Upper Key Stage 2

DIVISION

÷

Developing Conceptual Understanding:
CONTEXTUAL – LINGUISTIC – PRACTICAL – CONCRETE

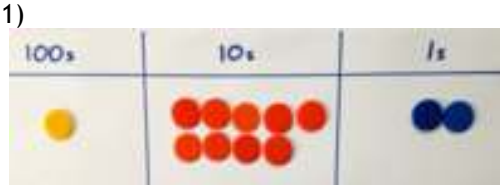
- **Language of division:**
  Continue to embed the correct use of the language of multiples and factors, enable children to identify key words in questions that signify division (eg 'each', 'shared', 'groups') and expand their understanding into new vocabulary, such as:

  Common factors
  Factor pairs
  Prime numbers (numbers with only two factors)
  Composite numbers (numbers which aren't prime)
  Square numbers and square roots
  Cube numbers and cube roots

- **Concrete/practical support for division of larger numbers:**
  Many children will still require access to apparatus as a way to model what's happening as we progress to dividing three digit numbers in UKS2:

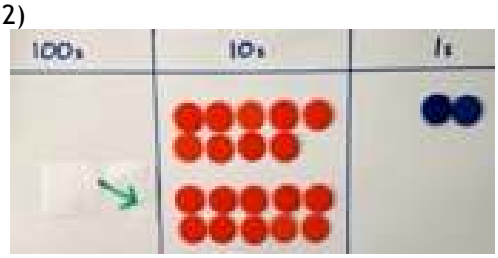
  Eg; 192 ÷ 6 Using place value counters and a place value mat:

1)



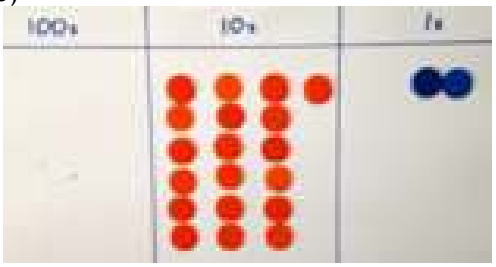
Set out the 192 using the counters (or Base 10 apparatus)

2)



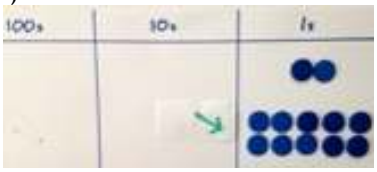
As we can't divide 1 (hundred) into 6 groups, exchange the 1 hundred for 10 tens.

3)



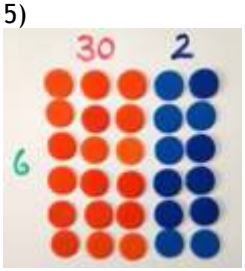
We have 19 tens, so share those into groups of 6 – giving three groups with 1 ten left over.

4)



Exchange the ten for 10 ones, giving 12 ones to share into groups of 6.

5)



So 196 shared into 6 equal groups, equals 32 in each group.

This is very effective to use alongside the standard (share-box or 'bus-stop') recording method, to illustrate each step of the process in order, and understand what the carrying signifies.

Upper Key Stage 2

DIVISION

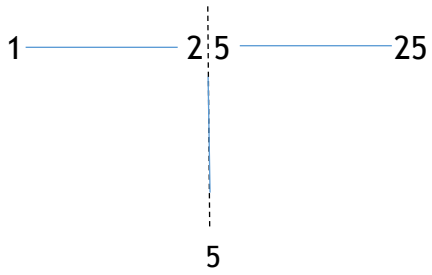
÷

Developing Conceptual Understanding: PICTORIAL – MENTAL

- **Factor fans:**
  Factor fans (introduced in LKS2) come into their own as a way of revising tables knowledge in x and ÷, investigating numbers within and beyond 12 x 12 as well as giving a pictorial representation to support the understanding of prime and square numbers:

  Square numbers:

  Eg; The factor fan for 25:

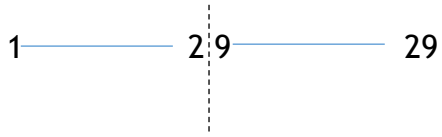
  

  The factors of 25 are 1, 5 and 25.

