Tanners Brook Primary School Calculation Strategy Policy

About Our Calculation Strategy Policy

Intent:
This policy has been introduced to support our children with calculating confidently, fluently and efficiently. We want all of our children to have a secure knowledge and a good understanding of the four operations (addition, subtraction, multiplication and division) so that we can enable all children, regardless of back-ground, ability and additional needs, to strive to achieve their personal best and make our community proud. Our aim is that our children have an efficient, reliable, written method of calculation for each operation that they are able to apply with confidence.

This policy has been produced to ensure consistency and progression in teaching throughout our school.

Implementation:
The strategies progress from Early Years to Year 6 organised according to the age / stage expectations as set out in the National Curriculum and Framework for Early Years.

For each operation, there is a page for each year group so that staff can clearly see all the stages to be covered by all children in their classes and there is clarity in start points.

The expectation is that:

- Skills and knowledge are built on year by year and sequenced appropriately to maximise learning for all children.

- Some children can spend more time with different approaches—eg, children of different abilities may work through the various strategies at an appropriate pace and teachers will ensure that individuals are secure at each stage before progressing.

- Vocabulary is used consistently across our school.

- Children can master the strategies in their year groups and do not go on beyond this until they move years.

Impact:
This policy clarifies the strategies to be used for addition, subtraction, multiplication and division through our school to ensure consistency of approach, enabling children to progress stage by stage through models and representations they recognise from previous teaching. These methods ensure consistency of teacher input and progression in pupil learning and spell out the steps that children need to take to master these four operations. Providing children with the opportunity to work on different representations of the same mathematical idea allows for deeper conceptual understanding and fluency.

This Calculation Strategy Policy makes teaching easier for teachers and learning easier for pupils. Teachers, TAs and pupils can easily see how one year builds on another. Teachers have layout models that are clear and mathematically correct so that children do not build up misconceptions through their early years that they will need to unpick later. Teachers say that this booklet is invaluable to inform them about prior learning and knowing what the next steps are for the children to learn effectively for their Maths journey through our school.

By the end of each year, children are confident and secure with the strategies for their year group and are ready to progress to the next year group. They will have flexibility and fluidity to move between different contexts and representations in their lives and having mastered the different methods for the four operations. By the end of Year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved and children will also be encouraged to consider if a mental calculation would be appropriate before using written methods.

This strategy policy promotes the accurate use of mathematical language by children and adults and improves mathematical communication.

Children's fluency in these calculation strategies is evident in our proven track record of high success in arithmetic in the KS2 SATs.

This is a working document and will be improved through additions throughout each year by all members of staff.

Addition

total

join

both

increase

all together

Addition

combined

sum

plus

in all

add

| 3 | + | 7 | = | 10 |

addend   addend   sum

Addition—Year EY

EY Framework: Automatically recall number bonds up to 5 and some number bonds to 10, including double facts and compare quantities up to 10 in different contexts, recognising when one quantity is greater than the other quantity.
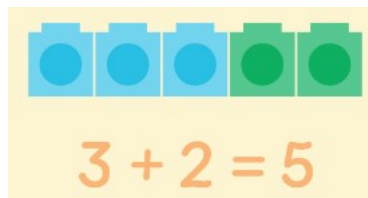
3- and 4-year-olds will be learning to:

Experiment with their own symbols and marks as well as numerals.

Solve real world mathematical problems with numbers up to 5.

Compare quantities using language: 'more than'.

"I think Jasmin has got more crackers…"

$3 + 2 = 5$

Support children to solve problems using fingers, objects and marks: "There are four of you, but there aren't enough chairs…."

Draw children's attention to differences and changes in amounts, such as those in stories like 'The Enormous Turnip', Mouse Count and Goldilocks and rhymes eg, 1, 2, 3, 4 , 5 Once I Caught a Fish Alive.

Children in Early Years will be learning to:

Compare

Understand the 'one more than' relationship between consecutive numbers

Explore the composition of numbers to 10.

Automatically recall number bonds for numbers 0–5 and some to 10.
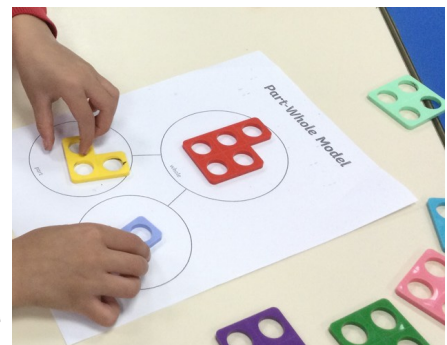
I have 3 sweets and you have 3 sweets. How many sweets altogether? Let's count them all.

I've got 2 biscuits, please can you give me 2 more? How many are there now?... Well done, you have just worked out 2 add 2 equals 4. You can write it like this, $2 + 2 = 4$.

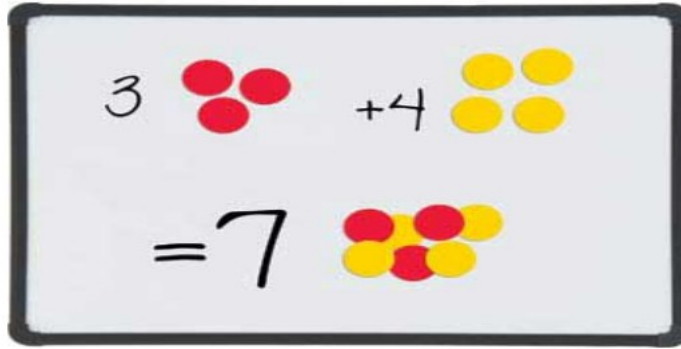Informal jottings or draw pictures to support their written calculations.
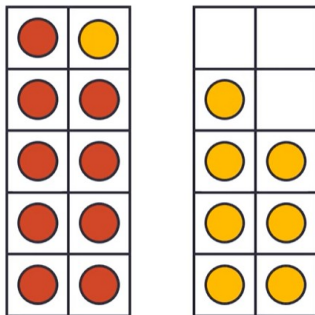
$5 + 5 = 10$

Addition—Year 1

National Curriculum: Add 1 digit and 2 digit numbers to 20, including 0.

