

Calculation Policy: Y5

Mathematical Manipulatives | Key Representations
Progression in Procedures



Avonwood Primary School

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Key vocabulary

Place value: ones, tens, hundreds, column, ascending, descending, consecutive

Addition: sum, addend, add

Subtraction: difference, subtrahend, subtract

Multiplication: product, multiplicand, multiplier, multiply, repeated addition, composite number, multiple, product, factor

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

Fractions: denominator, numerator, equal part, whole

Manipulatives: place value counters, Dienes

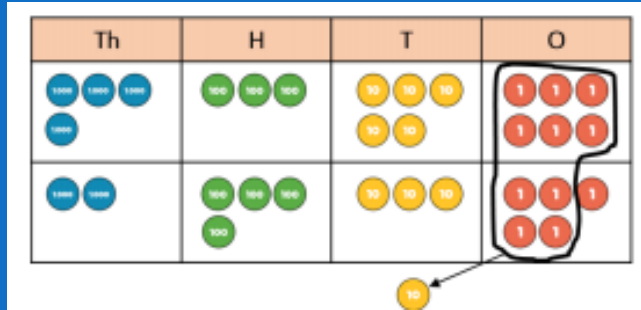
Representations: represent, representation, numberline, array, row/column, Part-Part-Whole diagram, bar model



YEAR 5: Addition

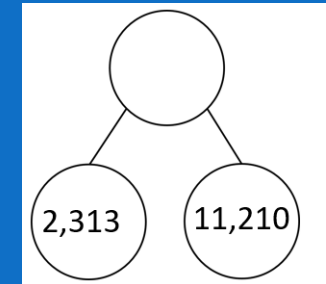
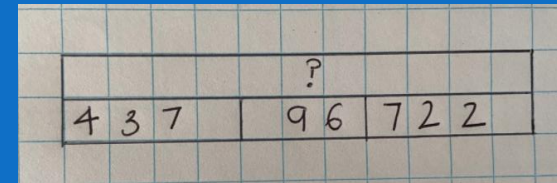
Manipulatives

The recommended manipulatives (physical resources) for adding numbers with more than 4- digits are **place value counters and Dienes**. This should build on prior knowledge.



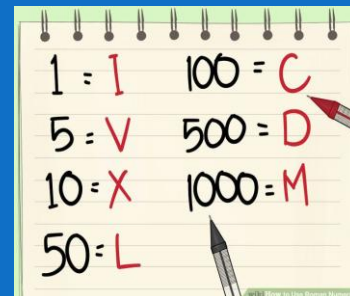
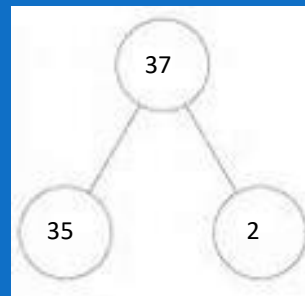
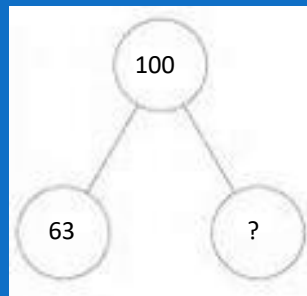
Representations

The key representations used are **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 100 and doubling/halving facts to 100 and Roman Numerals I-M.



Procedural knowledge









The key methods is **formal column addition**.


	Th	H	T	O
	4	3	5	6
+	2	4	3	5
	6	7	9	1
			1	

Addition in Year 5

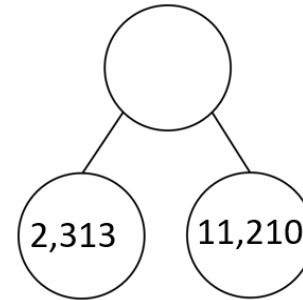
1. The recommended manipulatives (physical resources) for adding numbers with more than 4-digits are **place value counters and dienes**.
2. The key representations used are: **part-part-whole diagrams and , bar models** (which encourage children to apply their knowledge of place value) and **place value grids**.
3. The key methods is **formal column addition**.

