

Year 4 overview of calculations and calculation objectives in context of overall objectives for each year group.

N.B. CONNECTIONS should be made between these objectives in order for children to use and apply calculation strategies/methods.

### **Number and place value**

In Year 4, children use place value in four-digit numbers, such as 3742 is three thousands, seven hundreds, four tens and two ones. They learn to count in 6s, 7s, 9s, 25s and 1000s, and say 1000 more or less than a specific number. They encounter negative numbers by counting back past zero on number lines, and continue work on rounding (to the nearest 10, 100 or 1000) and estimation. Children are introduced to Roman numerals to 100 and find out how the number system has changed over time.

### **Addition and subtraction**

Children extend previous years' work by adding and subtracting numbers with up to four digits, using mental and written methods, including columnar addition and subtraction. They keep practising mental methods of addition and subtraction as well as written methods, performing calculations increasingly quickly and confidently. They continue using estimation as well as inverse operations to help check answers.

### **Multiplication and division**

Children learn the remaining multiplication tables up to the 12 multiplication table, and use facts from the tables to solve increasingly complex multiplication and division problems.

They build on their work with mental methods of calculation in Year 3, using their knowledge of place value and number facts to multiply and divide confidently. They begin to use a formal written layout for multiplication when multiplying two-digit and three-digit numbers by one-digit numbers.

### **Fractions (including decimals)**

Developing ideas from Year 3, most children begin to confidently count up and down in hundredths. They learn about and recognise equivalent fractions, simplifying them when necessary (for example, understanding that  $\frac{1}{3} = \frac{2}{6} = \frac{4}{12}$ ). They move on to understand and show families of equivalent fractions. They build on earlier work, practising adding and subtracting fractions with the same denominator ( $\frac{2}{3} + \frac{7}{9} = 1\frac{1}{9}$ ). Children also work with decimal equivalents of tenths and hundredths and of  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{3}{4}$ , understanding that decimals and fractions are different ways of expressing numbers. They round numbers with one decimal place to the nearest whole number, and compare numbers with the same number of decimal places, up to two decimal places. They use fractions and decimals to solve straightforward money and measure problems.

### **Measurement**

In Year 3, children learned to measure the perimeter of 2D shapes; they now extend this, calculating the perimeter of rectilinear shapes including squares. They work out the area of rectilinear shapes by counting. They begin using £ and p notation to record money.

**Mental calculations:**

- *Add and subtract: any pair of three-digit multiples of 10 , e.g.  $570 + 250$ ,  $620 - 380$*
- *Have quick recall of number bonds to 100 and be able to apply to other calculations.*
- *Work out what must be added to/subtracted from two/three-digit number to make next higher/lower multiple of 10 e.g.  $374 + ? = 400$ ,  $836 - ? = 800$*
- *Subtract any four-digit number from any four digit number when the difference is **small**: e.g.  $3641 - 2991$ ,  $6002 - 5991$*
- *Work out what must be added to a decimal fraction with units and tenths to make the next highest whole number e.g.  $4.3 + ? = 5$*
- *Add or subtract any pairs of decimal fractions each with units and tenths or each with tenths and hundredths e.g.  $5.7 + 2.5$ ,  $0.63 - 0.48$*
- *Subtract a four digit number - just less than a multiple of 1000 -from a four digit number just more than a multiple of 1000, e.g.  $5001 - 1997$ .*
- *Estimate the answer to a calculation and use inverse operations to check answers*
- *Solve missing number problems using relationship between addition and subtraction*
- *Use number facts and their understanding of place value and partitioning to solve addition and subtraction problems*
- *Pupils should continue to develop range of strategies **as appropriate** e.g. same difference (  $421 - 189$  becomes  $420 - 188$ )*
- *Balancing (  $217 + 24$  becomes  $220 + 221$ )*
- 

**Strategies should also include the following:**

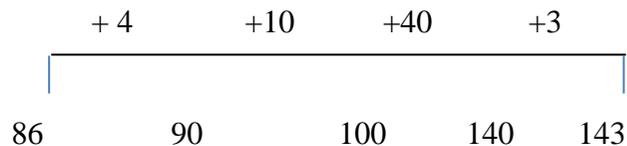
**-Counting backwards and forwards:**

Examples:  $73 - 68$  count on 2 to 70 then 3 to 73                      (B)  $570 + 300$  count on in hundreds from 300  
 $960 - 500$  count back in hundreds from 960 or count on in hundreds from 500  
 $1\frac{1}{2} + \frac{3}{4}$  count on in quarters

**Reordering:** (a)  $3 + 8 + 7 + 6 + 2 = 3 + 7 + 8 + 2 + 6$     (b)  $58 + 47 - 38 = 58 - 38 + 47$   
c)  $2.8 + 0.3 = 1.7 + 0.3 + 2.8$

**Partitioning:** An important aspect of number sense is to know when a number is close to 10 or a multiple of 10. The use of an empty number line where multiples of 10 are seen as **landmarks** enable children to have an image of jumping forward/backwards to these landmarks.