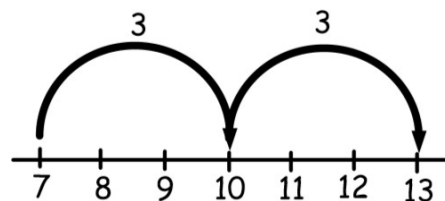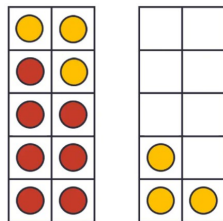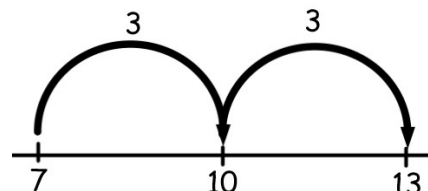### Using concrete object and putting groups together and counting.

$3 + 4 = 7$

Using 10 and then

$9 + 8 = \boxed{}$

Move to using an empty number line.

$7 + 6 = 13$

$7 + 6 = 7 + \boxed{3} + \boxed{3}$

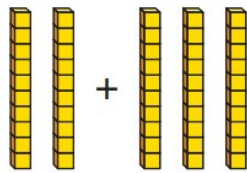$\quad = \boxed{13}$

$7 + 6 = 13$

Addition—Year 2

National Curriculum: Add 2 digit numbers and ones. Add 2 digit number and tens. Add two 2 digit numbers. Add three 1 digit numbers.

Related Facts
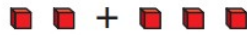
_____ ones + _____ ones = _____ ones

_____ + _____ = _____

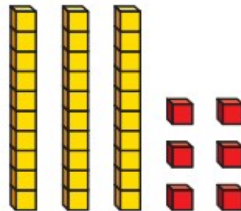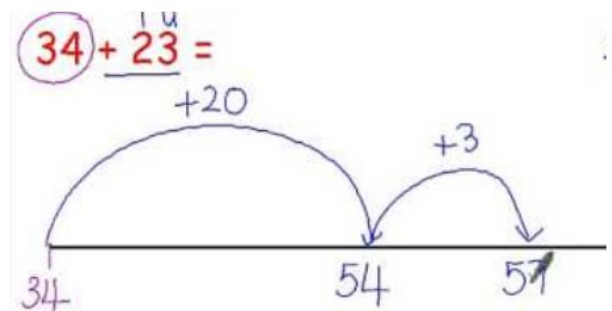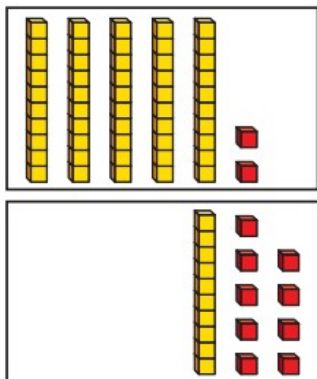_____ tens + _____ tens = _____ tens

_____ + _____ = _____

Add 10s to a 2-digit number.

The base 10 shows 36

What is 20 more than 36?

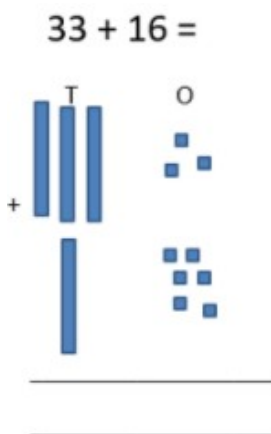## Expanded Column Addition—2 digit numbers crossing the 10s

52 + 19

(34) + 23 =

+20   +3

34   54   57

Addition—Year 3

National Curriculum: Add numbers with up to 3 digits, using the formal written method of columnar addition.

Expanded Column Addition—2- digit numbers with and without carrying

$37 + 52 = 89$

$$\begin{array}{r} 30 + 7 \\ 50 + 2 \\ \hline 80 + 9 = 89 \end{array}$$

$33 + 16 =$

$37 + 48$

$$\begin{array}{r} 30 + 7 \\ 40 + 8 \\ \hline 70 + 15 = 85 \end{array}$$

Expanded Column Addition—3 digit numbers with and without carrying

$$\begin{array}{r} 1\ 0\ 0 + 4\ 0 + 3 \\ + 2\ 0\ 0 + 3\ 0 + 5 \\ \hline 3\ 0\ 0 + 7\ 0 + 8 \end{array}$$

$143 + 235 = 378$

$353 + 268 = 621$

$$\begin{array}{r} 300 + 50 + 3 \\ 200 + 60 + 8 \\ \hline 600 + 20 + 1 = 621 \end{array}$$

100   10

Formal Column Addition with and without carrying

$143 + 235 = 378$

$$\begin{array}{r} 143 \\ + 235 \\ \hline 378 \end{array}$$

$$\begin{array}{r} 968 \\ + \ \ 338 \\ \hline 1306 \\ \hline \ 1\ 1 \end{array}$$

Addition—Year 4

National Curriculum: Add numbers with up to 4 digits, using the formal written method of columnar addition

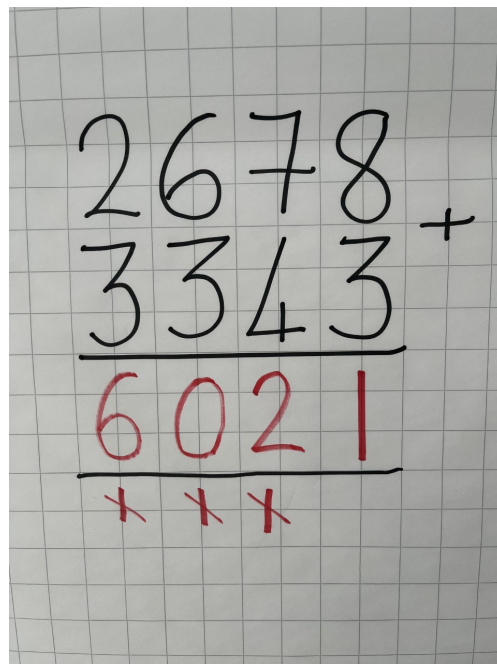Formal Column Addition without carrying (up to 4 digits)

1342+2421=

$$
\begin{array}{r}
1342 \\
+2421 \\
\hline
3763
\end{array}
$$

Formal Column Addition with carrying (up to 4 digits)

2486+4853 =

$$
\begin{array}{r}
2486 \\
+4853 \\
\hline
7339 \\
11
\end{array}
$$

Addition—Year 5

National Curriculum: Add whole numbers with more than 4 digits, using the formal written method of columnar addition.

