# Horton Park Primary School

# Calculation Policy
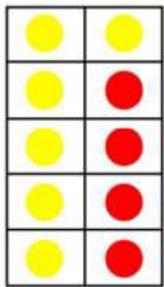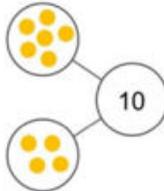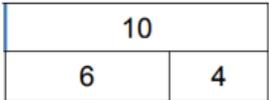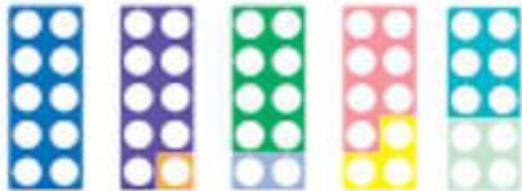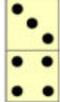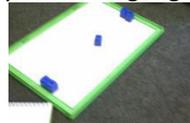
October 2021

This is the calculation policy for Horton Park Primary School (Linked with Sharon Day of SharonDayMaths Ltd, White Rose Maths Hub and NCETM)
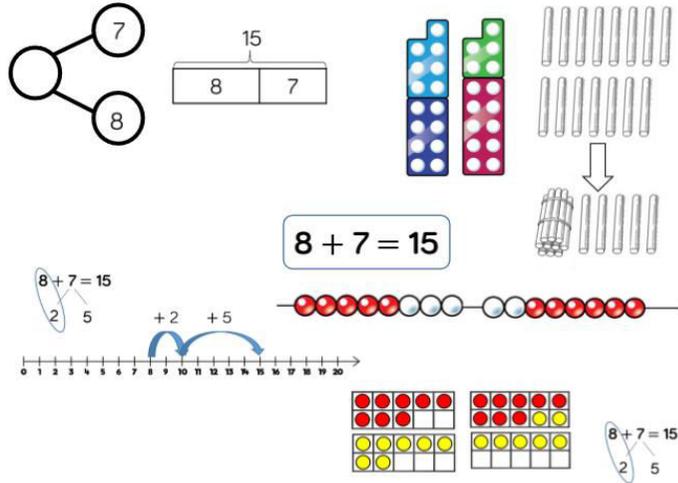
# Addition and Subtraction

- YR, Y1 and Y2 are mostly working mentally (which means using concrete resources to build conceptual understanding of the operations)
- The signs and number sentences for addition and subtraction are introduced throughout year 1.
- During year 3 the formal written methods for subtraction and addition are introduced as the children are working with numbers which demand this.
- Mental mathematics runs throughout with the children studying the numbers before they start to decide on the most efficient method for working it out.

Range of visual representations which will be used throughout school include:

| | | | |
|---|---|---|---|
| $6 + 4 = 10$<br>$4 + 6 = 10$<br>$10 - 4 = 6$<br>$10 - 6 = 4$ | $6 + 4 = 10$<br>$4 + 6 = 10$<br>$10 - 4 = 6$<br>$10 - 6 = 4$ | $6 + 4 = 10$<br>$4 + 6 = 10$<br>$10 - 4 = 6$<br>$10 - 6 = 4$ | $10 = \quad 1+9 \quad 2+8 \quad 3+7 \quad 4+6$ |
| Ten frame | Part Whole Model | Bar Model | Numicon |

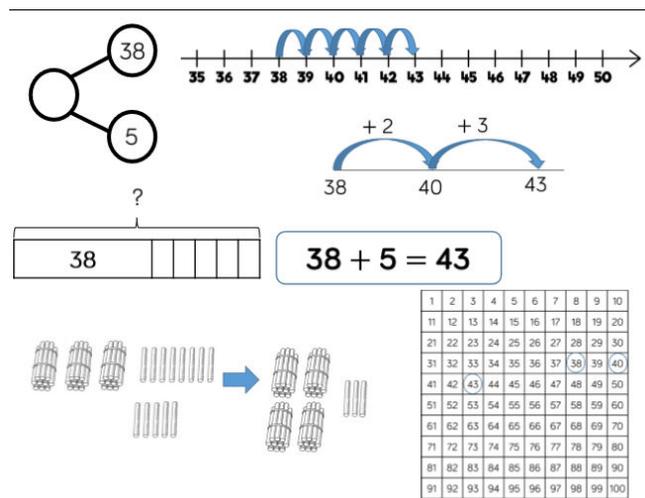| Year Group | Addition | Subtraction |
|---|---|---|
| **EYFS** | *Subitise (up to five items) firstly in recognised patterns then moving to random arrangements*<br><br>*Realise than when the same amount is rearranged it is the same number and that an amount only changes its quantity when more is added or some is taken away*<br>(including the game bunny ears – 'finger gnosia') | |

