Heaton St. Barnabas' CE Primary School

Whole School Mental & Written Calculation Policy

November 2022

These are the 'basics'	Speaking and Listening	Practice, practice, practice!
Children need to understand that a good grasp of mental calculation strategies 'built on' year on year, which will help them with their written methods and to use and apply in real-life contexts – e.g. working out the area of a floor to be carpeted or how much change they will get from a £10 note. Children need to be able to estimate and round and should be taught alongside written methods.	Encourage children to talk through their maths using mathematical terminology/vocabulary in mathematical sentences. Get them to explain **why** they think an answer is correct and/or why an answer must be incorrect. In-class opportunities for Talk Partners should be planned for, plus the opportunity to use 'Thinking Time'.	Children need to see the benefit of using mental strategy methods. However, they should also see the link between mental and recorded methods so that they can make appropriate choices as they get older – e.g. do I really need to use decomposition (subtraction) to subtract £2.99 from £5? Is there an easier way? Do I understand that 3004 – 2997 is 7 as the numbers are so close together?
Models and Images / 'manipulatives' & CPA – Concrete, Picture, Abstract This policy contains illustrations of some of the Models and Images that could be used in the classroom / outside the classroom to support learning. Working Walls should include useful reminders for children to help them calculate in their heads/with jottings. Manipulatives should be available to enable links to be made and to provide challenges linked to mental calculation strategies. The Bar Model is a useful diagram to show – e.g. – the connection between addition and subtraction.  	**Fluency (calculation fluency)** • Do children know their number bonds to 10 / 20 / 100? • Do they know all their times table facts? • Do they know all the related division facts? These three elements above are crucial to ensure that children become mathematicians that are more confident. Fluency is about being efficient in calculation approaches. Also, • Do they understand that the inverse can help them to check an answer? • Do they understand that estimation is a 'best guess' (a 'bestimate') and is not getting an answer wrong'?	**Making connections (cross-strand fluency)** Children should be encouraged, and supported, to make links between the strands of mathematics – e.g. confidence in calculation approaches requires a sound Place Value knowledge, which includes counting and sequencing skills. Measures and statistics both use scales / number lines and children in UKS2 need to understand (e.g.) that you can add, subtract, multiply and divide percentages to make new percentage statements or find 1% to make 51% by adding 50% (half of 100%) to 1% (divide 100% by 100 or ÷ by 10 twice…)

This policy outlines both the **mental** and **written** methods that should be taught from Year 1 to Year 6, plus a section on EYFS approaches.
It has been written according to the National Curriculum 2014 and the written calculations for all four operations are as outlined on the appendices of the Programme of Study.

The document builds on the interconnectedness of mathematics and outlines the progression for addition, subtraction, multiplication and division. It is our intention that addition and subtraction should be taught at the same time to ensure children are able to see the clear links between the operations and the inverse nature of them along with multiplication and division.

Children should **secure mental strategies**. They are taught the strategy of counting forwards and backwards in ones and tens first and then 'Special Strategies' are introduced. Children are taught to look carefully at the calculation and decide which strategy they should use. Children should explain and reason as to why they have chosen a strategy and whether it is the most efficient.

The formal written methods should be introduced with caution. Calculations that require a written method should be presented to the children with models and images, such as base ten apparatus, place value counters, bead strings etc. Children need to have a conceptual understanding of the written method and that it is not a process that the children use for every type of calculation regardless of whether it can be completed mentally or mentally with jotting i.e. the number line.

The policy outlines the **mental strategies** that children should be encouraged to use:

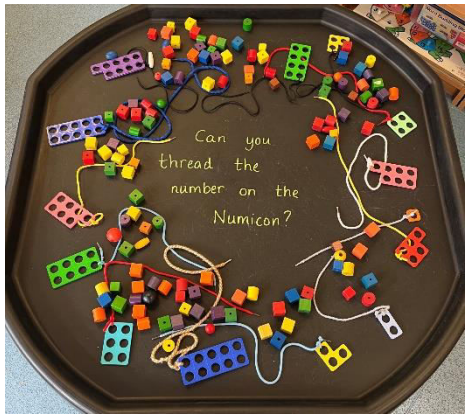
- A mental strategy that they can always rely on e.g. counting in tens and ones, forwards and backwards e.g. 56 – 25 (count back in 10s 56, 46, 36 and back in ones 36, 35, 34, 33, 32, 31)
- A special strategy they can select from a small range of strategies if they can see something special about the numbers they are being asked to calculate with e.g. 46 – 24 (I can use near doubles to support my calculation e.g. 46 – 23 – 1)

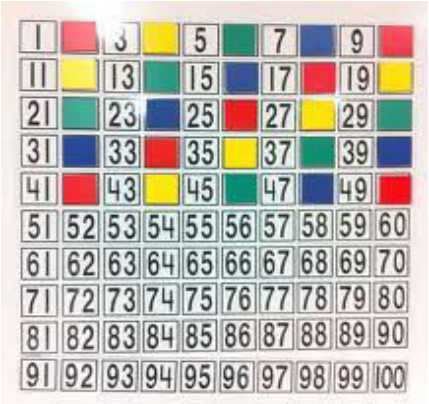
The policy outlines the **written methods** as suggested on the appendices of the Curriculum 2014 and suggests that children:

- Look at a calculation and decide whether it can be done mentally, mentally with a jotting or whether it needs a written method.
- Should always be shown written methods with place value apparatus to ensure children are clear about the value of the numbers that they are calculating with and the numbers do not just become digits.
- Estimate, calculate and check to ensure that the answer they generate has some meaning.

For the purpose of developing understanding there may be occasions when examples that can be completed mentally may be shown as a written method purely to develop understanding of the method. This needs to be made very clear to children and when they are practising the methods, appropriate calculations should be used. There is also a section on calculating with fractions; the expectations from Y1—Y6 and examples with the models and images that should be used in order to ensure children develop a conceptual understanding when calculating with fractions.

‘Manipulatives’ & key representations to support conceptual understanding of mathematics in Reception





DEVELOPING MATHMATICAL UNDERSTANDING IN RECEPTION

Children in Reception will be learning to:	Examples of how to support this:
• Count objects, actions and sounds.	• Develop the key skills of counting objects including saying the numbers in order and matching one number name to each item. • Say how many there are after counting – for example, "…6, 7, 8. There are 8 balls" – to help children appreciate that the last number of the count indicates the total number of the group. This is the cardinal counting principle. • Say how many there might be before you count to give a purpose to counting: "I think there are about 8. Shall we count to see?" • Count out a smaller number from a larger group: "Give me seven…" Knowing when to stop shows that children understand the cardinal principle. • Build counting into everyday routines such as register time, tidying up, lining up or counting out pieces of fruit at snack time. • Sing counting songs and number rhymes and read stories that involve counting. • Play games, which involve counting. • Identify children who have had less prior experience of counting and provide additional opportunities for counting practice.
• Subitise.	• Show small quantities in familiar patterns (for example, dice) and random arrangements. • Play games, which involve quickly revealing and hiding numbers of objects. • Put objects into five frames and then ten frames to begin to familiarise children with the tens structure of the number system. • Prompt children to subitise first when enumerating groups of up to 4 or 5 objects: "I don't think we need to count those. They are in a square shape so there must be 4." Count to check. • Encourage children to show a number of fingers 'all at once', without counting.
• Link the number symbol (numeral) with its cardinal number value.	• Display numerals in order alongside dot quantities or tens frame arrangements. • Play card games such as snap or matching pairs with cards where some have numerals, and some have dot arrangements. • Discuss the different ways children might record quantities (for example, scores in games), such as tallies, dots and using numeral cards.

DEVELOPING MATHMATICAL UNDERSTANDING IN RECEPTION

Children in Reception will be learning to:	Examples of how to support this:
• Count beyond ten.	• Count verbally beyond 20, pausing at each multiple of 10 to draw out the structure, for instance when playing hide and seek, or to time children getting ready. • Provide images such as number tracks, calendars and hundred squares indoors and out, including painted on the ground, so children become familiar with two-digit numbers and can start to spot patterns within them.
• Compare numbers.	• Provide collections to compare, starting with a very different number of things. Include more small things and fewer large things, spread them out and bunch them up, to draw attention to the number not the size of things or the space they take up. Include groups where the number of items is the same. • Use vocabulary: 'more than', 'less than', 'fewer', 'the same as', 'equal to'. Encourage children to use these words as well. • Distribute items evenly, for example: "Put 3 in each bag," or give the same number of pieces of fruit to each child. Make deliberate mistakes to provoke discussion. • Tell a story about a character distributing snacks unfairly and invite children to make sure everyone has the same.
• Understand the 'one more than/one less than' relationship between consecutive numbers.	• Make predictions about what the outcome will be in stories, rhymes and songs if one is added, or if one is taken away. • Provide 'staircase' patterns, which show that the next counting number includes the previous number plus one.
• Explore the composition of numbers to 10.	• Focus on composition of 2, 3, 4 and 5 before moving onto larger numbers. • Provide a range of visual models of numbers: for example, six as double three on dice, or the fingers on one hand and one more, or as four and two with ten frame images. • Model conceptual subitising: "Well, there are three here and three here, so there must be six." • Emphasise the parts within the whole: "There were 8 eggs in the incubator. Two have hatched and 6 have not yet hatched." • Plan games, which involve partitioning and recombining sets. For example, throw 5 beanbags, aiming for a hoop. How many go in and how many don't?

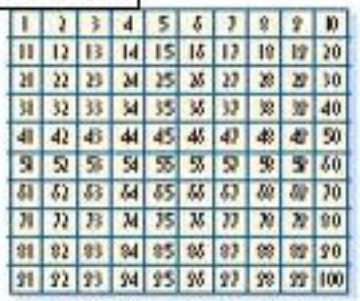
DEVELOPING MATHMATICAL UNDERSTANDING IN RECEPTION

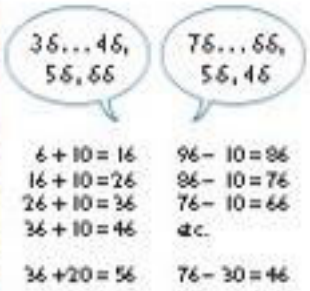
Children in Reception will be learning to:	Examples of how to support this:
• Automatically recall number bonds for numbers 0–5 and some to 10.	• Have a sustained focus on each number to and within 5. Make visual and practical displays in the classroom showing the different ways of making numbers to 5 so that children can refer to these. • Help children to learn number bonds through lots of hands-on experiences of partitioning and combining numbers in different contexts, and seeing subitising patterns. • Play hiding games with a number of objects in a box, under a cloth, in a tent, in a cave, etc.: "6 went in the tent and 3 came out. I wonder how many are still in there?" • Intentionally give children the wrong number of things. For example: ask each child to plant 4 seeds then give them 1, 2 or 3. "I've only got 1 seed, I need 3 more." • Spot and use opportunities for children to apply number bonds: "There are 5 of us but only 2 clipboards. How many more do we need?" • Place objects into a five frame and talk about how many spaces are filled and unfilled.
• Select, rotate and manipulate shapes to develop spatial reasoning skills.	• Provide high-quality pattern and building sets, including pattern blocks, tangrams, building blocks and magnetic construction tiles, as well as found materials. • Challenge children to copy increasingly complex 2D pictures and patterns with these 3D resources, guided by knowledge of learning trajectories: "I bet you can't add an arch to that," or "Maybe tomorrow someone will build a staircase." • Teach children to solve a range of jigsaws of increasing challenge.
• Compose and decompose shapes so that children recognise a shape can have other shapes within it, just as numbers can.	• Investigate how shapes can be combined to make new shapes: for example, two triangles can be put together to make a square. • Encourage children to predict what shapes they will make when paper is folded. Wonder aloud how many ways there are to make a hexagon with pattern blocks. • Find 2D shapes within 3D shapes, including through printing or shadow play.
• Continue, copy and create repeating patterns.	• Make patterns with varying rules (including AB, ABB and ABBC) and objects and invite children to continue the pattern. • Make a deliberate mistake and discuss how to fix it.
Compare length, weight and capacity.	Model comparative language using 'than' and encourage children to use this vocabulary. For example: "This is heavier than that." • Ask children to make and test predictions. "What if we pour the jugful into the teapot? Which holds more?"

These are the 'Reception' expectations but at HSTB we recognise each child is different and opportunities are given for those children emerging into or who have already mastered the Reception framework.

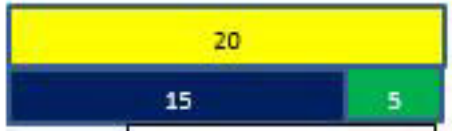
‘Manipulatives’ & key representations to support conceptual understanding of addition and subtraction.

Hundred square



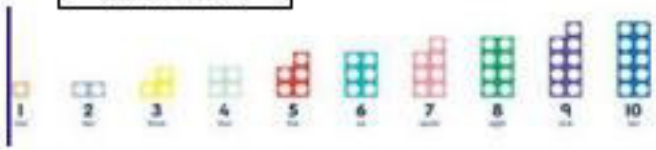


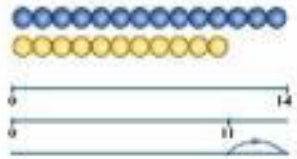
Money to find a total and give change



The Bar Model - + and – link, and finding the difference

Numicon tiles

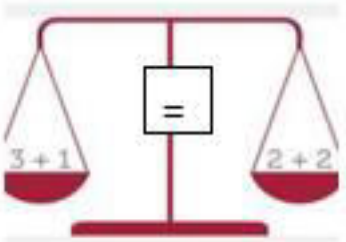




The difference between 11 and 14 is 3.
14 – 11 = 3
11 + □ = 14

$10 = 7 + 3$

Cuisenaire rods



Dienes – for understanding of Place Value – 36 can be partitioned into 30 + 6 or 20 + 16…

Place Value counters

Bundles of straws in tens and ones

DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION IN YEAR 1

Objectives

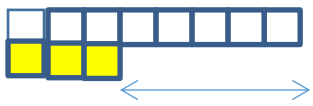
- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs.
- **Represent** and **use** number bonds and related subtraction facts within 20.
- Add and subtract one-digit and two-digit numbers to 20, including zero.

Mental Recall

- Know one more/ less than any number within 20
- Know bonds to and within 10
- Missing number 6 + ☐ = 10
- Begin to use bonds to – and within - 20
- Family of facts - if 4 + 5 = 9, 4 + 5 = 9, 9 – 5 = 4 and 9 – 4 = 5 (link to the bar model)
- All doubles to 10

Strategies

- **BIG ED** – put the biggest number in your head…count on
- **Counting on/back**
- **Partition to 'Magic 10'** – e.g. 8 + 3 = 8 + 2 + 1
- **Partition, double and adjust** – e.g. 7 + 8 = 7 + 7 + 1 = double 7 + 1…
- **Finding the difference** – children should be shown that a bar model approach can help them to see the difference
  e.g.

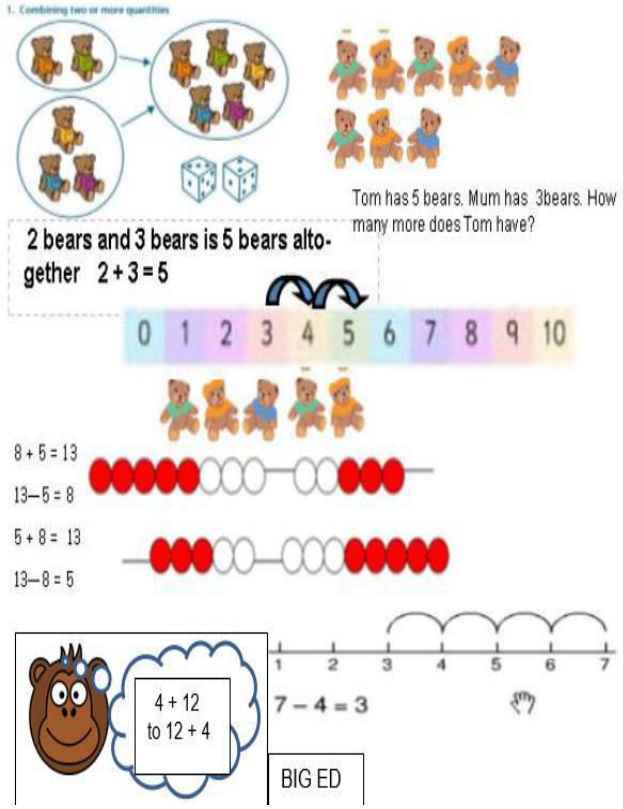


The difference between 8 and 3 is 5

- Children should have opportunities to read and write the addition (+), subtraction (-) and equals (=) signs

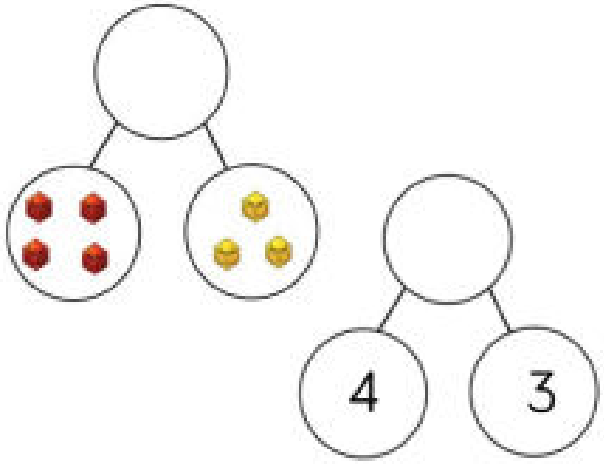
Mental Jottings with Representations

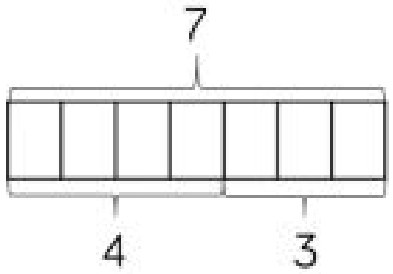
Immerse children in practical opportunities to develop understanding of addition and subtraction. Link practical representations to a number line. Also, include the bar model to make the addition / subtraction link. By the end of Year 1 children should be able to recall and use facts within and to 20.