1

Th	H	T	O
			
			



2



3

	Th	H	T	O
	4	3	5	6
+	2	4	3	5
	6	7	9	1

1

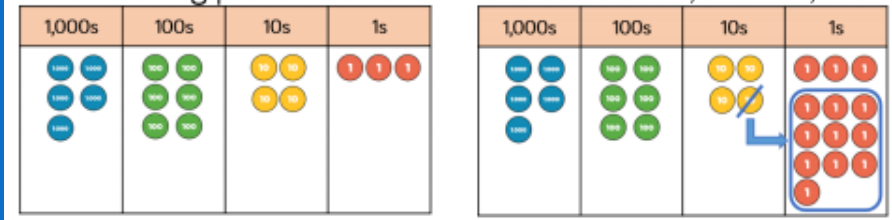


YEAR 5: Subtraction

Manipulatives

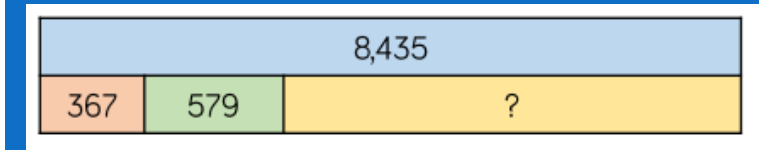
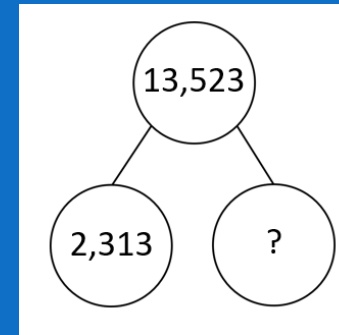
The recommended manipulatives (physical resources) for subtracting numbers with more than 4-digits are **place value counters and Dienes**.

Dexter is using place value counters to calculate $5,643 - 4,316$



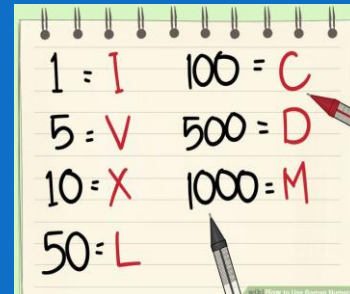
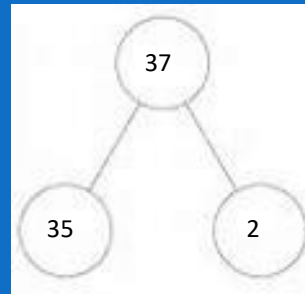
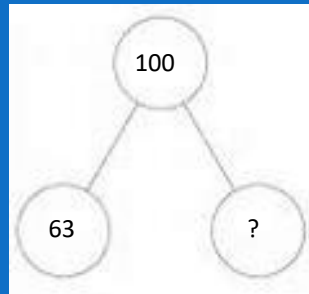
Representations

The key representations used are **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 100 and doubling/halving facts to 100 and Roman Numerals I-M.



Procedural knowledge

The key methods is **formal column subtraction**.

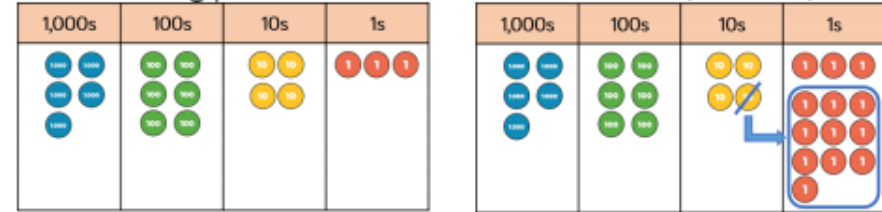
	Th	H	T	O
		6	3	13
-	4	3	1	6
	1	3	2	7

Subtraction in Year 5

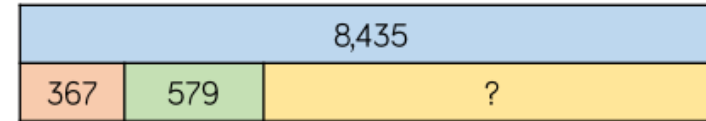
1. The recommended manipulatives (physical resources) for subtracting numbers with more than 4- digits are **place value counters and dienes**.
2. The key representations used are: **part-part-whole diagrams, bar models** (which encourage children to apply their knowledge of place value) and **place value grids**.
3. The key methods is **formal column subtraction**.

