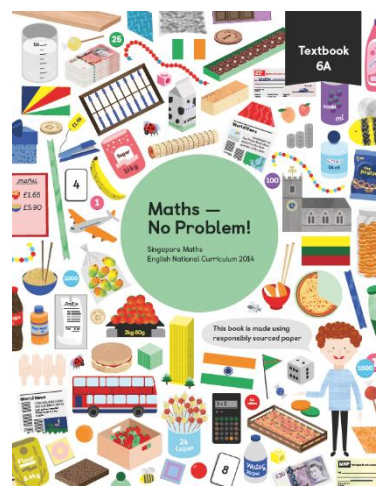
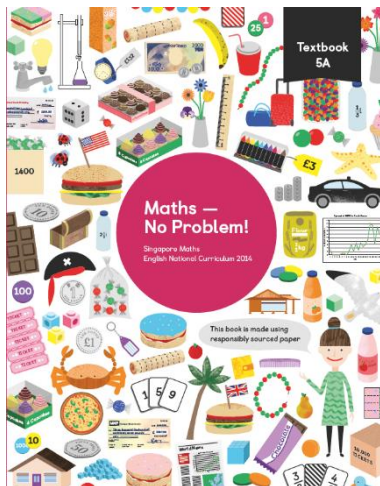


St Joseph's Calculation Policy for families



Years 5 and 6



Dear parents,

This Calculation Policy sets out the methods used in school to help your children with calculations. It has been written to meet the requirements of the National Curriculum 2014, and gives pupils a consistent and smooth progression of learning in calculations across the school. It works alongside the highly effective Singapore style of teaching from the scheme **Maths No Problem!**

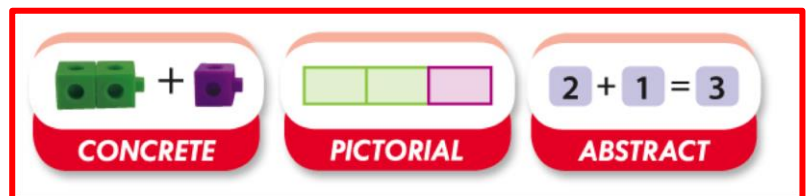
Children are taught strategies to develop and strengthen their mental agility daily. They also need to be able to apply written calculation skills in order to:

- represent work that has been done practically
- support, record and explain mental calculations
- keep track of steps in a longer task
- work out calculations that are too difficult to do mentally

This policy shows methods that pupils will be taught within their respective year group, in the order they are taught. Children will be encouraged to develop their confidence in choosing and using a strategy that they know will get them to the correct answer as efficiently as possible.

Concrete, Pictorial, Abstract (CPA):

A key principle behind the Singaporean methods used in Maths No Problem! is the concrete, visual and abstract



approach. Children are firstly introduced to an idea or skill by acting it out with real, **concrete** objects (a hands – on approach). They then move onto the **pictorial** (visual) stage, where they relate the concrete understanding to visual representations. The final **abstract** stage is a chance for them to represent problems by using mathematical calculations. The CPA approach is used continuously in all new learning and calculations throughout the school.

I hope the progression of skills you see in this booklet helps you when supporting your child at home.

Mrs. Corr

Maths Lead

Year 5 and 6 Addition

Addition in Years 5 and 6 includes:

- adding whole and decimal numbers with more than 4 digits, including using formal written (columnar) methods.
- adding numbers mentally with increasingly large numbers
- using rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solving multi-step problems in context, deciding which operations and methods to use and why.
- performing mental calculations with mixed operations and large numbers where they use their knowledge of the order of operations to carry out calculations involving the four operations (Year 6)
- estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy (Year 6)

Pupils practice using the formal written methods of columnar addition with increasingly large numbers to aid fluency, renaming and regrouping where necessary.

They undertake mental calculations with increasingly large numbers and more complex calculations.