Formal Column Addition (more than 4 digits)

6210+8219 =

6210
+8219
14429

TTh	Th	H	T	O
2	0	1	5	3
+ 1	9	1	7	5
3	9	3	2	8

Formal Column Addition with decimals .

```
    4 2 . 7
 +  8 9 . 5
  1 3 2 . 2
      1   1
```

Formal Column Addition with decimals (fill in missing numbers)

```
  1 0 5 . 8 ◯
 +◯◯6 . 9 4
  1 1 2 . 7 4
      1   1
```

Addition—Year 6

National Curriculum: Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why

Use of Formal Column Addition in different contexts.

$$
\begin{array}{cccc}
7 & 9 & 4 & 8 \\
1 & 2 & 2 & 3 \\
\hline
9 & 1 & 7 & 1 \\
1 & & & 1
\end{array}
$$

+

$$
\begin{array}{r}
1\ 0\ 5\ .\ 8\ 0 \\
+\ 0\ 0\ 6\ .\ 9\ 4 \\
\hline
1\ 1\ 2\ .\ 7\ 4 \\
\ \ \ \ \ \ 1\ \ \ 1
\end{array}
$$

63.82 + 217.7 = ☐

Correct or Not Correct?

$$
\begin{array}{r}
8\ 4\ 6\ 9 \\
+\ \ 5\ 9\ 7 \\
\hline
9\ 0\ 6\ 6 \\
1\ 1
\end{array}
\qquad
\begin{array}{r}
7\ 4\ 6\ 8 \\
+\ 5\ 2\ 3.5 \\
\hline
1\ 2\ 7\ 0\ 3 \\
1\ 1
\end{array}
\qquad
\begin{array}{r}
6\ 9\ 9\ 2 \\
+\ 3\ 4\ 4\ 7 \\
\hline
1\ 0\ 3\ 3\ 9 \\
1\ 1
\end{array}
$$

Write the three missing digits to make this **addition** correct.

$$
\begin{array}{ccccc}
5 & 3 & 2 & \boxed{\ } & 9 \\
+ & 7 & 4 & 2 & \boxed{\ } \\
\hline
\boxed{\ } & 0 & 6 & 7 & 6
\end{array}
$$

Explain the mistakes.

In a supermarket storeroom there are

    7 boxes of tomato soup

    5 boxes of pea soup

    4 boxes of chicken soup

There are **24 tins** in every **box**.

How many **tins** of soup are there **altogether**?

Subtraction

10	–	7	=	3

minuend	subtrahend	difference

Subtraction—EY

EY Framework: Automatically recall number bonds up to 5 and some number bonds to 10, including double facts and compare quantities up to 10 in different contexts, recognising when one quantity is less than the other quantity.

## 3- and 4-year-olds will be learning to:

Experiment with their own symbols and marks as well as numerals.

Solve real world mathematical problems with numbers up to 5.

Compare quantities using language: 'less than'.

"I think Jasmin has got less crackers…"

Support children to solve problems using fingers, objects and marks: "There are 4 bottles on the wall. 1 falls down. How many are there now?
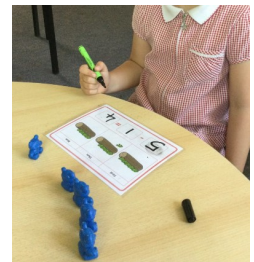
Draw children's attention to differences and changes in amounts, such as those in stories like 'The Enormous Turnip', 5 Little Ducks and 5 Little Monkeys

Children in Early Years will be learning to:

Compare

Understand the 'one less than' relationship between consecutive numbers

Explore the composition of numbers to 10.

Automatically recall number bonds for numbers 0–5 and some to 10.

I have 6 sweets and eat 3. How many are left? Let's pretend to eat 3 and count how many are left.

I've got 6 biscuits, if you eat 2 how many are there now? … Well done, you have just worked out 6 subtract 2 equals 4, you can write it like this 6 - 2= 4

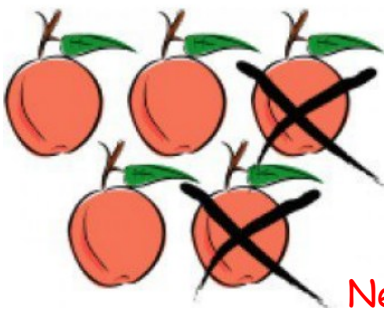Informal jottings or draw pictures to support their written calculations.
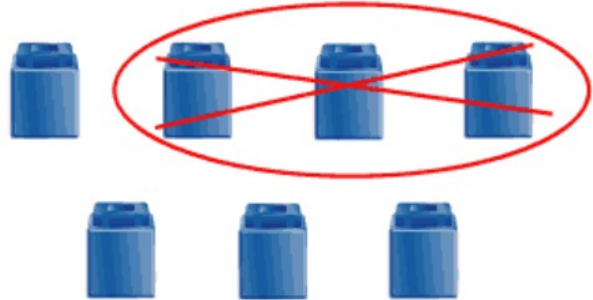
6 — 2 = 4

Subtraction—Year 1

National Curriculum: Subtract 1 digit and 2 digit numbers up to 20, including 0. Represent and use number bonds and related subtraction facts
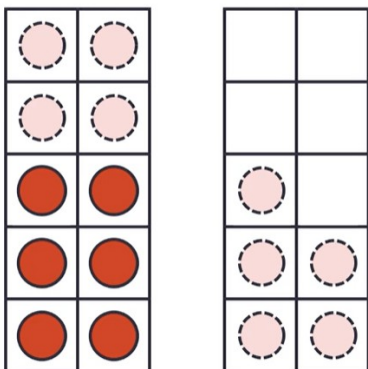
Using concrete object and counting back

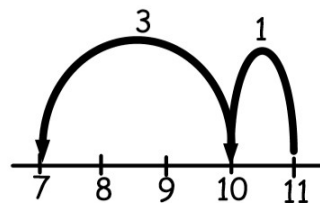Need to bring in links to NSM here

5 — 2 = 3

7 — 3 = 4

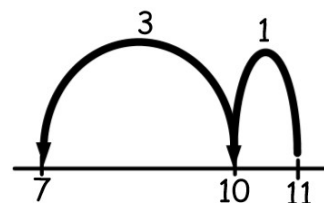Make 10 and then.

15 - 9 = 6

Using an empty number line.

