

Year 6 Mathematics

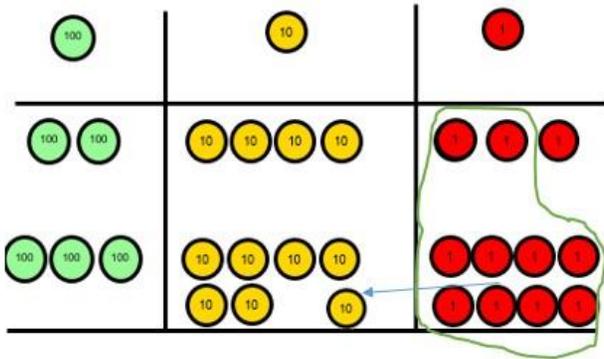
How to support your child at home

We have been really impressed by the number of parents who have been taking an interest in supporting their child with their mathematics learning at home. This year, we have changed the way we teach Mathematics to really focus on reasoning and problem solving. To teach mathematical fluency, we are now using a CPA (Concrete, Pictorial and Abstract) approach. This is shown in the calculation strategies outlined in this document. Understandably, it is really important the strategies used at home are the same as the strategies we are using in school.

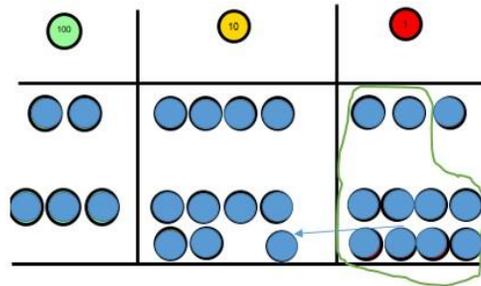
Addition-

Key language which should be used: *sum, total, parts and wholes, plus, add, altogether, more than, 'is equal to' 'is the same as'*

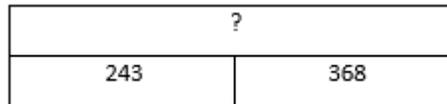
Use of place value counters to add HTO + TO, HTO + HTO etc. once the children have had practice with this, they should be able to apply it to larger numbers and the abstract



Children to represent the counters e.g. like the image below

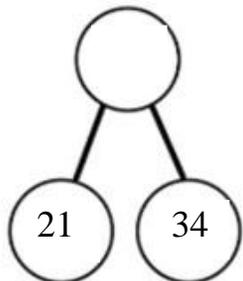


If the children are completing a word problem, draw a bar model to represent what it's asking them to do



$$\begin{array}{r} 243 \\ +368 \\ \hline 611 \\ \hline 11 \end{array}$$

Fluency variation, different ways to ask children to solve 21+34:



Sam saved £21 one week and £34 another. How much did he save in total?

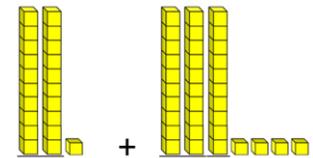
21+34=55. Prove it! (reasoning but the children need to be fluent in representing this)

$$\begin{array}{r} 21 \\ +34 \\ \hline \end{array}$$

$$21 + 34 =$$

$$= 21 + 34$$

What's the sum of twenty one and thirty four?



Always use missing digit problems too:

Tens		Ones
20	10	1
20	10	?
?		4

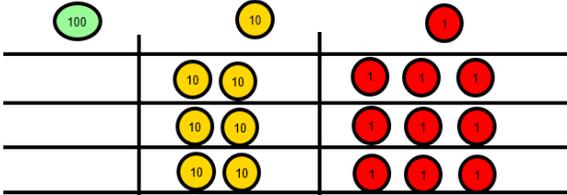
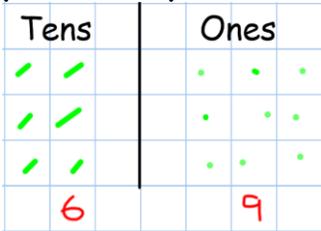
Subtraction-

Key language which should be used: take away, less than, the difference, subtract, minus, fewer, decrease, '7 take away 3, the difference is four'