Example:  $86 + 57$



Other examples of partitioning include:

- -Partitioning *using* multiples of 10 and 100 to add e.g.  $43 + 28 + 51 = 40 + 3 + 20 + 8 + 50 + 1 = 40 + 20 + 50 + 3 + 8 + 1$
- -Partitioning *using* multiples of 10 and 100 to subtract e.g.  $4.7 - 3.5 = 4.7 - 3 - 0$ .
- -Partitioning and **bridging** through multiples of 10 (shopkeeper's subtraction) to add e.g.  $57 + 14 = 57 + 3 + 11$  or  $57 + 13 + 1$
- -Partitioning and **bridging** through multiples of 10 (shopkeeper's subtraction) to subtract e.g.  $97 - 58 = 100 - 50 - 5 + 3$
- CHILDREN need to be able to partition numbers up to and including 10 e.g. **different ways to make six = 1 + 5, 4 + 2, 3 + 3**

This will enable children to bridge more efficiently e.g.  $26 + 6 = 26 + 4 + 2$

A similar method can apply to addition and subtraction of decimal but here instead of building up to a multiple of 10, numbers are built up to a whole number or to a tenth.

E.g.  $3.8 + 2.6 = 3.8 + 0.2 + 2.4$

**Other strategies include:**

**-Compensating for addition** Examples: a.  $138 + 69 = 138 + 70$  minus 1 (show **on number line.**)            b.  $2\frac{1}{2} + 1\frac{3}{4} = 2\frac{1}{2} + 2\frac{-1}{4}$

*Pupils continue to practise mental methods of addition and subtraction with increasingly large numbers to aid fluency and solve problems within context – deciding which operation to use and why. These include measuring and scaling problems. Pupils become adept at selecting when to use mental methods, mental with jottings, efficient written and formal written methods. Pupils use estimation and rounding when calculating. Pupils apply mental calculation strategies when tackling written worded problems – including two step problems and when doing so can select the correct operations and can explain choice of operations and methods. Pupils use estimation, number facts, PV and bench marks in order to be able to ascertain if partial steps and solutions are reasonable.*

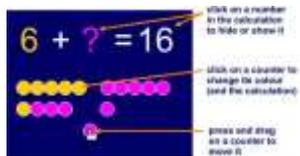
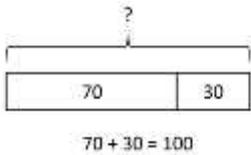
**Year 4 Addition:** Add up to 4 digits, using the formal written method of columnar addition **when appropriate**.

**NB** Ensure that children are secure with the methods outlined in the previous year's guidance **before** moving on

Use models, images and make connections between different methods using **SAME/DIFFERENT** approach. Use range of resources e.g. Dienes, counters, addition squares. Place stress on children explaining what is happening - particularly in terms of place value and exchanging.

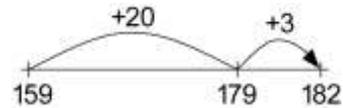
**Models - Bar model**

Using partitioning.



**REPRESENTATIONS**

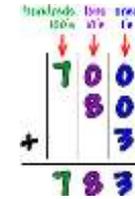
$$\begin{array}{r}
 \underline{648} + \underline{185} \\
 600 + 100 = 700 \\
 40 + 80 = 120 \\
 8 + 5 = 13 \\
 700 + 120 + 13 = 833 \\
 800 + 130 + 3 = 833
 \end{array}$$



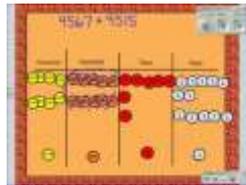
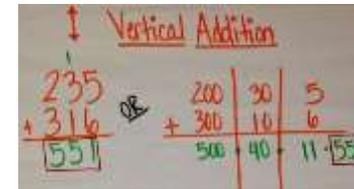
Empty number line

**INFORMAL WRITTEN**

$$\begin{array}{r}
 487 + 546 = \\
 \begin{array}{r}
 546 \\
 + 487 \\
 \hline
 13 \\
 120 \\
 900 \\
 \hline
 1033
 \end{array}
 \end{array}$$



Expanded



**LEADING TO FORMAL WRITTEN**

$$\begin{array}{r}
 367 \\
 + 85 \\
 \hline
 452 \\
 \hline
 11
 \end{array}$$

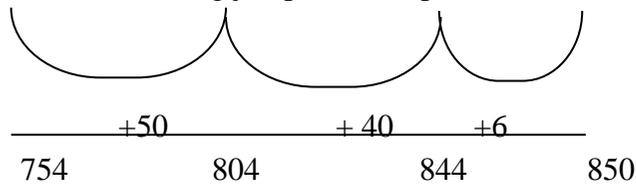
**Extend** to decimal – link to money.

£14.75 + £2.40 = 14.73

$$\begin{array}{r}
 14.75 \\
 + 2.20 \\
 \hline
 16.95
 \end{array}$$

Encourage use of **ESTIMATION** throughout.

754 + 96 (taking jumps in multiples of 10 or 100)

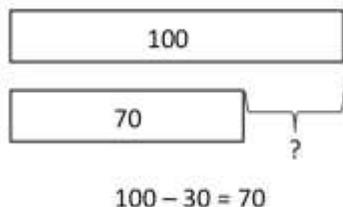


**Year 4 Subtraction** up to 4 digits using a formal written method.

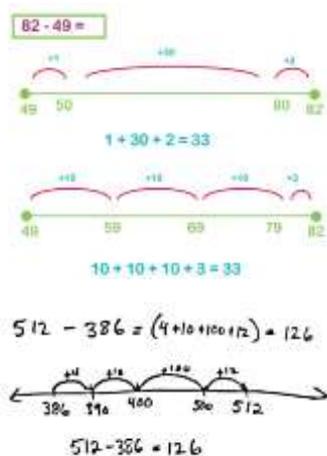
Children should continue to use horizontal number line – encourage use of visualisation of lines and grids. **Decomposition should only be introduced when children are secure.** Children need to have really good recall of number bonds up to 10 + 10 e.g.  $17 - 8 = 5$ . Children should also be encouraged to look at the difference between two numbers before making a decision about how to use the number line e.g. small or large difference – count on or count back. Children should be taught subtraction alongside addition.