Key vocabulary:

sum, total, parts and wholes, plus, add, altogether, more, is equal to, is the same as, rename, regroup

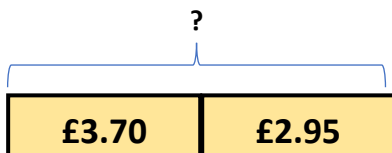
Addition problem:

Find the total cost of the shopping if:

1 book cost £3.70

1 comic cost £2.95

When solving an addition problem, pupils are encouraged to draw a bar model to help them to visualise what they are being asked to do.



Concrete	Pictorial	Abstract
<p>Place value grid and number discs</p>	<p>Drawn place value grid</p> <p style="text-align: center;">6 6 5</p>	<p>Addition equation</p> $ \begin{array}{r} ^1 \\ \text{£ } 3.70 \\ + \text{£ } 2.95 \\ \hline \text{£ } 6.65 \\ \hline \end{array} $
<p>An addition word problem is focussed on.</p> <p>Pupils represent the problem using a place value grid.</p> <p>They take care when regrouping and renaming.</p>	<p>Pupils represent the values by drawing their own place value grid. They carefully talk through the renaming and regrouping and add the values together.</p>	<p>When using decimals, ensure the decimal point is positioned correctly.</p> <p>Addition begins with the smallest value.</p> <p>When renaming, place the required digit at the top of the column on the left.</p> <p>Ensure this number is added correctly.</p>

Year 5 and 6 Subtraction

Subtraction in Years 5 and 6 includes:

- subtracting whole and decimal numbers with more than 4 digits, including using formal written (columnar) methods.
- subtracting numbers mentally with increasingly large numbers
- using rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- solving multi-step problems in context, deciding which operations and methods to use and why.
- performing mental calculations with mixed operations and large numbers where they use their knowledge of the order of operations to carry out calculations involving the four operations (Year 6)
- estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy (Year 6)

Pupils practice using the formal written methods of columnar subtraction with increasingly large numbers to aid fluency, renaming and regrouping where necessary.

They undertake mental calculations with increasingly large numbers and more complex calculations.

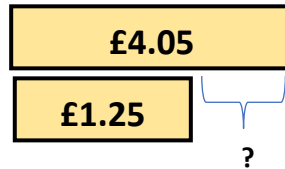
Key language:

take away, less than, the difference, subtract, minus, fewer, decrease, rename, regroup.

Subtraction problem:



When solving a subtraction problem, pupils are encouraged to draw a bar model to help them to visualise what they are being asked to do.



Concrete	Pictorial	Abstract
<p>Place value grid and number discs:</p>	<p>Drawn place value grid:</p>	<p>Subtraction equation</p> $ \begin{array}{r} \overset{3}{\cancel{4}} \overset{10}{\cancel{0}} 5 \\ - \quad 1 \quad 2 \quad 5 \\ \hline \quad 2 \quad 8 \quad 0 \\ \hline \end{array} $
<p>A subtraction word problem is focussed on. Pupils represent the values with a place value grid and number discs, and subtract. They take care to carefully regroup and rename.</p>	<p>Pupils can draw their own place value grid, and talk carefully when regrouping and renaming.</p>	<p>When using decimals, ensure the decimal point is positioned correctly.</p> <p>Subtraction begins with the smallest value.</p> <p>When renaming and regrouping, place the required digit at the top of the column on the left. Ensure this number is added correctly.</p>

Year 5 Multiplication

Multiplication in Year 5 includes:

- identifying multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers
- knowing and using the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- establishing whether a number up to 100 is prime and recall prime numbers up to 19
- multiplying whole numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication, for two-digit numbers
- multiplying numbers mentally, drawing upon known facts
- multiplying whole numbers, and those involving decimals, by 10, 100 and 1,000
- recognising and using square numbers and cube numbers, and the notation for squared (²) and cubed (³)
- solving problems involving multiplication and division, including using their knowledge of factors and multiples, squares and cubes
- solving problems involving all operations, including understanding the meaning of the equals sign
- solving problems involving multiplication and division, including scaling by simple fractions and problems

Pupils practise and extend their use of the formal written methods of multiplication. They apply all the multiplication tables and related facts frequently, commit them to memory and use them confidently to make larger calculations.