**Number ELG**:
Have a deep understanding of number to 10 including composition of each number
Subitise up to 5
Automatically recall number bonds to 5, including subtraction facts and some number bonds to 10 including double facts.
**Patterns ELG**:
Verbally count beyond 20 recognising the counting system
Compare quantities up to 10

| Year 1 | Read, write and interpret mathematical statements involving addition (+) and equals (=) signs (using numbers from 0 to 20) | Read, write and interpret mathematical statements involving subtraction (-) and equals (=) signs (using numbers from 0 to 20) |
|---|---|---|
| | **Add two 1 digit numbers to 10** | **Subtract two 1-digit numbers to 10** |
| |  |  |
| | $4 + 3 = 7$ | $7 - 3 = 4$ |
| | **Add 1 and 2 – digit numbers to 20** | **Subtract 1 and 2 digit numbers to 20** |

Solve one-step problems that involve addition, using concrete objects and pictorial representations, and missing number problems such as 17= □ + 9
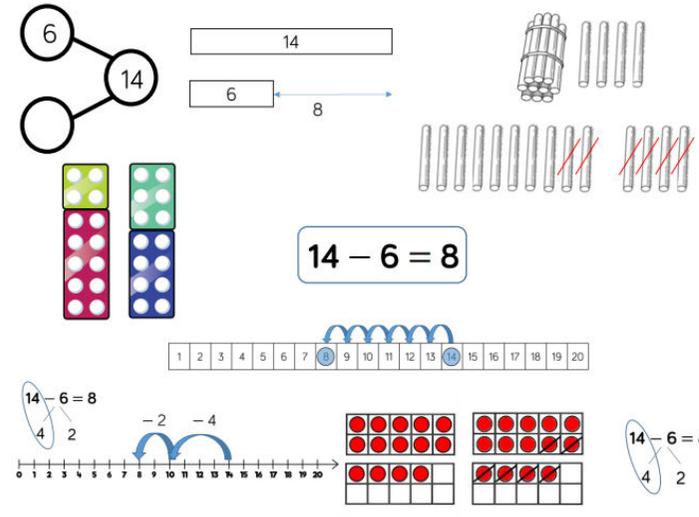


Solve one-step problems that involve subtraction, using concrete objects and pictorial representations, and missing number problems such as 7= □ - 9.