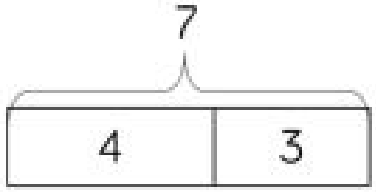


Skill: Add 1-digit numbers within 10

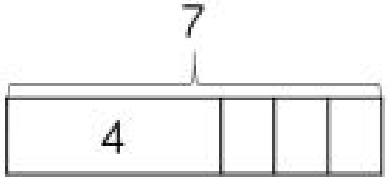
Year: 1

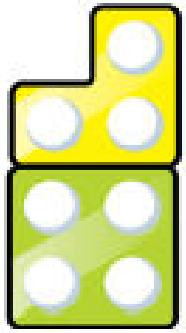


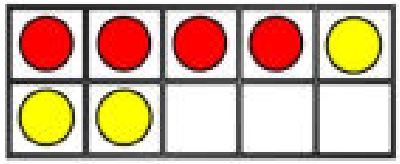


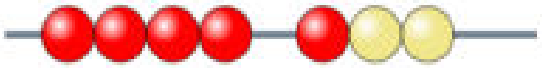


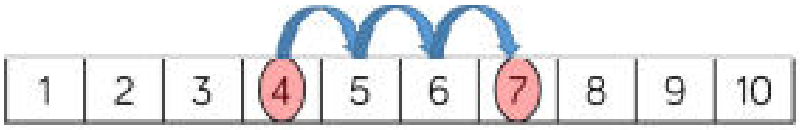
$4 + 3 = 7$







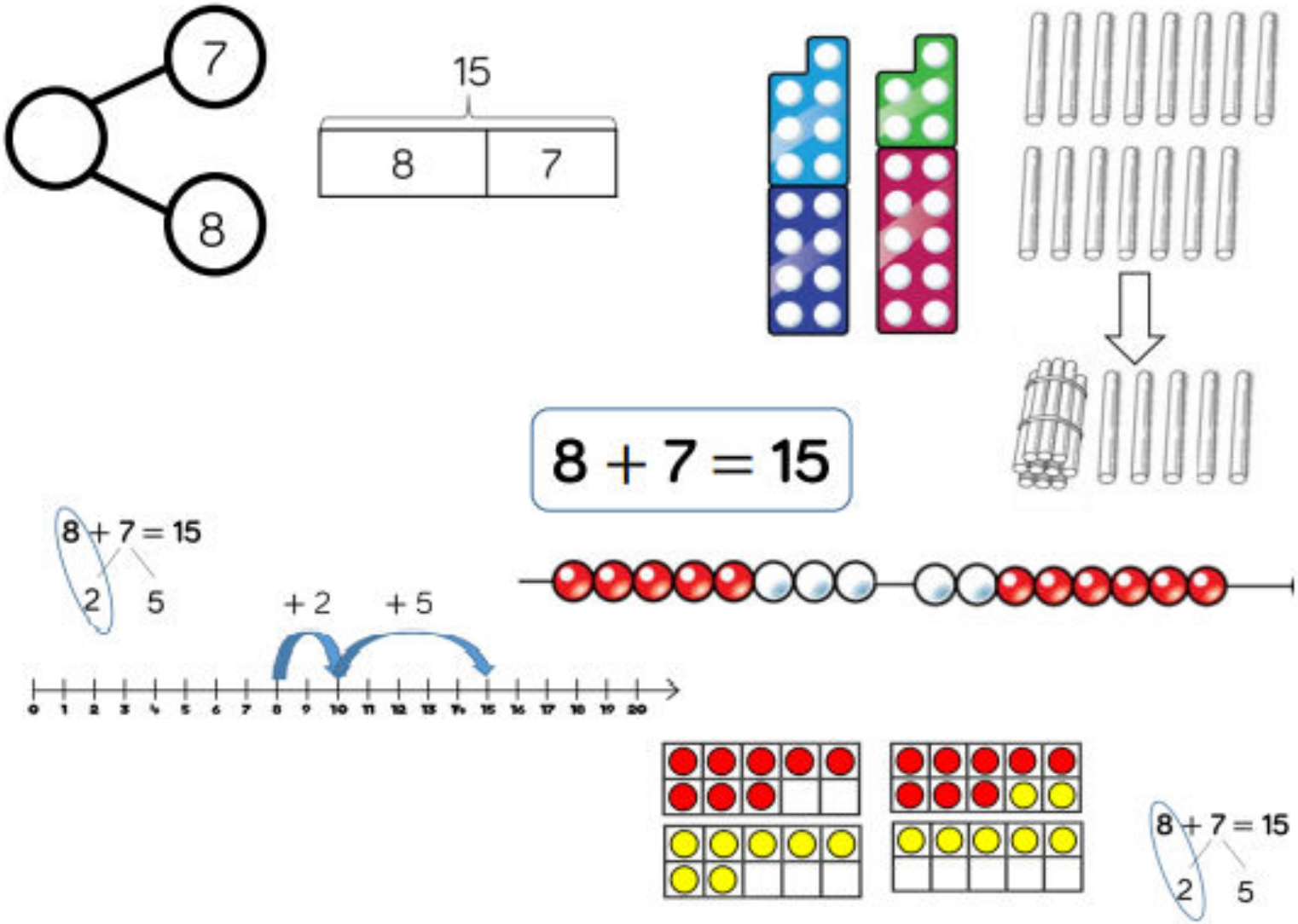




When adding numbers to 10, children can explore both aggregation and augmentation.

The part-whole model, discrete and continuous bar model, number shapes and ten frame support aggregation.

The combination bar model, ten frame, bead string and number track all support augmentation.

Skill: Add 1 and 2-digit numbers to 20	Year: 1/2
	When adding one-digit numbers that cross 10, it is important to highlight the importance of ten ones equalling one ten. Different manipulatives can be used to represent this exchange. Use concrete resources alongside number lines to support children in understanding how to partition their jumps.

DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION IN YEAR 2

Objectives

- Order and subtraction cannot.
- Recall and use addition and subtraction facts to 20 fluently and derive and use related facts up to 100.
- Add and subtract numbers using concrete objects, pictorial presentations and mentally including:-
  - 2 digit number and ones.
  - 2 digit number and tens.
- Recognise inverse relationship.
- Two 2 digit numbers.
- Add three 1 digit numbers.
- Use Knowledge of inverse to find missing numbers.
- Solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures applying their increasing knowledge of mental and written methods.

N.B. children should still be partitioning numbers in different ways to support subtraction using decomposition in KS2 – e.g. 90 + 2 = 80 + 12 = 70

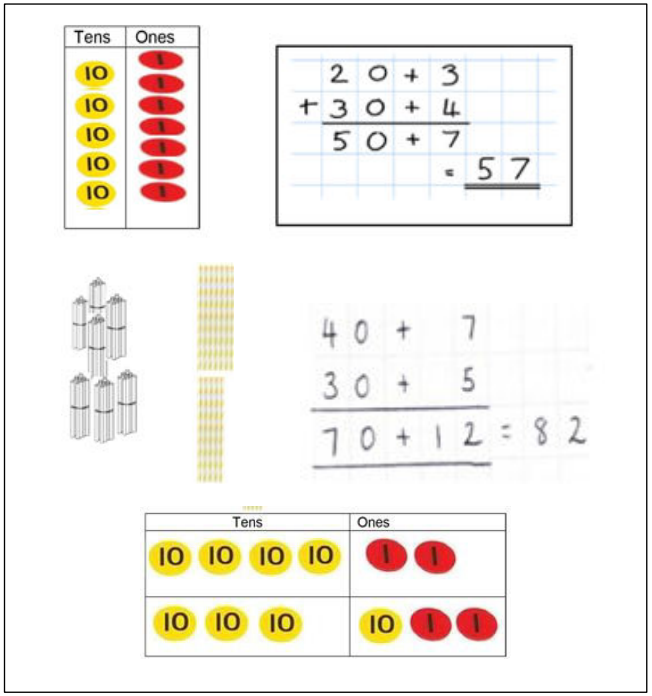
Mental Recall

- Recall all +/- facts to and within 20
- Find different ways to answer (e.g. ☐ + ☐ = 15)
- Recall all multiples of 10 pairs to 100 – e.g. 60 + 40
- Recall all doubles within 20 – e.g. double 17
- Know all doubles of multiples of tens (10 to 50) Family of facts – if 30 + 20 = 50, 20 + 30 = 50, 50 – 30 = 20 and 50 – 20 = 30 (link to the bar model)

Strategies

- **Use known facts** – e.g. if I know 2 + 3 = 5, then 20 + 30 = 50…
- **Bridge through 10** – e.g. 26 + 7 = 26 + 4 + 3
- **Partition into T & O** – e.g. 24 + 15 = 20 + 10 and 4 + 5
- **Partition the second number** – e.g. 24 + 15 = 24 + 10 + 5
- **+ /- a multiple of 10 to/from any 2-digit number** – e.g. 67 + 20 = 87 (T digit changes)
- **Smile Maths / Magic 10** – add 3 1-digit numbers – e.g. 3 + 5 + 7
- **Round and adjust** - +9 / + 11 / - 9 / - 11 by adding 10 and adjusting – e.g. add 9 by adding 10, subtracting 1

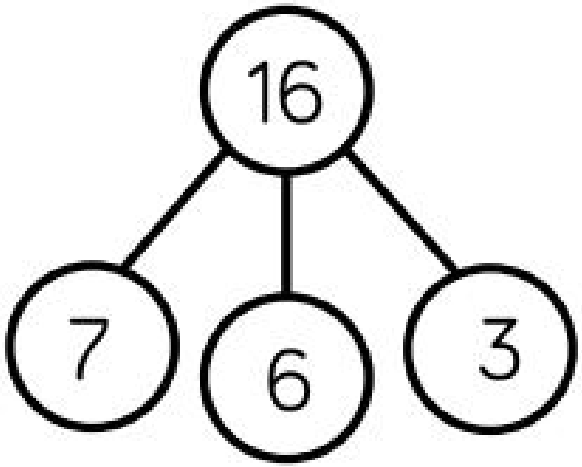
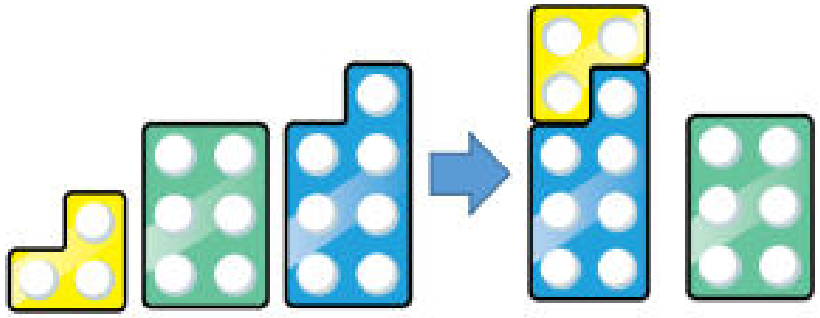
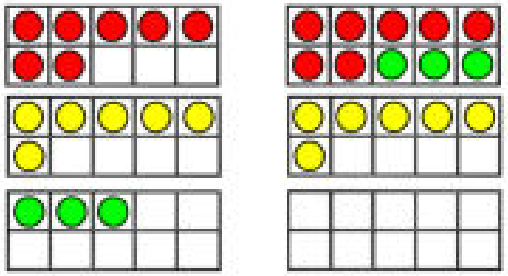
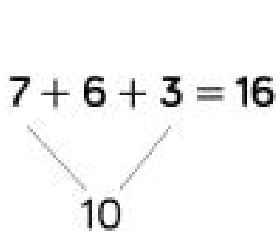
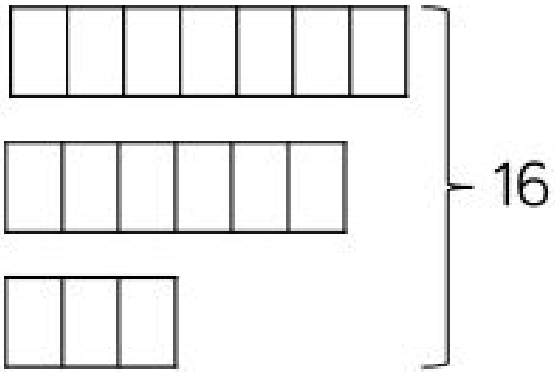
Mental Jottings with Representations



Encourage children to recognise how Place Value understanding can help to solve 42 – 15 easily

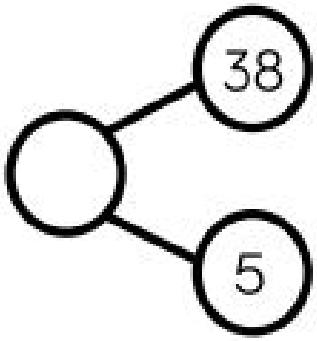
40 + 2 → 30 12
10 + 5 → − 10 5
20 7

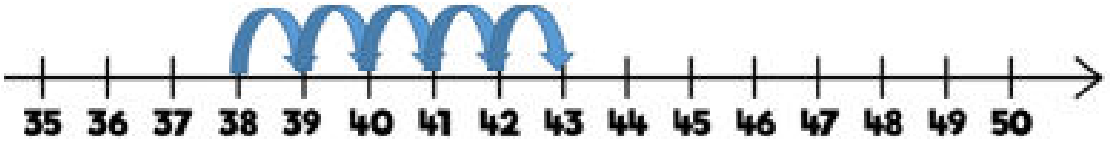
so, 42 – 15 = 27

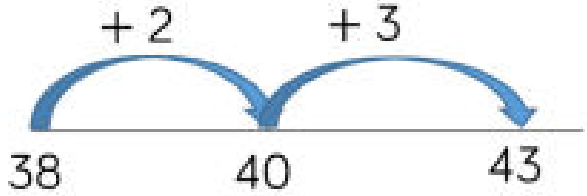
Skill: Add three 1-digit numbers	Year: 2
  $7 + 6 + 3 = 16$   	When adding three 1-digit numbers, children should be encouraged to look for number bonds to 10 or doubles to add the numbers more efficiently. This supports children in their understanding of commutativity. Manipulatives that highlight number bonds to 10 are effective when adding three 1-digit numbers.

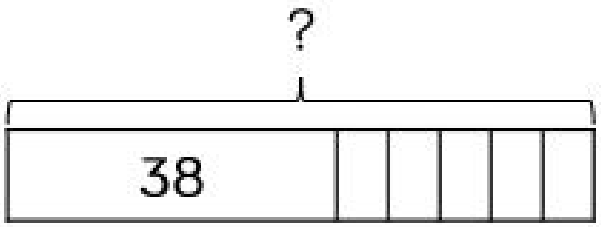
Skill: Add 1-digit and 2-digit numbers to 100

Year: 2/3

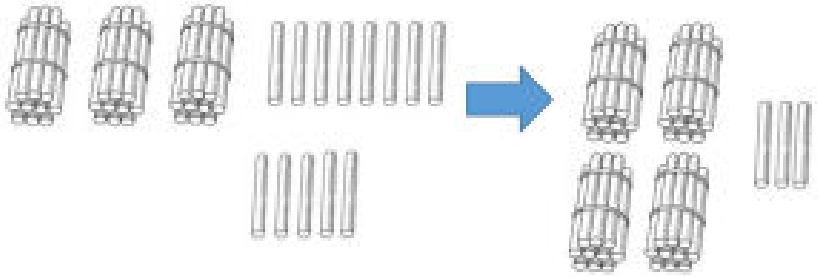








$$38 + 5 = 43$$



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

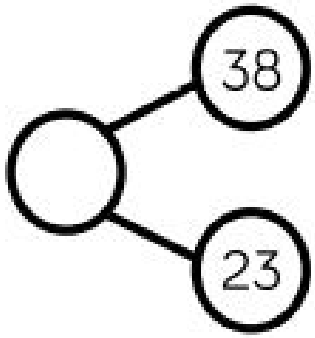
When adding single digits to a two-digit number, children should be encouraged to count on from the larger number.

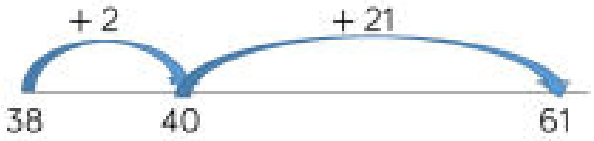
They should also apply their knowledge of number bonds to add more efficiently e.g. $8 + 5 = 13$ so $38 + 5 = 43$.

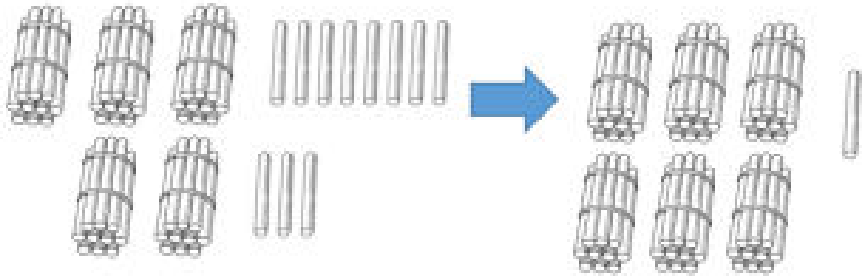
Hundred squares and straws can support children to find the number bond to 10.