They use and understand the terms factor, multiple and prime, square and cube numbers.

Pupils use multiplication and division as inverses to support the introduction of ratio in Year 6, by multiplying and dividing by powers of

10 in scale drawings or by multiplying and dividing by powers of a 1,000 in converting between units such as kilometres and metres.

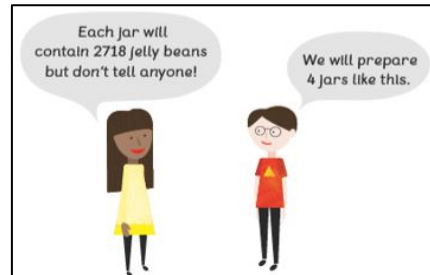
They understand the terms factor, multiple and prime, square and cube numbers and use them to construct equivalence statements (for example, $4 \times 35 = 2 \times 2 \times 35$; $3 \times 270 = 3 \times 3 \times 9 \times 10 = 9^2 \times 10$).

Pupils use and explain the equals sign to indicate equivalence, including in missing number problems (for example $13 + 24 = 12 + 25$; $33 = 5 \times ?$).

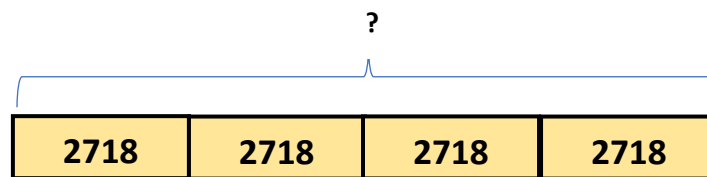
Key language:

double, times, multiplied by, the product of, groups of, lots of, equal groups, rename, regroup.

Multiplication by a single digit problem:



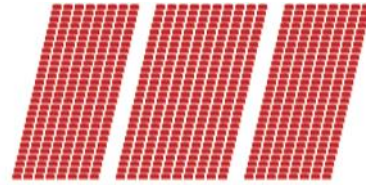
When solving a multiplication problem, pupils are encouraged to draw a bar model to help them to visualise what they are being asked to do.



Concrete	Pictorial	Abstract										
<p>Place value grid and number discs</p>	<p>Multiplication grid</p> <table border="1"> <tr> <td>x</td> <td>4</td> </tr> <tr> <td>2000</td> <td>8000</td> </tr> <tr> <td>700</td> <td>2800</td> </tr> <tr> <td>10</td> <td>40</td> </tr> <tr> <td>8</td> <td>32</td> </tr> </table> <p>Add the totals together: $8000 + 2800 + 40 + 32 = 10872$</p>	x	4	2000	8000	700	2800	10	40	8	32	<p>Multiplication equation</p> $ \begin{array}{r} 2 7 1 8 \\ \times 4 \\ \hline 10872 \end{array} $
x	4											
2000	8000											
700	2800											
10	40											
8	32											
<p>A multiplication word problem is focussed on.</p> <p>Pupils represent the values with a place value grid and number discs, and see the link between repeated addition and multiplication.</p> <p>They take care when regrouping and renaming.</p>	<p>The link with a place value grid is made by using a multiplication grid. Pupils multiply each part of the multiplier by the multiplicand. The product is achieved by adding each total together.</p>	<p>Multiply each digit on the top row (multiplier) by 4 (multiplicand) beginning with the smaller value.</p> <p>As $8 \times 4 = 32$, it is necessary to rename and regroup the Tens and 3tens is placed above the Tens column to the left. This will be added in the next stage.</p> <p>Pupils are taught then to regroup. ($10 \times 4 = 40$, then add on 30, which equals 70. 7tens is placed in the answer box).</p>										

Multiplication by 2 digit problem:

How many seats are there in this theatre?