  Square numbers are unique in that they have an *odd* number of factors (in the case of 25 which = 5 x 5, we only need to record the factor 5 once, so it sits on the line of symmetry of the factor fan).

  Prime numbers:

  Eg; The factor fan for 29:

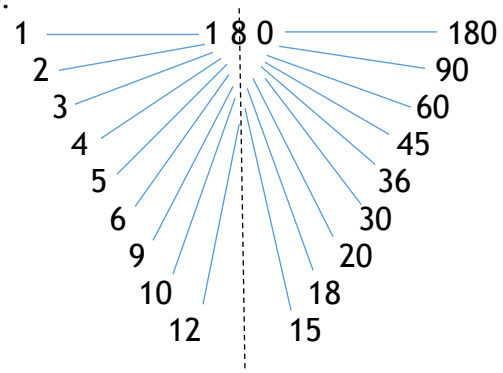
  

  The factors of 29 are 1 and 29.

  Prime numbers are numbers *with only two factors* – 1 and the number itself (they are not multiples of any other number so do not appear as 'answers' in any times tables). Activities such as Eratosthenes' Sieve should be used to reinforce this concept.

- **Factor fans of numbers beyond 12 x 12:**

  Eg; The factor fan of 180:



  So 180 has 18 factors: 1,2,3,4,5,6,9,10,12,15,18,20,30,36,45,60,90 and 180.

  When producing factor fans for large numbers, the layout supports their mental calculation of numbers beyond their times table knowledge. For example, to work out how many times 5 goes into 180, they can look at 10 x 18 = 180 – because 5 is half of ten, they can double 18 to work out the corresponding factor pair to 5 is 36.

- **Tests of divisibility:**
  Children in UKS2 should be ready to learn the tests of divisibility to see which large numbers will divide exactly by certain numbers:

Divisibility Tests	Example
A number is divisible by 2 if the last digit is even (ie 0, 2, 4, 6 or 8).	168 is divisible by 2 since the last digit is 8.
A number is divisible by 3 if the sum of the digits is divisible by 3.	168 is divisible by 3 since the sum of the digits is 15 (1+6+8=15), and 15 is divisible by 3.
A number is divisible by 4 if the number formed by the last two digits is divisible by 4.	316 is divisible by 4 since 16 is divisible by 4.
A number is divisible by 5 if the last digit is either 0 or 5.	195 is divisible by 5 since the last digit is 5.
A number is divisible by 6 if it is divisible by 2 (ie even) **AND** it is divisible by 3.	168 is divisible by 6 since it is even **AND** it is divisible by 3 (since the digit sum = 15).
A number is divisible by 8 if the number formed by the last three digits is divisible by 8.	7,120 is divisible by 8 since 120 is divisible by 8.
A number is divisible by 9 if the sum of the digits is divisible by 9.	549 is divisible by 9 since the sum of the digits is 18 (5+4+9=18), and 18 is divisible by 9.
A number is divisible by 10 if the last digit is 0.	1,470 is divisible by 10 since the last digit is 0.

- **Halving and quartering mentally:**
  Continue to halve and quarter numbers (to include larger numbers and numbers including decimals) mentally by applying the partitioning jotting and 'halving and halving again' methods introduced in LKS2.

- **Dividing by powers of 10:**
  Children should be confidently able to divide large numbers (to include numbers going into or including decimals) by powers of ten - using place value column jottings to support where necessary, applying the following rules:

when we divide a number by 10 the digits move ONE place value column to the RIGHT
when we divide a number by 100 the digits move TWO place value columns to the RIGHT
when we divide a number by 1000 the digits move THREE place value columns to the RIGHT
when we divide a number by 10,000 the digits move FOUR place value columns to the RIGHT
when we divide a number by 100,000 the digits move FIVE p. v. columns to the RIGHT
when we divide a number by 1,000,000 the digits move SIX p. v. columns to the RIGHT
and so on…

- JUST KNOW IT! YEAR 5 and 6
  Recall prime numbers up to 100 and square numbers up to 144
  Halve and find quarters of larger numbers including decimals
  Divide large numbers and/or decimals by 10, 100 and explain how digits move

