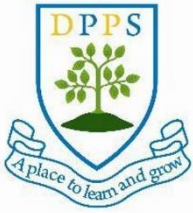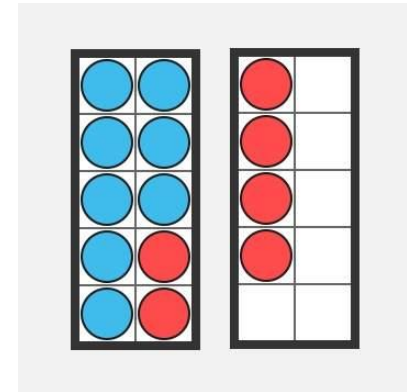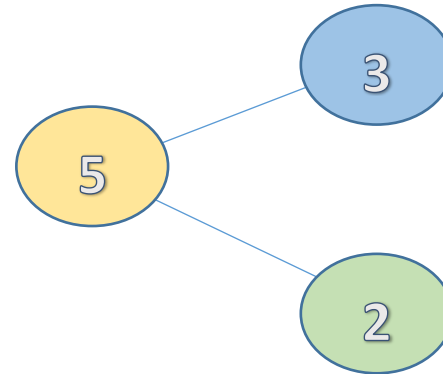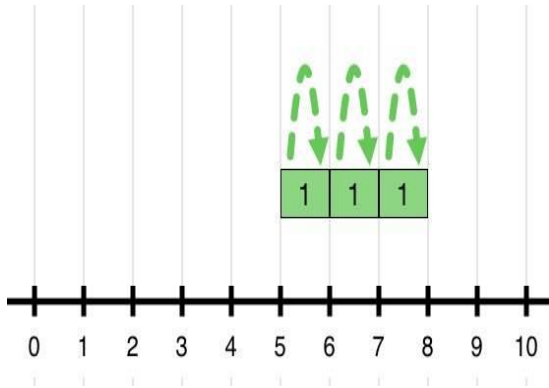# Calculation Policy 2017-18

This policy documents the mathematical concepts and procedures encountered throughout the school's Singapore Maths approach. The methods and the approach are tailored to meet the expectations and objectives of the National Curriculum.
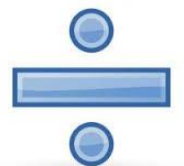
Early Addition

5 + 3 = 8

Children use 'unifix' cubes and/or a number line to learn to 'count on.'

3 + 2 = 5

Part/Whole diagrams are introduced to display number bonds within 10.

8 + 6 = 14

Children use ten frames to support efficient strategies for adding (e.g. using number bonds to make ten).

Children have access to a range of 'concrete' resources to support the exploration of addition. Addition is presented to them in a variety of contexts, progressing from single digit addition to word problems that require addition within 20.