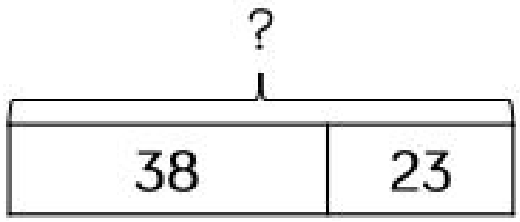
Skill: Add two 2-digit numbers to 100

Year: 2/3

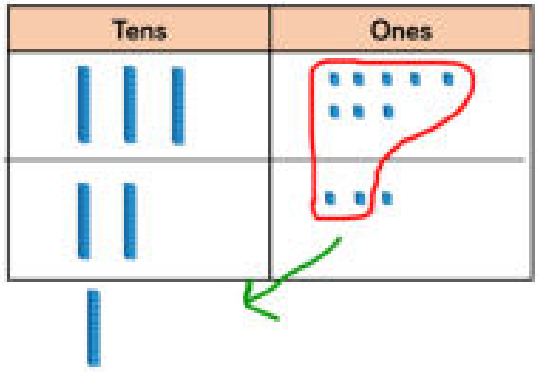




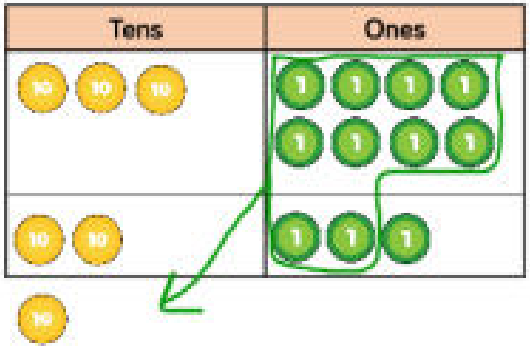




$$38 + 23 = 61$$



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



At this stage, encourage children to use the formal column method when calculating alongside straws, base 10 or place value counters. As numbers become larger, straws become less efficient.

Children can also use a blank number line to count on to find the total. Encourage them to jump to multiples of 10 to become more efficient.

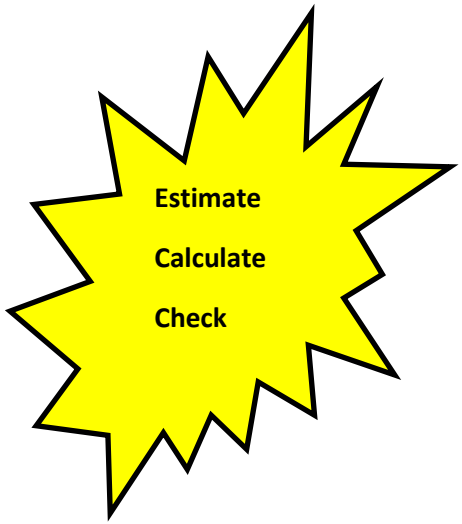
DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION IN YEAR 3

Objectives

- Add and subtract numbers mentally :-

  a 3 digit number and 1s
  a 3 digit number and 10s
  a 3 digit number and 100s

- Add and subtract numbers with up to 3 digits using formal written methods of columnar addition and subtraction.



Mental Recall

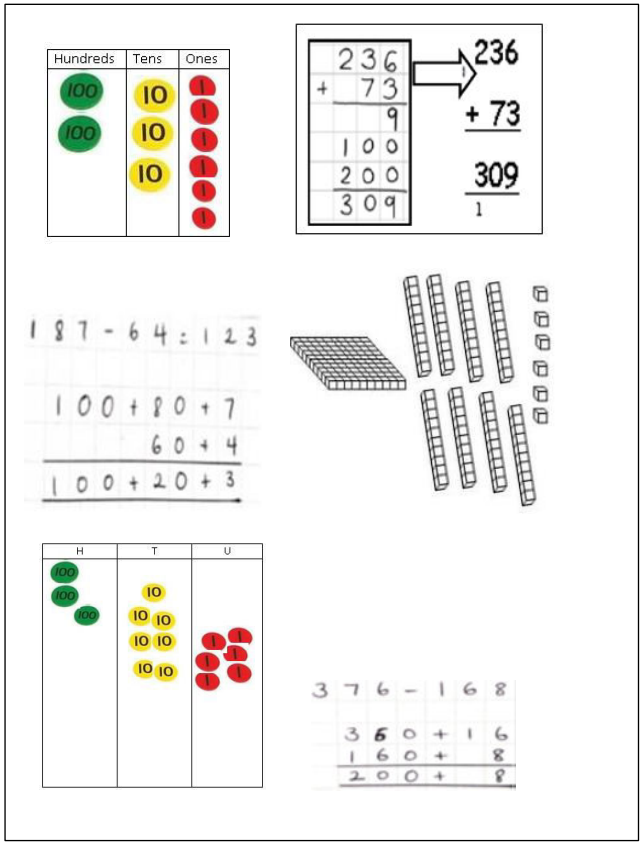
- Know number bonds to 100 (multiples of 10 and 5) – e.g. 75 + 25 = 100 or 85 + 15 = 100
- Instant recall of all pairs of multiples of 10 to 100 – e.g. 30 + ? = 100
- Know 10/100 more/less than a given number – e.g. 100 more than 315 is 415 (only the H digit will change in this case)
- Know number pairs of multiples of hundreds that total 1000 – e.g. 400 + 600 or 800 + 200

Strategies

- **Bridge through 10** – e.g. 425 + 8 = 425 + 5 + 3 = 430 + 3 = 433
- **Round and adjust** - +9, 99(p) or 90 / - 9, 99(p) or 90 by adding 100 and adjusting – e.g. add 90 by adding 100, subtracting 10 – e.g. 425 + 90 becomes 425 + 100 to 525 – 10 = 515
- **Partition into H, T & O** – e.g. 234 + 153 = 200 + 100, 30 + 50, 4 + 3 = 387
- **Partition the second number** – e.g. 146 – 60 = 146 – 40 – 20 = 86
- **Count forwards/backwards in 100s** – e.g. 636 – 500 = 136 (only the H digit will change in this case)
- **Small gap/difference** – e.g. 303 – 297 = 6
- **Use what I know**… - if 14 + 15 = 29, then 140 + 250 = 290…

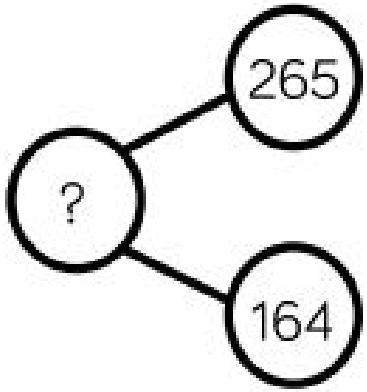
Mental Jottings with Representations

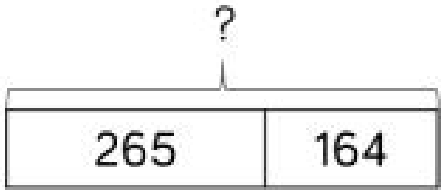
Pupils use their understanding of place value and partitioning, and practise using columnar addition and subtraction with increasingly large numbers up to three digits to become fluent.

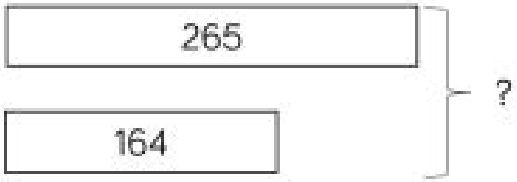


Skill: Add numbers with up to 3 digits

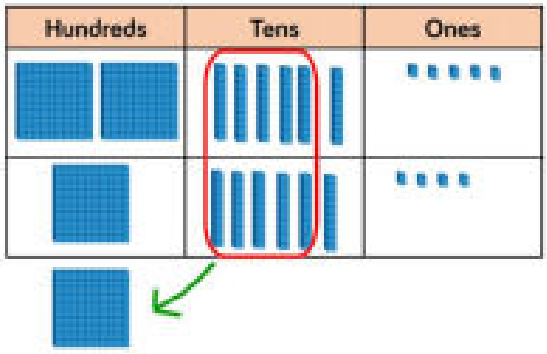
Year: 3



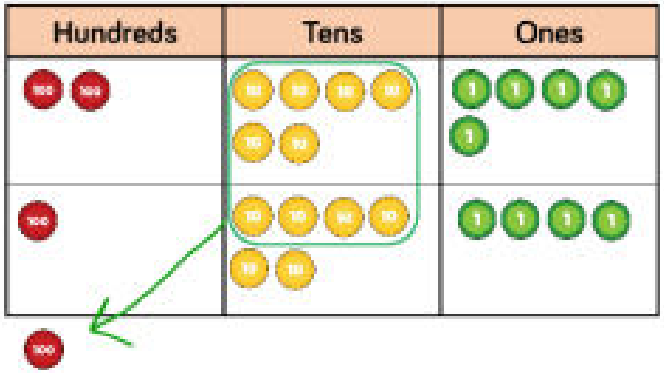




$$265 + 164 = 429$$



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



Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 3 digits.

Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method.

Plain counters on a place value grid can also be used to support learning.

DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION IN YEAR 4

Objectives

- Continue to secure and extend mental methods from previous year groups.
- Develop confidence at calculating mentally with larger numbers using the full range of strategies.
- To select whether a calculation can be done mentally, with a jotting or using a formal written method.
- Add and subtract numbers with up to 4 digits using formal written methods of column addition and subtraction where appropriate.
- Children should be making decisions as to whether they can calculate mentally, mentally with jottings or using a more formalised written method

Mental Recall

- Know sums and differences of pairs of multiples of 10, 100, 1000 – e.g. 7000 + 3000 = 10 000 or 900 – 700 = 200
- Recall doubles within 100 – e.g. double 72 = 144
- Add / subtract multiples of 1, 10, 100, 1000 – e.g. 267 + 2000 = 2267 or 7846 – 300 = 7546

Strategies

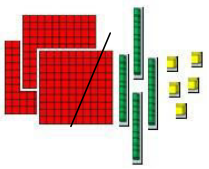
- **Bridge through multiples of 10** – e.g. 870 + 250 = 870 + 30 + 220 = 900 + 220 = 1120
- **Partitioning** – e.g. 467 + 763 = 400 + 700, 60 + 60, 7 + 3 = 1100 + 120 + 10 = 1230
- **Rounding and adjusting** – e.g. 945 + 199 becomes 945 + 200 = 1145, subtract 1 = 1145 – 1 = 1144 (include money examples)
- **Counting on**
- **Reordering numbers**
- **Add near doubles** – e.g. 600 + 601 = double 600 + 1 = 1200 + 1 = 1201
- **Small gap/difference** – e.g. 1003 – 997 = 6
- **Bridging through 60 when calculating with time** – 45 mins + 35 mins
  = 45 mins + 15 mins + 20 mins
  = 60 mins + 20 mins
  = 80 mins or 1 hour and 20 mins

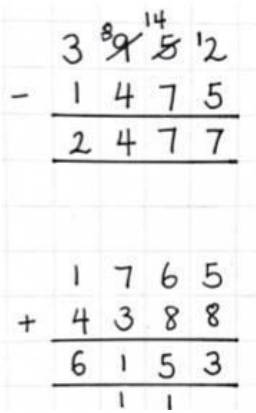
(General advice re. time / duration, IF IT'S TIME, DRAW A LINE!)

Mental Jottings with Representations

Add and subtract up to 4 digit numbers.

345 - 100 = 245





Use the written method with decimals in the context of money

£ 32.50 + £ 21.75 = £54.25

£32.50
+ £21.75
£54.25
1

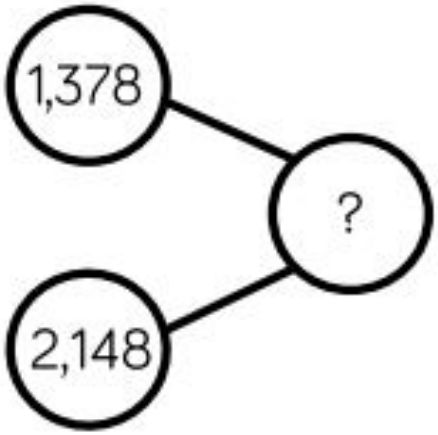
£ 42.50 - £ 13.35 = £ 29.15

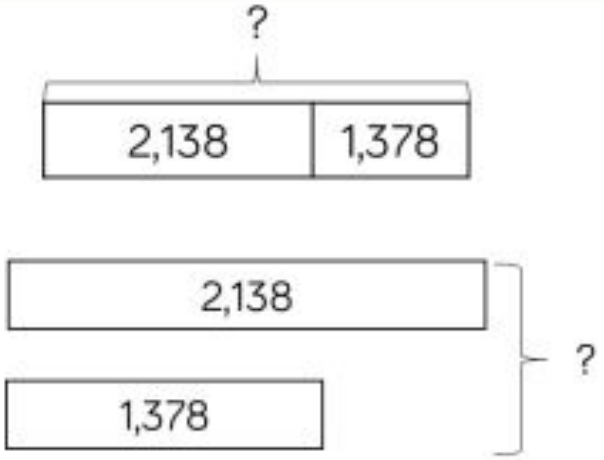
£ 3 4 1/2 . 4 5 10
- £ 1 3 . 3 5
£ 2 9 . 1 5

Using numbers that ensure children understand the process before quickly moving into numbers that do require a written method.

Skill: Add numbers with up to 4 digits

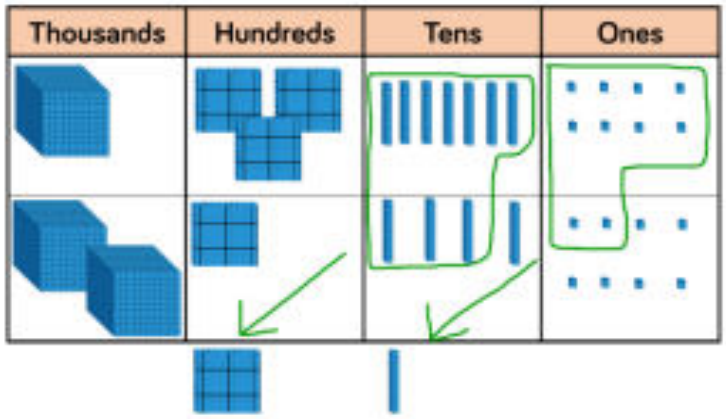
Year: 4

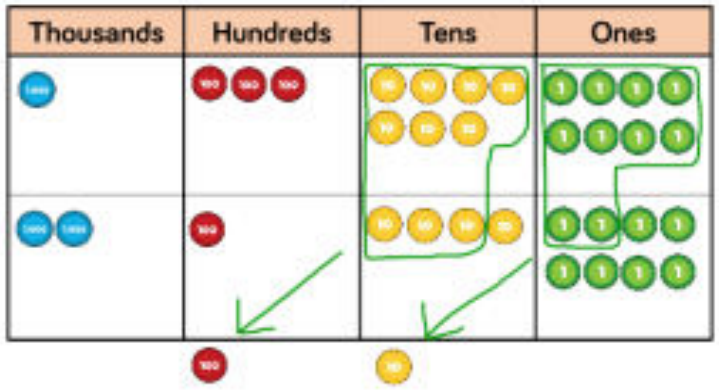




	1	3	7	8
+	2	1	4	8
	3	5	2	6
		1	1	

$$1{,}378 + 2{,}148 = 3{,}526$$





Base 10 and place value counters are the most effective manipulatives when adding numbers with up to 4 digits.

Ensure children write out their calculation alongside any concrete resources so they can see the links to the written column method.

Plain counters on a place value grid can also be used to support learning.

DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION IN YEAR 5

Objectives

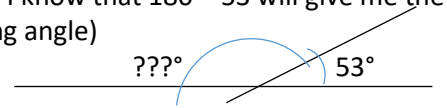
- Add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction).
- Add and subtract numbers mentally with increasingly larger numbers.
- Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

Mental Recall

- Know pairs of decimals that equal 1 – e.g. 0.7 + 0.3 = 1 or 0.75 + 0.25 = 1

Strategies

- **Round and adjust** – e.g. 8364 + 1999 becomes 8364 + 2000 = 10 364, subtract 1 = 10 363 (include money examples)
- **Partition and recombine** – e.g. 13 484 + 2400 = 13 000 + 2000 = 15 000 / 484 + 400 = 884 becomes 15 000 + 884 = 15 884
- **Partition the second number** – 13 486 – 5000 becomes 13 486 – 3000 = 10 486 – 2000 = 8486
- **Sums and differences with decimal numbers** – (ignore the decimal point and then replace it OR think of money – especially with decimals to two places) – e.g. 6.5 + 2.7 – think of 65 + 27 (= 92) and then replace the decimal point for 9.2 OR 3.65 + 0.7…think of £3.65 + £0.70 and then 'lose' the '£' sign
- **Count up through the next multiple of 10, 100, 1000** – e.g. 8006 – 2993…2993 (+ 5000 = 7993)…(+ 10 = 8003)…(+3 = 8006)…so 5000 + 10 + 3 = the answer of 5013
- (**Angles on a straight line** – if I know that one angle is 53°, I know that 180 – 53 will give me the missing angle)

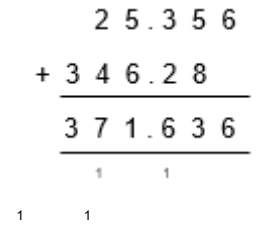


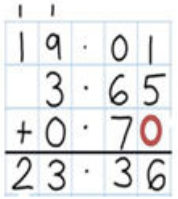
Mental Jottings with Representations

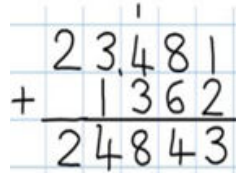
Encourage estimation and checking.