**Models**

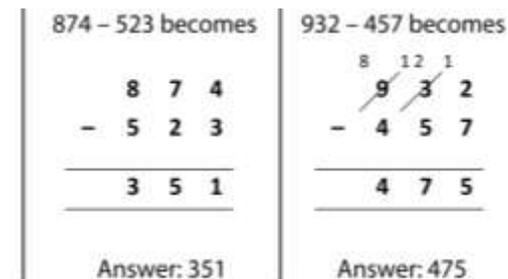
**BAR MODEL**



**Representations:**



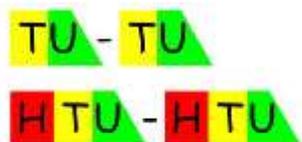
**Formal written method.**



**Informal written methods:**

**Horizontal expansion:** e.g.  $458 - 124$

$$\begin{array}{r} 400 \ 50 \ 8 \\ - 100 \ 20 \ 4 \\ \hline 300 + 30 + 4 = 334 \end{array}$$



**Horizontal expansion with adjustment:** e.g.  $754 - 286$

$$\begin{array}{r} 600 \ 140 \ 14 \\ 700 + 50 + 4 \\ - 200 + 80 + 6 \\ \hline 400 + 60 + 8 = 468 \end{array}$$

## **Year 4 Developing Mental Fluency in Multiplication and division.**

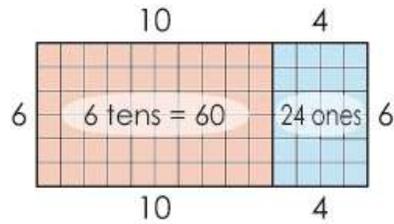
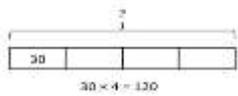
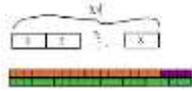
- Recall and use multiplication and division facts for tables to 12 times.
- Be able to count in multiples to 12 x, 15 and 25.
- To be able to divide mentally by 50 and 25.
- Use knowledge of place value and number facts to multiply and divide mentally including 3 digit numbers multiplied by one digit number.
- Confidently  $\times$  and  $\div$  by 10,100 and 1000 – expressing answer to a decimal place when appropriate.
- Understand that multiplication is commutative
- Use commutative rule for re-ordering e.g.  $2 \times 17 \times 5 = 1 \times 5 \times 17$
- Use partitioning e.g.  $267 \times 4 = (200 \times 4) + (60 \times 4) + (7 \times 4)$
- Solve missing number problems using relationship between  $\times$  and  $\div$
- To recognise and use factor pairs and commutativity in mental calculations
- Learn and apply divisibility rules.
- Use known multiplication facts to work out unknown e.g.  $7 \times 3 = 21$  therefore  $7 \times 30 = 210$ ,  $70 \times 30 = 2100$ ,  $7 \times 0.3 = 2.1$
- Children to be able to solve scaling problems such as which n objects are connected to m objects.
- Recall square numbers to 12 x 12
- Use estimation and bench marks to judge whether answer is reasonable

**Year 4 Multiplication TU by U, HTU by U, ThHTU by U**

Children should not be using column method until secure with concept. **Grid method is an excellent stepping stone to column method and should be taught.** Same /different approach should be applied. Childrens' understanding that multiplication is associative should be highlighted here.

**Models**

Bar model/  
written



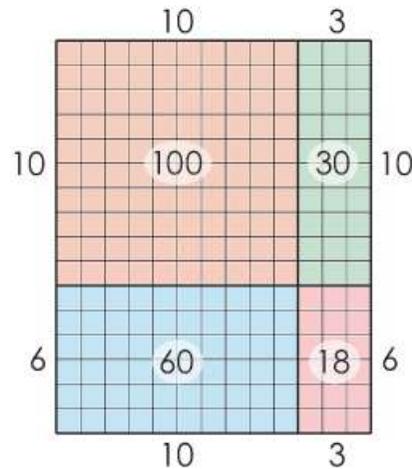
10 + 4
x 6
24
+ 60
84

**Informal**

<b>x</b>	<b>30</b>	<b>5</b>
<b>7</b>	<b>210</b>	<b>35</b>

**210 + 35 = 245**

Counters and Large PV mats.