When solving a multiplication problem, pupils are encouraged to draw a model to help them to visualise what they are being asked to do.

$$\begin{array}{r}
 \begin{array}{cc}
 & \times 20 & & \times 8 \\
 \times 20 & \boxed{400} & \boxed{160} & = 560 \\
 \times 6 & \boxed{120} & \boxed{48} & = 168
 \end{array} \\
 \boxed{560 + 168} \\
 = 728
 \end{array}$$

Concrete	Pictorial	Abstract									
<p>Multiplication grid using number discs</p> <p>There are 28 rows. Each row consists of 26 seats.</p> <p>There are 728 seats.</p>	<p>Multiplication grid</p> <table border="1"> <thead> <tr> <th>x</th> <th>20</th> <th>8</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>400</td> <td>160</td> </tr> <tr> <td>6</td> <td>120</td> <td>48</td> </tr> </tbody> </table> <p>Add the totals together: 560 + 168 = 728</p>	x	20	8	20	400	160	6	120	48	<p>Multiplication equation</p> $ \begin{array}{r} 1 \\ 4 \\ 28 \\ \times 26 \\ \hline 168 \rightarrow 28 \times 6 \\ + 560 \rightarrow 28 \times 20 \\ \hline 728 \end{array} $
x	20	8									
20	400	160									
6	120	48									
<p>As 26 rows of 28 would be rather large, it would be best to use number discs in a multiplication grid. They are making connections with the importance of partitioning within the multiplication calculation.</p>	<p>Pupils multiply each part of the multiplier by each part of the multiplicand. The product is achieved by adding each total together.</p>	<p>28 is multiplied firstly by 6, following the same procedure for multiplying by 1 digit.</p> <p>28 is then multiplied by 20. A zero is inserted as a place holder, and then each digit from the top row is multiplied by 20.</p> <p>Any regrouping is completed as before.</p>									

Year 6 Multiplication

Multiplication in Year 6 includes:

- multiplying multi-digit whole and decimal numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- performing mental calculations, including with mixed operations and large numbers
- identifying common factors, common multiples and prime numbers
- using their knowledge of the order of operations to carry out calculations involving the four operations
- solving multi-step problems in context, deciding which operations and methods to use and why
- estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Pupils practise multiplication for larger numbers, using the formal written methods of short and long multiplication.

They undertake mental calculations with increasingly large numbers and more complex calculations.

Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.

Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., but not to a specified number of significant figures.

Distributivity can be expressed as $a(b + c) = ab + ac$.





Pupils explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$.

Common factors can be related to finding equivalent fractions.

Key language:

double, times, multiplied by, the product of, groups of, lots of, equal groups, rename, regroup.

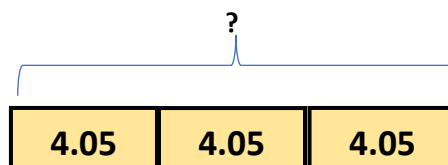
Multiplication of decimals problem:

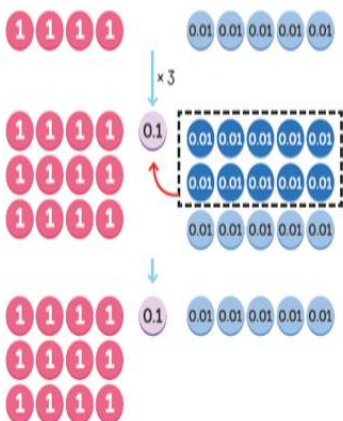
 has 3 times as much money as  has.
 has £4.05. How much has  got?
 Who made a mistake?

$$\begin{array}{r}
 \text{Boy} \\
 \times 4.05 \\
 \hline
 12.15
 \end{array}$$

$$\begin{array}{r}
 \text{Girl} \\
 \times 4.05 \\
 \hline
 12.35
 \end{array}$$

When solving a multiplication problem, pupils are encouraged to draw a model to help them to visualise what they are being asked to do.