Was your answer close to your estimate?

25.356 + 346.28 / estimate 25 + 350 = 375

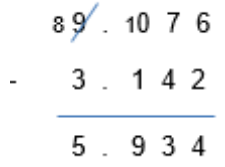






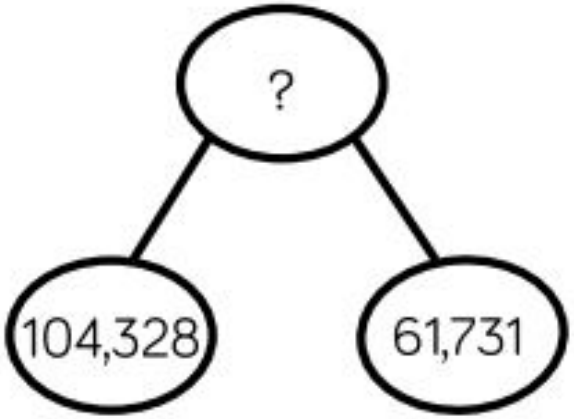
Was your answer close to your estimate?

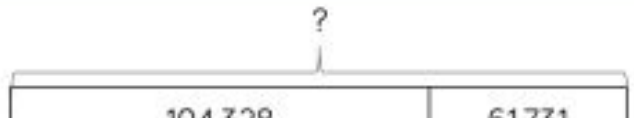
9.076 - 3.142 / estimate 9 – 3 = 6

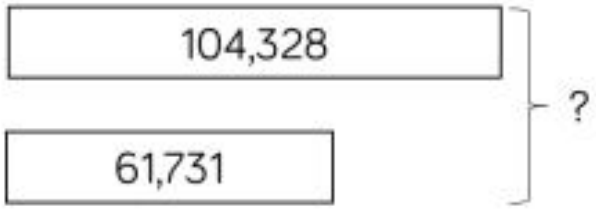


Skill: Add numbers with more than 4 digits

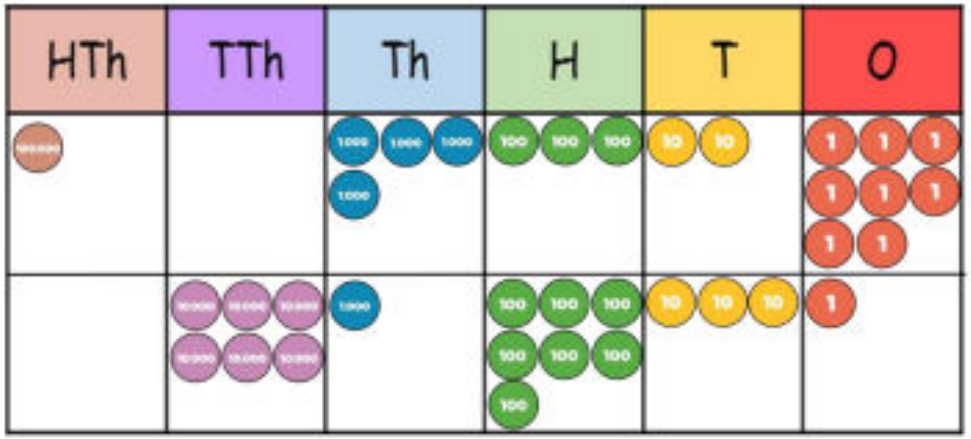
Year: 5/6







$$104{,}328 + 61{,}731 = 166{,}059$$



1	0	4	3	2	8
+	6	1	7	3	1
1	6	6	0	5	9

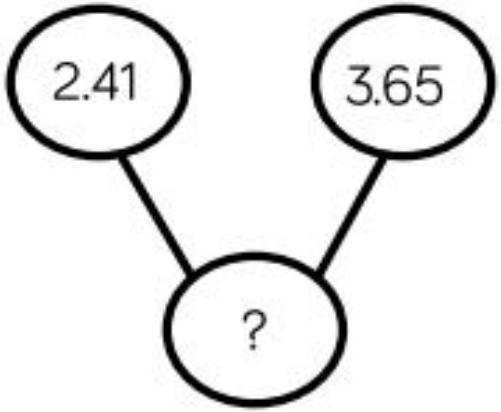
1

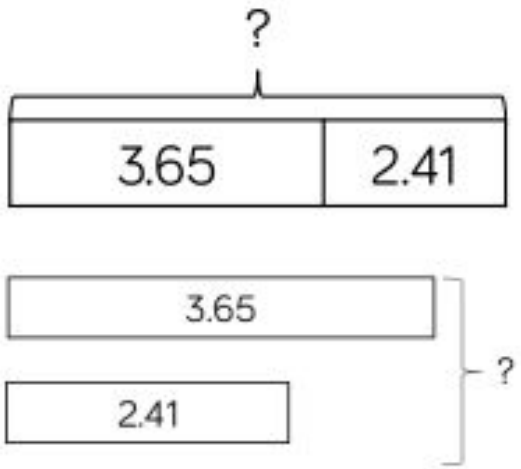
Place value counters or plain counters on a place value grid are the most effective concrete resources when adding numbers with more than 4 digits.

At this stage, children should be encouraged to work in the abstract, using the column method to add larger numbers efficiently.

Skill: Add with up to 3 decimal places

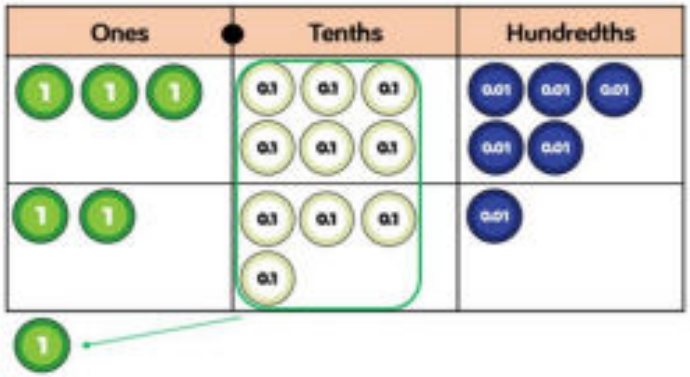
Year: 5

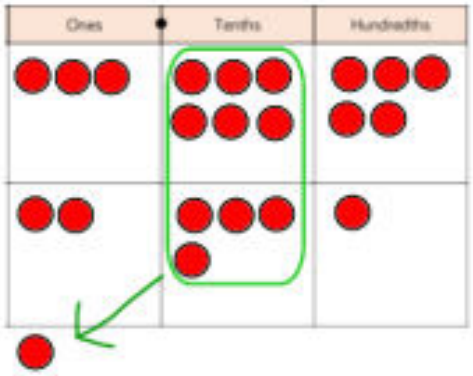




$$\begin{array}{r} 3.65 \\ +\ 2.41 \\ \hline 6.06 \\ \hline 1 \end{array}$$

$$3.65 + 2.41 = 6.06$$





Place value counters and plain counters on a place value grid are the most effective manipulatives when adding decimals with 1, 2 and then 3 decimal places.

Ensure children have experience of adding decimals with a variety of decimal places. This includes putting this into context when adding money and other measures.

DEVELOPING UNDERSTANDING OF ADDITION AND SUBTRACTION IN YEAR 6

Objectives

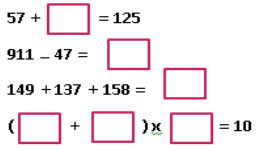
- Perform mental calculations, including with mixed operations and larger numbers (Children to use a wide range of mental Strategies when calculating including decimals and increasingly larger numbers – e.g. what is 2 – 0.005?).
- Use their knowledge of the order of operations to carry out calculations involving the four operations.
- Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.

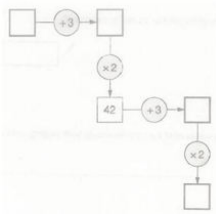
Mental Recall

Consolidation of previous years

Strategies

- **BIDMAS** – Brackets, Indices, Division, Multiplication, Addition, Subtraction
- **Add near doubles of decimals** – e.g. 5.35 + 5.36 goes to double 5.35 + 0.01 = double 5 + double 0.35 + 0.01 = 10 + 0.7 + 0.01 = 10.71
- **Rounding and adjusting with decimals** – e.g. 44.3 + 2.9 = 44.3 + 3 – 0.1 = 47.3 – 0.1 = 47.2
- **Use what you know…** - e.g. 630 + 430 = 1060, so 0.63 + 0.43 = 1.06…



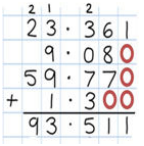


Mental Jottings with Representations

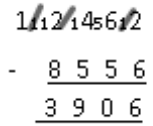
12 462 + 8456

Estimate:
21 000 = 12 500 + 8 500

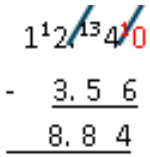
12 462
+ 8 456
20 918
1 1



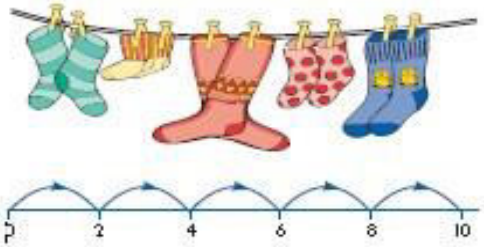
Estimate:
4000 = 12 500 – 8 500



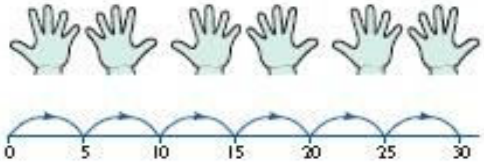
Add and subtract numbers with a different number of decimal places. 12.4 – 3.56 = Estimate: 12 – 4 = 8 (my answer should be between 8 and 9)



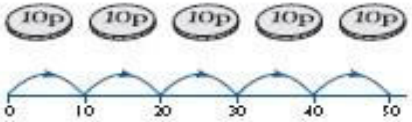
‘Manipulatives’ & key representations to support conceptual understanding of multiplication and division



$2 + 2 + 2 + 2 + 2 = 10$
$2 \times 5 = 10$
2 multiplied by 5
5 pairs
5 hops of 2



$5 + 5 + 5 + 5 + 5 + 5 = 30$
$5 \times 6 = 30$
5 multiplied by 6
6 groups of 5
6 hops of 5

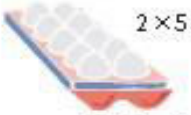


$10p + 10p + 10p + 10p + 10p = 50p$
$10p \times 5 = 50p$
5 hops of 10

$4 \times 2 = 8$
$2 \times 4 = 8$

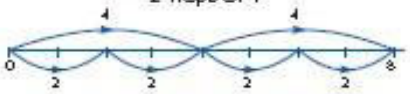
$5 \times 2 = 10$
$2 \times 5 = 10$

$2 \times 4 = 8$
$4 \times 2 = 8$



$2 \times 5 = 10$
$5 \times 2 = 10$

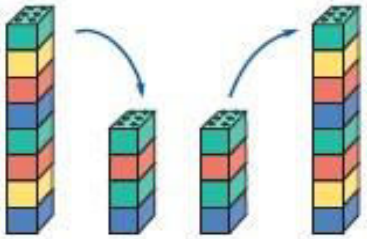
2 hops of 4



4 hops of 2

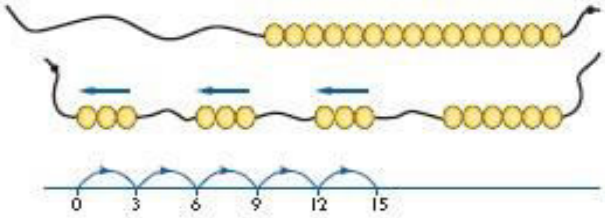
2 hops of 5

5 hops of 2



half of 8 is 4
$8 \div 2 = 4$

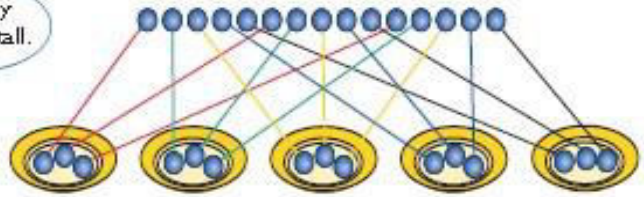
double 4 is 8
$4 \times 2 = 8$

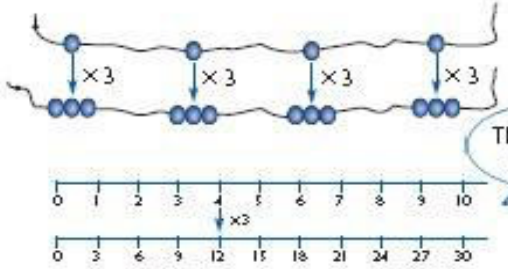


How many 3s in 15?

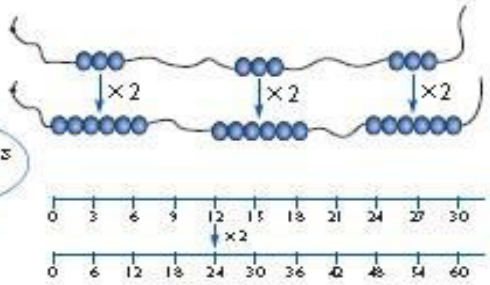
$15 \div 3 = 5$

5 hops in 15. How big is each hop?
$15 \div 5 = 3$
15 shared between 5



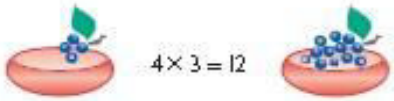


Three times as many



$12 \times 2 = 24$

Twice as many



$4 \times 3 = 12$

DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION IN YEAR 1

Objectives

- Count, read and write numbers to 100 in numerals; count in multiples of two, five and ten.
- Double numbers to 20.
- Solve one step problems by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.

Mental Recall

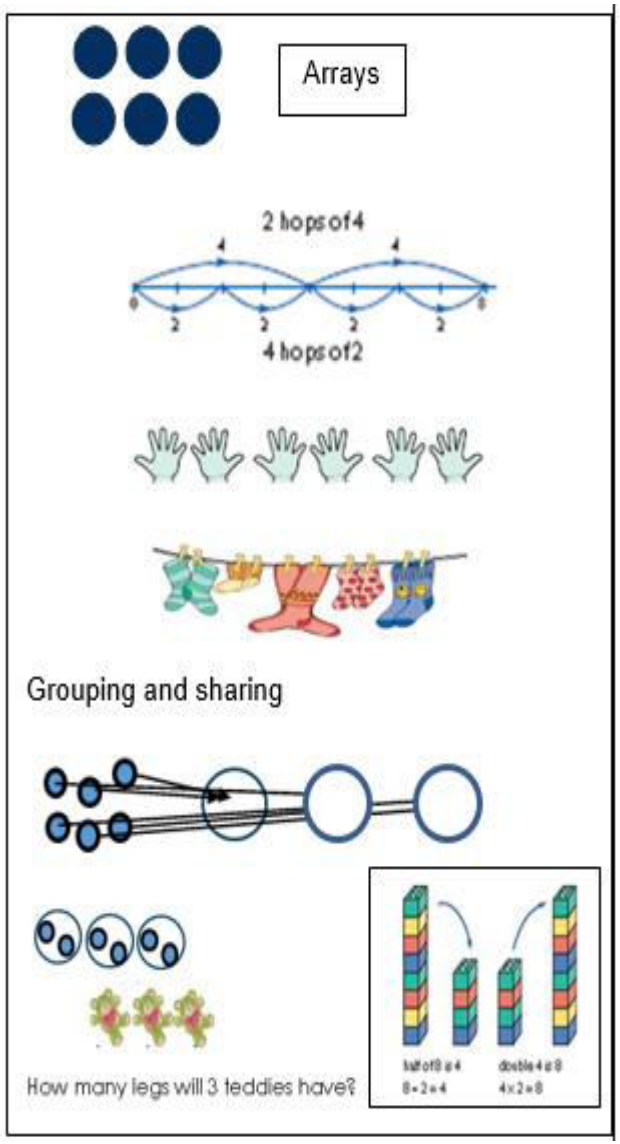
- Know odd and even numbers to 20…100 (?)
- Know doubles of numbers within 20 – e.g. double 9 = 18.
- Know halves of numbers within 20 – e.g. half of 14 is 7.

Strategies

- **Count on / back in ones** – from 0 to 100 / from 100 to 0
- **Count on / back in twos, fives and tens** – use of real objects and support children in looking for patterns when counting
- **Use the pattern of last digits** – e.g. when counting in twos, the last digit is even / when counting in 5s, the last digit is a 5 or a 0 / when counting in 10s, the last digit is a 0
- **Sharing** – find half of a group by sharing

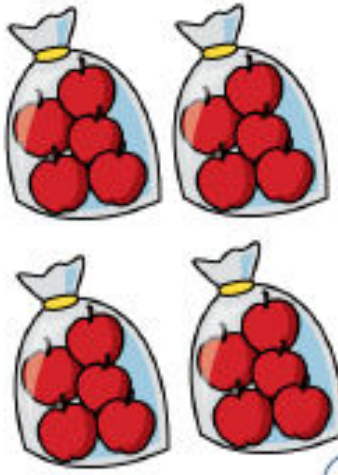
(N.B.
Children do not need to record number sentences using the symbols in Year 1. Develop the vocabulary by encouraging children to explain what they are doing) Include money examples double and half.