10 + 3
x 10 + 6
18
60
30
+ 100
208

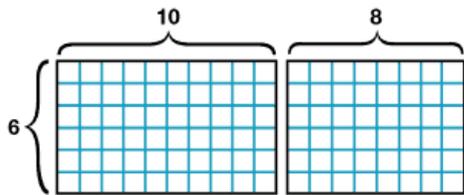
<b>x</b>	<b>30</b>	<b>5</b>
<b>20</b>	<b>600</b>	<b>100</b>
<b>6</b>	<b>180</b>	<b>30</b>

**600 + 100 = 700**

**180 + 30 = 210**

**700 + 210 = 910**

Models - use arrays



$6 \times (10 + 8) = (6 \times 10) + (6 \times 8)$   
 $= 60 + 48$   
 $= 108$

**Formal Written – columnar.**

24 x 6 becomes

24
x 6
144

Answer: 144

342 x 7 becomes

342
x 7
2394

Answer: 2394

2741 x 6 becomes

2741
x 6
16446

Answer: 16446

Partition/decompose 2-digit numbers;

Model area representations using **distributive property** and partial product arrays. Use concrete resources then

Children **represent** arrays using pencil and paper – then apply to grid method.

Emphasis on **partial products** as this aids transition to conceptual understanding of **formal written method.**

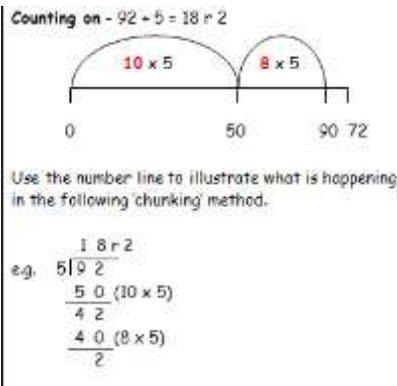
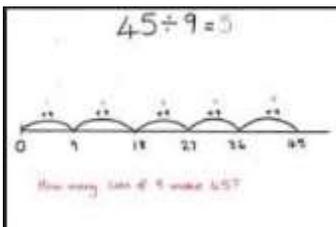
Year Four division:  $TO \div O$  and  $HTO \div U$  with no remainder or remainder expressed as remainder e.g.  $13r2$ .

Children should be progressing to using a formal written method for short division with  $TO \div O$  and  $HTO \div U$  with no remainder or remainder expressed as remainder e.g.  $13r2$ . However - huge emphasis should still be placed on using numbers lines and using resources such as place value counters and arrays to support conceptual understanding of formal methods. Children should also be taught what to do with remainder in context of worded problem.

**Models**

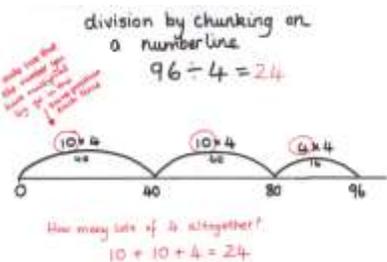
**Informal written methods.**

**Formal – i.e. short division (bus stop)**



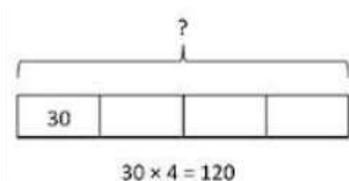
$$\begin{array}{r} 122r1 \\ 3 \overline{)367} \end{array}$$

When working with children – key questions are : How many **groups** of three are there? **1 group of three** in answer box.

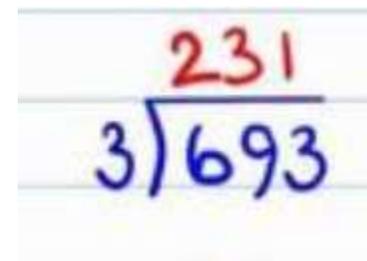
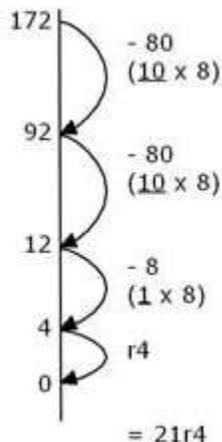


‘CHUNKING’  $172 \div 8$

PART/WHOLE



MODEL – link to Multiplication



Above method must be taught using place value counters, arrays and applying same/different model.

## Year five: Overview of calculations and objectives

### Number and place value

Children work with numbers up to at least 1,000,000, using knowledge of place value to work out the value of digits. They continue working with negative numbers in different contexts, and practise reading Roman numerals to 1000 (M), which helps them work out years written in Roman numerals. They continue using techniques introduced in earlier years for approximation and estimation.

### Addition and subtraction

Children use columns in written addition and subtraction, accurately adding and subtracting numbers with more than four digits. They use mental methods to add and subtract increasingly large numbers, and use rounding to check their answers. With support they choose appropriate operations and methods, and work out the level of accuracy required to answer a particular problem. They will continue to develop this work in Year 6.

### Multiplication and division

Children identify multiples and factors, and find all the factor pairs of a given number. With support, they use factors to help solve multiplication and division problems involving larger numbers, and they confidently use written methods to multiply and divide large numbers. They extend their mathematical vocabulary and understanding, beginning to work with prime numbers, prime factors, composite (non-prime) numbers, square and cubed numbers.

### Fractions (including decimals and percentages)

Children compare fractions with denominators that are multiples of the same number (comparing  $\frac{3}{7}$  with  $\frac{6}{14}$ ). They also identify equivalent fractions of a given fraction including tenths and hundredths. They learn about mixed numbers and improper fractions, and understand how mixed numbers could be converted to improper fractions, and vice versa. With support and using practical equipment and diagrams, they multiply proper fractions and mixed numbers by whole numbers.

Children convert decimal numbers into fractions ( $0.65 = \frac{65}{100}$ ). Extending their work from previous years, they use thousandths and make connections between these and tenths, hundredths and their decimal equivalents. They round decimals to the nearest whole number, and to one decimal place, and begin to work with numbers with three decimal places.