Concrete	Pictorial	Abstract						
<p>Place value grid and number discs</p> 	<p>Drawn multiplication grid</p> <table border="1" data-bbox="628 1025 1027 1211"> <tr> <td>X</td> <td>3</td> </tr> <tr> <td>4</td> <td>12</td> </tr> <tr> <td>0.05</td> <td>0.15</td> </tr> </table> <p>Add the totals together: $12 + 0.15 = 12.15$</p>	X	3	4	12	0.05	0.15	<p>Multiplication equation</p> $ \begin{array}{r} \times 4.05 \\ \hline 12.15 \end{array} $
X	3							
4	12							
0.05	0.15							
<p>3 rows of 4.05 are made using number discs. Pupils make the link between repeated addition and multiplication. They carefully consider the values of the digits, as they are using decimals here.</p>	<p>Pupils multiply each part of the multiplier by the multiplicand. The product is achieved by adding each total together.</p>	<p>The decimal point is inserted in the correct place. When using squared paper, this is on the line separating the whole and fraction values.</p> <p>Multiplication is carried out as taught previously.</p> <p>They are reminded that they are multiplying 4.05 three times, so consideration is given to where digits are placed here.</p>						

Year 5 Division

Division in Year 5 includes:

- identifying multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers
- dividing whole numbers up to 4 digits by a one- or two-digit number using a formal written long division method
- dividing numbers mentally, drawing upon known facts
- dividing whole numbers and those involving decimals by 10, 100 and 1,000
- solving problems involving all operations, including using their knowledge of factors and multiples, squares and cubes, and understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions

Pupils practise and extend their use of the formal written methods of division. They apply all the multiplication tables and related division facts frequently, commit them to memory and use them confidently to make larger calculations. They use their knowledge and understanding that division is a process of repeated subtraction, and when calculating, they efficiently subtract groups of the multiple they are dividing by.

Pupils continue to use number bonds and partitioning to split the dividend into manageable parts. They use their knowledge of multiplication, number bonds and repeated subtraction to support the division process of grouping and sharing. They are introduced to long division (which displays repeated subtraction of multiples to solve division problems) in Year 3 and build on this learning into Years 5 and 6.

Pupils use multiplication and division as inverses to support the introduction of ratio by multiplying and dividing by powers of 10 in scale drawings or by multiplying and dividing by powers of a 1,000 in converting between units such as kilometres and metres.

Pupils use and explain the equals sign to indicate equivalence, including in missing number problems (for example $13 + 24 = 12 + 25$; $33 = 5 \times ?$).

Key language:

share, group, divide, divided by, half, dividend, divisor, quotient, remainder, rename, regroup

quotient
divisor | dividend

Division by a single digit problem:



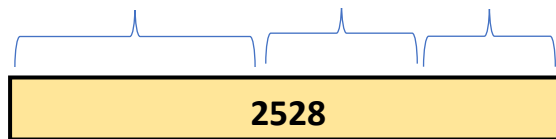
's story

A bakery makes 2528 cupcakes.

The cupcakes are packed into boxes of 8. How many boxes are needed?

When solving a division problem, pupils are encouraged to draw a model to help them to visualise what they are being asked to do.

