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***'I will instruct you and teach you in the way you should go; I will counsel you with my loving eye on you' Psalm 32.8***

# Maths (Calculation) Policy

## Introduction

In order to ensure that all children at Shiplake achieve their maximum potential in Mathematics in a safe and secure learning environment, this policy sets out the stages of development in written calculation and highlights the strategies to be taught.

Throughout Reception and Key Stage 1, children at Shiplake will be introduced to the processes of calculation through lively and fun practical, oral and mental activities, leading on to informal written methods of calculation at the end of the key stage. At the beginning of key stage 2 the children will begin formalising their written methods while also using informal methods to demonstrate understanding of mathematical concepts. These methods (both informal and formal) will be consolidated and applied to new areas of maths in upper key stage 2.

Our goal is that when children leave Shiplake Primary School they:

 have a secure knowledge of number facts and a strong understanding of the four operations;

 are able to use this knowledge and understanding to carry out calculations mentally and to apply general strategies when using one-digit and two-digit numbers and apply particular strategies to special cases involving bigger numbers;

 make use of diagrams and informal notes to help record steps and part answers when using mental methods that generate more information than can be kept in their heads;

 have an efficient, reliable, compact written method for each operation that they can apply with confidence when undertaking calculations that they cannot carry out mentally;

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 use a calculator effectively, using their mental skills to monitor the process, check the steps involved and decide if the numbers displayed make sense.

## Rationale

The purpose of this policy is to outline the progression through written calculations as taught in our school.

The reasons for using written methods include:

 to assist in a mental calculation by writing down some of the numbers involved;

 to clarify a mental procedure for the writer;

 to help communicate solutions and methods with other mathematicians;

 to provide a record of work done for themselves, teachers and others;

 to work out calculations which are too difficult to be done mentally;

 to develop, refine and use a set of rules for correct and efficient calculations.

It is expected that by the end of Year 6 all children will understand, and use successfully, the conventional standard written methods to carry out and record calculations that they cannot do 'in their head'. On the way to this mathematical fluency children will need to use an expanded layout but should be encouraged to work towards the most compact form. It is important that these methods build on children's understanding and that the children do not move on until they understand each step of the method. The teaching and learning of written methods should develop from the children's deeper mathematical understanding and understanding of the four operations.

## Our Curriculum

At Shiplake CE Primary we use the White Rose scheme along with a variety of other resources to teach and plan mathematics lessons. Our maths

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curriculum provides a structured and systematic approach to teaching calculation skills.

Across the school written work takes many forms which are dependent upon: the children's age; ability and the task that has been set. This is evidenced as:

 Pictorial recording.

 Informal jottings that help the learner but are not easily read by anyone else.

 Words describing a mental calculation.

 Use of appropriate signs and symbols.

 Use of increasingly compact and efficient formal methods.

Our school curriculum meets the requirements of the National Curriculum 2013 for the teaching and learning of mathematics, and is also designed to give pupils a consistent and smooth progression of learning in calculations across the school. It should be noted that early learning in number and calculation in Reception follows the *Development Matters 2021* EYFS document using the White Rose Maths Scheme.

## Age stage expectations

Our school curriculum is organised according to age stage expectations as set out in the National Curriculum 2013, **however it is vital that pupils are taught according to the stage that they are currently working at,** being moved onto the next level as soon as they are ready, or working at a lower stage until they are secure enough to move on.

## Providing a context for calculation

It is important that any type of calculation is given a real life context or problem solving approach to help build children's understanding of the purpose of calculation, and to help them recognise when to use certain operations and methods when faced with problems. This must be a priority within calculation lessons.

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## Choosing a calculation method

Children need to be taught and encouraged to use the following processes in deciding what approach they will take to a calculation, to ensure they select the most appropriate method for the numbers involved:

Can I do it in my head using a mental strategy?

Could I use some jottings to help me?

Should I use a written method to work it out?

To work out a tricky calculation: Approximate, Calculate, Check.