11 - 4

1 3

So,
11 – 4 = 11 – 1 – 3
          = 7

3   1

7   8   9   10   11

11 - 4 = 7

3   1

7   10   11

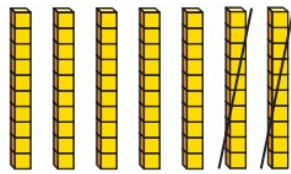11 - 4 = 7

Subtraction—Year 2

National Curriculum: Subtract 2 digit numbers and ones. Subtract 2 digit number and tens. Subtract two 2 digit numbers. Subtract three 1 digit numbers.
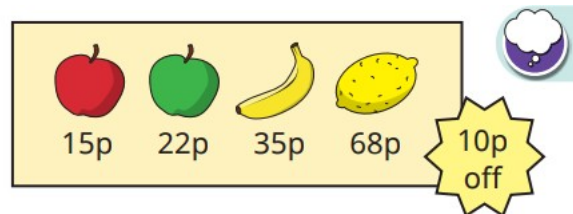
Related Facts

_____ ones – _____ ones = _____ ones

_____ – _____ = _____

_____ tens – _____ tens = _____ tens

_____ – _____ = _____

Subtract 10s from 2-digit number.
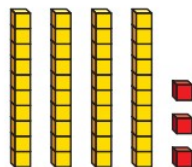
15p   22p   35p   68p   10p off

Each piece of fruit is now 10p cheaper.

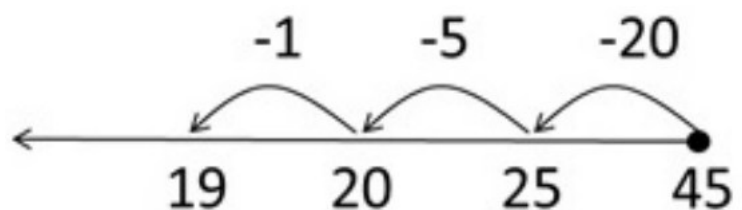What are the new prices?

Using partitioning

Mo uses base 10 to make the number 43

Mo wants to subtract 15

$45 - 26 = 19$

-1   -5   -20

19   20   25   45

Subtraction—Year 3

National Curriculum: Subtract numbers with up to 3 digits using the formal written method of columnar subtraction.

Expanded Column Subtraction– No Exchange.

$$47 - 24 = 23$$

$$\begin{array}{r} 40 + 7 \\ - \ 20 + 4 \\ \hline 20 + 3 \end{array}$$

Expanded Column Subtraction – with exchange

$$82 - 37 = 45$$

$$\begin{array}{r} 70 \quad 10 \\ 80 + 2 \\ - \ 30 + 7 \\ \hline \end{array} \qquad \begin{array}{r} 70 + 12 \\ - 30 + 7 \\ \hline 40 + 5 \end{array}$$

$$\begin{array}{r} \quad 30 \quad 12 \\ 900 \quad 40 \quad 2 \\ - \ 200 \quad 10 \quad 4 \\ \hline 700 \quad 20 \quad 8 \end{array}$$

Formal Column Subtraction – with and without exchange

$$\begin{array}{r} 3 \quad 8 \quad 8 \\ - \ 3 \quad 1 \quad 3 \\ \hline 0 \quad 7 \quad 5 \end{array}$$

$$\begin{array}{r} 1 \\ 2\,3 \quad 6 \\ - \ 0 \quad 7 \quad 4 \\ \hline 1 \quad 6 \quad 2 \end{array}$$

Subtraction—Year 4

National Curriculum: Subtract numbers up to 4 digits using the formal written method of columnar subtraction.

Formal Column Subtraction with exchange over zeros.

$$\begin{array}{r} {}^{1}2\,{}^{9}0\,{}^{9}0\,{}^{1}0 \\ -\ 1\,2\,3 \\ \hline 1\,8\,7\,7 \end{array}$$

Formal Column Subtraction – up to 4 digits

$$\begin{array}{r} 2\,{}^{6}\cancel{7}\,{}^{1}5\,4 \\ -\ 1\,5\,6\,2 \\ \hline 1\,1\,9\,2 \end{array}$$

$$\begin{array}{r} {}^{3}\cancel{4}\,{}^{12}\cancel{3}\,{}^{9}\cancel{0}\,{}^{12}\cancel{2} \\ -\ 1\,6\,4\,8 \\ \hline 2\,6\,5\,4 \end{array}$$

Subtraction—Year 5

National Curriculum: Subtract numbers with more than 4 digits.

Formal Column Subtraction

75532-12487=

```
      4   12
7 5 5̷ 3̷ ¹2
1 2 4 8 7
6 3 0 4 5
```

```
  TTh Th  H   T   O
    1  5  7̷  ¹3   5
 -     2  5   8   2
    1  3  1   5   3
```

Formal Column Subtraction with decimals.

```
 H   T   U       t   h   th
     7  11       3   1
 6   8̷  2̷  ·  ¹1  4̷   2
-6   6   5   ·   7   3   3
 0   1   6   ·   4   0   9
```

Subtraction—Year 6

Tanners Brook PRIMARY SCHOOL

National Curriculum: Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Use of Formal Column Subtraction in different contexts.

Th	H	T	U
7	0	0	0
- 4	8	2	6
2	1	7	4

H	T	U		t	h	th
6	8 2	·	1 1	4	2
- 6	6 5	·	7	3	3
0	1 6	·	4	0	9

Multi-Step

Jack bought 5 pieces of fruit and paid with a £5 note. He got 80p change.
What did he buy?

| Melons: 90p |
| Pineapples: 75p |
| Mangoes: 55p |

32.18 − 7.62 = [   ]

Jamie takes three parcels to be posted.
One parcel has a mass of 750 g
Another weighs 2.8 kg