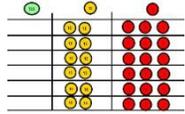
<p>Column method (using place value counters) 234-88</p>	<p>Once the children have had practice with the concrete, they should be able to apply it to any subtraction.</p> <p>Like the other pictorial representations, children to represent the counters.</p>	$\begin{array}{r} \overset{2}{2} \overset{1}{3} 4 \\ - 88 \\ \hline 6 \end{array}$							
<p>Fluency variation, different ways to ask children to solve 391-186:</p>									
	<p>Raj spent £391, Timmy spent £186. How much more did Raj spend?</p> <p>I had 391 metres to run. After 186 I stopped. How many metres do I have left to run?</p>	$\begin{array}{r} 391 - 186 \\ = 391 - 186 \\ 391 \\ - 186 \\ \hline \end{array}$ <p>Find the difference between 391 and 186 Subtract 186 from 391. What is 186 less than 391?</p>	<p>What's the calculation? What's the answer?</p> <table border="1" data-bbox="1449 779 1879 974"> <thead> <tr> <th>Hundreds</th> <th>Tens</th> <th>Ones</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> </tr> </tbody> </table> $\begin{array}{r} 39\ \square \\ - \square\square 6 \\ \hline \square 0 5 \end{array}$	Hundreds	Tens	Ones			
Hundreds	Tens	Ones							

Multiplication-

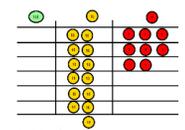
Key language which should be used: double times, multiplied by, the product of, groups of, lots of, 'is equal to' 'is the same as'

Concrete	Pictorial	Abstract
<p>Formal column method with place value counters or base 10 (at the first stage- no exchanging) 3×23</p> <p>Make 23, 3 times. See how many ones, then how many tens</p> 	<p>Children to represent the counters in a pictorial way</p> 	<p>Children to record what it is they are doing to show understanding</p> $3 \times 23 \quad 3 \times 20 = 60$ $20 \quad 3 \quad 3 \times 3 = 9$ $60 + 9 = 69$ $\begin{array}{r} 23 \\ \times 3 \\ \hline 69 \end{array}$
<p>Formal column method with place value counters (children need this stage, initially, to understand how the column method works)</p>	<p>Children to represent the counters/base 10, pictorially e.g. the image below.</p>	<p>6×23</p> $6 \times 3 = 18$ $6 \times 20 = 120$ $120 + 18 = 138$

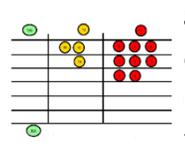
6×23



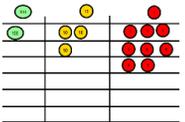
Step 1: get 6 lots of 23



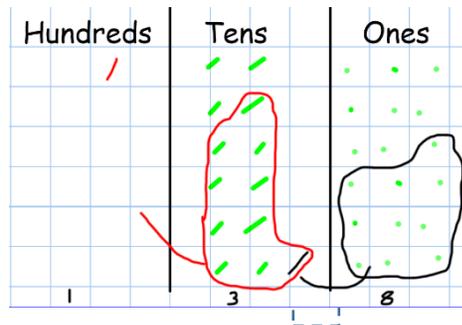
Step 2: 6×3 is 18. Can I make an exchange? Yes! Ten ones for one ten....



Step 3: 6×2 tens and my extra ten is 13 tens. Can I make an exchange? Yes! Ten tens for one hundred...



Step 4- what do I have I each column?



The aim is to get to the formal method but the children need to understand how it works.

$$\begin{array}{r}
 6 \times 23 = \\
 23 \\
 \times 6 \\
 \hline
 138 \\
 \hline
 1 \quad 1
 \end{array}$$

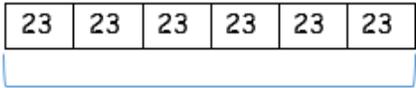
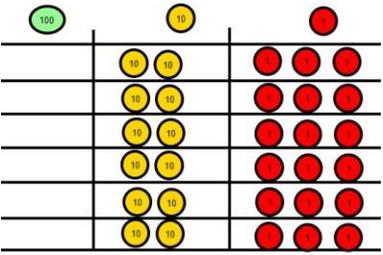
When children start to multiply 3d x 3d and 4d x 2d etc, they should be confident with the abstract:

To get 744 children have solved 6×124
 To get 2480 they have solved 20×124

$$\begin{array}{r}
 1 \quad 2 \quad 4 \\
 \times \quad 2 \quad 6 \\
 \hline
 7 \quad 4 \quad 4 \\
 \\
 2 \quad 4 \quad 8 \quad 0 \\
 \hline
 3 \quad 2 \quad 2 \quad 4 \\
 \hline
 1 \quad 1
 \end{array}$$