$$2400 \div 8 = 300 \quad 80 \div 8 = 10 \quad 48 \div 8 = 6$$

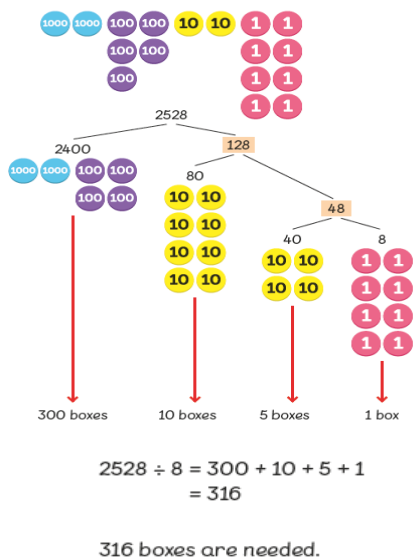


$$300 + 10 + 6$$

$$= 316$$

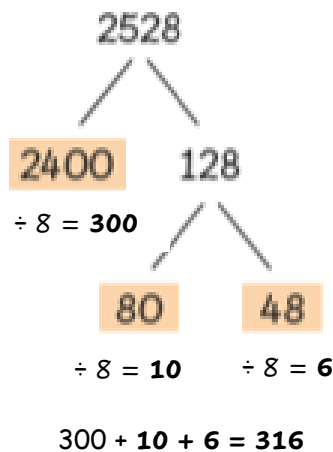
Concrete

Number discs



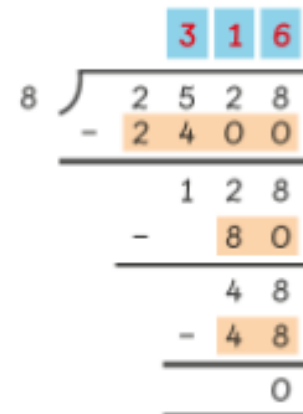
Pictorial

Partitioning



Abstract

Long division



The pupils make the dividend 2528 with number discs.

Multiples of the divisor (8) are considered in order to help partition 2528 into manageable amounts.

Here, 2528 is partitioned into **2400 and 128**.

$$2400 \div 8 = 300.$$

128 is partitioned into 80 and 48 as they can be divided by 8 easily.

The answers to each part are then added together.

Here, the number discs are replaced by number values.

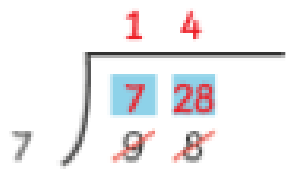
Each partitioned number is divided by 8, and the answers added together.

They are reminded to view division as **repeated subtraction**.

Step One

Using the 8x table, what can they pull out of 2528? They can see that 2528 can be made from 2400 and 80 and 48.

They can use equipment here to see that 2400 (24 hundreds) is shared

		<p>between 8, so each gets 3 hundreds.</p> <p>They may write the answer 3 hundreds above.</p> <p>They show that 2400 is subtracted from 2528, leaving 128 to be divided by 8.</p> <p>Step two Use the 8x table and equipment to see that 8 tens shared between 8 = 1 ten.</p> <p>They may write the answer 1 ten above.</p> <p>They show that 80 is subtracted from 128, leaving 48 to be divided by 8.</p> <p>Step three Use the 8x table and equipment to see that 48 ones shared between 8 = 6 ones.</p> <p>They may write the answer 6 ones above.</p>
		<p>Short division</p> 
		<p>With short division, 98 is regrouped and renamed as 7 tens and 28 ones.</p> <p>From here, 7 tens can be divided easily by 7 to equal 1 ten. This is written above.</p>

		Then 28ones are divided by 7 to equal 4ones, which is written above.
--	--	--

Year 6 Division

Division in Year 6 includes:

- dividing whole and decimal numbers, up to 4 digits, by a two-digit whole number using the formal written method of long and short division, and interpreting remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- performing mental calculations, including with mixed operations and large numbers
- using their knowledge of the order of operations to carry out calculations involving the four operations
- solving multi-step problems involving all operations in context, deciding which operations and methods to use and why
- estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.

Pupils practise all operations for larger numbers, using the formal written methods of columnar addition and subtraction, short and long multiplication, and short and long division.

They undertake mental calculations with increasingly large numbers and more complex calculations.

Pupils continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency.

Pupils round answers to a specified degree of accuracy, for example, to the nearest 10, 20, 50 etc., but not to a specified number of significant figures.

Pupils explore the order of operations using brackets; for example, $2 + 1 \times 3 = 5$ and $(2 + 1) \times 3 = 9$.

Common factors can be related to finding equivalent fractions.