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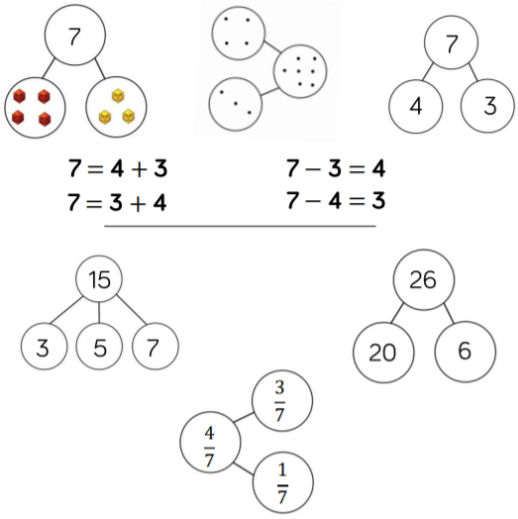
# Examples of informal written calculation methods

## Part Whole Models

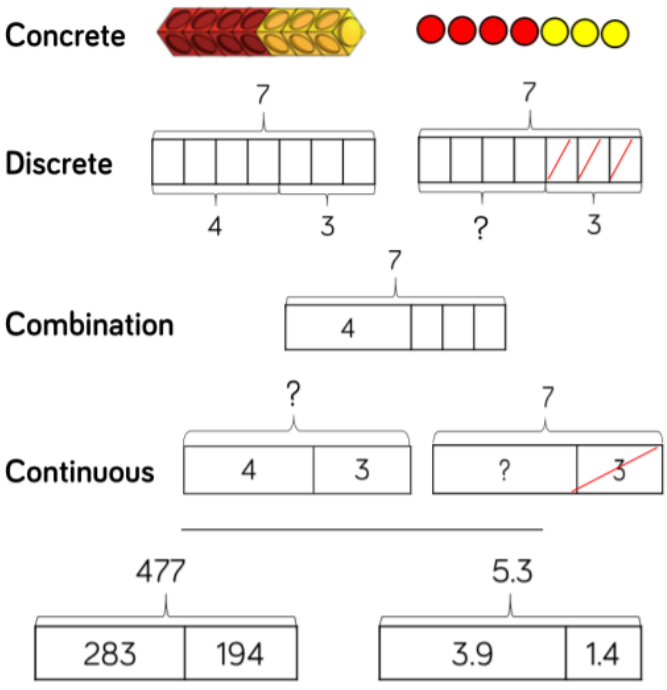
Part whole models can support children in their understanding of aggregation and partitioning. They can support children in their understanding that a number can be partitioned into two or more parts or to partition a number into ones, tens, hundreds etc. They can also be adapted to key stage 2 concepts like adding and subtracting decimals and fractions.




## Bar Modelling

Bar modelling can be a powerful visual approach to supporting calculation. They can be used singly or in combination to support children of different abilities and to represent different concepts and calculations. They can be used to represent simple calculations such as counting on in lower key stage 1, through to calculating adding and subtracting fractions and decimals in upper key stage 2.

Bar models can also aide multiplication and division calculations. Bars can be divided up to represent equal groups, or sections of bars can represent multiples of a number. In more complicated problem solving tasks bar models can help in organising and representing calculations.



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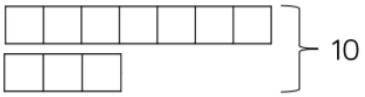
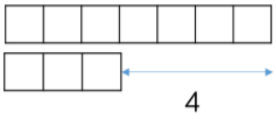
**Discrete**