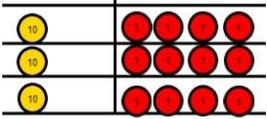
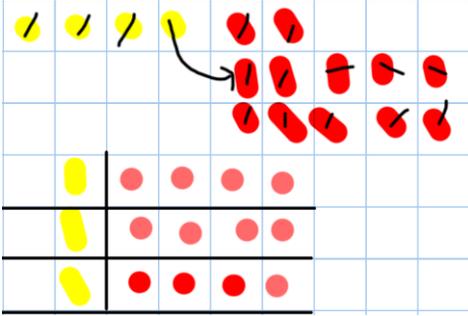
Answer: 3224

Fluency variation, different ways to ask children to solve 6×23 :

 <p>?</p> <p>With the counters, prove that $6 \times 23 = 138$</p> <p>Why is $6 \times 23 = 32 \times 6$?</p>	<p>Mai had to swim 23 lengths, 6 times a week. How many lengths did she swim in one week?</p> <p>Tom saved 23p three days a week. How much did he save in 2 weeks?</p>	<p>Find the product of 6 and 23</p> $6 \times 23 =$ $= 6 \times 23$ $\begin{array}{r} 6 \quad 23 \\ \times \quad 23 \\ \hline \end{array}$ $\begin{array}{r} 6 \quad 23 \\ \times \quad 6 \\ \hline \end{array}$	<p>What's the calculation? What's the answer?</p> 
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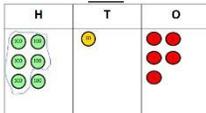
Division-

Key language which should be used: share, group, divide, divided by, half, 'is equal to' 'is the same as'

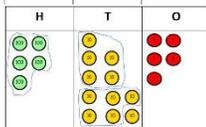
Concrete	Pictorial	Abstract
<p>Sharing using place value counters.</p> $42 \div 3 = 14$  <p>1. Make 42. Share the 4 tens between 3. Can we make an exchange with the extra 10? Exchange the ten for 10 ones and share out the 12 ones.</p>	 <p>Exchange the ten for 10 ones and share out 12 ones</p>	$42 \div 3$ $42 = 30 + 12$ $30 \div 3 = 10$ $12 \div 3 = 4$ $10 + 4 = 14$

Use of the 'bus stop method' using grouping and counters. Key language for grouping- how many groups of X can we make with X hundreds'- *this can also be done using sharing!*

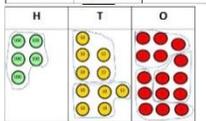
$$615 \div 5$$



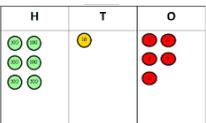
Step 1: make 615



Step 2: Circle your groups of 5



Step 3: Exchange 1H for 10T and circle groups of 5



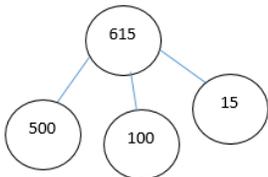
Step 4: exchange 1T for 10ones and circles groups of 5

This can easily be represented pictorially until the children no longer to do it. It can also be done to decimal places if you have a remainder!

$$\begin{array}{r} 123 \\ 5 \overline{) 615} \\ \underline{5} \\ 11 \\ \underline{10} \\ 15 \\ \underline{15} \\ 0 \end{array}$$

Fluency variation, different ways to ask children to solve $615 \div 5$:

Using the part whole model below, how can you divide 615 by 5 without using the 'bus stop' method?



I have £615 and share it equally between 5 bank accounts. How much will be in each account?

615 pupils need to be put into 5 groups. How many will be in each group?

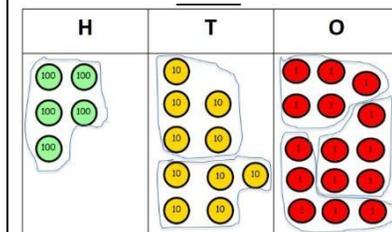
$$5 \overline{) 615}$$

$$615 \div 5 =$$

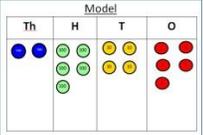
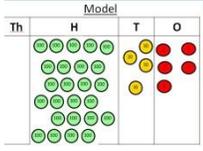
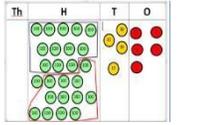
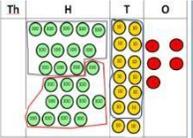
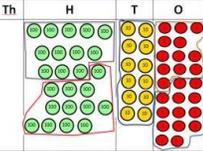
$$= 615 \div 5$$

How many 5's go into 615?

