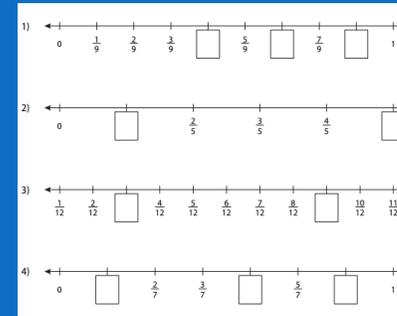
Manipulatives

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



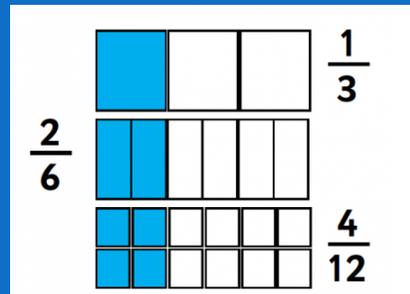
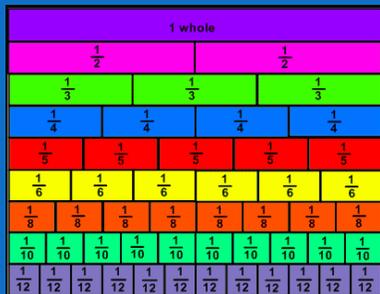
Representations

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



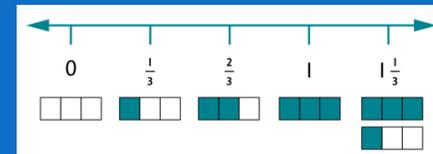
Factual knowledge

The key factual knowledge includes the recall and recognition of equivalent fractions with small denominators using a **fraction wall**.

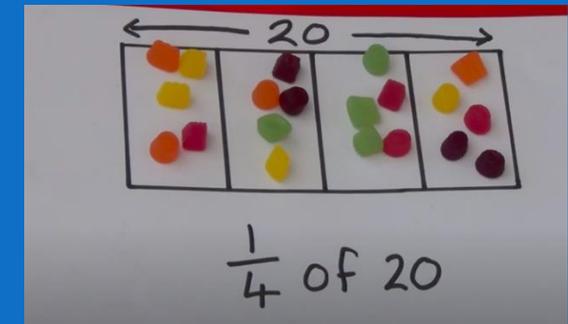


Procedural knowledge

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



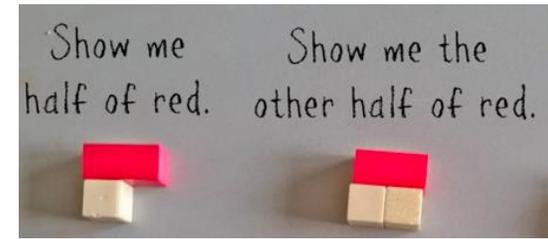
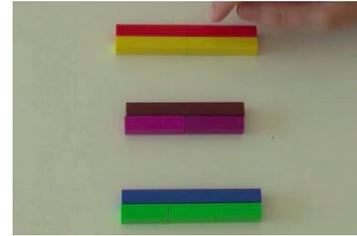
$$\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$$



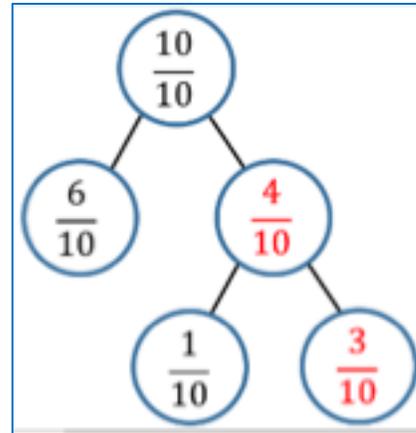
Fractions in Year 3

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

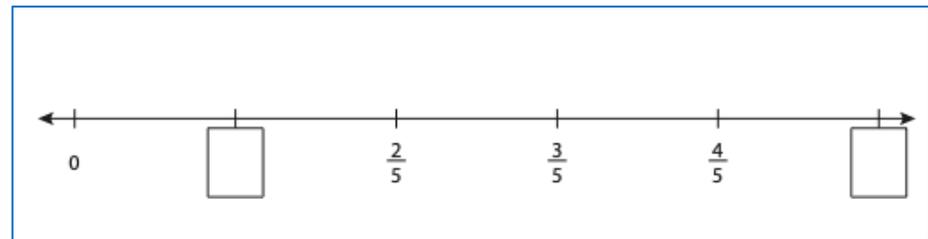
1



2



3



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