The total mass of the three parcels is 5.13 kg
What is the mass of the third parcel?
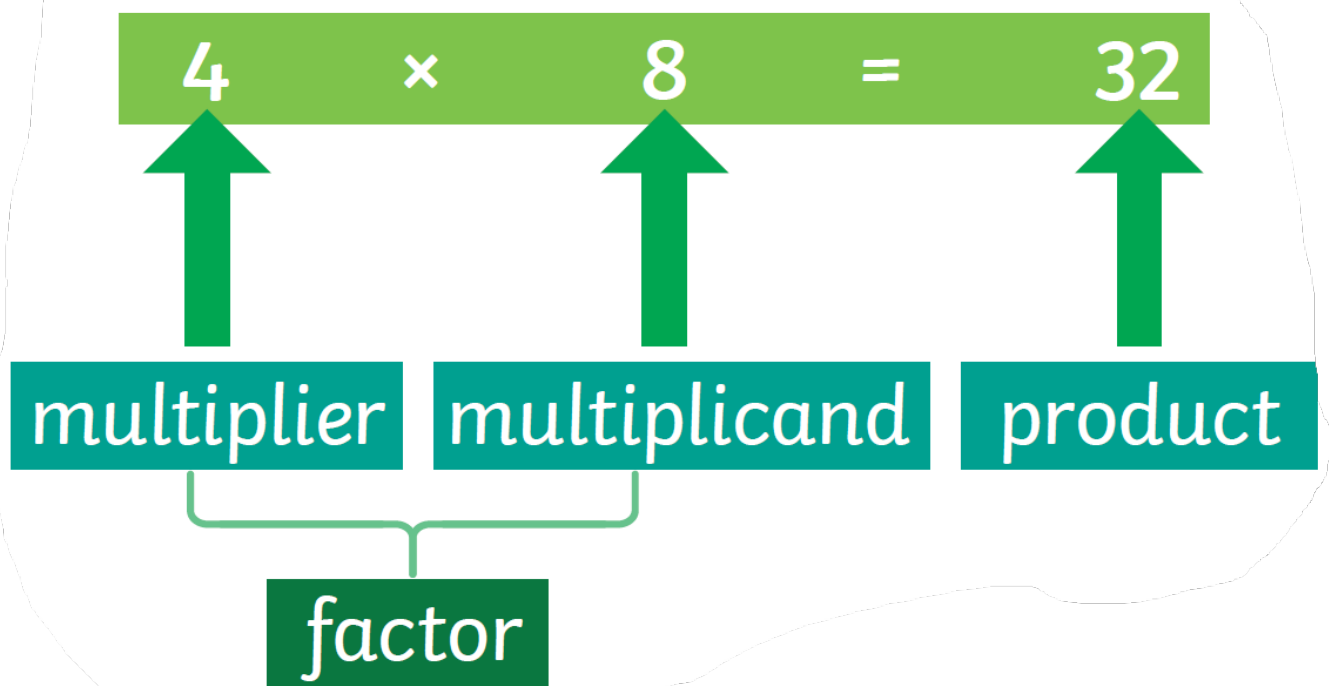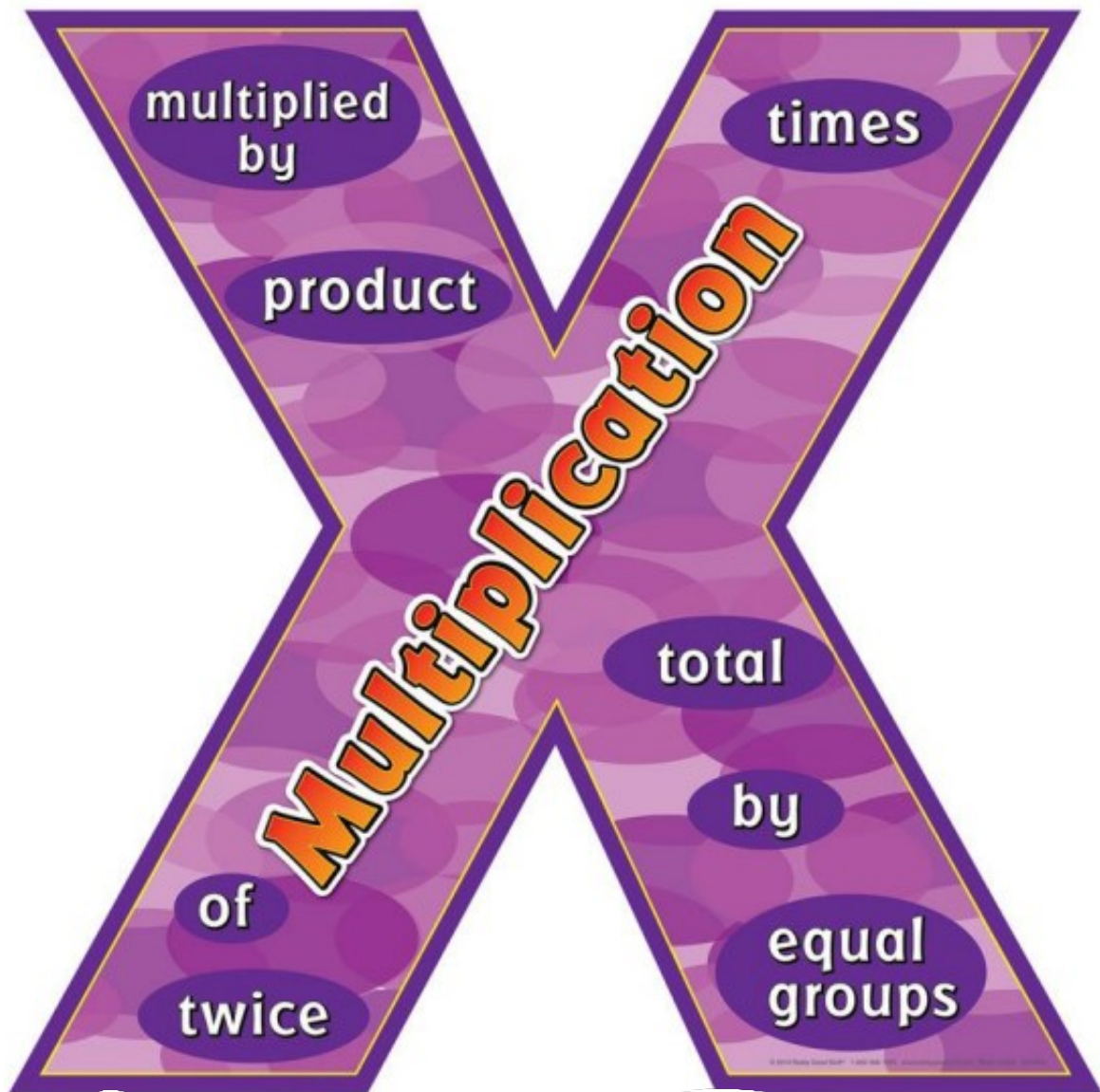
Correct or Incorrect?

| 6 0 0 8 |
| − 1 8 6 3 |
| 4 1 3 5 |

| 5 0 8.6 |
| − 1 8 3.9 |
| 3 2 4.7 |

| 1 3.7 0 |
| − 8.4 5 |
| 5.3 5 |

Multiplication

multiplied by

times

product

Multiplication

total

by

of

twice

equal groups

| 4 | × | 8 | = | 32 |

multiplier | multiplicand | product

factor

Multiplication—Year 1

Tanners Brook PRIMARY SCHOOL
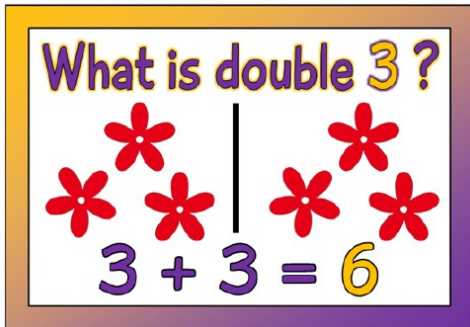
National Curriculum: Solve one step problems involving multiplication, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Doubling using concrete objects

What is double 3 ?