Tens and Ones

Tens   Ones

Tens   Ones

Tens   Ones

20   3   2   3

+   +   +   +   +

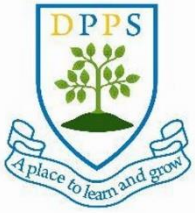10   2   1   2

=   =   =   =   =
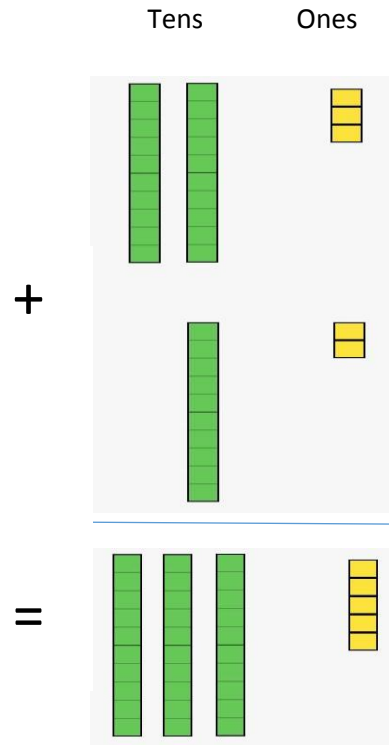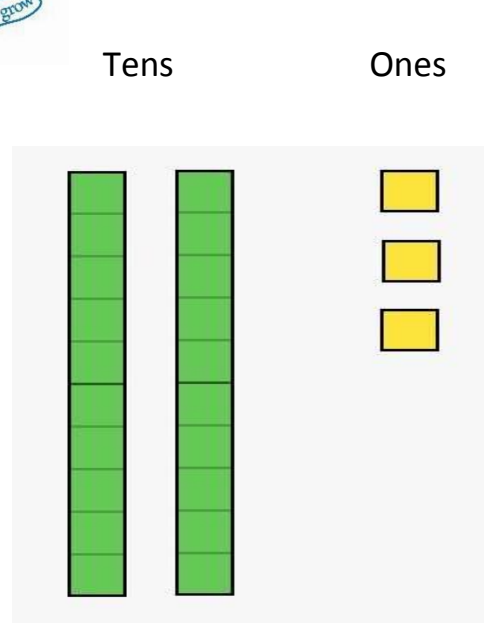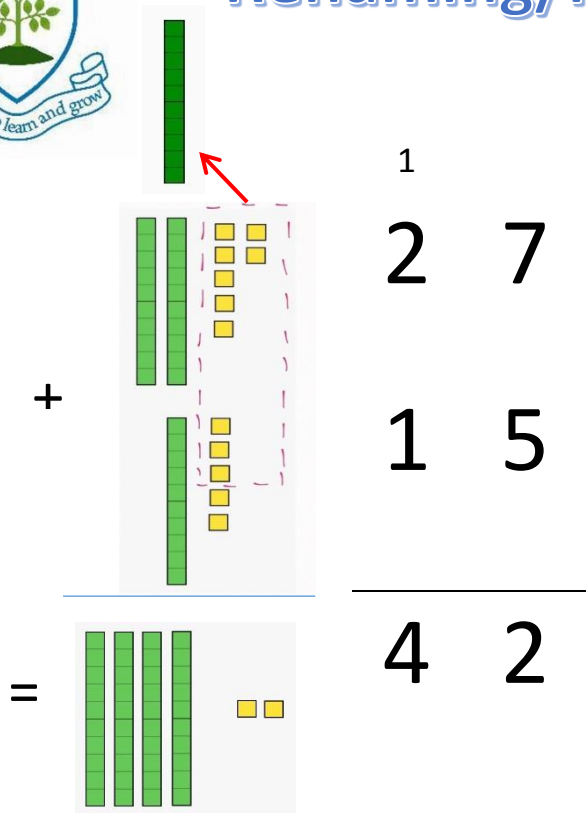
30   5   3   5

DIENES

Children build on their use of ten-frames to explore numbers using Dienes. These help embed an understanding of 'tens and ones' when looking at two-digit numbers.

BUILDING TOWARDS COLUMN ADDITION

This exploration with Dienes provides a concrete link to column addition. This is reinforced with two-digit addition learning opportunities spanning several lessons during Year 2.

Renaming/Regrouping and further application

¹
$$2\ 7$$
$$+\ 1\ 5$$
$$\overline{4\ 2}$$

¹
$$4\ 8\ 6\ 2$$
$$+\ \ \ 3\ 1\ 7$$
$$\overline{5\ 1\ 7\ 9}$$

¹ ¹ ¹
$$1.\ 0\ 3\ 8$$
$$+\ 0.\ 9\ 8\ 4$$
$$\overline{2.\ 0\ 2\ 2}$$

| DIENES	GREATER NUMBERS	DECIMAL ADDITION
Continuing their exploration using Dienes, children encounter two-digit addition that requires 'regrouping' or 'renaming' ten ones as one ten. This is then linked to the column addition method.	As they progress through Key Stage 2, children apply column addition to larger numbers. There is an increasing amount of 'renaming/regrouping' across a range of values.	Column addition is then applied to the addition of decimal numbers in Upper Key Stage 2.