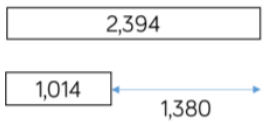

$7 + 3 = 10$



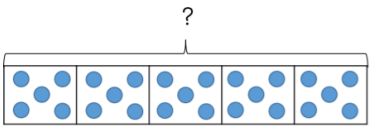

$7 - 3 = 4$

**Continuous**

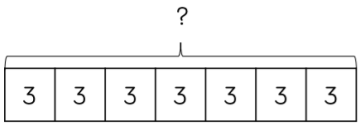

$7 - 3 = 4$




$2{,}394 - 1{,}014 = 1{,}380$

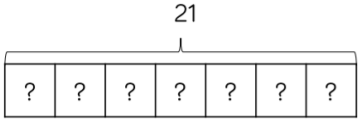



$5 \times 5 = 25$




$3 \times 7 = 21$

$7 \times 3 = 21$




$21 \div 7 = 3$

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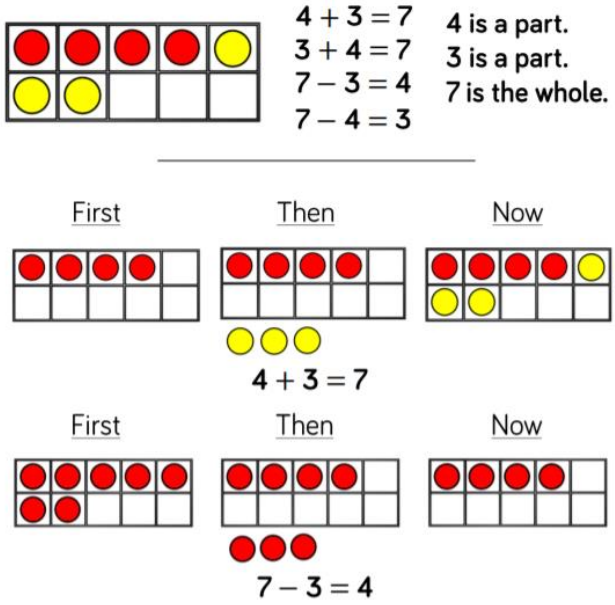
## Tens Frames

Tens frames can support children in understanding different calculation structures such as aggregation and partitioning. They can also be used to calculate by augmentation and taking away. They can demonstrate that a 'ten' is made of ten 'ones' and can support children when calculating across multiples of ten. They can support the link between mental calculation and effective recorded calculation.

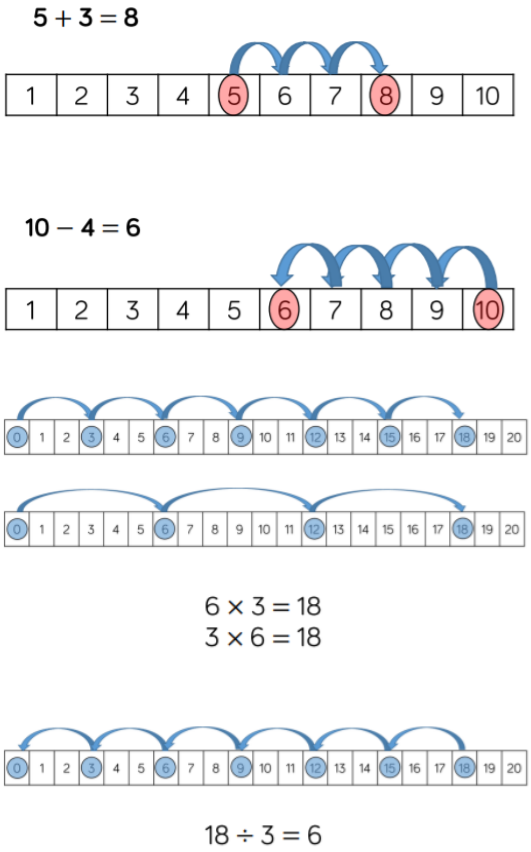



## Number Tracks

Number tracks are a precursor to number lines. They can be used for children to calculate by augmentation or by reduction (counting on and counting back).

They can also be used to aide counting in multiples or in sharing a number into equal groups through counting back in groups of a given amount.

Number tracks are useful when calculating with smaller amounts but become less efficient as the numbers that are being used get bigger.