1

Dexter is using place value counters to calculate $5,643 - 4,316$



2



3

	Th	H	T	O
	5	6	3	13
-	4	3	1	6
	1	3	2	7



YEAR 5: Multiplication

Manipulatives

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

Annie earns £1,325 per week.
How much would he earn in 4 weeks?

Thousands	Hundreds	Tens	Ones
1000	100 100 100	10 10	1 1 1 1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1 1 1 1

Representations

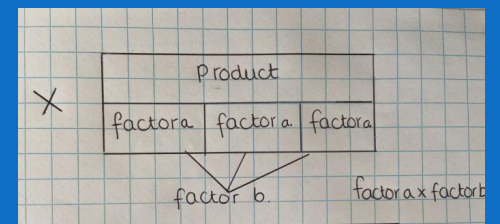
The key representations used are **number lines, place value grids and bar models**.



Rosie adapts the Base 10 method to calculate 44

×	10	10	10	10	1	1	1	1
30	100	100	100	100	10	10	10	10
30	100	100	100	100	10	10	10	10
30	100	100	100	100	10	10	10	10
1	10	10	10	10	1	1	1	1
1	10	10	10	10	1	1	1	1

×	40	4
30	1,200	120
2	80	8



Factual knowledge

The key factual knowledge includes recall of all multiplication tables.

Multiplication Table

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

TIMES TABLES

1x	2x	3x	4x	5x	6x
1x1=1	1x2=2	1x3=3	1x4=4	1x5=5	1x6=6
2x1=2	2x2=4	2x3=6	2x4=8	2x5=10	2x6=12
3x1=3	3x2=6	3x3=9	3x4=12	3x5=15	3x6=18
4x1=4	4x2=8	4x3=12	4x4=16	4x5=20	4x6=24
5x1=5	5x2=10	5x3=15	5x4=20	5x5=25	5x6=30
6x1=6	6x2=12	6x3=18	6x4=24	6x5=30	6x6=36
7x1=7	7x2=14	7x3=21	7x4=28	7x5=35	7x6=42
8x1=8	8x2=16	8x3=24	8x4=32	8x5=40	8x6=48
9x1=9	9x2=18	9x3=27	9x4=36	9x5=45	9x6=54
10x1=10	10x2=20	10x3=30	10x4=40	10x5=50	10x6=60
11x1=11	11x2=22	11x3=33	11x4=44	11x5=55	11x6=66
12x1=12	12x2=24	12x3=36	12x4=48	12x5=60	12x6=72
7x	8x	9x	10x	11x	12x
1x7=7	1x8=8	1x9=9	1x10=10	1x11=11	1x12=12
2x7=14	2x8=16	2x9=18	2x10=20	2x11=22	2x12=24
3x7=21	3x8=24	3x9=27	3x10=30	3x11=33	3x12=36
4x7=28	4x8=32	4x9=36	4x10=40	4x11=44	4x12=48
5x7=35	5x8=40	5x9=45	5x10=50	5x11=55	5x12=60
6x7=42	6x8=48	6x9=54	6x10=60	6x11=66	6x12=72
7x7=49	7x8=56	7x9=63	7x10=70	7x11=77	7x12=84
8x7=56	8x8=64	8x9=72	8x10=80	8x11=88	8x12=96
9x7=63	9x8=72	9x9=81	9x10=90	9x11=99	9x12=108
10x7=70	10x8=80	10x9=90	10x10=100	10x11=110	10x12=120
11x7=77	11x8=88	11x9=99	11x10=110	11x11=121	11x12=132
12x7=84	12x8=96	12x9=108	12x10=120	12x11=132	12x12=144

Procedural knowledge

The key methods are **grid method** and **formal column multiplication**.