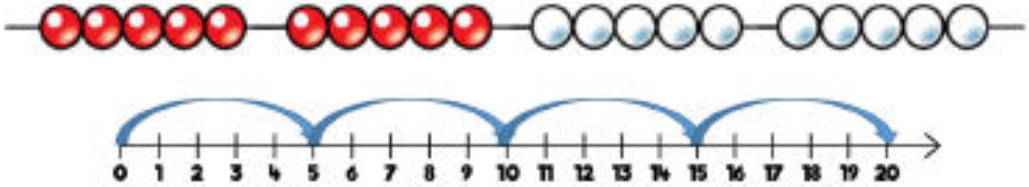
Mental Jotting with Representations



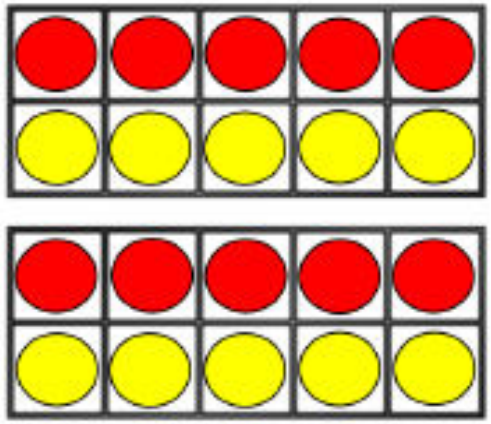
Skill: Solve 1-step problems using multiplication

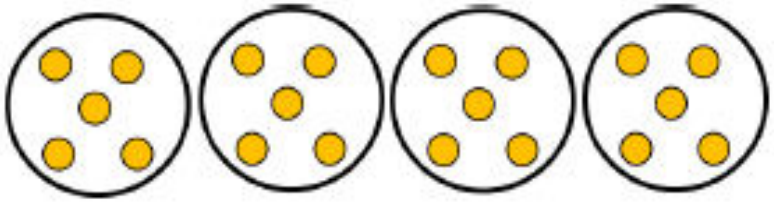
Year: 1/2

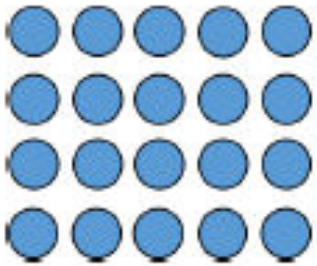




One bag holds 5 apples.
How many apples do 4 bags hold?







$5 + 5 + 5 + 5 = 20$

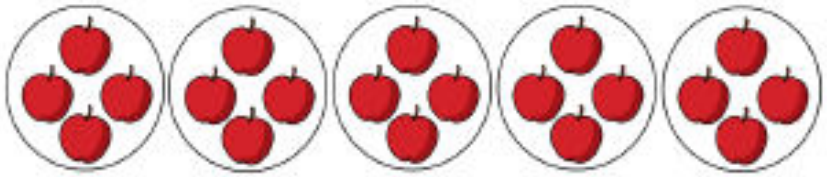
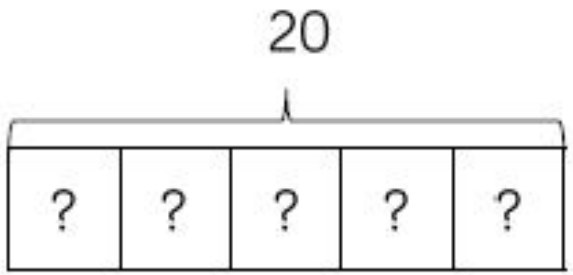
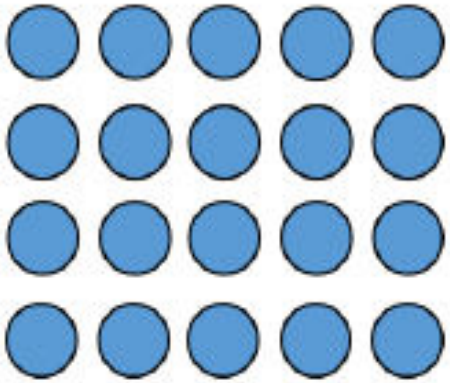
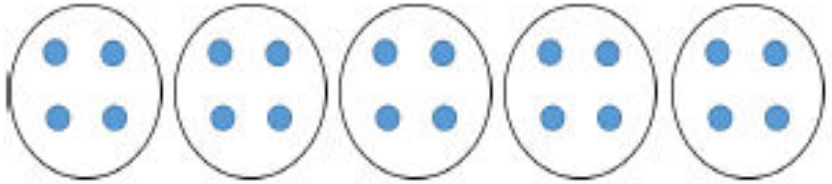
$4 \times 5 = 20$

$5 \times 4 = 20$

Children represent multiplication as repeated addition in many different ways.

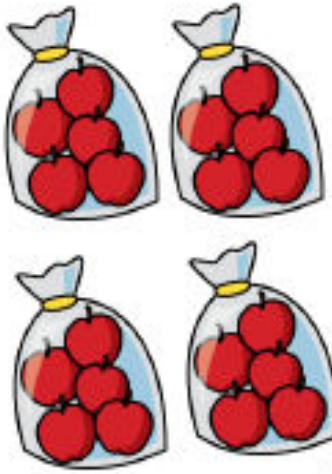
In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record multiplication formally.

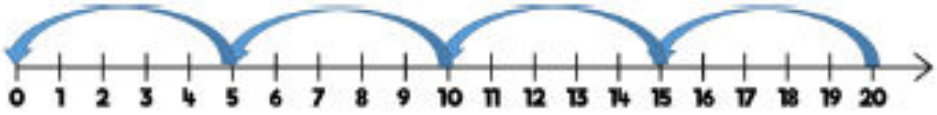
In Year 2, children are introduced to the multiplication symbol.

Skill: Solve 1-step problems using multiplication (sharing)	Year: 1/2
  There are 20 apples altogether. They are shared equally between 5 bags. How many apples are in each bag?   $20 \div 5 = 4$	Children solve problems by sharing amounts into equal groups. In Year 1, children use concrete and pictorial representations to solve problems. They are not expected to record division formally. In Year 2, children are introduced to the division symbol.

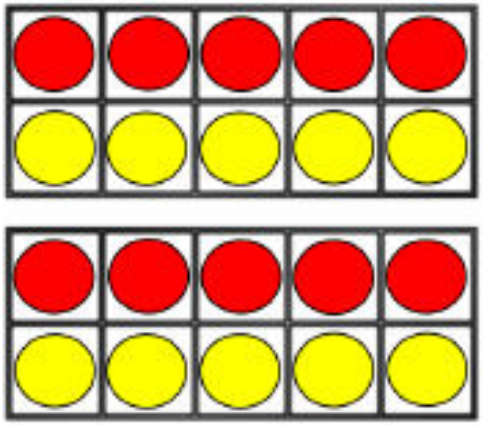
Skill: Solve 1-step problems using division (grouping)

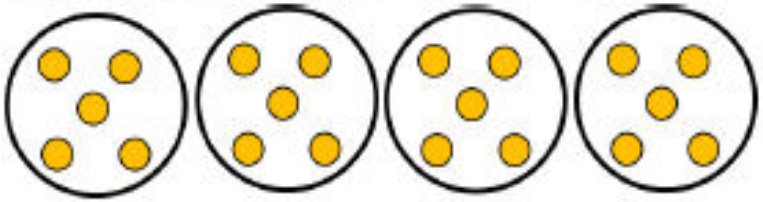
Year: 1/2

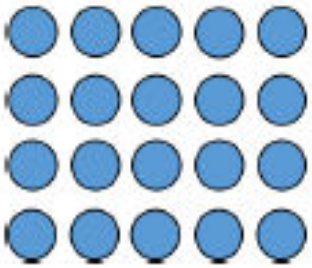




There are 20 apples altogether.
They are put in bags of 5.
How many bags are there?







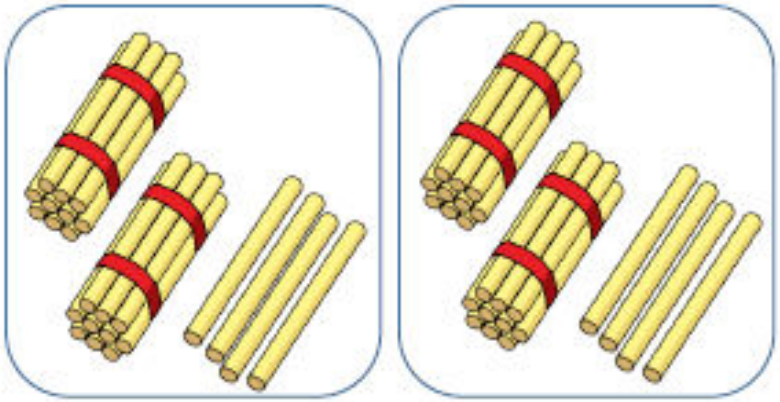
$20 \div 5 = 4$

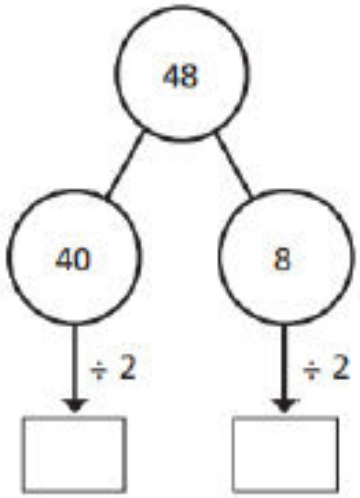
Children solve problems by grouping and counting the number of groups. Grouping encourages children to count in multiples and links to repeated subtraction on a number line. They can use concrete representations in fixed groups such as number shapes which helps to show the link between multiplication and division.

Skill: Divide 2-digits by 1-digit (sharing with no exchange)

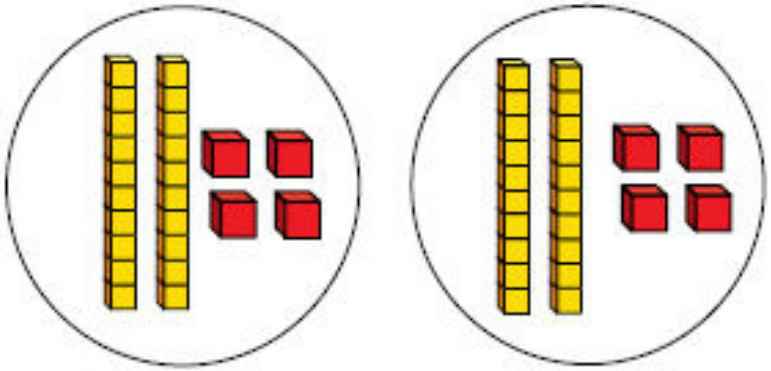
Year: 1/2

Tens	Ones
10 10	1 1 1 1
10 10	1 1 1 1





$$48 \div 2 = 24$$



When dividing larger numbers, children can use manipulatives that allow them to partition into tens and ones.

Straws, Base 10 and place value counters can all be used to share numbers into equal groups.

Part-whole models can provide children with a clear written method that matches the concrete representation.

DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION IN YEAR 2

Objectives

- Count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward (copied from Number and Place Value)
- Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
- Written - calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs.

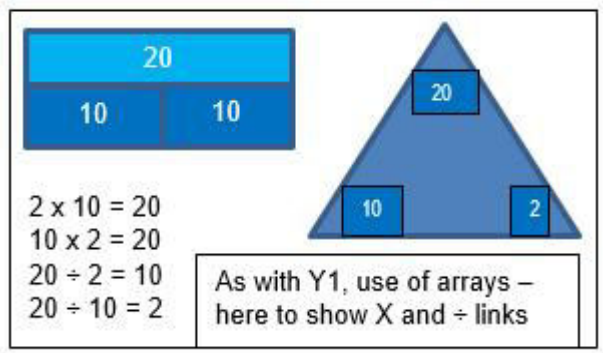
Mental Recall

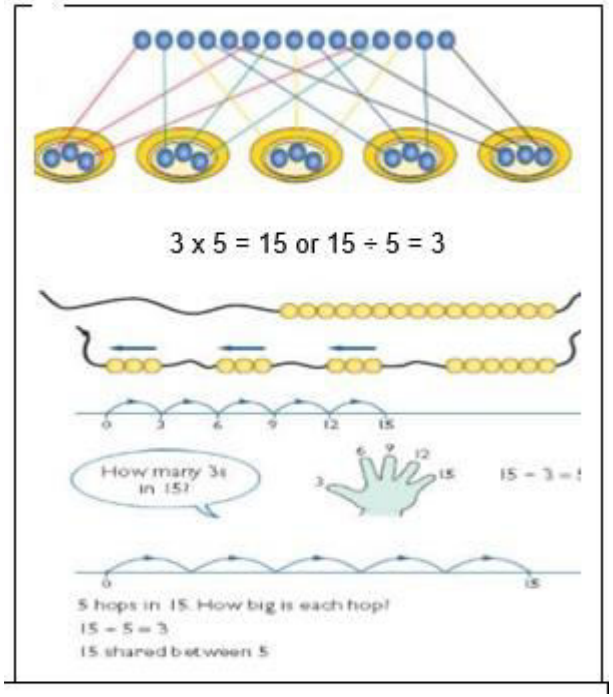
- Know odd and even numbers to 100
- Recall multiplication and corresponding division facts for the 2, 10 and 5 X tables (to the 12 x…)
- Recall doubles of all numbers within 20 – e.g. double **13** = 26 (inc money examples)
- Know halves of numbers within 20 – e.g. half of 32 = **16** (inc money examples)
- Know doubles and corresponding halves of multiples of 10 to 50 – e.g. double 40 = 80 and half of 60 = 30

Strategies

- **Double any multiple of 5** up to and including 50 – e.g. double 35**…**
- **…partition, double and recombine** – e.g. double 45 = double 40 + double 5 = 80 + 10 = 90
- **Find half of an even number – partition, halve, recombine** – e.g. half of 68 = half of 60 and half of 8 = 30 + 4 = 34
- **Halve any multiple of 10 up to and including 100 – partition, halve, recombine**
- **(x by 10 moves the digit one place to the left and needs '0' as a place holder (?)** – e.g. 4 x 10 = 40, so the '4' moves and we need the '0' to make 40…NOT ADD A ZERO!)
- **Use the inverse** – to find missing numbers in number sentences / calculations

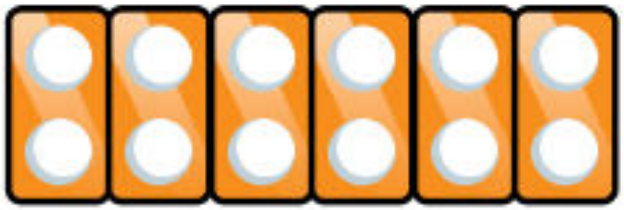
Mental Jotting with Representations

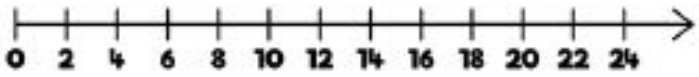




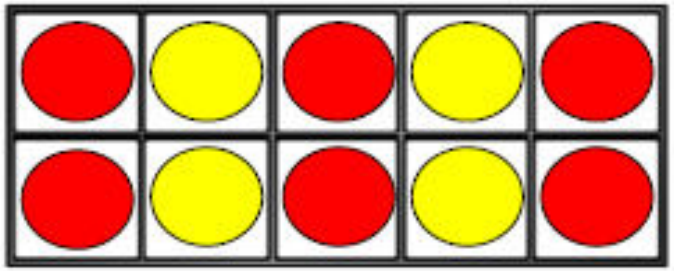
Skill: 2 times table

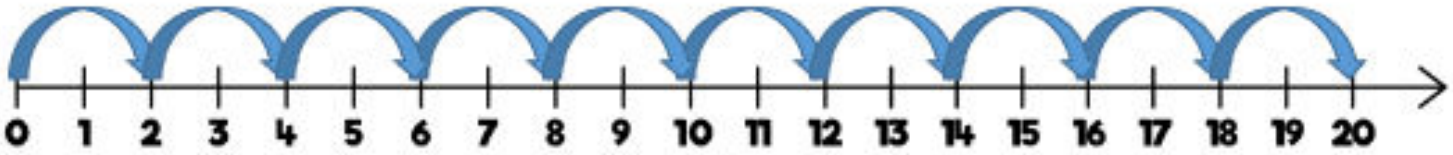
Year: 2





1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50





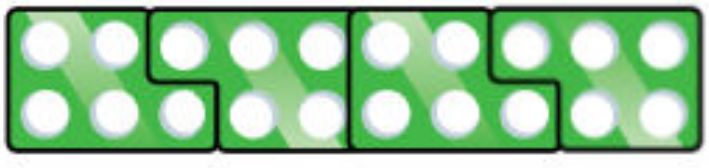
Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.

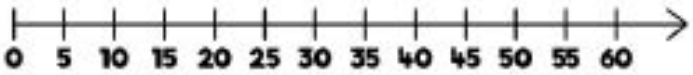
Look for patterns in the two times table, using concrete manipulatives to support. Notice how all the numbers are even and there is a pattern in the ones.

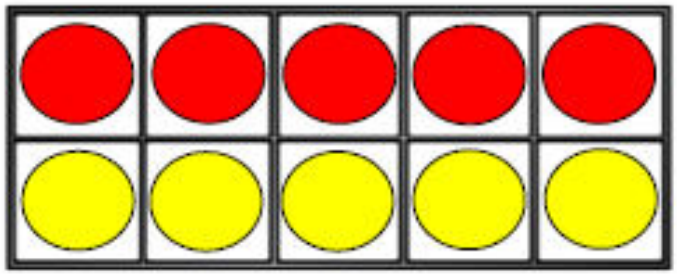
Use different models to develop fluency.