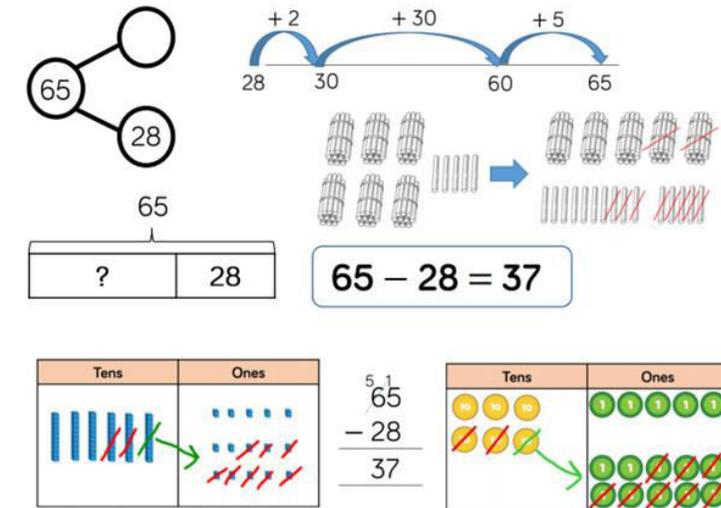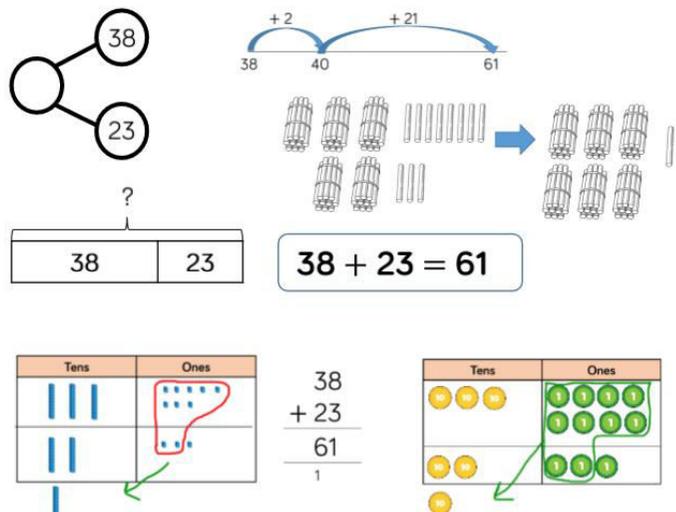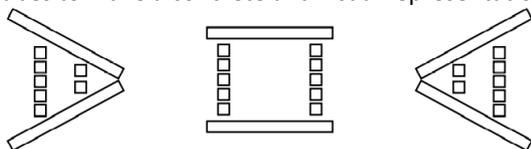| Year 2 | **Add 1 and 2 digit numbers to 100** | **Subtract 1 and 2-digit numbers to 100** |
|---|---|---|
| |  $$38 + 5 = 43$$ |  $$65 - 28 = 37$$ |
| | **Add two 2-digit numbers up to 100** | Subtract numbers using concrete objects, pictorial representations, and mentally, including: |

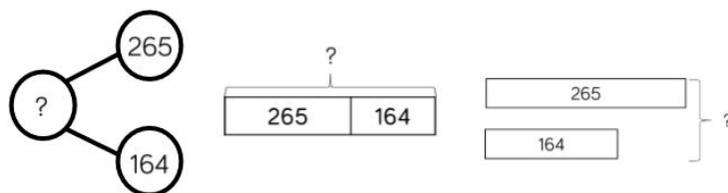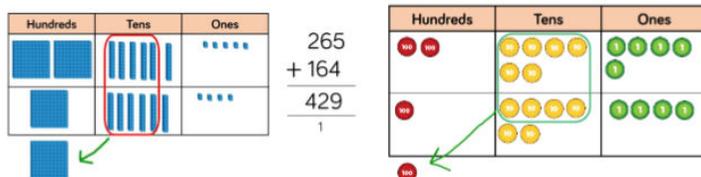|  | | |
|---|---|---|
| | <br><br>Add numbers using concrete objects, pictorial representations, and mentally, including:<br>- a two-digit number and ones<br>- a two-digit number and tens<br>- two two-digit numbers<br>- adding three one-digit numbers | - a two-digit number and ones<br>- a two-digit number and tens<br>- two two-digit numbers |
| **KS1** | Introduce the < and > signs is to use rods and<br>cubes to make a concrete and visual representations such as:<br> | |
| **Year 3** | **Mental Methods**<br>Pupils should be taught to add and subtract numbers mentally, including:<br>&bull; a three-digit number and ones:<br>363+4 (count on and/or use knowledge of bonds of seven)<br>373+7 (use bonds of ten)<br>458+7 (count on and/or use bonds)<br>&bull; a three-digit number and tens<br>534+40 (count on from 534 in tens)<br>&bull; a three-digit number and hundreds<br>457 +300 (use knowledge of four plus three with hundreds | **Mental Methods**<br>Pupils should be taught to add and subtract numbers mentally, including:<br>&bull; a three-digit number and ones:<br>63-4 (count back and/or use knowledge of bonds)<br>567-7 (use knowledge of partitioning)<br>324-9 (use knowledge of subtracting ten and add on – adjust)<br>&bull; a three-digit number and tens<br>672-30 (count back from 672 in tens)<br>523 – 20 (partition/'take out' the tens)<br>&bull; a three-digit number and hundreds |

673 – 400 (use knowledge of six subtract four with hundreds)