Early Subtraction
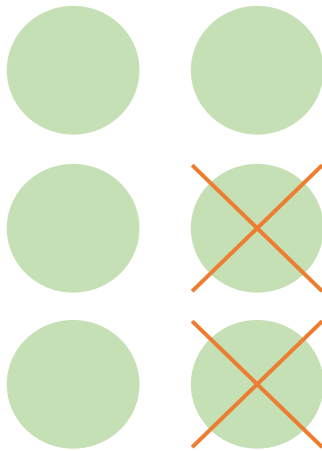
6 − 2 = 4
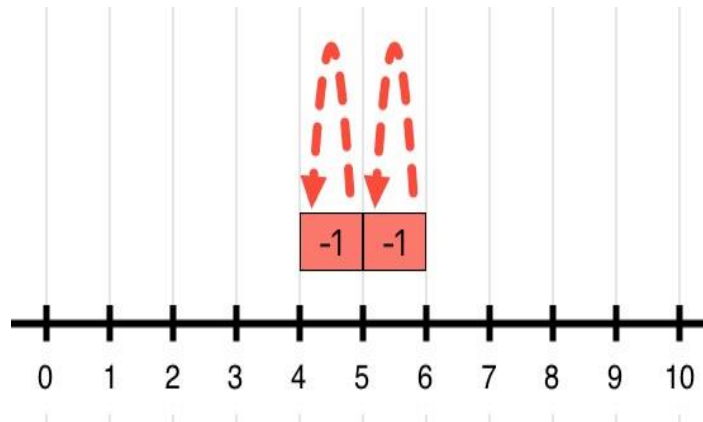
6 − 2 = 4
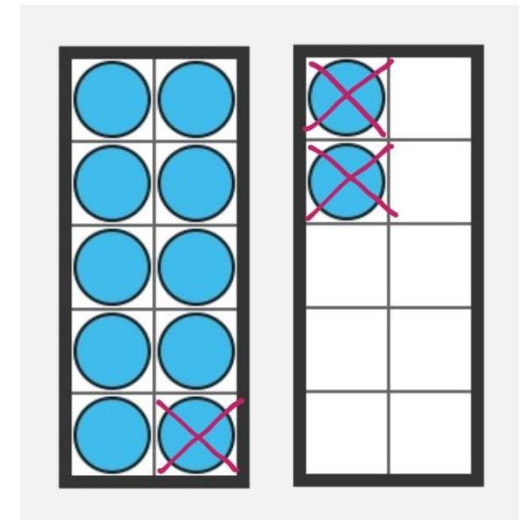
12 − 3 = 9

CROSSING OUT

Children begin exploring the concept of subtraction by removing concrete resources or by crossing out pictorial representations.

COUNTING BACK

Unifix and number lines continue to support children as they explore subtraction within 10, making links to, and reinforcing, number bonds. Part/Whole diagrams are used too (See Early Addition).

TEN FRAMES

Progressing to subtraction within 20, ten-frames help develop their understanding of number bonds and introduces the concept of tens and ones.
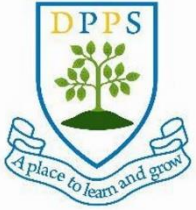
Tens and Ones
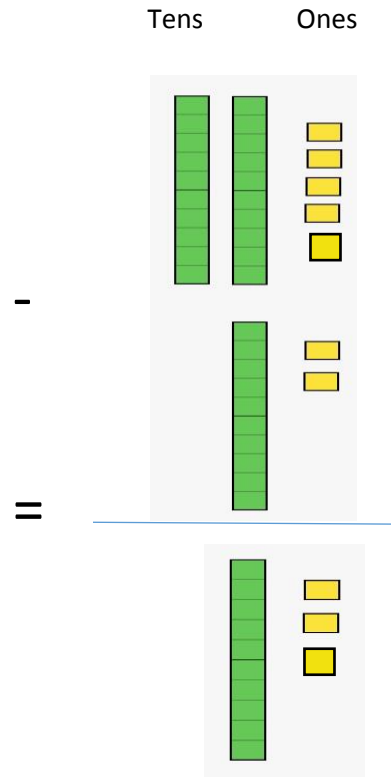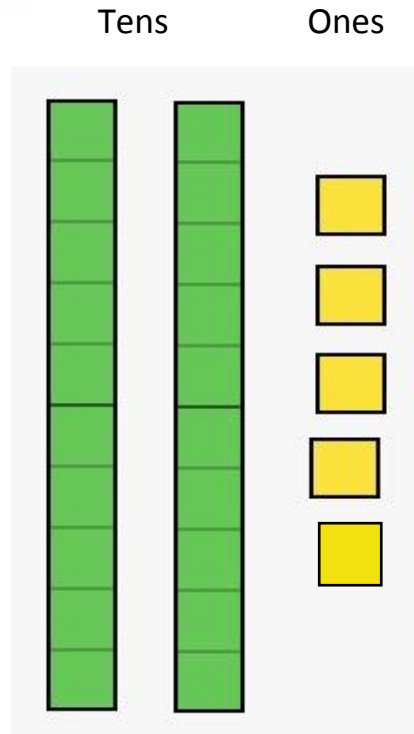
Tens   Ones