×	40	4
30	1,200	120
2	80	8

		2	3	
×		1	4	
		9	2	(23 × 4)
	2	3	0	(23 × 10)

Multiplication in Year 5

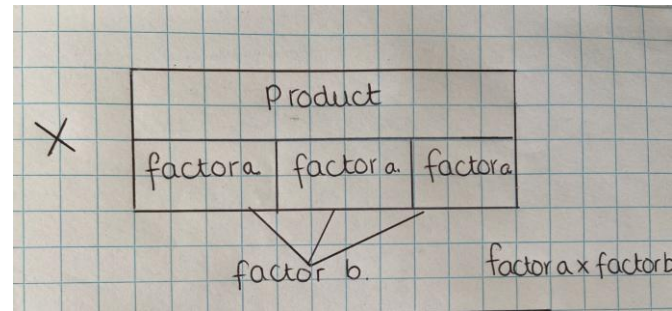
1. The recommended manipulatives (physical resources) for multiplying 4- digit numbers by 2- digit numbers are **place value counters and dienes**.
2. The key representations used are: **bar model** and **place value grids**.
3. The key methods are **Grid method**, and **formal column method**.

1

Annie earns £1,325 per week.
How much would he earn in 4 weeks?

Thousands	Hundreds	Tens	Ones
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1
1000	100 100 100	10 10	1 1 1 1 1

2



3

x	40	4
30	1,200	120
2	80	8

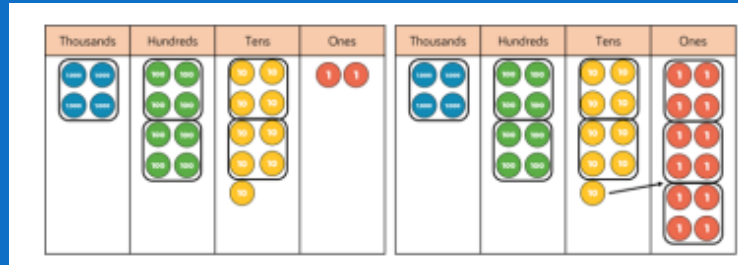
		2	3	
x		1	4	
		9	2	(23 × 4)
	2	3	0	(23 × 10)



YEAR 5: Division


Manipulatives

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



Representations

The key representations used are **bar models and part-part whole models**.

Jack is dividing 84 by 4 using place value counters. 

First, he divides the tens. Then, he divides the ones.

Factual knowledge

The key factual knowledge includes recall of all multiplication tables.

Division Table												
	+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 methods are **short division**.

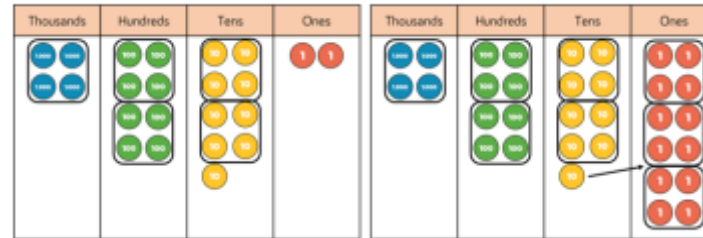
		1	2	2	3
4	4	8	9	4	r2

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

Division in Year 5

1

1. The recommended manipulatives (physical resources) for dividing 4- digit numbers by 2- digit numbers are **place value counters and dienes**.

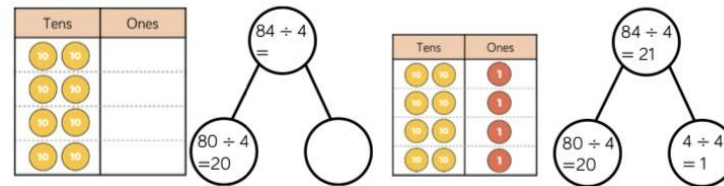


	1	2	2	3
4	4	8	9	¹ 2

2

2. The key representations used are: **blank number lines** (to show the link with repeated addition), **and bar model**.

Jack is dividing 84 by 4 using place value counters. 
 First, he divides the tens. Then, he divides the ones.



3

3. The key methods are **short division**.

	1	2	2	3		
4	4	8	9	¹ 4		r2



YEAR 5: Fractions

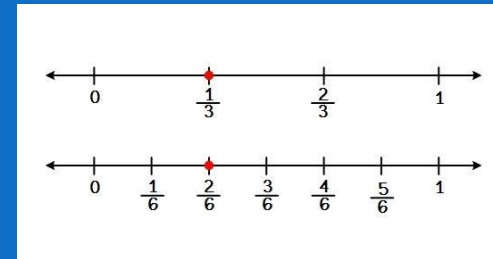
Manipulatives

The recommended manipulatives (physical resources) for fractions are **Cuisenaire**.