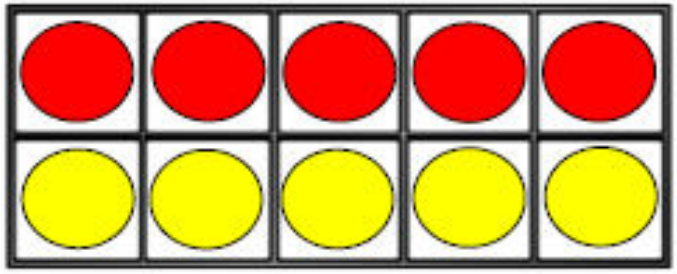
Skill: 5 times table

Year: 2







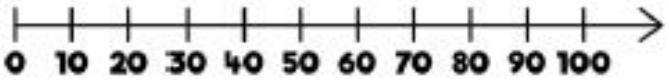


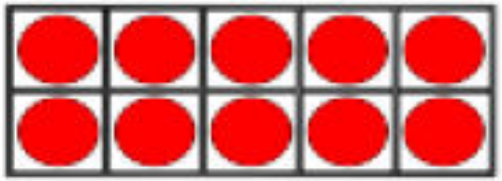
Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.

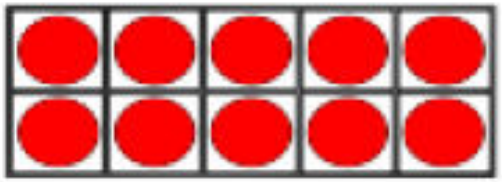
Look for patterns in the five times table, using concrete manipulatives to support. Notice the pattern in the ones as well as highlighting the odd, even, odd, even pattern.

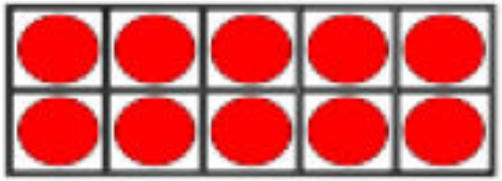
Skill: 10 times table

Year: 2









1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.

Look for patterns in the ten times table, using concrete manipulatives to support. Notice the pattern in the digits- the ones are always 0, and the tens increase by 1 ten each time.

DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION IN YEAR 3

Objectives

- Count from 0 in multiples of 4, 8, 50 and 100 (copied from Number and Place Value).
- Recall and use multiplication and division facts for the 3, 4 and 8 times tables.
- Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods.
- Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.

(N.B.
Children should understand the associativity of multiplication – i.e. that numbers can be moved around and still give the same answer – see example in the 'strategies' section)

(There should also be opportunities to make cross-strand fluency links by scaling up/down using measures – e.g. in recipe examples)

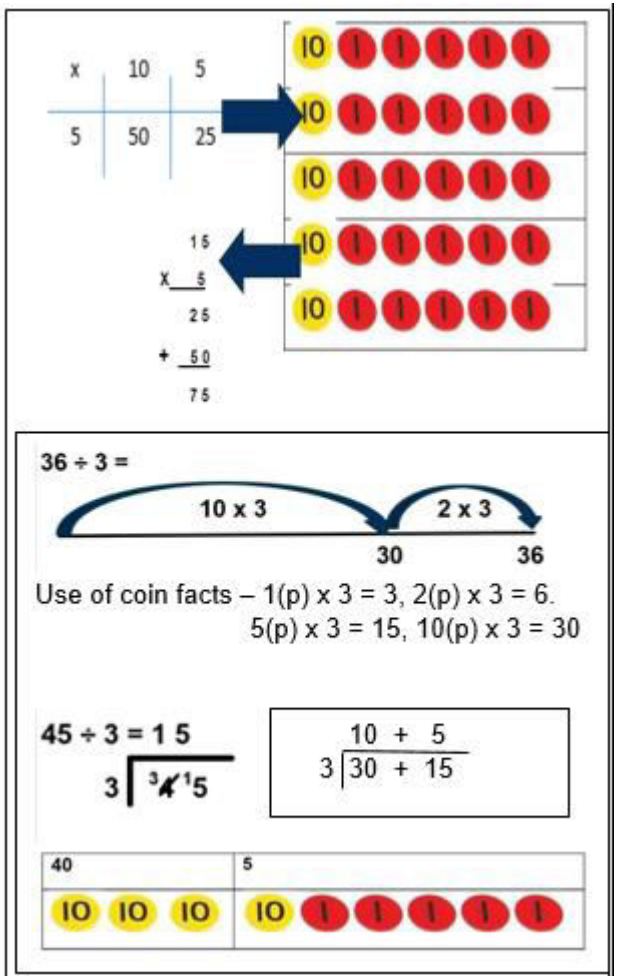
Mental Recall

- Recall multiplication and corresponding division facts for the 2, 10 and 5 X tables (to the 12 x…) (Y2) and now for the 3, 4 and 8 X tables (to the 12 x…)
- Know doubles and halves of all whole numbers – including odd numbers – within 20 – e.g. half of 13 is 6½ (links to fractions)

Strategies

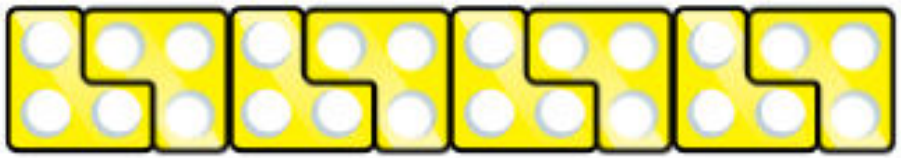
- **Use what you know…** - e.g. if 6 ÷ 3 = 2, then 60 ÷ 3 = 20, 600 ÷ 3 = 200…
- **Partition, double and recombine** – e.g. double 234 = double 200 + double 30 + double 4 = 400 + 60 + 8 = 468 / **including doubles and halves of multiples of 50 to 500**
- **Making links between the times tables ('double-double')** – i.e. doubling a x2 fact gives a x4 fact and doubling a x4 fact gives a x8 fact / 'double-double' a x2 fact gives a x8 fact!
- **Associativity or 'push the numbers around'** – e.g. 4 x 12 x 5 is the same as 4 x 5 x 12 = 20 x 12 or 2 x 12 x 10 = 24 x 10 = 240
- **X / ÷ by 10 / 100** – the digits move one/two place(s) to the left or right and we need the '0' to act as a place holder…NOT ADD A ZERO!)

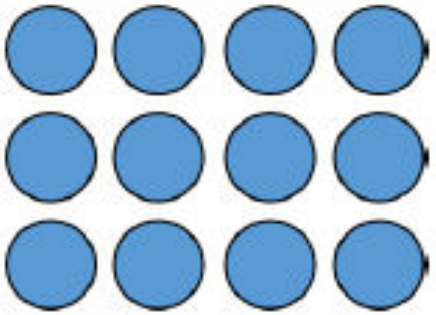
Mental Jotting with Representations



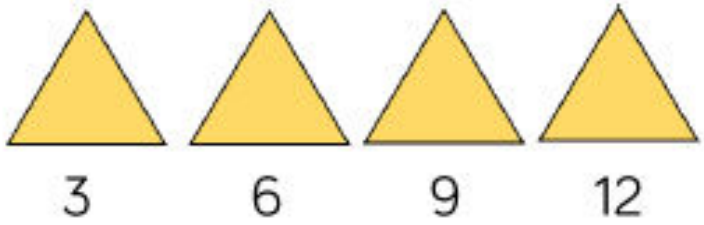
Skill: 3 times table

Year: 3





1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50

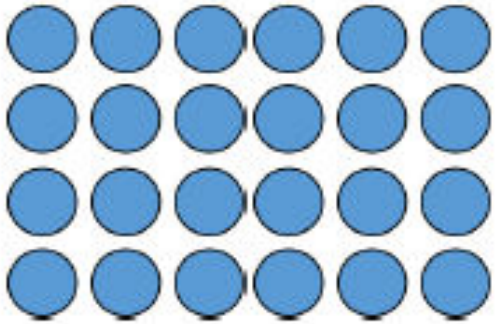


Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.

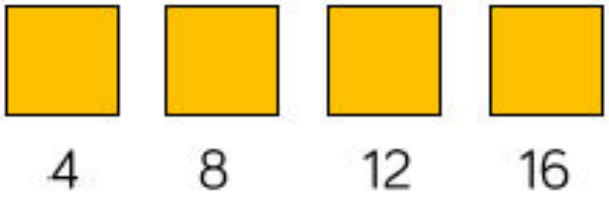
Look for patterns in the three times table, using concrete manipulatives to support. Notice the odd, even, odd, even pattern using number shapes to support. Highlight the pattern in the ones using a hundred square.

Skill: 4 times table

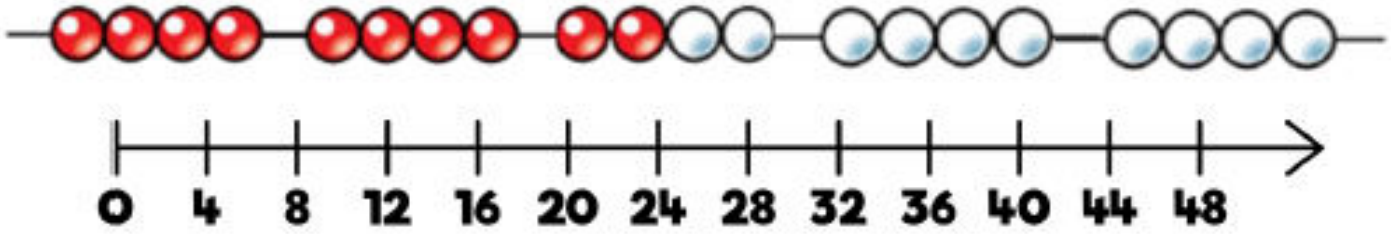
Year: 3



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50



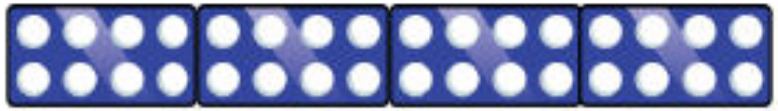
4	8	12	16	20
24	28	32	36	40
44	48	52	56	60



Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the four times table, using manipulatives to support. Make links to the 2 times table, seeing how each multiple is double the twos. Notice the pattern in the ones within each group of five multiples. Highlight that all the multiples are even using number shapes to support.

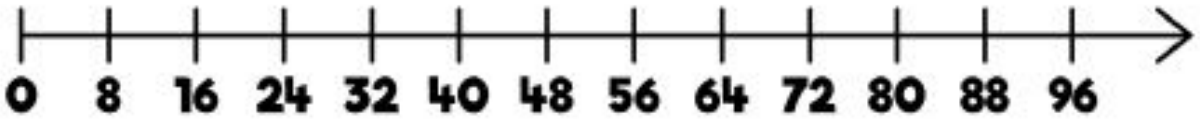
Skill: 8 times table

Year: 3



8	16	24	32	40
48	56	64	72	80

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the eight times table, using manipulatives to support. Make links to the 4 times table, seeing how each multiple is double the fours. Notice the pattern in the ones within each group of five multiples. Highlight that all the multiples are even using number shapes to support.

Skill: Multiply 2-digit numbers by 1-digit numbers

Year: 3/4

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

$$34 \times 5 = 170$$

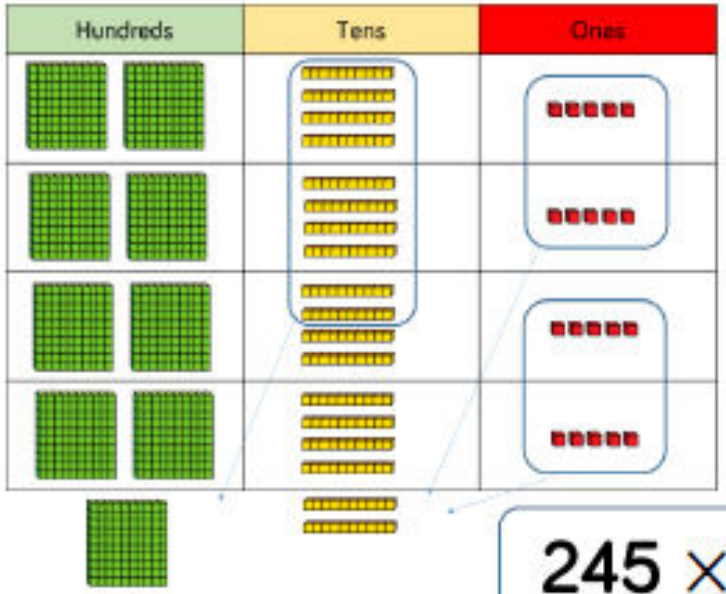
	H	T	O	
		3	4	
×			5	
	1	7	0	
	1	2		

Teachers may decide to first look at the expanded column method before moving on to the short multiplication method.

The place value counters should be used to support the understanding of the method rather than supporting the multiplication, as children should use times table knowledge.

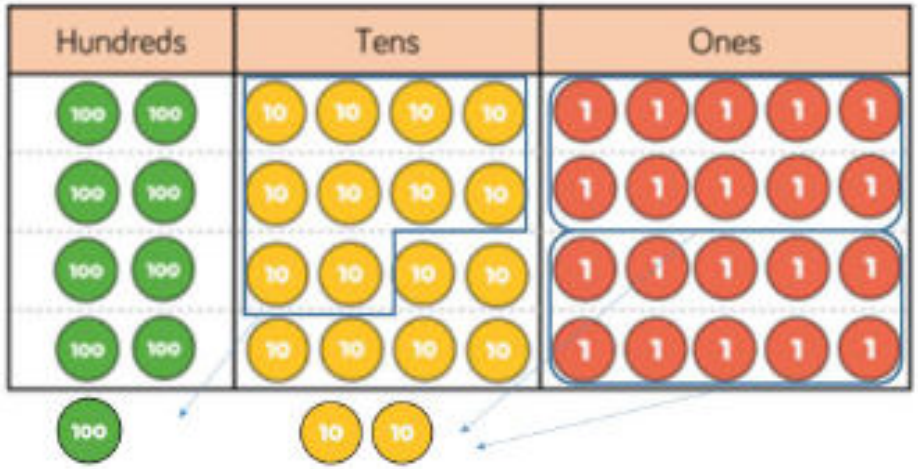
Skill: Multiply 3-digit numbers by 1-digit numbers

Year: 3/4



	H	T	O
	2	4	5
×			4
	9	8	0
	1	2	

$$245 \times 4 = 980$$



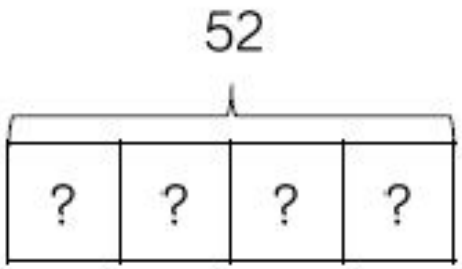
When moving to 3-digit by 1-digit multiplication, encourage children to move towards the short, formal written method.

Base 10 and place value counters continue to support the understanding of the written method.

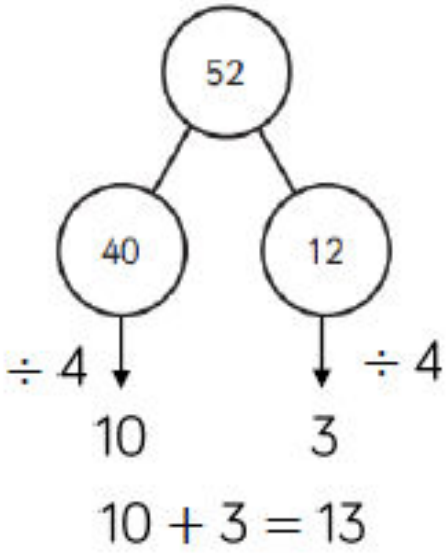
Limit the number of exchanges needed in the questions and move children away from resources when multiplying larger numbers.

Skill: Divide 2-digits by 1-digit (sharing with exchange)

Year: 3/4



$$52 \div 4 = 13$$



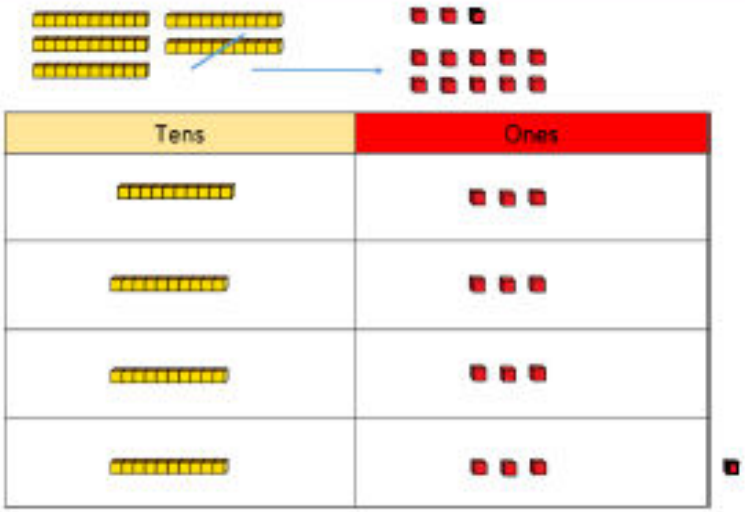
$$10 + 3 = 13$$

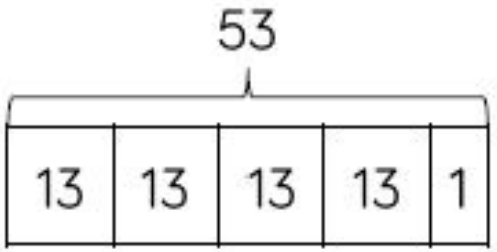
When dividing numbers involving an exchange, children can use Base 10 and place value counters to exchange one ten for ten ones.
Children should start with the equipment outside the place value grid before sharing the tens and ones equally between the rows.