Tens   Ones

Tens   Ones

20   5   2   5

−   −   −

10   2   1   2

=   →

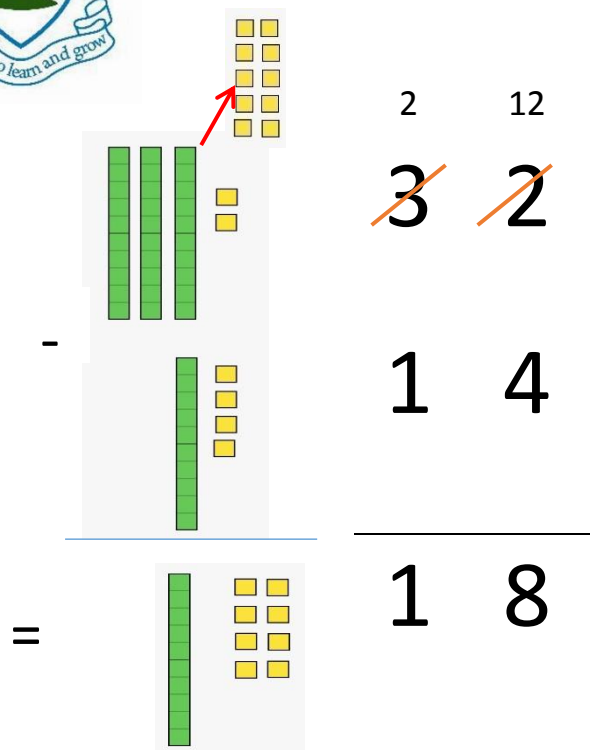=   10   3   =   1   3

DIENES
Children build on their use of ten-frames to explore numbers using Dienes. These help embed an understanding of 'tens and ones' when looking at two-digit numbers.

BUILDING TOWARDS COLUMN SUBTRACTION
This exploration with Dienes provides a concrete link to column subtraction. This is reinforced with two-digit subtraction learning opportunities spanning several lessons during Year 2.
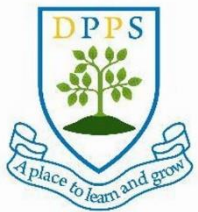
Renaming/Regrouping and further application

$$\begin{array}{cc} \overset{2}{\cancel{3}} & \overset{12}{\cancel{2}} \\ 1 & 4 \\ \hline 1 & 8 \end{array}$$

$$\begin{array}{cccc} & 6 & 14 & \\ 3 & \cancel{7} & \cancel{4} & 3 \\ - & 2 & 8 & 2 \\ \hline 3 & 4 & 6 & 1 \end{array}$$

$$\begin{array}{cccc} & 2 & 10 & \\ \cancel{3}. & \cancel{0} & 2 & 6 \\ - 1. & 6 & 1 & 4 \\ \hline 1. & 4 & 1 & 2 \end{array}$$

| DIENES |
| --- |
| Continuing their exploration using Dienes, children encounter two-digit subtraction that requires 'regrouping' or 'renaming' one ten as ten ones. This is then linked to the column subtraction method. |

GREATER NUMBERS
As they progress through Key Stage 2, children apply column subtraction to larger numbers. There is an increasing amount of 'renaming/regrouping' across a range of values.