Children begin to work with percentages and find solutions to problems using percentage and decimal equivalents of  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{5}$ ,  $\frac{2}{5}$ ,  $\frac{4}{5}$ , for example. This forms a basis for further work on percentages in Year 6. Link to mental calculation strategies for division and multiplication e.g.  $\frac{2}{3}$  of 18 =  $(18 \div 3) \times 2 = 12$ ; 10% of 150 =  $150 \div 10$

### Measurement

In Year 4, children calculated the perimeter of rectilinear shapes; they now extend this to composite (or compound) rectilinear shapes, and calculate the area of squares and rectangles. Link to multiplication and division.

Year 5          Developing Mental Fluency in Addition and Subtraction

Mental calculations:

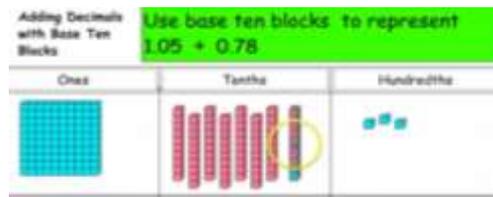
- *Add and subtract: any pair of three-digit multiples of 10 , e.g.  $570 + 250$ ,  $620 - 380$*
- *Add several numbers*
- *Add and subtract whole numbers with more than 4 digits. Mentally add and subtract tenths and one digit whole numbers and tenths, Add or subtract any pairs of decimal fractions each with units and tenths or each with tenths and hundredths e.g.  $5.7 + 2.5$ ,  $0.63 - 0.48$*
- *Subtract a four digit number - just less than a multiple of 1000 -from a four digit number just more than a multiple of 1000, e.g.  $5001 - 1997$ .*
- *Estimate the answer to a calculation and use inverse operations to check answers*
- *Solve missing number problems using relationship between addition and subtraction*
- *Use number facts and their understanding of place value and partitioning to solve addition and subtraction problems*
- *Pupils should continue to develop range of strategies **as appropriate** and build upon previous years.*

**Year 5 Addition:** children will be calculating ThHTO + ThHTO and **decimals** - using the formal written method of columnar addition **when appropriate**.

**NB** Ensure that children are secure with the methods outlined in the previous year's guidance *before moving on*

Use models, images and make connections between different methods using **SAME/DIFFERENT** approach. Use range of resources e.g. Dienes, counters, addition squares, place value cards and other resources to ensure that children have a secure knowledge of place value to 2 decimal places. Place stress on children understanding the value of a digit and what happens when this is exchanged. Ensure that children are taught from the start to line up decimal calculations correctly and can explain the rationale behind this. Children should use column method as Year 4 - with the least significant different first.

Models: Dienes



**Informal written**

$$7468 + 1486$$

$$\begin{array}{r} 7468 \\ + 1486 \\ \hline 14 \\ 140 \\ 800 \\ \hline 8000 \\ 8954 \end{array}$$

**Formal written.**

$$\begin{array}{r} 7468 \\ 1486 \\ \hline 8954 \end{array}$$

Children should be continuing to use strategies from previous years and resources such as place value counters, Dienes, number lines.

Estimation should be strongly encouraged and when estimating children should be rounding and giving an approximate answer.

When introducing decimal addition - ensure that sufficient time is given to understand what the decimal fractions represent and how to exchange. Place value counters and place value cards must be used here. Children should use to represent the calculation and then record in written form.

Stress should be placed from the word go on *children lining calculation up with decimal point in vertical line*. Another strategy to support children's understanding is to place a zero - when it has no value - in the calculation. e.g.  $12.03 + 3.6$

Estimation: my answer will be less than  $13 + 4$  i.e. 17.  $12.03$

$$\begin{array}{r} 12.03 \\ + 3.60 \\ \hline \end{array}$$

Year Five SUBTRACTION .Children should be progressing to using formal column method for subtraction with numbers more than 4 digits.

E.g. ThHTO – ThHTO – extending to decimal/. **If children not ready then repeat methods from previous year(s)** as appropriate.

E.g.

**Expanded method** – (Building on understanding of Place value and Partitioning and in conjunction with the use of place value resources.)

$$700\ 50\ 4 = 600\ 140\ 14$$

Place value counters, Dienes, Children should also continue to use number lines when appropriate.

$$\begin{array}{r} 700\ 50\ 4 \\ -\quad 80\ 6 \\ \hline \end{array}$$

$$600\ 60\ 8 = 668$$

*Encourage children to make estimations first using rounding i.e.  $750 - 90 = 660$  and  $750 - 80 = 670$ ; my answer will be between 660 and 670.*

**Use of same different model**

$$3597 - 1324$$

$$3000\quad 500\quad 90\quad 7$$

$$3597$$

$$\begin{array}{r} 1000 \\ \hline 300\ 20\ 4 \end{array}$$

$$\begin{array}{r} 1324 \\ \hline \end{array}$$

$$\begin{array}{r} 2000 \\ +\quad 200 + 70 + 3 \\ \hline \end{array} = 2273$$

$$\begin{array}{r} 2273 \\ \hline \end{array}$$

Same /Different? Children should compare both methods side by side and identify similarities/differences and be able to explain these.