3 + 3 = 6

Maths
Doubles

Arrays using concrete objects.

Arrays.
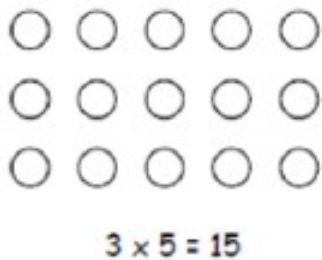

3 x 5 = 15

4 x 6 = 24

6 x 4 = 24
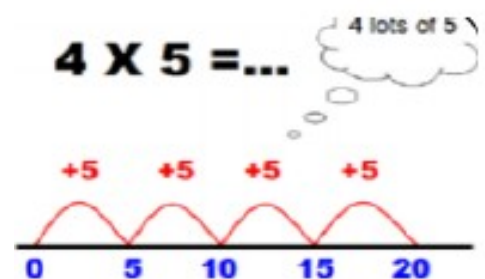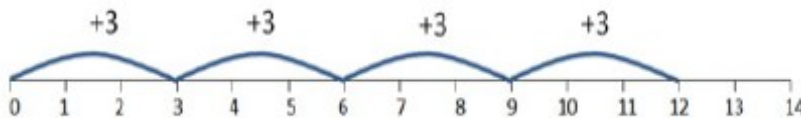
Multiplication—Year 2

National Curriculum:
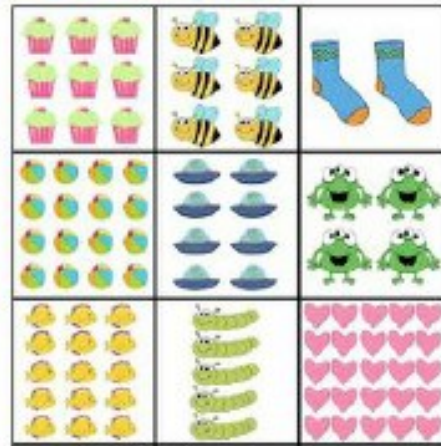
Arrays

$3 \times 5 = 15$

$4 \times 6 = 24$

$6 \times 4 = 24$

Repeated Addition on a Number Line.

$4 \times 3 = 12$

+3   +3   +3   +3

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

$4 \times 5 = ...$

4 lots of 5

+5   +5   +5   +5

0   5   10   15   20

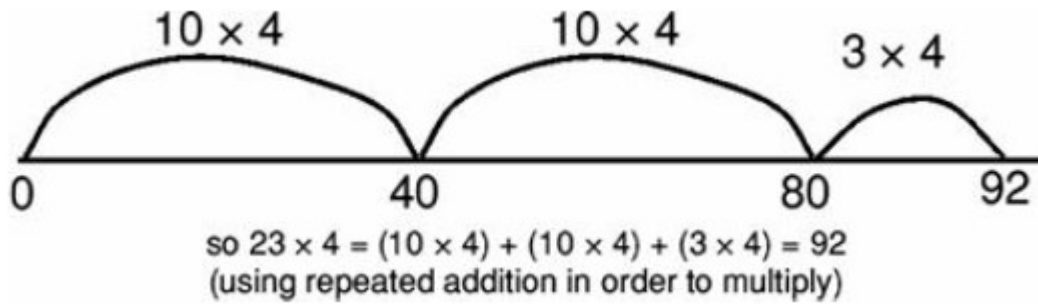**Multiplication as repeated addition**

$2 + 2 + 2 = 6$

$3 \times 2 = 6$

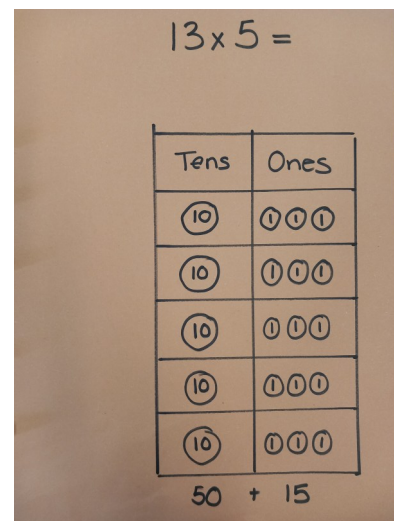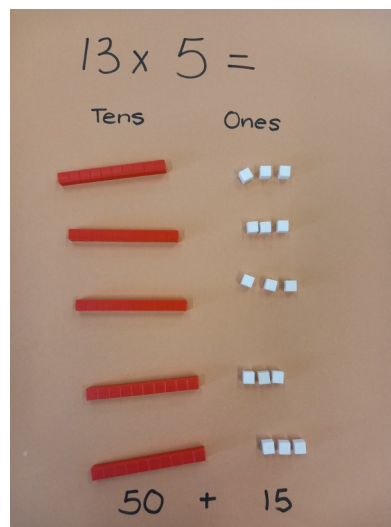$4 + 4 + 4 + 4 + 4 = 20$

$5 \times 4 = 20$

Multiplication—Year 3

National Curriculum: Multiply 2 digits by 1 digit, using mental and progressing to formal written methods.

Chunking Repeated Addition

$$10 \times 4 \qquad 10 \times 4 \qquad 3 \times 4$$

0   40   80   92

so $23 \times 4 = (10 \times 4) + (10 \times 4) + (3 \times 4) = 92$
(using repeated addition in order to multiply)

Array Grid Method

$13 \times 5 =$

Tens   Ones

$50 + 15$

$13 \times 5 =$

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

$50 + 15$

Expanded Method of Multiplication.

$$
\begin{array}{r}
\text{T O} \\
2\ 7 \\
\times \quad 3 \\
\hline
2\ 1 \quad (7 \times 3) \\
6\ 0 \quad (20 \times 3) \\
\hline
8\ 1
\end{array}
$$

Multiplication—Year 4

National Curriculum: Multiply 2 digits by 1 digit using formal written layout. Multiply 3 digits by 1 digit using formal written layout.