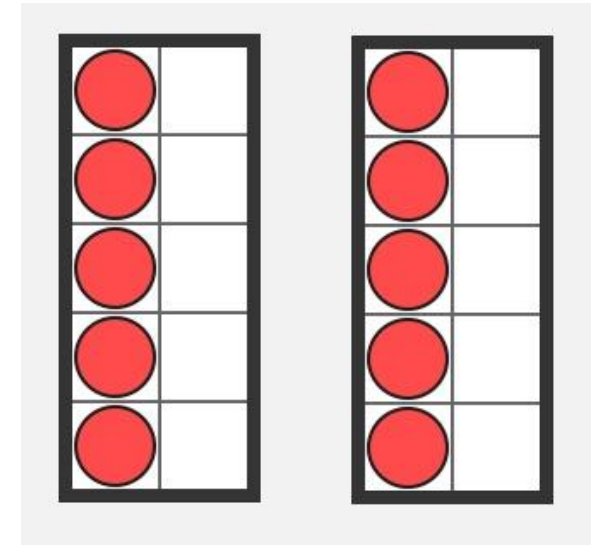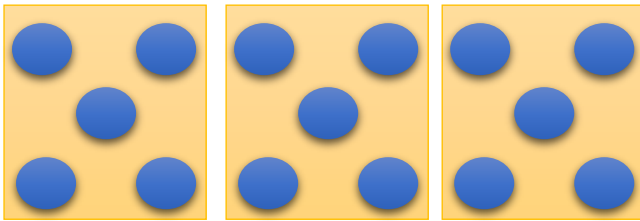| DECIMAL SUBTRACTION |
| --- |
| Column subtraction is then applied to the subtraction of decimal numbers in Upper Key Stage 2. |
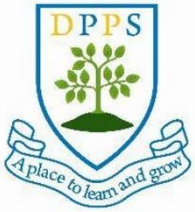
Early Multiplication
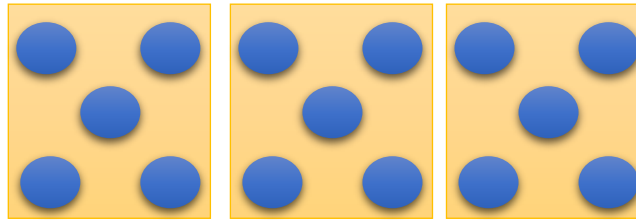
5 + 5 + 5 = 15

3 groups of 5 = 15

3 fives = 15

Double 5 = 10

Equal Groups

Children first encounter multiplication as equal groups. Once they have established the concept of 'equal' they progress to adding the groups.

Repeated Addition

Children use their knowledge and understanding of equal groups to find the total using repeated addition. This then leads to the phrase 'groups of' and children develop their ability to count in multiples.

Doubles

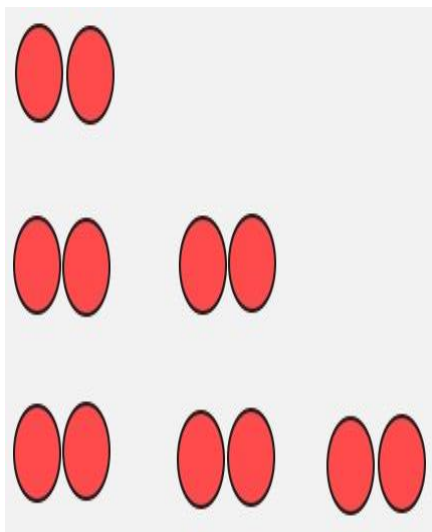Children also explore doubles beginning with numbers less than 10.

Times Tables

Concrete

🔴🔴	1 group of 2
🔴🔴 🔴🔴	2 groups of 2
🔴🔴 🔴🔴 🔴🔴	3 groups of 2

Pictorial

1 x 2 = 2

2 x 2 = 4

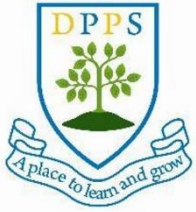3 x 2 = 6

4 x 2 = 8

Abstract

4 x 2 = 8

10 x 2 = 20

6 x 2 = 12

Phase 1: Children use modelling and/or counting to find the answer. For example, solving 3 x 2 by drawing 3 groups of 2 dots and skip counting the dots.

Phase 2: Children derive answers using reasoning strategies based on known facts. For example, solving 6 x 4 by thinking 5 x 4 = 20 and adding one more group of 4.

Phase 3: Children know that 6 x 4 = 24 and can demonstrate mastery of this by their efficient production of the answer.