Key language:

share, group, divide, divided by, half, dividend, divisor, quotient, remainder, rename, regroup

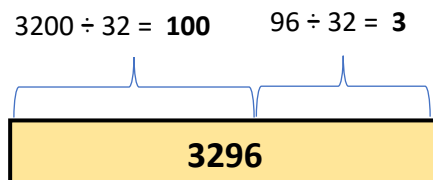
quotient
divisor | dividend

Division by 2 digit numbers problem:

Is it possible to share
£3296 equally among
32 people?



When solving a division problem, pupils are encouraged to draw a model to help them to visualise what they are being asked to do.



$100 + 3$ $= 103$

Concrete Number discs	Pictorial Partitioning	Abstract Long division
<div style="border: 1px solid red; padding: 5px; margin-bottom: 10px;"> </div> <div style="margin-left: 150px;"> $3200 \div 32 = 100$ </div> <div style="border: 1px solid red; padding: 5px; margin-bottom: 10px;"> </div> <div style="margin-left: 100px;"> $96 \div 32 = 3$ </div>		$ \begin{array}{r} 103 \\ 32 \overline{) 3296} \\ \underline{- 3200} \quad \rightarrow 3200 \div 32 = 100 \\ 96 \\ \underline{- 96} \quad \rightarrow 96 \div 32 = 3 \\ 0 \end{array} $
<p>Make the dividend 3296 with number discs.</p> <p>Multiples of the divisor (32) are considered in order to help partition 3296 into manageable amounts. Here, 3296 is partitioned into 3200 and 96.</p> <p style="text-align: center;">$3200 \div 32 = 100.$</p> <p style="text-align: center;">$96 \div 32 = 3$</p> <p>The answers to each part are then added together.</p>	<p>Here, the number discs are replaced by number values. Each partitioned number is divided by 32, and the answers added together.</p>	<p>Following the same procedure for long division in Year 5. Pupils will benefit from making a list of multiples of 32 along the side that they can refer to.</p>

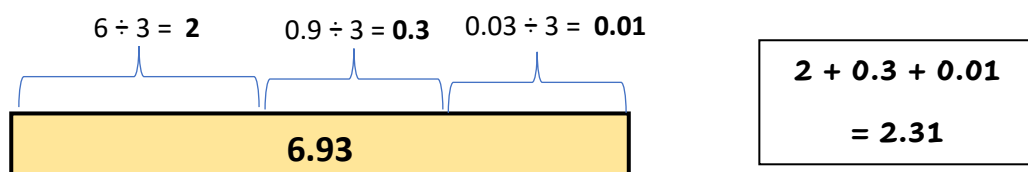
Division by decimal numbers up to 2 digits problem:

6.93 l of juice is divided into 3 containers.



Find the volume of juice in each container.

When solving a division problem, pupils are encouraged to draw a model to help them to visualise what they are being asked to do.



Concrete	Pictorial	Abstract
<p>Number discs</p> <p>$6.93 \div 3 =$ </p>	<p>Partitioning</p> <p style="text-align: center;">$6.93 \div 3 = 2.31$</p>	<p>Long division</p>
<p>The pupils use number discs here, and divide each value by 3.</p> <p style="text-align: center;"> $6 \div 3 = 2$ $0.9 \div 3 = 0.3$ $0.03 \div 3 = 0.01$ </p> <p>Each answer is then recombined to give the total answer 2.31</p>	<p>The number discs are replaced by number values. Each partitioned number is divided by 3, and the answers added together.</p>	<p>Division using decimals follows the same procedure as previously. Ensure that the decimal point is placed correctly before starting.</p>

What can you do to help at home?

- Be positive
- Talk about maths with your child
- Involve your child in any maths activity (shopping, cooking, DIY) and let your child lead where they can
- Talk about maths in sport
- Look at number puzzles in papers or magazines
- Share strategies and methods used at school (allow your child to be the expert)

A thought to finish:

Good mathematics is not about how many answers you know – it's how you behave when you don't know'