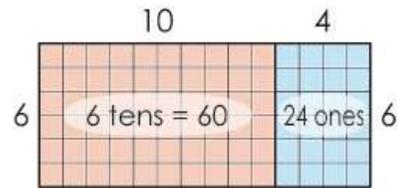
CHILDREN should be encouraged to check answers using inverse operation or alternative method. Children should also be encouraged to check with a calculator when subtracting with decimal numbers.

Children should be using decomposition with exchanging but do as expanded first.

## **Year 5 Developing Mental Fluency in Multiplication and division.**

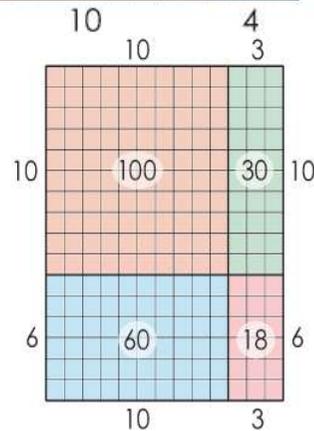
- Recall and use multiplication and division facts for tables to 12 times.
- Confidently  $\times$  and  $\div$  by 10, 100 and 1000 – expressing answer to a decimal place when appropriate.
- Understand that multiplication is commutative
- To use divisibility rules/multiplications facts + factors to establish if a number up to 100 is prime and recall prime numbers to 10.
- Use commutative rule for re-ordering e.g.  $2 \times 17 \times 5 = 1 \times 5 \times 17$
- Use partitioning to solve multiplication calculations mentally .e.g.  $267 \times 4 = (200 \times 4) + (60 \times 4) + (7 \times 4)$
- Solve missing number problems using relationship between  $\times$  and  $\div$
- Recognise and use factor pairs and commutativity in mental calculations
- Learn and apply divisibility rules.
- Children to be able to solve scaling problems such as which  $n$  objects are connected to  $m$  objects.
- Use estimation and bench marks to judge whether answer is reasonable

Year 5 Multiplication .Children should be working with calculations to: ThHTO x O and T0 x TO, HTO x TO. Questions should include ‘What are some of the similarities /differences in these methods?’ Children need to see both methods alongside, Children should be able to identify all methods use part products and recombining. Children should identify that in column methods – you start from the right (i.e. lowest value) – however this is not necessary in grid method.



$$\begin{array}{r} 10 + 4 \\ \times \quad 6 \\ \hline 24 \\ + \quad 60 \\ \hline 84 \end{array}$$

$$\begin{array}{r} 123 \times 5 \\ \times \quad 5 \quad | \quad 100 \quad | \quad 20 \quad | \quad 3 \\ \hline 500 \quad | \quad 100 \quad | \quad 15 \\ \hline 615 \end{array}$$



$$\begin{array}{r} 10 + 3 \\ \times 10 + 6 \\ \hline 18 \\ 60 \\ 30 \\ + 100 \\ \hline 208 \end{array}$$

FORMAL Columnar method:

$$\begin{array}{r} 123 \\ \times 5 \\ \hline 615 \end{array}$$

Children should move onto multiplying whole numbers and decimal numbers by whole numbers. **Use grid method as stepping stone.**

E.g.

	Tens	ones	tenths	hundredths
12.62 x 8	10	2	0.6	0.02
	80	16	4.8	0.16
=	80 + 16 + 4.8 + 0.16 + = 100.96			

formal column method

$$\begin{array}{r} 12.62 \\ \times 8 \\ \hline 100.96 \\ 241 \end{array}$$

Children should estimate first e.g.  $12 \times 8 = 96$  and  $13 \times 8 = 104$  so my answer will lie between these and will have 2 decimal places.

Next stage should be long multiplication: using grid method as stepping stone to formal long multiplication.

YEAR 5 Division:

Children will be tackling calculations in the form  $TO \div O$  and  $HTO \div U$ . Children should be using number lines – **KEY POINT** : often an error is teaching division and consequently children's understanding of division is moving onto short division formal method without the conceptual understanding being present. **Key message – embed – move broadly not onwards.** Children should not move onto long division but focus on embedding current understanding and application of all four operations the use of rich tasks. Children need to be secure with partitioning and have a real grasp of place value to understand what happens when number 'carried'. Place value counters should be used alongside written method for short division.

Number lines should still be used to reinforce conceptual understanding if necessary. *See Year four strategies.*

Models and practise with place value counters



Introduce formal written method by using SAME/DIFFERENT APPROACH

**Same /different model:**

**Chunking for short division)**

**Formal written method – short division (also called bus stop)**

$$964 \div 7 =$$

$$\begin{array}{r} 964 \quad (100 \times 7) \\ - 700 \\ \hline 264 \quad (30 \times 7) \\ - 210 \\ \hline 54 \quad (7 \times 7) \\ - 49 \\ \hline 5 \quad \underline{137 R 5} \end{array}$$

$$\begin{array}{r} 137 \text{ r } 5 \\ 7 \overline{) 964} \end{array}$$

$$964 \div 7 = 137 \text{ r } 5$$

Children should be making a decision as regards to a remainder in the context of problem. 16 pizzas shared equally between 3 people = 5 and one third; £16.00 shared between 4 people = £4.00 . 16 children going on trip – car takes four - how many cars need? 4 Cars. Car takes 4 people, 17 people going on trip – how many cars needed? 5 cars

## **Year 6 Overview of calculations and objectives.**

### **Number and place value**

Children work with numbers up to 10,000,000, using knowledge of place value to work out the value of digits. They continue working with negative numbers in different contexts, and work out intervals across zero.