Upper Key Stage 2

DIVISION
÷

Abstract Recording:
INFORMAL JOTTINGS

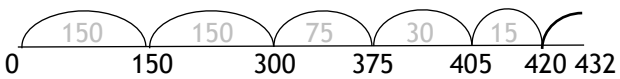
- **Number line Long Division:**
  Since many of the jumps will go beyond times tables knowledge, the 'Coin Fact' Ready Reckoner is a really useful support:

  Coin facts:
  Children should be taught to simplify the process of long division by producing a ready reckoner of multiples of the divisor. This builds on simple recall of multiplying by 10 and 100; halving them to find 5x or 50x the number; doubling them to find 20x or 200x the number or combining to find other lots (eg 5x add 2x = 7x the number).

  Coins are only made for the easiest numbers to work with to combine into other amounts: 1p, 2p, 5p, 10p, 20p, 50p, £1 = 100p.
  These are also the simplest multiples to find in order to 'chunk' large numbers into smaller jumps on the number line. Children should become familiar with deciding which coin multiples they need for each sum, as they won't need them all!

  Eg: 432 ÷ 15

  10 x 15 10 x 15 5 x 15 2 x 15 1 x 15 r12



  Coin Facts Ready Reckoner:

  10 x 15 = 150
  5 x 15 = 75 (halve 10x)
  2 x 15 = 30 (double 15)

  432 ÷ 15 = 28 remainder 12
  Express remainders as fractions and/or decimals: 432 ÷ 15 = 28 r 12/15
  since 12 out of 15 can be simplified to 4 out of 5 and 4/5 = 0.8, the answer can be expressed as:
  432 ÷ 15 = 28 r4/5 or 28.8

Upper Key Stage 2

DIVISION
÷

Abstract Recording:
OUR WRITTEN METHOD

Note that in KS2 SATs, children will be able to use 'Long Division' (see LKS2 section) OR 'Short Division' as acceptable standard methods and can obtain method marks for correct application of either strategy.

Children who are secure with long division and the use of coin fact ready reckoners, may be introduced to the more efficient, quicker method of 'Short Division':

- **Short division:**

In UKS2, children should secure two-digit divided by one-digit 'share-box' short division first (see LKS2 written method section), advancing this into calculations with remainders.

They should be introduced to Coin Fact Ready Reckoners (see previous section) and should be introduced to recording short division calculations alongside the numberline 'chunking' jotting (and practical demonstrations with concrete apparatus where necessary).

3 digit ÷ 1 digit:

Eg; 459 ÷ 9

H	T	O
0	5	1

9 | 4 (4) 5 9

OR

H	T	O
0	5	1

9 | 4 5 9

Instead of doing "9's into 4 won't go" and carrying the 4 ……

….. look at dividing a bigger group by including the next place value column (so, "9's into 4 won't go – put 0 as a place holder in the answer space – so 9's into 45 go 5 times)

3 digit ÷ 1 digit with remainders:

Eg; 342 ÷ 5

H	T	O
0	6	8

5 | 3 (3) 4 (4) 2 (2) = 68 r2

3 digit ÷ 1 digit with decimal remainders:

Eg; 658 ÷ 8

H	T	O • t^{ths}	h^{ths}
0	8	2 • 2	5

8 | 6 (6) 5 (1) 8 •(2) 0 (4) 0

Set out the decimal point in the share box, followed by 0's. Continue dividing beyond the decimal point, carrying in the normal way until the sum is complete.

- **Dividing by 2-digit numbers (beyond times tables):**

Short division:

A worked example of putting all the strategies for UKS2 division into place, to divide efficiently at the maximum level of difficulty within KS2 Arithmetic:

Eg; 432 ÷ 15

	H	T	O	•	t^{ths}
	0	2	8	•	8
15	4	3^{13}	2	$•^{12}$	0

Coin facts:

10 x 15 = 150
5 x 15 = 75
\+ 2 x 15 = 30
7 x 15 = 105
\+ 1 x 15 = 15
8 x 15 = 120

432 ÷ 15 = 28.8

NB: this method is for dividing by ANY 2-digit number

Expectation: We would expect the majority of Year 6 children to be secure in using this standard method by KS2 SATs, for dividing any 4-digit number by a 2-digit number