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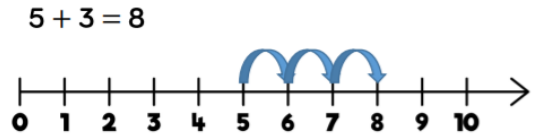
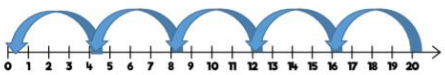
## Labelled and blank Number Lines

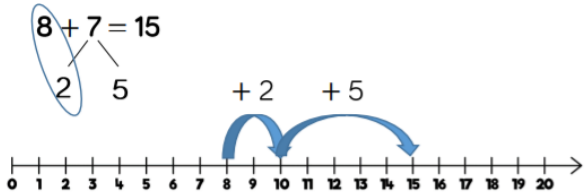
Labelled number lines can be used in a similar way to number tracks. They can be used to aide addition and subtraction by augmentation or reduction (counting on or counting back).They can also support calculations involving dividing or multiplying. This takes a very similar form to number tracks.



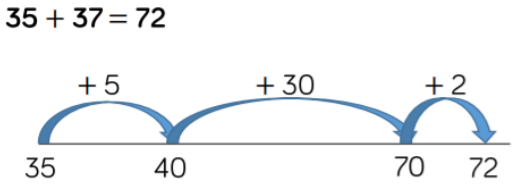

4 × 5 = 20
5 × 4 = 20

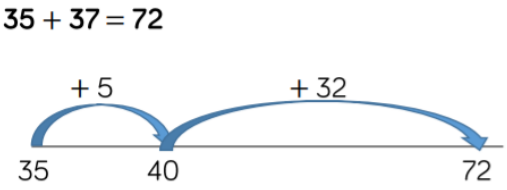


20 ÷ 4 = 5




Blank number lines can provide a structure for calculation with larger numbers by allow numbers to be added or subtracted in parts. They can also be used to demonstrate subtraction as the difference between two numbers.




## Base 10/Dienes

Using Base 10 is an effective way to support the concept of place value during the calculation process. It also models the process of exchanging when subtracting or adding. It is limited by its physical/drawn size when working with larger numbers – this would be when place value counters are more appropriate.

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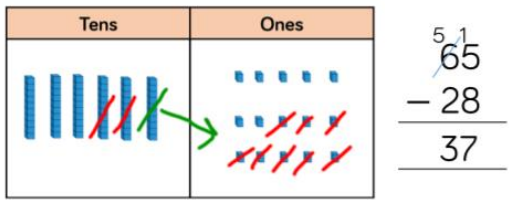
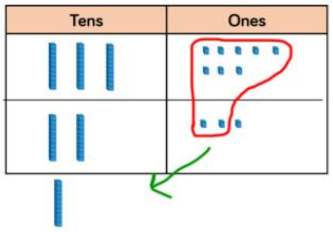
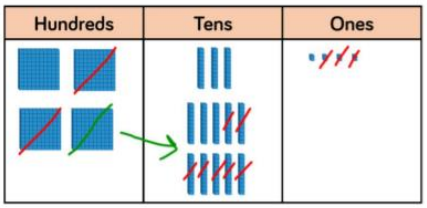
Base 10 is a good platform for showing how a physical model can be represented pictorially and in an abstract form such as a written column method.



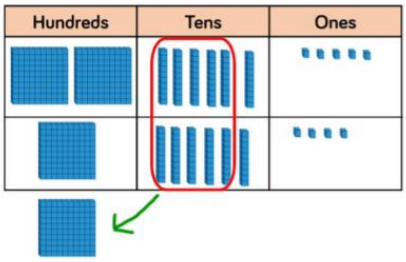

$$\begin{array}{r} {}^{5}\not{6}\,{}^{1}\not{5} \\ -\ 28 \\ \hline 37 \end{array}$$




$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

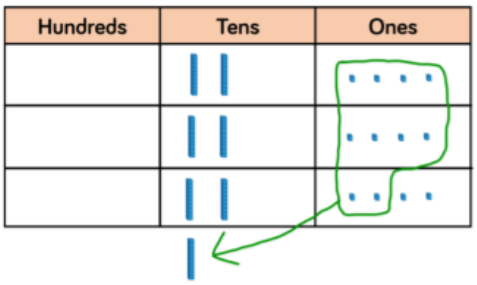



$$\begin{array}{r} {}^{3}\not{4}\,{}^{1}\not{3}\,5 \\ -\ 273 \\ \hline 262 \end{array}$$