**Add up to 3 digits**
Add numbers with up to three digits, using formal written method of columnar addition

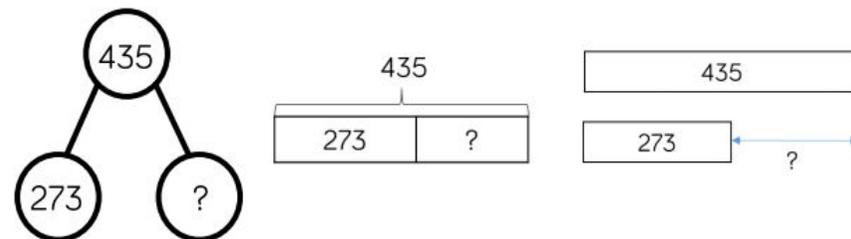**Subtract with up to 3 digits**
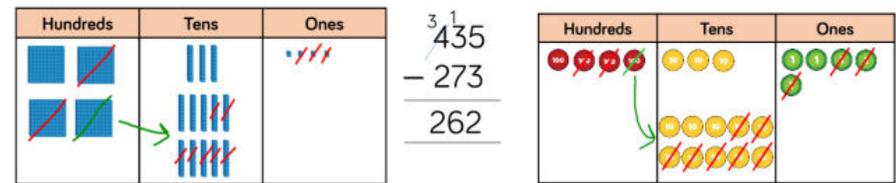


$$265 + 164 = 429$$

$$435 - 273 = 262$$

| Year 4 | **Mental Methods**<br>3000 + 567<br>3472 + 1111<br>3456 + 1000  (as all of these can be done mentally referring to place value)<br>5634 +   100<br>6743 +    10<br><br>**Add up to 4 – digits**<br>Add numbers with up to 4 digits using the efficient written method of columnar addition where appropriate. | **Subtract up to 4 –digits** |

$1,378 + 2,148 = 3,526$
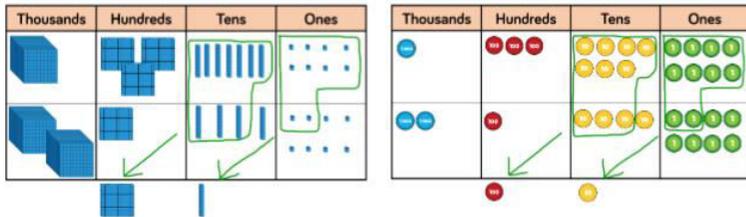


$4,357 - 2,735 = 1,622$
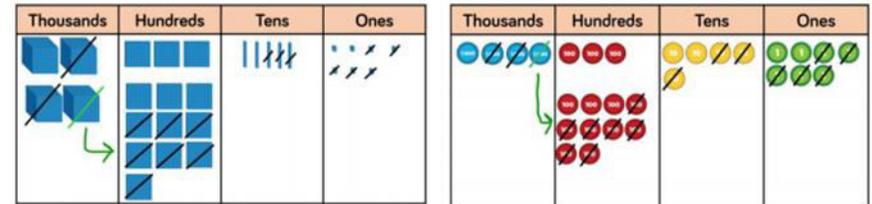
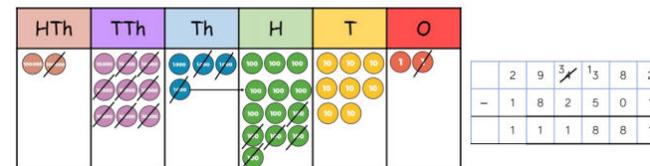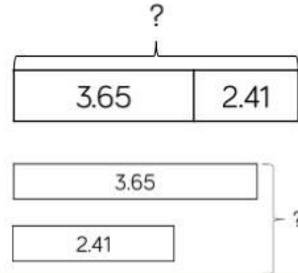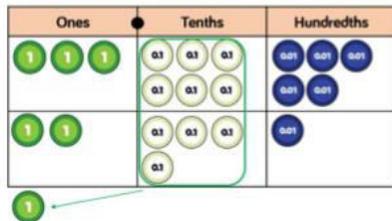| Year 5 | **Add with more than 4 digits** | **Subtract with more than 4 digits** |
|---|---|---|
| |  $104,328 + 61,731 = 166,059$ |  $294,382 - 182,501 = 111,881$ |