**Addition, subtraction, multiplication and division** Children continue to practise using efficient written and mental methods for all four operations, working with larger numbers and increasingly complex calculations, and confidently using number facts from the multiplication and division tables. They learn about the correct order of operations, understanding that (for example) to work out  $(7 + 8) \div 3$  they need to tackle the operation in brackets first.

### **Fractions (including decimals and percentages)**

Children begin to add and subtract fractions with different denominators. They multiply pairs of simple proper fractions together, and divide proper fractions by whole numbers.

Children begin to multiply and divide numbers with two decimal places by one-digit and two- digit whole numbers. They are introduced to this in practical contexts such as measures and money (for example, multiplying 1.80 metres by 2, or dividing £1.80 by 3).

Children extend their work on percentage and decimal equivalents of fractions, begun in Year 5. They work out simple percentages of whole numbers, and encounter equivalences between fractions, decimals and percentages in different contexts.

### **Ratio and proportion**

In Year 6, children are introduced to the concepts of ratio and proportion and use these to compare quantities and sizes; for example, understanding that mixing sugar and flour in a ratio of 1:2 means using 1 part of sugar for every 2 parts of flour, and that the proportion of sugar in the mixture is 1 out of 3 parts, which is  $\frac{1}{3}$ .

### **Measurement**

Children extend their Year 5 work on calculating area and estimating volume and capacity to calculate the area of parallelograms and triangles, and work out the volume of cubes and cuboids using standard units. They convert measurements from miles to kilometres.

### **Statistics**

Children continue working with line graphs and also learn how to use pie charts, linking this with their work on angles, percentages and fractions. Children learn how to work out the mean of a set of data and understand when it might be appropriate to calculate the mean, and why.

Year 6 Developing mental fluency in addition and subtraction.

*Strategies from previous years should continue to be developed and children should continue to practice these at regular intervals and apply to larger numbers and mixed operations*

*Children should be able use mental methods to identify common factors, common multiples and know prime numbers to 10*

**Year 6 Addition:** Children should now be progressing to working with numbers with mixed number of digits

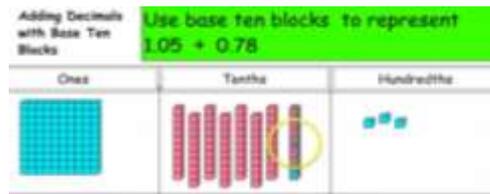
e.g. 10ThThHTu + ThHTO; TO.t + O.th

Ideally children should be using formal columnar methods.

**NB ENSURE THAT CHILDREN ARE SECURE WITH THE METHODS FROM THE PREVIOUS YEARS GUIDANCE BEFORE MOVING ON**

Use models, images and make connections between different methods using **SAME/DIFFERENT** approach. Use range of resources e.g. Dienes, counters, addition squares, place value cards and other resources to ensure that children have a secure knowledge of place value to 2 decimal places. Place stress on children understanding the value of a digit and what happens when this is exchanged. Ensure that children are taught from the start to line up decimal calculations correctly and can explain the rationale behind this. Children should use column method as Year 4 - with the least significant different first.

Models: Dienes



140

**Informal written**

$$7468 + 1486$$

$$7468$$

$$+ \begin{array}{r} 1486 \\ \hline 14 \end{array}$$

800

$$\begin{array}{r} 8000 \\ \hline 8954 \end{array}$$

**Formal written.**

$$7468$$

$$\begin{array}{r} 1486 \\ \hline 8954 \end{array}$$

Estimation should be strongly encouraged and when estimating children should be rounding and giving an approximate answer.

When introducing decimal addition - ensure that sufficient time is given to understand what the decimal fractions represent and how to exchange. Place value counters and place value cards must be used here. Children should use to represent the calculation and then record in written form.

Stress should be placed from the word go on children lining calculation up with decimal point in vertical line. Another strategy to support children's understanding is to place a zero - when it has no value - . e.g.

$$12.03 + 3.6$$

Estimation: my answer will be less than  $13 + 4$  i.e. 17.

$$\begin{array}{r} 12.03 \\ +3.60 \\ \hline 15.03 \end{array}$$

Mixed numbers:  $11.92 + 3.3 + 0.6$

$$\begin{array}{r} 11.92 \\ 3.30 \\ +0.60 \\ \hline 15.82 \end{array}$$

Year Six subtraction: Children should be using progressing to using formal column method for subtraction with numbers more than 4 digits and mixed numbers of digits etc. 10ThThHTo – ThHTO; TU.t – U.th.

. IF CHILDREN NOT READY THEN REPEAT METHODS and CONSOLIDATE MAETHODS FROM PREVIOUS YEAR(s) as appropriate.

E.g. Expanded method – no carrying; expanded with exchanging and decomposition; formal written with no decomposition; formal written with decomposition.

CHILDREN should be encouraged to check answers using inverse operation or alternative method. Children should also be encouraged to check with a calculator when subtracting with decimal numbers.

When children secure with method – introduce equivalent different method of subtraction – see below.

Use same/ different model. Ensure that children can explain what is happening. Begin with simple model.

e.g.  $10 - 2 = 8$  Equivalent different model would be  $11 - 3 = 8$ !