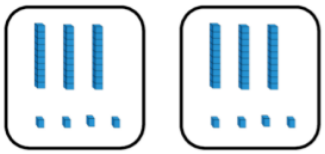



$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

Base 10 can also aide multiplication calculations as it clearly demonstrates several 'lots of' a particular amount. It can also be used as an effective way to divide large numbers into equal groups. It clearly demonstrates the process of exchanging when doing a division calculation because the size of each resource (for example that one 'ten' is greater than one 'hundred' even though they are both one thing).




$$\begin{array}{r} 24 \\ \times\ 3 \\ \hline 72 \\ \hline 1 \end{array}$$



$$68 \div 2 = 34$$

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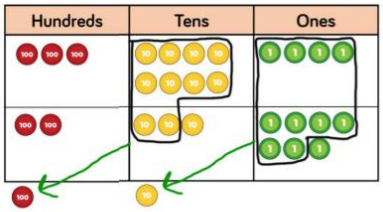
As with addition and subtraction, Base 10 become less efficient when the numbers in the calculation get bigger. This is where place value counters become more effective.

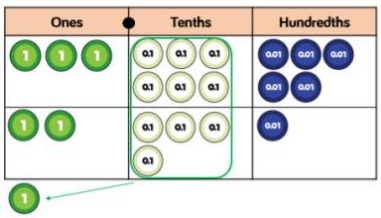
## Place Value Counters

Place value counters can be an effective way for children understanding addition and subtraction. Unlike Base 10 it is less cumbersome as the physical/drawn resource is not as large and therefore works well with larger numbers. They can also be used to demonstrate decimal fractions.



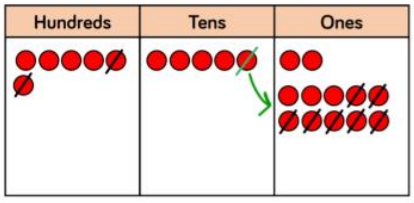

$$\begin{array}{r} 384 \\ +\ 237 \\ \hline 621 \\ \hline 1\ 1 \end{array}$$

Place value counters can effectively show the process of exchanging from one column to another in a place value chart.



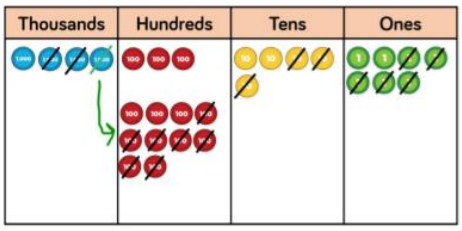

$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

They are a useful resource for making the transition from a physical or pictorial model to an abstract written form such as a written column method.




$$\begin{array}{r} {}^{4}\not{6}\,{}^{1}\not{5}2 \\ -\ 207 \\ \hline 445 \end{array}$$

Place value counters can also be used to model the multiplication and division of larger numbers.




$$\begin{array}{r} {}^{3}\not{4}\,{}^{1}357 \\ -\ 2735 \\ \hline 1622 \end{array}$$

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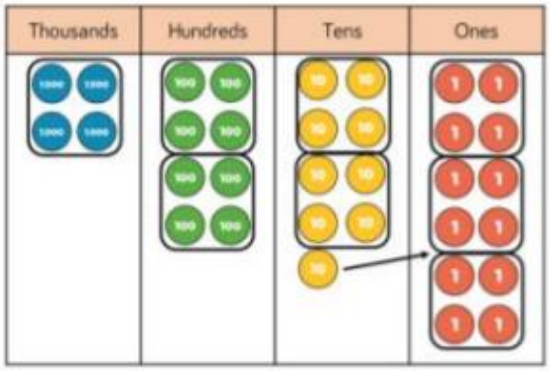
Place value counters are a more efficient way of representing larger numbers and dealing with exchanges. They also link to the written method of calculation really clearly.