Grid Method (TU x U)

Eg. $136 \times 5 = 680$

X	100	30	6
5	500	150	30

```
  500
  150
+  30
-----
  680
```

Grid Method (HTU x U)

123×5

x	100	20	3
5	500	100	15

```
  500
+ 100
+  15
-----
  615
```

Short Multiplication (3 digits).

```
    3 2 7
  ×     4
  -------
  1 3 0 8
    1   2
```

Multiplication—Year 5

National Curriculum: Multiply numbers up to 4 digits by a 1 digit number using the formal written method of short multiplication. Multiply numbers up to 4 digits by a 2 digit number using the formal written method of long multiplication. Multiple whole numbers and those involving decimals by 10, 100, 1000.

Short Multiplication (4 digits)

```
    3 6 5 2
  ×       8
  2 9,2 1 6
    5 4 1
```

Grid Method (TUxTU) leading to formal method

×	30	5
20	600	100
6	180	30

600 + 100 = 700
180 + 30 = 210

700 + 210 = 910

```
      3 5
      2 6
    2 ³1 0   (X 6)
  ¹7 0 0   (X 20)
    9 1 0
```

Long Multiplication..

```
      1 2 3 4
    ×     1 6
      7 4 0 4   (1234 × 6)
    1 2 3 4 0   (1234 × 10)
    1 9,7 4 4
```

Multiplication—Year 6

National Curriculum: Multiply up to 4 digits by 2 digits using the formal written method of long multiplication. Multiply numbers by 10,100, 1000 giving answers up to 3 decimal places

Long and Short Multiplication with decimals

$$3 . 19 \times 8 = 25 . 52$$

$$6.37 \times 7 = \boxed{}$$

$$\begin{array}{r} 3.72 \\ \times\ 23 \\ \hline 11.16 \\ 74.40 \\ \hline 85.56 \end{array}$$

$$\begin{array}{r} 836 \\ \times\ 27 \\ \hline \end{array}$$

Use of Long and Short Multiplication in different context

Layla makes jewellery to sell at a school fair.

Each bracelet has **53** beads.

She makes **68** bracelets.

Each necklace has **105** beads.

She makes **34** necklaces.

How many beads does Layla use **altogether?**

Part-Complete Examples

$$\begin{array}{r} 73 \\ \times\ 32 \\ \hline 14\ \square \\ \square\square\ 90 \\ \hline \square\square\ 3\ \square \end{array}$$

$$\begin{array}{r} 28 \\ \times\ 24 \\ \hline \square\square\ 2 \\ \square\square\ 0 \\ \hline \square\square\ 2 \end{array}$$

$$\begin{array}{r} 86 \\ \times\ 43 \\ \hline \square\square\ 8 \\ \square\square\square\square \\ \hline \square\square\square\square \end{array}$$

Division

each

share equally

parts

Division

quotient

divided by

half (or other fraction)