**Adding several numbers using column method:**

$$
\begin{array}{r}
81{,}059 \\
3{,}668 \\
15{,}301 \\
+\ 20{,}551 \\
\hline
120{,}579 \\
\end{array}
$$

**Add with up to 3 decimal places**
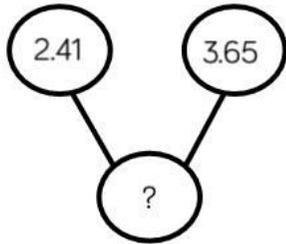


$$3.65 + 2.41 = 6.06$$
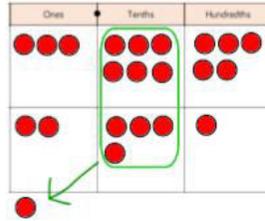


**Subtract with up to 3 decimals**
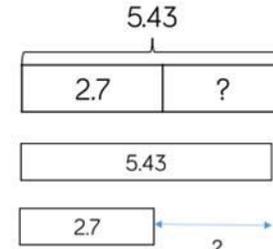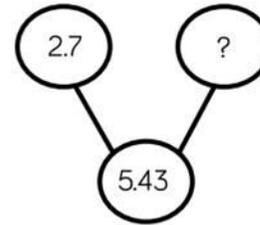


$$5.43 - 2.7 = 2.73$$
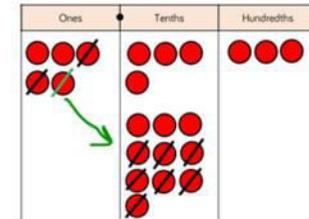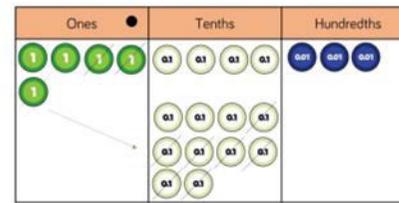
| Year 6 | Consolidate Year 5 Skills | |
|---|---|---|
| **Formal written methods taken from the National Curriculum (2014) appendix** | 789 + 642 becomes<br><br>```
    7  8  9
 +  6  4  2
 ─────────
 1  4  3  1
    1     1
```<br><br>Answer: 1431 | 874 – 523 becomes<br><br>```
    8  7  4
 −  5  2  3
 ─────────
    3  5  1
```<br><br>Answer: 351 | 932 – 457 becomes<br><br>```
   8  12  1
   9   3  2
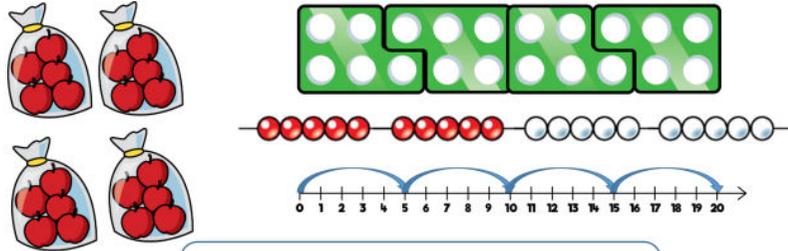 − 4   5  7
 ─────────
   4   7  5
```<br><br>Answer: 475 |

# Multiplication and Division

- YR, Y1 and Y2 and Y3 are mostly working mentally (which means using concrete resources to build conceptual understanding of the operations and then using growing knowledge of times table facts).
- The signs and number sentences for division and multiplication are introduced throughout year 2.
- During year 4 the formal written methods for multiplication and division are introduced as the children are working with numbers which demand this.
- Long multiplication is introduced in year 5.
- Long division is introduced in year 6
- Mental mathematics runs throughout with the children being trained to study the numbers before they start to decide on the most efficient method for working it out.

| Year Group | Multiplication skills | Division skills |
|---|---|---|
| EYFS | Numerical Pattern ELG: Explore and represent patterns within numbers up to 10 including evens and odds, double facts and how quantities can be distributed equally.<br><br><br><br>*Provide opportunities to have experience of recognising where items are organised into equal groups and then putting together equal groups of items in various areas of provision.*<br><br> | <br>*'How many bags of apples with five in each bag can you make?' 'I can make two bags of five apples.'* |

| Year 1 | **Solve one step problems with multiplication** | **Solve one step problems with division (Sharing)** |
|---|---|---|

**Solve one step problems with multiplication**

One bag holds 5 apples.
How many apples do 4 bags hold?

$5 + 5 + 5 + 5 = 20$

$4 \times 5 = 20$

$5 \times 4 = 20$

Children use concrete and pictorial representations.

**Mental Methods**
Practical experiences of arrays; items into equal groups; sharing items out. Counting physical items in twos and fives (and 2p and 5p coins)

**Solve one step problems with division (Sharing)**

20

There are 20 apples altogether.