$$\begin{array}{r} 34 \\ \times\ 5 \\ \hline 120 \\ \hline 1\ 2 \end{array}$$




$$4\overline{)4892}^{\,1}\quad 1223$$

## Formal Written methods

The following diagrams illustrate the formal written methods of calculation that pupils of Shiplake CE Primary should be able to use and apply by the end of Key Stage 2.

$$\begin{array}{r} 38 \\ +\ 23 \\ \hline 61 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 265 \\ +\ 164 \\ \hline 429 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 1378 \\ +\ 2148 \\ \hline 3526 \\ \hline 1\ 1 \end{array}$$

$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

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| | | | |
|---|---|---|---|
| $^{5}\cancel{6}^{1}5$ | $^{3}\cancel{4}^{1}35$ | $^{3}\cancel{4}^{1}357$ | $^{4}\cancel{5}^{1}.43$ |
| $-\ 28$ | $-\ 273$ | $-\ 2735$ | $-\ 2.7$ |
| $37$ | $262$ | $1622$ | $2.73$ |

| | H | T | O | |
|---|---|---|---|---|
| | | 3 | 4 | |
| × | | | 5 | |
| | 1 | 7 | 0 | |
| | 1 | 2 | | |

| | H | T | O | |
|---|---|---|---|---|
| | | 3 | 4 | |
| × | | | 5 | |
| | | 2 | 0 | (5 × 4) |
| + | 1 | 5 | 0 | (5 × 30) |
| | 1 | 7 | 0 | |

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

| TTh | Th | H | T | O |
|---|---|---|---|---|
| | 2 | 7 | 3 | 9 |
| × | | | 2 | 8 |
| $^{2}2$ | $^{5}1$ | $^{3}9$ | $^{7}1$ | 2 |
| $^{1}5$ | 4 | $^{1}7$ | 8 | 0 |
| 7 | 6 | 6 | 9 | 2 |
| | | 1 | | |

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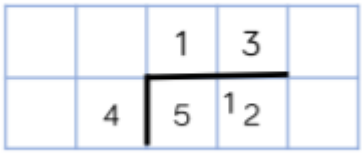
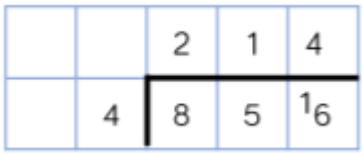
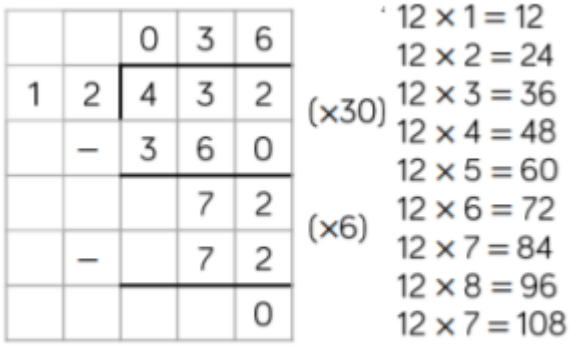
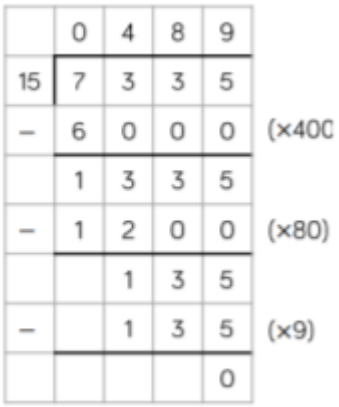



12 × 1 = 12
12 × 2 = 24
12 × 3 = 36
12 × 4 = 48
12 × 5 = 60
12 × 6 = 72
12 × 7 = 84
12 × 8 = 96
12 × 7 = 108
12 × 10 = 120




1 × 15 = 15
2 × 15 = 30
3 × 15 = 45
4 × 15 = 60
5 × 15 = 75
10 × 15 = 150

Reviewed November 2021
3 year cycle