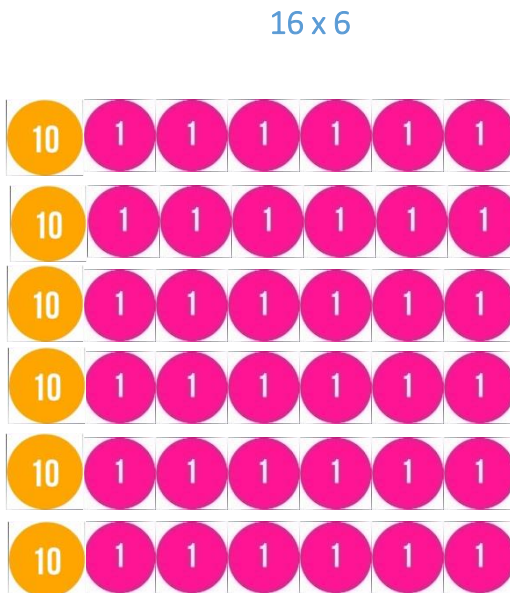*Times tables taught (National Curriculum 2014 expectations): 2, 5, 10 (Y2), 3, 4, 8 (Y3), 6, 7, 9, 11, 12 (Y4).*

Formal Multiplication

3 x 118

This shows 118:

16 x 6

3 x 8   =   24

3 x 10 =   30

3 x 100 = 300

3 x 118 = 354

```
      1  1  8
x           3
_____
         2  4      → Multiply by ones
         3  0      → Multiply by tens
+     3  0  0      → Multiply by hundreds
_____
      3  5  4
```

6 x 10 = 60   6 x 6= 36   60 + 36= 96

Children use place value discs to represent two digit numbers, allowing them to then calculate answers to multiplication questions. Links are made to allow children to set out their working 'formally'.

Children are able to represent three digit numbers using discs and use this structure their working: multiplying by ones, then by tens and finally hundreds before adding the answers together. These steps are mirrored using the formal method so children understand why they set out their working in such a manner.

Once children become confident in the formal method they can use this to multiply four digit numbers by one digit progressing to three digits by two digits.
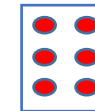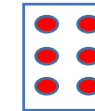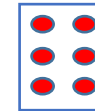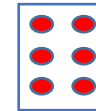
Early Division
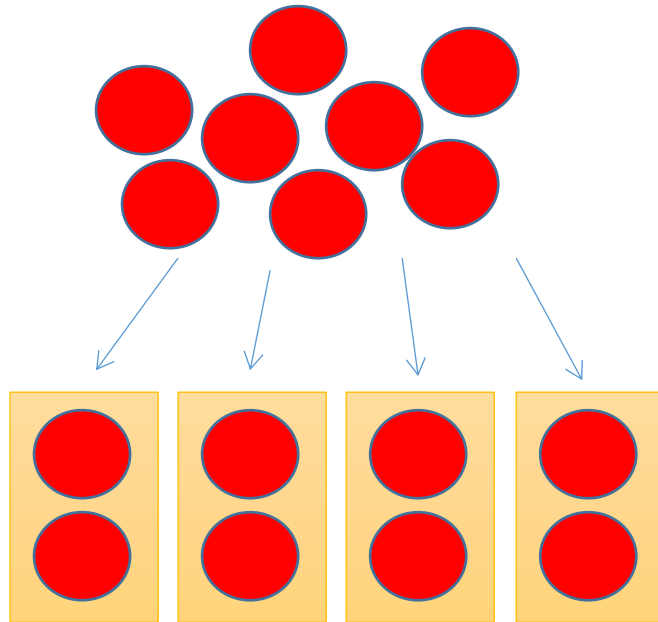
8 shared between 4 = 2

8 ÷ 4 = 2

1 x 6 = 6

6 ÷ 1 = 6

2 x 6 = 12

12 ÷ 2 = 6
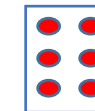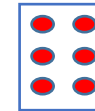
3 x 6 = 18

18 ÷ 3 = 6

Creating Equal Groups

Children first encounter division in the context of sharing into equal groups.