split equally

goes into
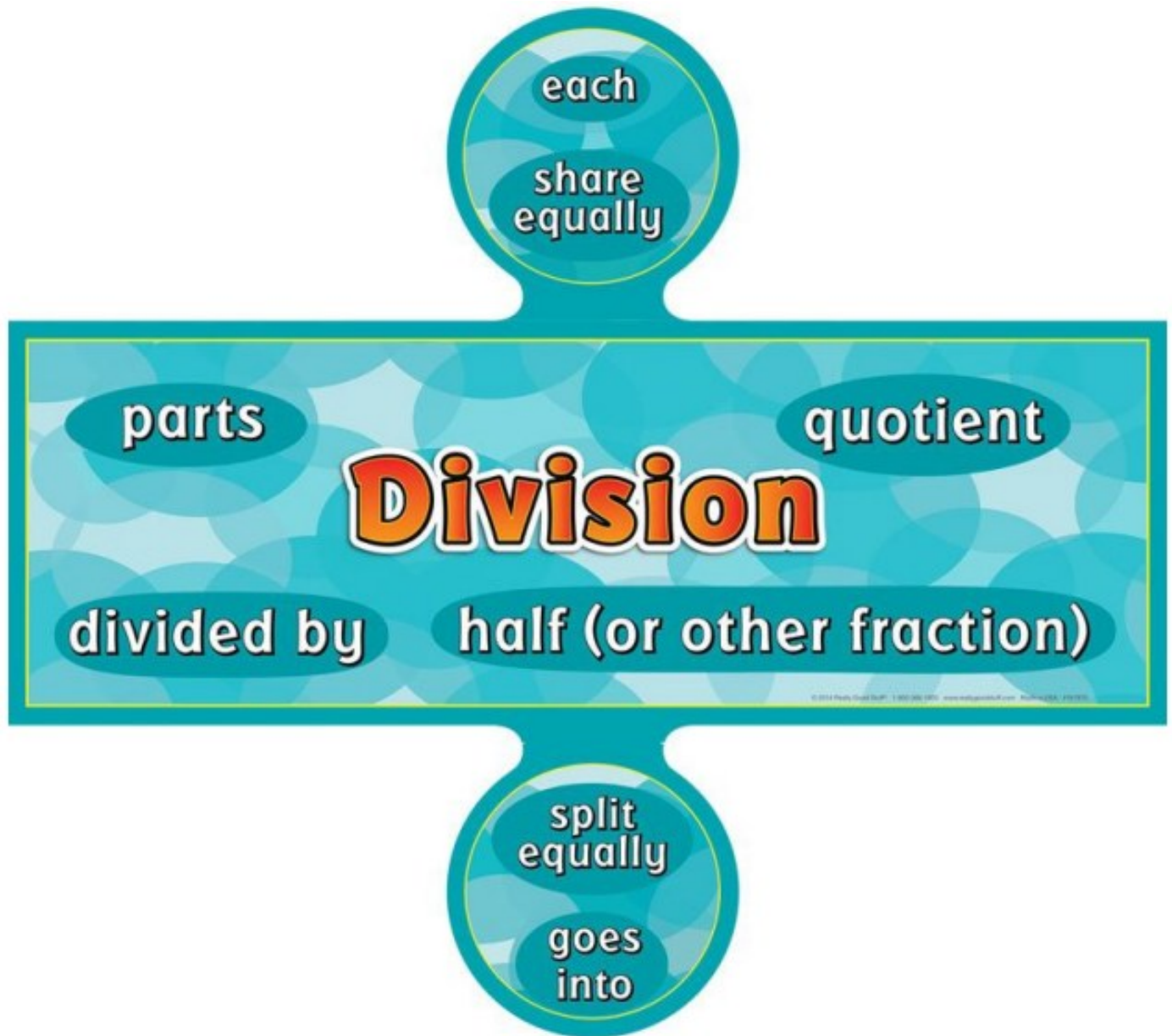
32	÷	8	=	4

dividend   divisor   quotient

Division—Year 1
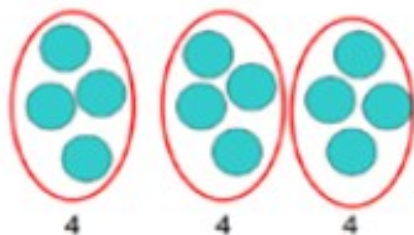
Halving using concrete objects (cakes, paper, shapes etc)

Grouping concrete objects.

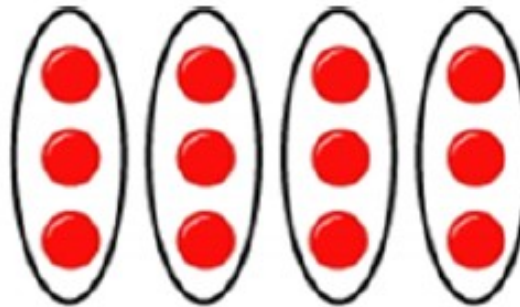
Sharing concrete objects.

12 shared between 3 is 4

Division—Year 2

National Curriculum: Solve problems involving division using materials, mental methods and division facts.
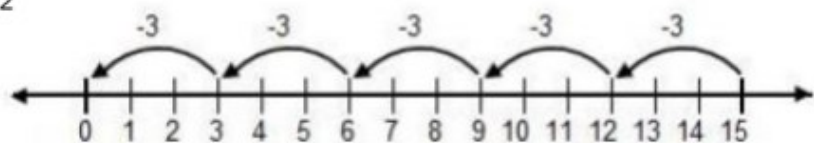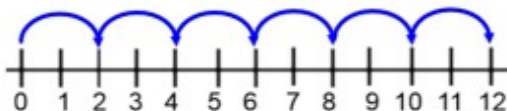
Sharing Arrays.

$12 \div 4 = 3$

Known division facts (2-, 5– and 10– times tables)

Pencils come in packs of 20
We need to put 5 in each pot.
How many pots will we need?

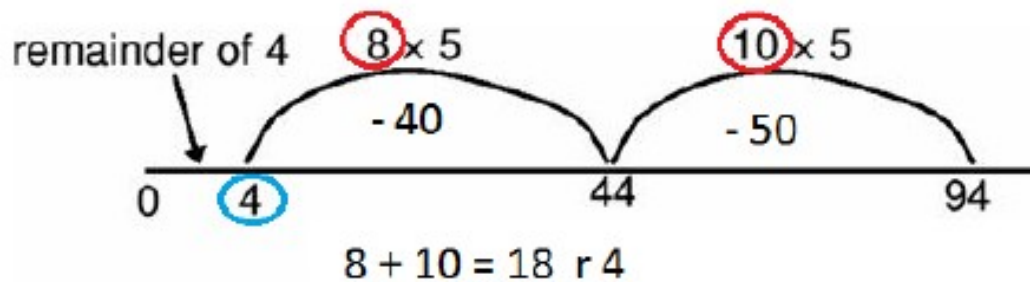Chunking with Repeated Addition and Subtraction (no remainders)

$15 - 3 - 3 - 3 - 3 - 3 = 0$
$15 \div 3 = 5$

Division—Year 3

National Curriculum: Division questions based on multiplication tables they know. Divide 2 digits by 1 digit, progressing to formal written methods.

Chunking with Repeated Subtraction (with remainders)

remainder of 4   ⑧× 5   ⑩× 5

- 40   - 50

0   ④   44   94

8 + 10 = 18 r 4

Division using the Grouping Method

```
      1 3
 5 | 6 5
   - 5 0   (5x10)
     1 5
   - 1 5   (5x3)
       0
```

Division using Short Division with exact answers.

```
      3 2
 3 | 9 6
```

Division—Year 4

National Curriculum:

Short Division (2digits) involving carrying, with exact answers.

Short Division (3digits) involving carrying, with exact answers.

Short Division – with remainders

Division—Year 5

National Curriculum: Divide 2 digits by 1 digit. Divide 3 digits by 1 digit. Divide 4 digits by 1 digit. Divide whole numbers and those involving decimals by 10, 100, 1000.

Divide whole numbers and those involving decimals by 10, 100 and 1000.

	÷ 10	÷ 100	÷ 1000
43	4.3	0.43	0.043
64.8	6.48	0.648	0.0648
2560	256	25.6	2.56

Short division (4-digits) with remainders

Short Division – with decimal / fraction remainders

Division—Year 6

National Curriculum: Divide numbers up to 4 digits by a 2-digit number using the formal written method of short division where appropriate. Divide up to 4-digits by a 2-digit whole numbers using the formal written method of long division.

Division with chunking

$$13 \overline{)41^27^13}$$ gives 0321

H.H
13	78
26	91
39	104
52	117
65	130

$$43 \overline{)645}$$

Division with decimals

$$10.6 \div 4 = \boxed{}$$

$$8 \overline{)6^54^69^17.^30^20^40} = 0812.125$$

$$73.8 \div 6 = \boxed{}$$

$$3 \overline{)4.^11^24} = 1.38$$

Use of division in different contexts.

Form of Answer

$$8 \overline{)1^19^34} = 024\,r2$$

Question	Answer
194 apples are packed in bags of 8. **How many full bags of apples can be packed?**	
The restaurant bill for 8 people is £194. **How much does each person need to pay?**	
An author spends 194 hours writing a book, working over 8 weeks. **On average, how long does she work each week?**	

Amina posts three large letters.

The postage costs the same for each letter.

She pays with a £ 20 note.

Her change is £14.96

What is the cost of posting **one** letter?