They are shared equally between 5 bags.
How many apples are in each bag?

$20 \div 5 = 4$

| Year 2 | **Solve one step problems with multiplication including using the X symbol** | **Solve one step problems with division (Grouping)** |
|---|---|---|



One bag holds 5 apples.
How many apples do 4 bags hold?

$$5 + 5 + 5 + 5 = 20$$
$$4 \times 5 = 20$$
$$5 \times 4 = 20$$

Children use concrete and pictorial representations and **begin to record multiplications formally**

Show that multiplication of two numbers can be done in any order (commutative)
Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

**Mental Methods**
Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers
Number sentences for multiplying and dividing by 2, 5 and 10.
Counting in multiples of three.



There are 20 apples altogether.
They are put in bags of 5.
How many bags are there?

$$20 \div 5 = 4$$

Show that division of one number by another cannot be done in any order.

**Mental Methods**
Explore 'dividing by 3' in the summer term (finding 1/3 of an amount as well as 'into groups of three').

| Year 3 | **Multiply 2 digit numbers by a 1-digit number** | **Divide two digits by one digit (No exchange, sharing)** |
|---|---|---|

**Multiply 2 digit numbers by a 1-digit number**

Expanded method



$$34 \times 5 = 170$$

Formal method

Children begin with the expanded method and move to the formal written method.

**Mental Methods**
Number sentences for multiplying and dividing by 2, 5, 10, 3, 4 and 8. Use of concrete resources moving into pictorial representations.
Recall of tables 2, 3, 4, 5, 8, 10

**Divide two digits by one digit (No exchange, sharing)**



$$48 \div 2 = 24$$

**Divide two digits by one digit (Sharing with exchange)**



$$52 \div 4 = 13$$

$$10 + 3 = 13$$

| Year 4 | **Multiply 3 digit numbers by a 1-digit number** | **Divide two digits by one digit (Sharing with remainders)** |
|---|---|---|

Formal method



$$245 \times 4 = 980$$



**Make connections between calculation to improve fluency. Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers**

| 2 × 3 = | 6 × 7 = | 9 × 8 = |
| 2 × 30 = | 6 × 70 = | 9 × 80 = |
| 2 × 300 = | 6 × 700 = | 9 × 800 = |
| 20 × 3 = | 60 × 7 = | 90 × 8 = |
| 200 × 3 = | 600 × 7 = | 900 × 8 = |

**Mental Methods**
Recall multiplication and division facts for multiplication tables up to 12 × 12
Recognise and use factor pairs and commutativity in mental calculations

**Divide two digits by one digit (Sharing with remainders)**



$$53 \div 4 = 13 \ r1$$

**Divide two digits by one digit (Grouping)**



$$52 \div 4 = 13$$

| | | **Divide three digits by one digit (Sharing with exchange)** |
|---|---|---|
| | | $844 \div 4 = 122$  $844 \div 4 = 122$  |
| **Year 5** | **Multiply 4 digit numbers by a 1-digit number**  $1,826 \times 3 = 5,478$  | **Divide three digits by one digit (Grouping)**  $856 \div 4 = 214$ |