What's the calculation? What's the answer?



Long Division

Concrete	Pictorial	Abstract
<p>$2544 \div 12$ How many groups of 12 thousands do we have? None</p>  <p>Exchange 2 thousand for 20 hundreds.</p>  <p>How many groups of 12 are in 25 hundreds? 2 groups. Circle them.</p> <p>We have grouped 24 hundreds so can take them off and we are left with one.</p>  <p>Exchange the one hundred for ten tens so now we have 14 tens. How many groups of 12 are in 14? 1 remainder 2.</p>  <p>Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2</p> 	<p>Children to represent the counters, pictorially and record the subtractions beneath.</p>	<p>Step one- exchange 2 thousand for 20 hundreds so we now have 25 hundreds.</p> $12 \overline{) 2544} \begin{array}{r} 0 \\ 24 \\ \hline 1 \end{array}$ <p>Step two- How many groups of 12 can I make with 25 hundreds? The 24 shows the hundreds we have grouped. The one is how many hundreds we have left.</p> $12 \overline{) 2544} \begin{array}{r} 02 \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$ <p>Exchange the one hundred for 10 tens. How many groups of 12 can I make with 14 tens? The 14 shows how many tens I have, the 12 is how many I grouped and the 2 is how many tens I have left.</p> $12 \overline{) 2544} \begin{array}{r} 021 \\ 24 \\ \hline 14 \\ 12 \\ \hline 2 \end{array}$ <p>Exchange the 2 tens for 20 ones. The 24 is how many ones I have grouped and the 0 is what I have left.</p> $12 \overline{) 2544} \begin{array}{r} 0212 \\ 24 \\ \hline 14 \\ 12 \\ \hline 24 \\ 24 \\ \hline 0 \end{array}$

Year 6 Age-Related Expectations

Number and Place Value

- read, write, order and compare numbers up to 10,000,000 and determine the value of each digit
- round any whole number to a required degree of accuracy
- use negative numbers in context, and calculate intervals across 0
- solve number and practical problems that involve all of the above

Addition, Subtraction, Multiplication and Division

- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- perform mental calculations, including with mixed operations and large numbers
- identify common factors, common multiples and prime numbers
- use their knowledge of the order of operations to carry out calculations involving the 4 operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving addition, subtraction, multiplication and division
- use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy

Fractions (including decimals and percentages)

- use common factors to simplify fractions; use common multiples to express fractions in the same denomination
- compare and order fractions, including fractions >1
- add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions
- multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, $\frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$]
- divide proper fractions by whole numbers [for example, $\frac{1}{3} \div 2 = \frac{1}{6}$]

- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, $\frac{3}{8}$]
- identify the value of each digit in numbers given to 3 decimal places and multiply and divide numbers by 10, 100 and 1,000 giving answers up to 3 decimal places
- multiply one-digit numbers with up to 2 decimal places by whole numbers
- use written division methods in cases where the answer has up to 2 decimal places
- solve problems which require answers to be rounded to specified degrees of accuracy
- recall and use equivalences between simple fractions, decimals and percentages, including in different contexts

Ratio and Proportion

- solve problems involving the relative sizes of 2 quantities where missing values can be found by using integer multiplication and division facts
- solve problems involving the calculation of percentages [for example, of measures and such as 15% of 360] and the use of percentages for comparison
- solve problems involving similar shapes where the scale factor is known or can be found
- solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

Algebra

- use simple formulae
- generate and describe linear number sequences
- express missing number problems algebraically
- find pairs of numbers that satisfy an equation with 2 unknowns
- enumerate possibilities of combinations of 2 variables

Measurement

- solve problems involving the calculation and conversion of units of measure, using decimal notation up to 3 decimal places where appropriate

- use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to 3 decimal places
- convert between miles and kilometres
- recognise that shapes with the same areas can have different perimeters and vice versa
- recognise when it is possible to use formulae for area and volume of shapes
- calculate the area of parallelograms and triangles
- calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3]

Geometry - Properties of Shapes

- draw 2-D shapes using given dimensions and angles
- recognise, describe and build simple 3-D shapes, including making nets
- compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons
- illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius
- recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles

Geometry - Position and Direction

- describe positions on the full coordinate grid (all 4 quadrants)
- draw and translate simple shapes on the coordinate plane, and reflect them in the axes

Statistics

- interpret and construct pie charts and line graphs and use these to solve problems
- calculate and interpret the mean as an average