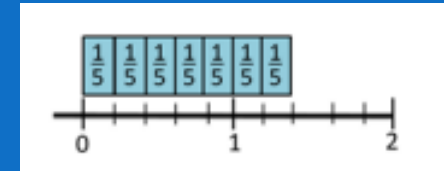


Representations

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



$$\frac{1}{5} \times 7 = \frac{7}{5} = 1\frac{2}{5}$$



Factual knowledge

The key factual knowledge includes the recall and recognition of **equivalent fractions** (whose denominators are multiples of the same number); writing **decimal numbers as fractions**.

$$\frac{1}{2} = \frac{2}{4} = \frac{3}{6} = \frac{4}{8}$$
$$\frac{1}{3} = \frac{2}{6} = \frac{3}{9} = \frac{4}{12}$$
$$\frac{1}{5} = \frac{2}{10} = \frac{3}{15} = \frac{4}{20}$$

[for example, $0.71 = \frac{71}{100}$]

Procedural knowledge

The key procedures are **converting** between mixed numbers and fractions, **adding/subtracting** fractions with different denominators and **multiplying fractions by integers**.

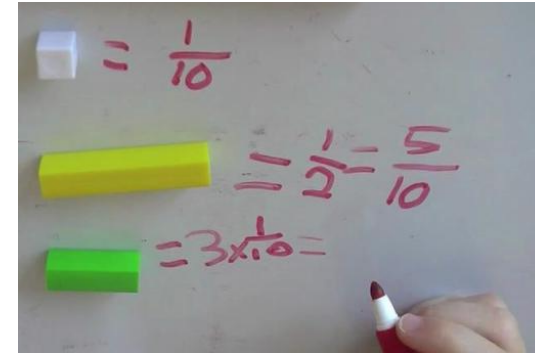
$$2\frac{3}{4} = \frac{(4 \times 2) + 3}{4} = \frac{11}{4}$$

$$\begin{array}{r} \frac{3}{4} + \frac{4}{5} \\ \times 5 \quad \times 4 \\ \hline \frac{15}{20} + \frac{16}{20} = \frac{31}{20} \end{array}$$

Fractions in Year 5

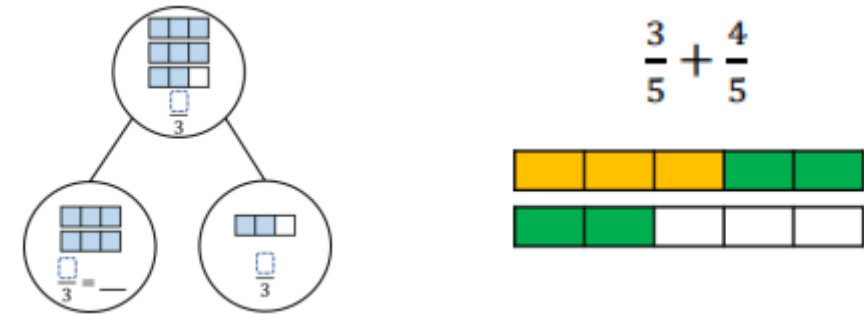
1. The recommended manipulatives (physical resources) for fractions are Cuisenaire.

1



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

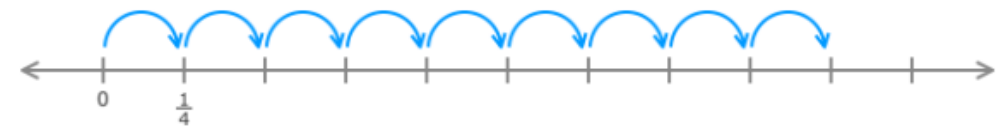
2



3. The key procedural knowledge includes: **counting in fractions on a number line**, **ordering fractions with the same denominator**, **multiplying fractions by integers**.

3

The model shows the product of $\frac{1}{4}$ and 9.



Multiply:

$$\frac{1}{4} \times 9 = \frac{\square}{\square}$$