## Multiply 2 digit or three digit numbers by 2 digit numbers



$$22 \times 31 = 682$$

| H | T | O |
|---|---|---|
|   | 2 | 2 |
|   | 3 | 1 |
|   | 2 | 2 |
| 6 | 6 | 0 |
| 6 | 8 | 2 |

Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Recognise and use square numbers and cube numbers, and the notation for squared (2) and cubed (3)

of factors and multiples, squares and cubes

Solve problems involving multiplication and division, including scaling

### Mental Methods

Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers up to 100

Multiply and divide numbers mentally drawing upon known facts

| | | |
|---|---|---|
| 2 × 3 = | 6 × 7 = | 9 × 8 = |
| 2 × 30 = | 6 × 70 = | 9 × 80 = |
| 2 × 300 = | 6 × 700 = | 9 × 800 = |
| 20 × 3 = | 60 × 7 = | 90 × 8 = |
| 200 × 3 = | 600 × 7 = | 900 × 8 = |

## Divide four digits by one digit (Grouping)



$$8,532 \div 2 = 4,266$$

Interpret remainders appropriately for the context e.g. cannot have half a person.

| Year 6 | **Multiply 4 digit numbers by two digits** | **Divide multi digits by two digits (Short division)** |

**Multiply 4 digit numbers by two digits**

| TTh | Th | H | T | O |
|-----|-----|-----|-----|-----|
|  | 2 | 7 | 3 | 9 |
| × |  |  | 2 | 8 |
| 2² | 1⁵ | 9³ | 1⁷ | 2 |
| 5¹ | 4 | 7¹ | 8 | 0 |
| 7 | 6 | 6 | 9 | 2 |
|  |  |  | 1 |  |

$$2,739 \times 28 = 76,692$$

Make sure exchanged digits are placed consistently.

**Divide multi digits by two digits (Short division)**



$$432 \div 12 = 36$$

$$7,335 \div 15 = 489$$



| 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 | 135 | 150 |
|----|----|----|----|----|----|-----|-----|-----|-----|

**Division multi digits by two digits (Long division)**



$12 \times 1 = 12$
$12 \times 2 = 24$
$12 \times 3 = 36$
$12 \times 4 = 48$
$12 \times 5 = 60$
$12 \times 6 = 72$
$12 \times 7 = 84$
$12 \times 8 = 96$
$12 \times 7 = 108$
$12 \times 10 = 120$

$$432 \div 12 = 36$$

$$7,335 \div 15 = 489$$



$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

Interpret

remainders as whole number remainders,
fractions, or by rounding, as appropriate for the context

**National Curriculum Examples**

**Short multiplication**

| 24 × 6 becomes | 342 × 7 becomes | 2741 × 6 becomes |
|---|---|---|
| ```
    2  4
  ×    6
  ------
  1  4  4
     2
``` | ```
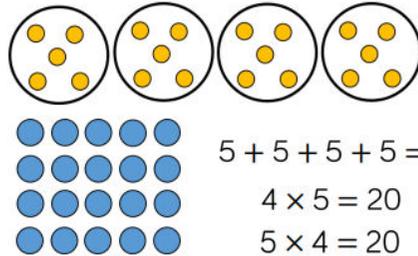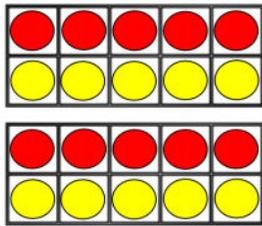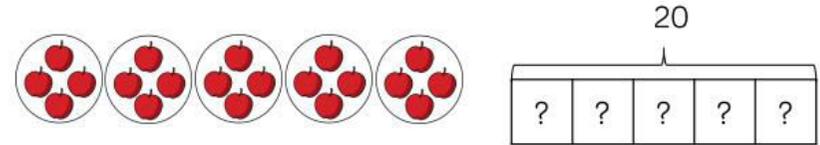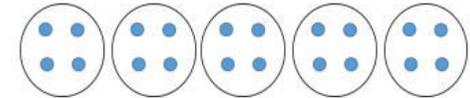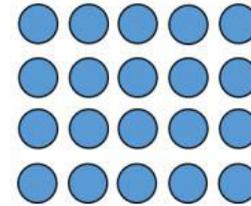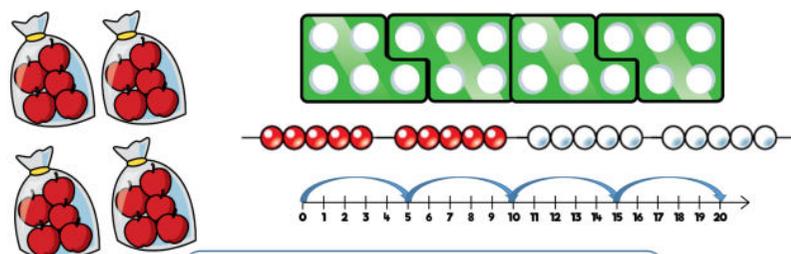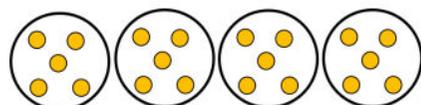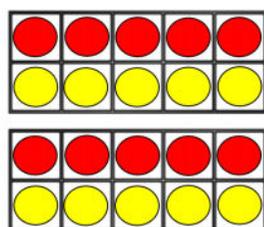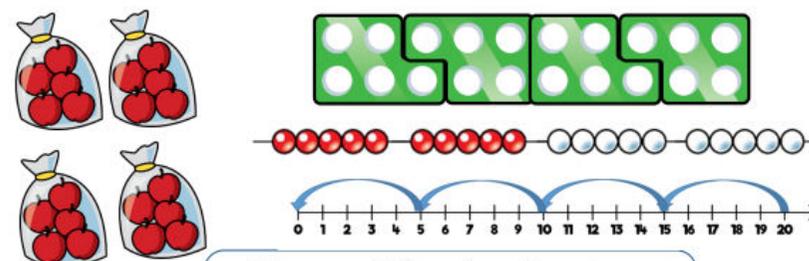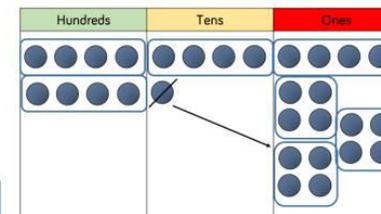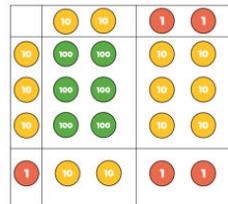    3  4  2
  ×       7
  ---------
  2  3  9  4
     2  1
``` | ```
    2  7  4  1
  ×          6
  ------------
  1  6  4  4  6
     4  2
``` |
| Answer: 144 | Answer: 2394 | Answer: 16 446 |