Recording Division formally

After concrete and pictorial representations, children are soon able to record the more conventional way of expressing division.
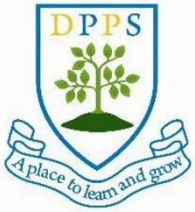
Times Tables

During their exploration of times tables, children begin to make links between times and divide. This gives rise to children knowing and understanding related times tables facts, such as:

3 x 6 = 18

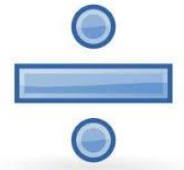*6 x 3 = 18*

18 ÷ 6 = 3

18 ÷ 3 = 6

Formal Division

930 ÷ 3

930

900   30

3

3 | 9 3 0
-   9 0 0   → 300

3 1 0

3 | 9 3 0
-   9 0 0
        3 0

        3 0   → 10
           0

5048 ÷ 4

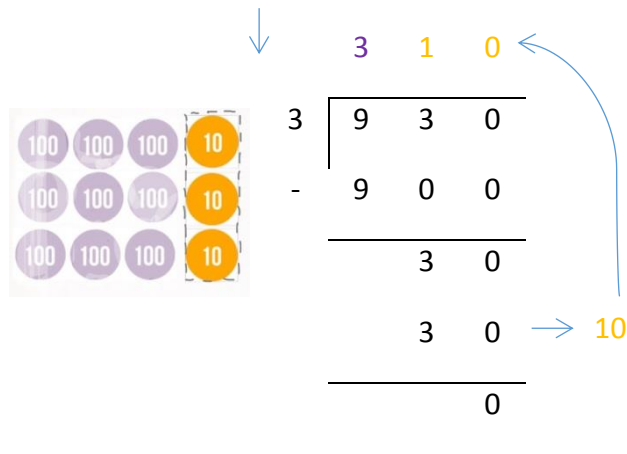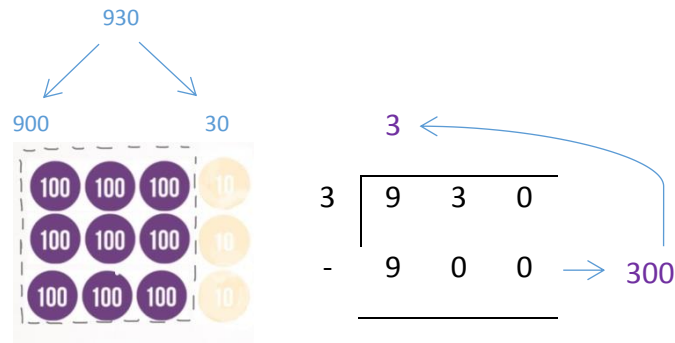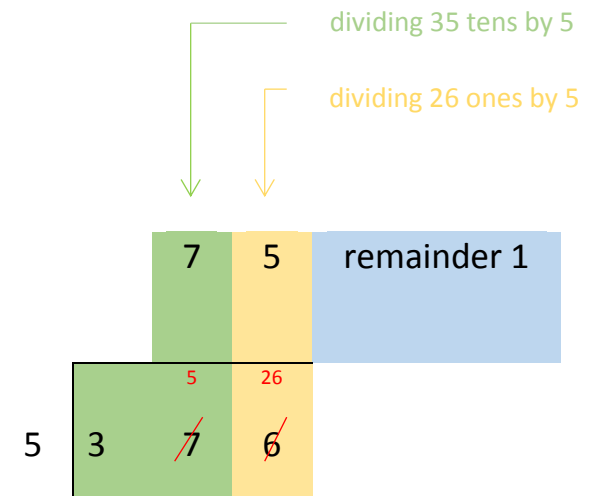1 2 6 2

4 | 5 0 4 8
-   4 0 0 0   → 1000

    1 0 4 8

    -   8 0 0   → 200

        2 4 8

    -   2 4 0   → 60

               8

    -          8   → 2
               0

376 ÷ 5 = 75 remainder 1

dividing 35 tens by 5

dividing 26 ones by 5

| 7 | 5 | remainder 1 |

| | 5 | 26 | |
| 5 | 3 | 7̶ | 6̶ |

The use of place value discs help children partition and share numbers into the desired number of groups. These steps are then linked to the convention of the formal method.

Children progress to dividing three and four digit numbers and also numbers that give rise to a remainder.

Children are also shown formal short division when appropriate.

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