Equivalent different model. (See last calculation strategy from new curriculum subtraction methods)

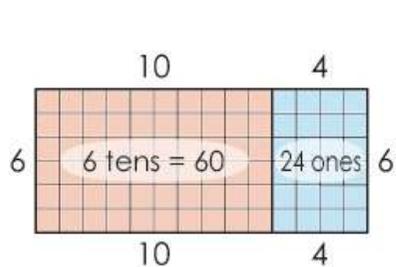
$$\begin{array}{r}
 \overset{1}{\cancel{2}}\overset{1}{\cancel{3}}\overset{1}{\cancel{4}}.\overset{9}{\cancel{0}}\overset{9}{\cancel{0}}\overset{1}{\cancel{0}} \\
 - \quad 8.327 \\
 \hline
 15.673
 \end{array}
 \quad \text{or} \quad
 \begin{array}{r}
 2\overset{1}{4}.1\overset{1}{0}1\overset{1}{0}1\overset{1}{0} \\
 - \quad 1\overset{1}{8}1.\overset{1}{3}\overset{1}{2}\overset{1}{7} \\
 \hline
 15.673
 \end{array}$$

## **Year 6 Developing Mental Fluency in Multiplication and division.**

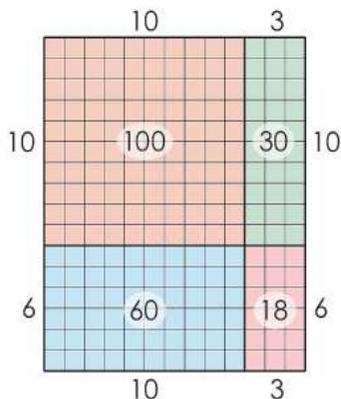
- Recall and use multiplication and division facts for tables to 12 times.
- Confidently  $\times$  and  $\div$  by 10, 100 and 1000 – expressing answer to a decimal place when appropriate.
- Understand that multiplication is commutative
- Establish if a number up to 100 is prime using multiplication facts and divisibility rules
- Use commutative rule for re-ordering e.g.  $2 \times 17 \times 5 = 1 \times 5 \times 17$
- Use partitioning to solve multiplication calculations mentally .e.g.  $267 \times 4 = (200 \times 4) + (60 \times 4) + (7 \times 4)$
- Use doubles and halving to solve e.g.  $35 \times 14 = 70 \times 7$ ;
- Use known facts e.g.  $25 \times 16 = (16 \div 4) \times 100 = 400$
- Solve missing number problems using relationship between  $\times$  and  $\div$
- Recognise and use factor pairs and commutativity in mental calculations
- Learn and apply divisibility rules.
- Children to be able to solve scaling problems such as which  $n$  objects are connected to  $m$  objects.
- Use estimation and benchmarks to judge whether answer is reasonable

Year 6 Multiplication .Children should be working with calculations to : ThHTO x O and T) x TO, HTO x TU TO.t x O . Use same different model when teaching. Children need to use estimation – this is particularly helpful to ascertain where decimal point goes in final answer. With long multiplication – children should understand that a 0 is added to show that the number acting as an operator is a multiple of ten. Children should identify that in column methods – you start from the right (i.e. lowest value) – however this is not necessary in grid method.

Models to support (arrays)



$$\begin{array}{r} 10 + 4 \\ \times 6 \\ \hline 24 \\ + 60 \\ \hline 84 \end{array}$$



$$\begin{array}{r} 10 + 3 \\ \times 10 + 6 \\ \hline 18 \\ 60 \\ 30 \\ + 100 \\ \hline 208 \end{array}$$

Stepping stones:

$$\begin{array}{r} 123 \times 5 \\ \hline \begin{array}{r|l} \times & 100 & 20 & 3 \\ 5 & 500 & 100 & 15 \end{array} \\ \hline 500 \\ + 100 \\ + 15 \\ \hline 615 \end{array}$$

Formal written methods.

$$\begin{array}{r} 123 \times 5 \\ 123 \\ \times 5 \\ \hline 615 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \times 13 \\ 12 \\ \times 13 \\ \hline 36 \\ \hline 120 \\ \hline 156 \end{array}$$

$$\begin{array}{r} 12.75 \times 4 \quad (\text{estimation } 12 \times 4 = 48) \\ 12.75 \\ \times 4 \\ \hline 51.00 \end{array}$$

Year Six division:

Children will be progressing to using formal written methods for long and short division and expressing remainders as fraction, decimals, rounding up/down or leaving depending on the context of the problem.

Previous strategies for teaching short division formal method should be used

Children should then do short division with decimal answer.

Key teaching points: estimation; making decision as regards to remainder prior to calculating. .

Examples to use:

16 pizzas shared equally between 3 people =

$$\begin{array}{r} 5^{1/3} \text{ pizzas} \\ 3 \overline{)16} \end{array}$$

£16.00 shared between 4 people = £4.00

16 children going on trip – car takes four. How many cars need? 4 Cars

Car takes 4 people, 17 people going on trip – how many cars needed? 5 cars

Bus stop method to 1 decimal place

Refer to Year five models for formal short division method. Use place value counters to teach how to use short division method where answer will include decimals. Ensure children know what answer represent in terms of units e.g. mass, capacity, length, money

£32 is shared equally between 5 children. How much will each receive?

$$\begin{array}{r} 06.4 \\ 5 \overline{)32.0} \end{array} \quad \text{Answer} = \text{£6.40}$$