**Long multiplication**

| 24 × 16 becomes | 124 × 26 becomes | 124 × 26 becomes |
|---|---|---|
| ```
      2
    2  4
  ×  1  6
  -------
  2  4  0
  1  4  4
  -------
  3  8  4
``` | ```
     1  2
   1  2  4
  ×    2  6
  --------
  2  4  8  0
     7  4  4
  ---------
  3  2  2  4
     1  1
``` | ```
     1  2
   1  2  4
  ×    2  6
  --------
     7  4  4
  2  4  8  0
  ---------
  3  2  2  4
     1  1
``` |
| Answer: 384 | Answer: 3224 | Answer: 3224 |

**Short division**

| 98 ÷ 7 becomes | 432 ÷ 5 becomes | 496 ÷ 11 becomes |
|---|---|---|
| ```
    1  4
 7 | 9  8
      2
``` | ```
       8  6  r 2
 5 | 4  3  2
       3
``` | ```
       4  5  r 1
 1 1 | 4  9  6
          5
``` |
| Answer: 14 | Answer: 86 remainder 2 | Answer: $45\frac{1}{11}$ |

**Long division**

| 432 ÷ 15 becomes | 432 ÷ 15 becomes | 432 ÷ 15 becomes |
|---|---|---|
| ```
        2  8  r 12
 1  5 | 4  3  2
        3  0  0
        1  3  2
        1  2  0
        ------
           1  2
``` | ```
        2  8
 1  5 | 4  3  2
        3  0  0   15×20
        1  3  2
        1  2  0   15×8
        ------
           1  2

  12/15 = 4/5
``` | ```
        2  8 · 8
 1  5 | 4  3  2 · 0
        3  0
        1  3  2
        1  2  0
           1  2  0
           1  2  0
           ------
              0
``` |
| Answer: 28 remainder 12 | Answer: $28\frac{4}{5}$ | Answer: 28·8 |