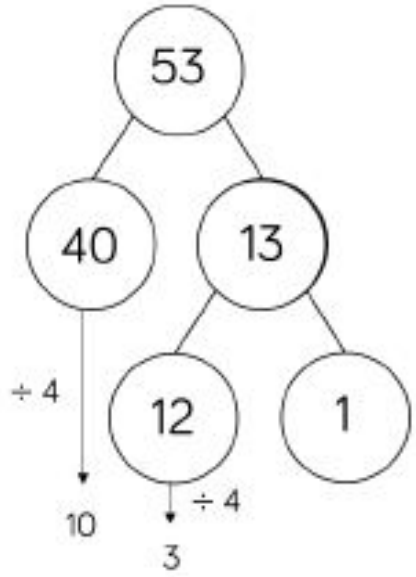
Flexible partitioning in a part-whole model supports this method.

Skill: Divide 2-digits by 1-digit (sharing with remainders)

Year: 3/4







$$53 \div 4 = 13 \text{ r}1$$

When dividing numbers with remainders, children can use Base 10 and place value counters to exchange one ten for ten ones.
Starting with the equipment outside the place value grid will highlight remainders, as they will be left outside the grid once the equal groups have been made.
Flexible partitioning in a part-whole model supports this method.

DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION IN YEAR 4

Objectives

- Count in multiples of 6, 7, 9, 25 and 1 000 (copied from Number and Place Value).
- Recall multiplication and division facts for multiplication tables up to 12 × 12.
- Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together 3 numbers.
- Recognise and use factor pairs and commutativity in mental calculations.
- Multiply two-digit and three-digit numbers by a one-digit number using formal written layout.
- Solve problems involving multiplying and adding, including using the distributive law to multiply two-digit numbers by 1 digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

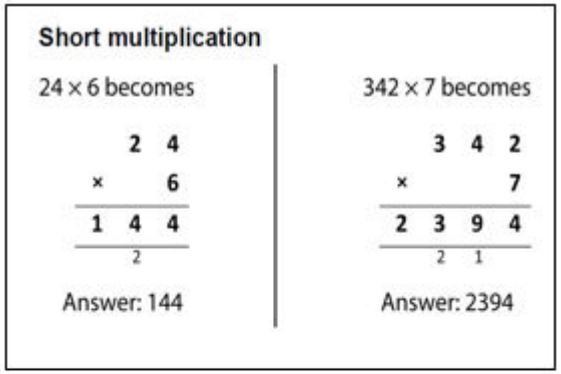
Mental Recall

- Recall multiplication and corresponding division facts for all times tables to 12 x 12.
- Recognise and use factor pairs for known number multiplication facts up to 144 – e.g. the factor pairs of 24 are 1 & 24, 2 & 12, 3 & 8, 4 & 6.
- Doubles and halves of all numbers to 100 – e.g. double 71 is 142 and half of 65 = 32.5.

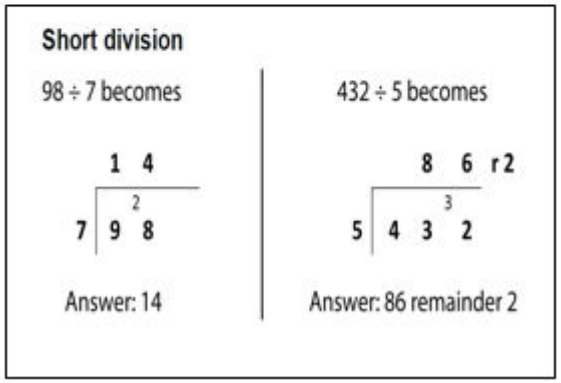
Strategies

- Recall multiplication and corresponding division facts for all times tables to 12 x 12.
- Recognise and use factor pairs for known number multiplication facts up to 144 – e.g. the factor pairs of 24 are 1 & 24, 2 & 12, 3 & 8, 4 & 6.
- Doubles and halves of all numbers to 100 – e.g. double 71 is 142 and half of 65 = 32.5.

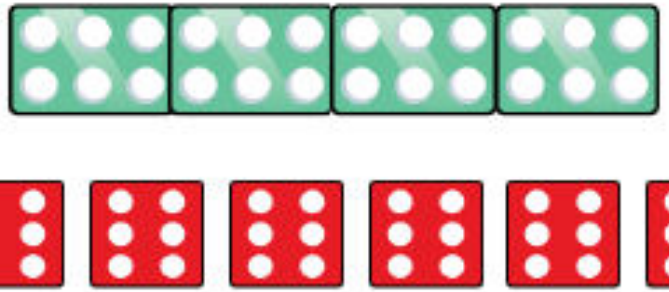
Mental Jotting with Representations



These are the methods that appear in the NC for Mathematics appendix.

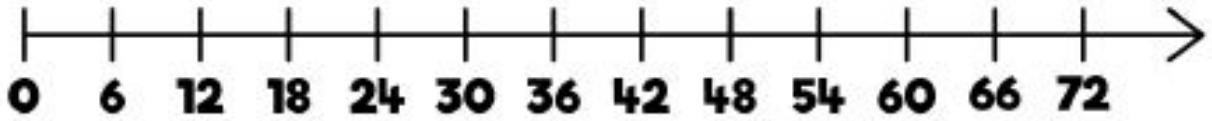


Skill: 6 times table	Year: 4



6	12	18	24	30
36	42	48	54	60
66	72	78	84	90

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the six times table, using manipulatives to support. Make links to the 3 times table, seeing how each multiple is double the threes. Notice the pattern in the ones within each group of five multiples. Highlight that all the multiples are even using number shapes to support.

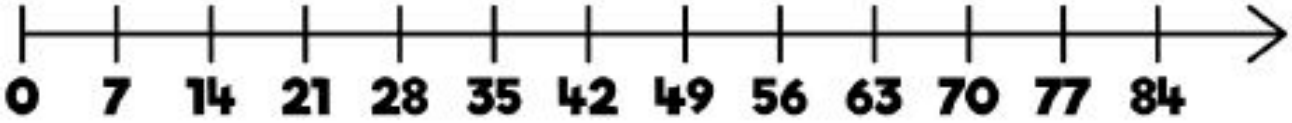
White Rose Maths

Skill: 7 times table

Year: 4

7	14	21	28	35
42	49	56	63	70

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Encourage daily counting in multiples both forwards and backwards, supported by a number line or a hundred square.

The seven times table can be trickier to learn due to the lack of obvious pattern in the numbers, however they already know several facts due to commutativity.

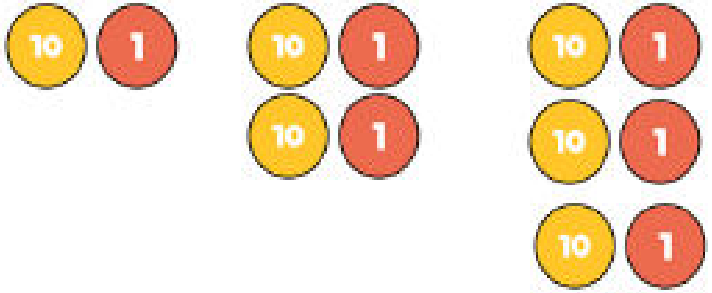
Children can still see the odd, even pattern in the multiples using number shapes to support.

White Rose Maths

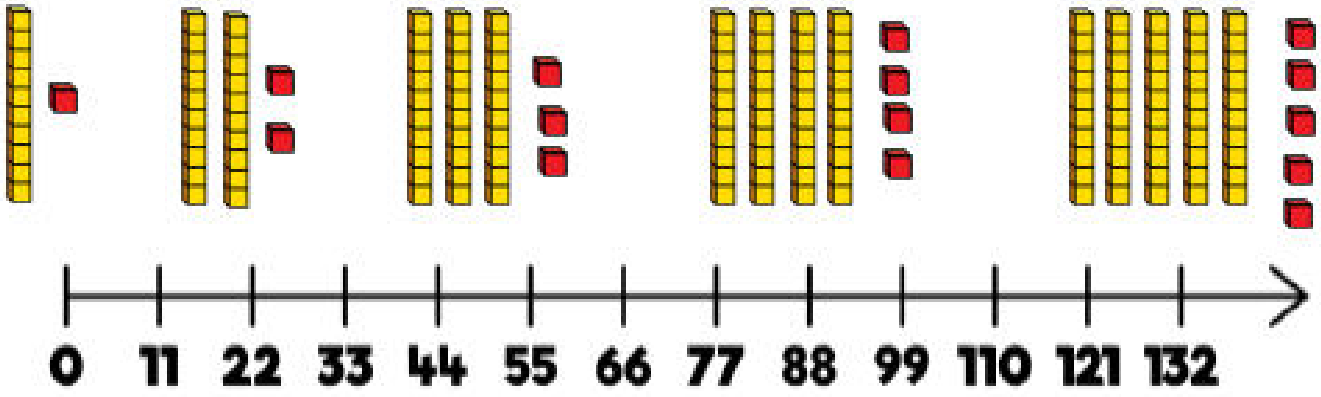
Skill: 11 times table

Year: 4

11	22	33	44	55	66
77	88	99	110	121	132



1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Encourage daily counting in multiples both forwards and backwards. This can be supported using a number line or a hundred square.

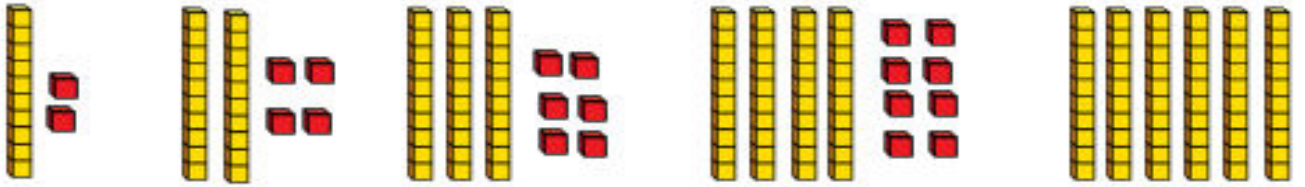
Look for patterns in the eleven times table, using concrete manipulatives to support. Notice the pattern in the tens and ones using the hundred square to support. Also consider the pattern after crossing 100

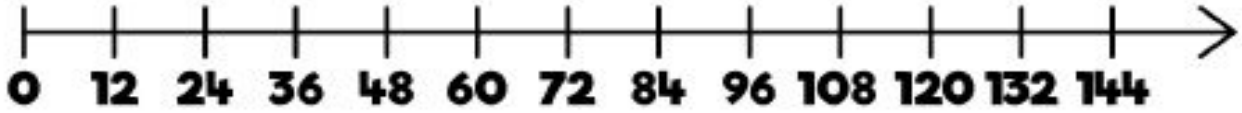
Skill: 12 times table

Year: 4

12	24	36	48	60
72	84	96	108	120
132	144			

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

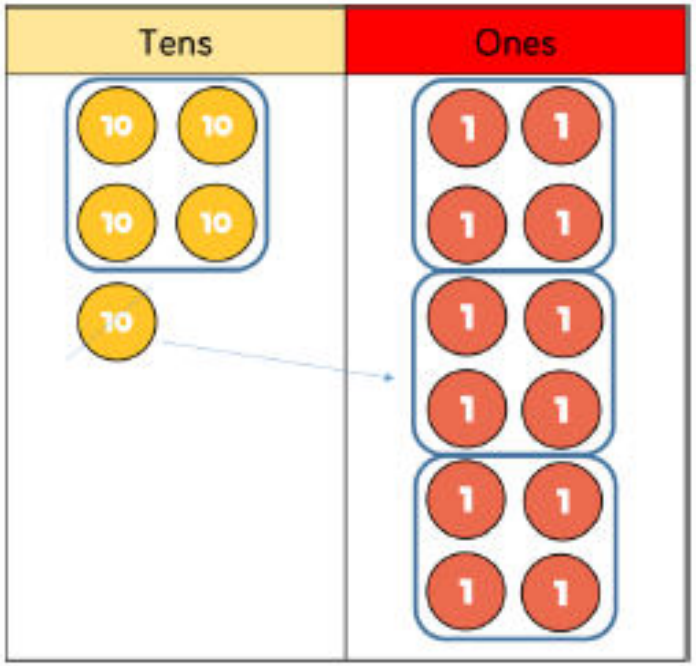




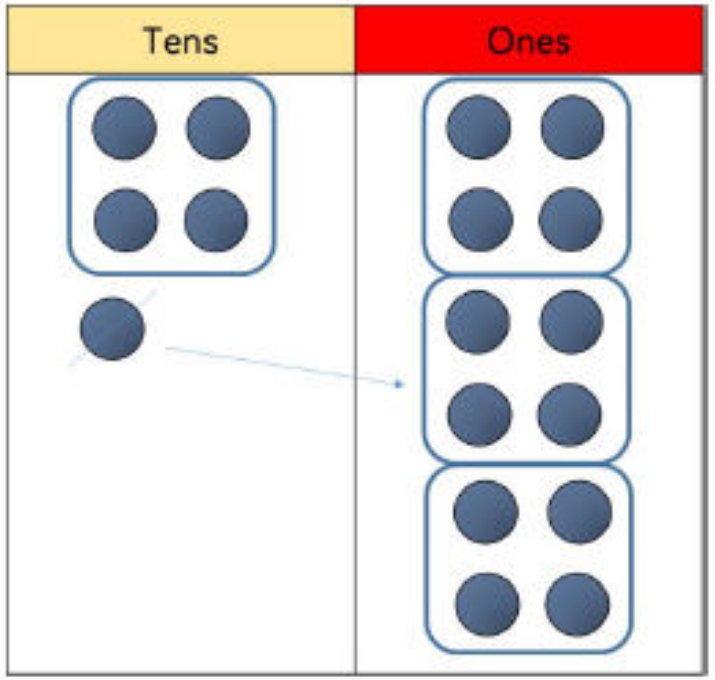
Encourage daily counting in multiples, supported by a number line or a hundred square. Look for patterns in the 12 times table, using manipulatives to support. Make links to the 6 times table, seeing how each multiple is double the sixes. Notice the pattern in the ones within each group of five multiples. The hundred square can support in highlighting this pattern.

Skill: Divide 2-digits by 1-digit (grouping)

Year: 4/5



		1	3	
	4	5	1 2	



$$52 \div 4 = 13$$

When using the short division method, children use grouping. Starting with the largest place value, they group by the divisor.

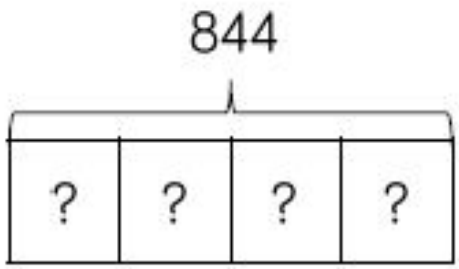
Language is important here. Children should consider 'How many groups of 4 tens can we make?' and 'How many groups of 4 ones can we make?'

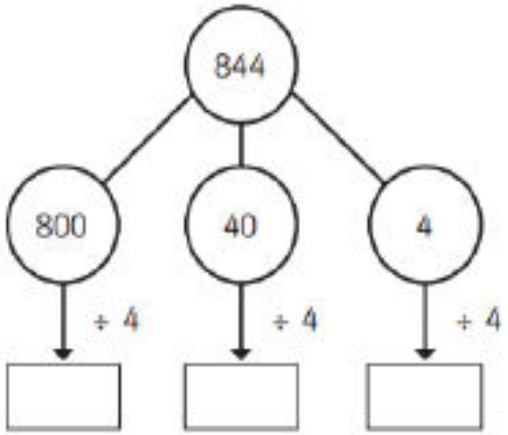
Remainders can also be seen as they are left ungrouped.

Skill: Divide 3-digits by 1-digit (sharing)

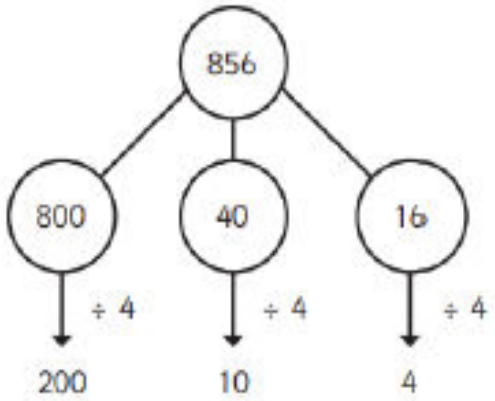
Year: 4

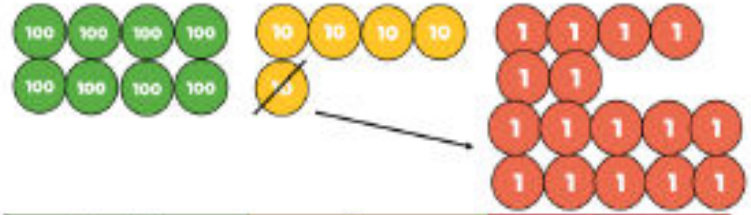
844 ÷ 4 = 211





844 ÷ 4 = 211





Children can continue to use place value counters to share 3-digit numbers into equal groups.
Children should start with the equipment outside the place value grid before sharing the hundreds, tens and ones equally between the rows.
This method can also help to highlight remainders.
Flexible partitioning in a part-whole model supports this method.

DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION IN YEAR 5

Objectives

- Identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers.
- Know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers
- Establish whether a number up to 100 is prime and recall prime numbers up to 19.
- Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers.
- Multiply and divide numbers mentally, drawing upon known facts.
- Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context.
- Multiply and divide whole numbers and those involving decimals by 10, 100 and 1,000.
- Recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}).
- Solve problems involving multiplication and division, including using their knowledge of factors and multiples, squares and cubes.
- Solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign.
- Solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates.

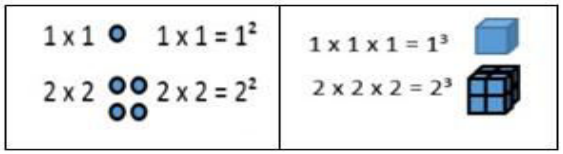
Mental Recall

- Doubles and halves of all numbers within 1000.
- Understand how multiplying and dividing whole numbers and decimals by 10 / 100 / 1000 moves the digits to the left or right and apply this to measures.
- Recall all prime numbers to 19.
- Know all square numbers to 144.

Strategies

- **Multiply by near multiples of 10** – e.g. 29 x 6 = 30 x 6 – 6 = 180 – 6 = 174 (inc money and measures examples)
- **Multiply by 5** – multiply by 10 and halve the answer – e.g. 3200 x 5 = 3200 x 10 and halve the answer = half of 32 000 = 16 000
- **Multiply by 50** – multiply by 100 and halve the answer – e.g. 64 x 50 = half of 64 x 100 = half of 6400 = 3200
- **Multiply by 25** – multiply by 100 and halve the answer twice – e.g. 56 x 25 = a quarter of 56 x 100 = a quarter of 5600 / half of 5600 = 2800 / half of 2800 = 1400
- **Using what I know…** - 35 ÷ 7 = 5, so 3.5 ÷ 7 = 0.5, 0.35 ÷ 7 = 0.05…
- **Doubles and halves of decimal numbers –** if e.g. double 23 is 46, then double 2.3 = 4.6 and double 0.23 = 0.46…
- **Multiply by ½ -** e.g. 72 x ½ = 36 (72 ÷ 2)
- **Multiply with factor pairs –** e.g. 24 x 16 = 2 x 12 x 8 x 2 = 2 x 2 x 8 x 12 = 2 x 2 x 96…

Mental Jotting with Representations



2307 x 8 =

Estimate: 2000 x 8 = 16000

Calculate: (Short multiplication)

```
  2 3 0 7
X       8
---------
1 8 4 5 6
  2   5
```

1431 x 23 = Estimate: 1431 x 20 = 28620

Calculate: (Long multiplication)

```
  1 4 3 1
X   2 3
---------
  4 2 9 3   (1431 x 3)
2 8 6 2 0   (1431 x 20)
---------
3 2 9 1 3
  1 1
```

6496 ÷ 8 = Estimate: 6400 ÷ 8 = 800

Calculate: (Short division)

```
      8 1 2
    ---------
8 | 6 4 9 1 6
```

432 ÷ 5 =

Estimate: 400 ÷ 5 = 80

Calculate (short division)

432 ÷ 5 becomes…

```
      8  6  r 2
    ------------
5 | 4  3  1 2
```

Answer: 86 remainder 2

N.B.Children need to understand that if this was a word problem they may need to round up to the nearest whole number – e.g. if 432 people go on a camping trip and tents sleep five people, you would need 87 tents or else two people would be 'tent-less'!

Skill: Multiply 4-digit numbers by 1-digit numbers

Year: 5

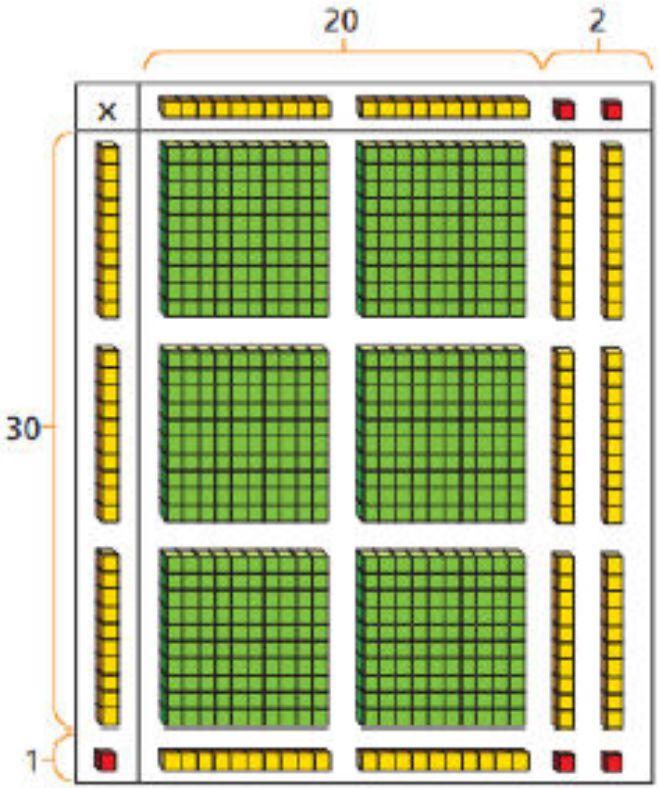
$$1{,}826 \times 3 = 5{,}478$$

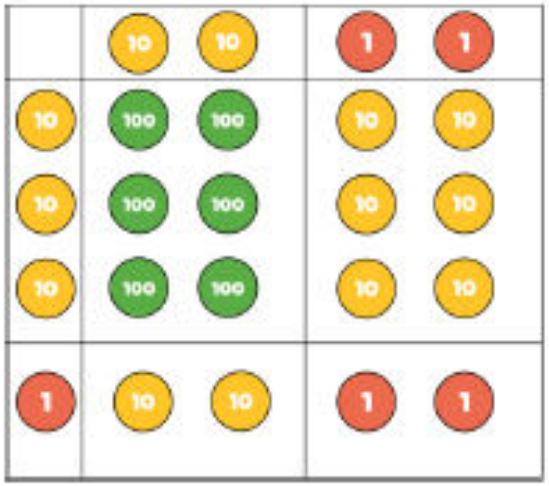
	Th	H	T	O
	1	8	2	6
×				3
	5	4	7	8
	2		1	

When multiplying 4-digit numbers, place value counters are the best manipulative to use to support children in their understanding of the formal written method.
If children are multiplying larger numbers and struggling with their times tables, encourage the use of multiplication grids so children can focus on the use of the written method.

Skill: Multiply 2-digit numbers by 2-digit numbers

Year: 5





×	20	2
30	600	60
1	20	2

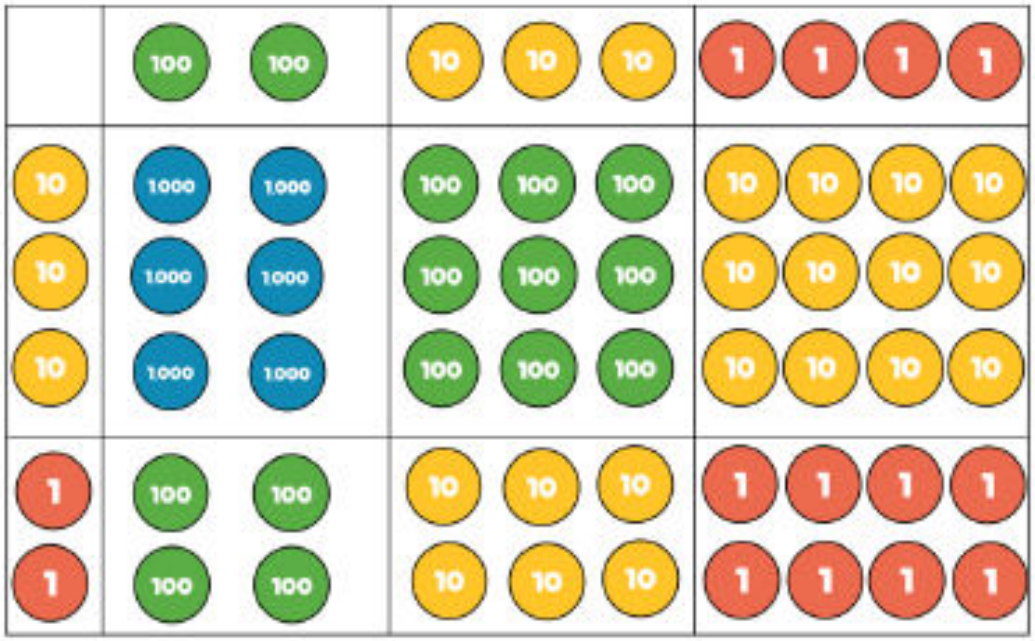
	H	T	O
		2	2
×		3	1
		2	2
	6	6	0
	6	8	2

$$22 \times 31 = 682$$

When multiplying a multi-digit number by 2-digits, use the area model to help children understand the size of the numbers they are using. This links to finding the area of a rectangle by finding the space covered by the Base 10.
The grid method matches the area model as an initial written method before moving on to the formal written multiplication method.

Skill: Multiply 3-digit numbers by 2-digit numbers

Year: 5



Th	H	T	O
	2	3	4
×		3	2
	4	6	8
$^{1}7$	$^{1}0$	2	0
7	4	8	8

×	200	30	4
30	6,000	900	120
2	400	60	8

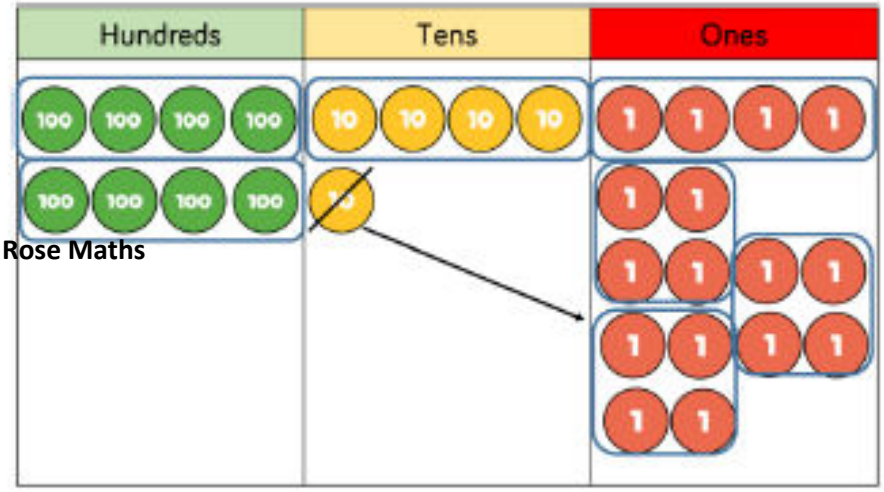
$234 \times 32 = 7{,}488$

Children can continue to use the area model when multiplying 3-digits by 2-digits. Place value counters become more efficient to use but Base 10 can be used to highlight the size of numbers.

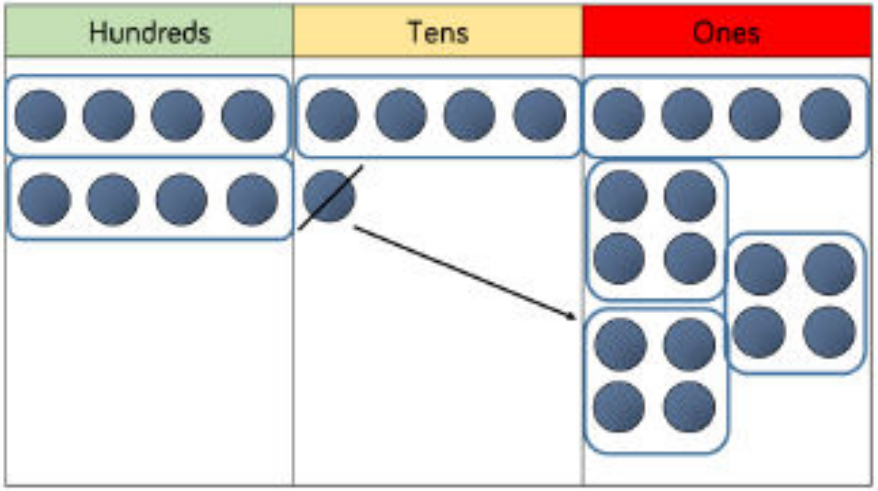
Encourage children to move towards the formal written method, seeing the links with the grid method.

Skill: Divide 3-digits by 1-digit (grouping)

Year: 5



		2	1	4
	4	8	5	16



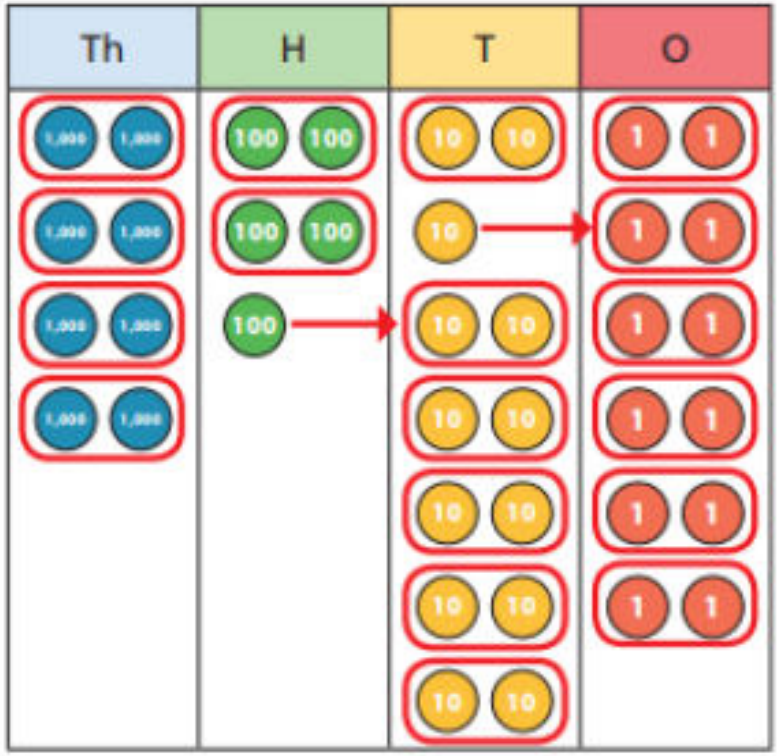
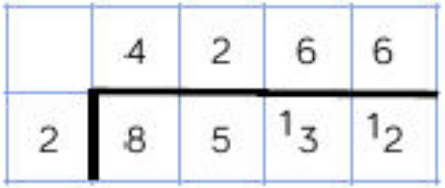
$$856 \div 4 = 214$$

Children can continue to use grouping to support their understanding of short division when dividing a 3-digit number by a 1-digit number.

Place value counters or plain counters can be used on a place value grid to support this understanding. Children can also draw their own counters and group them through a more pictorial method.

White Rose Maths

White Rose Maths

Skill: Divide 4-digits by 1-digit (grouping)	Year: 5
  8,532 ÷ 2 = 4,266	Place value counters or plain counters can be used on a place value grid to support children to divide 4-digits by 1-digit. Children can also draw their own counters and group them through a more pictorial method. Children should be encouraged to move away from the concrete and pictorial when dividing numbers with multiple exchanges.

DEVELOPING UNDERSTANDING OF MULTIPLICATION AND DIVISION IN YEAR 6

Objectives

- 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 four operations.
- Multiply multi-digit numbers up to four digits by a two-digit whole number using the formal written method of long multiplication.
- Divide numbers up to four digits by a two-digit whole number using the formal written method of short division where appropriate for the context.
- Divide numbers up to four 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.

Mental Recall

- Know doubles and halves of all numbers to 10 000 (?)
- Use and apply times table / multiple knowledge for generalisations – e.g. any number that has a digit sum of a multiple of 3 is exactly divisible by 3 – e.g. 72 = 7 + 2 = 9 which is divisible by 3 / 111 636 = 1 + 1 + 1 + 6 + 3 + 6 = 18 which is divisible by 3…

Strategies

- **BIDMAS** – Brackets, Indices, Division, Multiplication, Addition, Subtraction
- **Scaling up / down** – use multiplication/division knowledge to scale up or down depending on the context
- **Multiply and divide decimals by 10/100/1000 & 10 000** - the digits move one/two/three/four place(s) to the left or right and we need the '0' to act as a place holder…NOT ADD A ZERO!)

Mental Jotting with Representations

1243 x 26

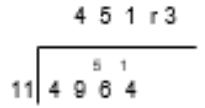
Estimate: 1200 x 30 = 36 000

Calculate (long multiplication)

4956 ÷ 11

Estimate: 5000 ÷ 10 = 500

Calculate (short division)



Answer: 451 r 3 or 451 3/11…

In Year 6, children will…

- Undertake mental calculations with increasingly large numbers and more complex calculations
- Continue to use all the multiplication tables to calculate mathematical statements in order to maintain their fluency
- 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
- Explore the order of operations using brackets; for example, 2 + 1 x 3 = 5 and (2 + 1) x 3 = 9 from BIDMAS – i.e. Brackets, Indices (squares, cubes of numbers), Division, Multiplication, Addition and Subtraction / calculate 900 ÷ (45 × 4) – start with the brackets
- Appreciate that common factors can be related to finding equivalent fractions
- Solve word problems with mixed operations – e.g.

16 Large pizzas cost £8.50 each.

Small pizzas cost £6.75 each.

Five children together buy one large pizza and three small pizzas.

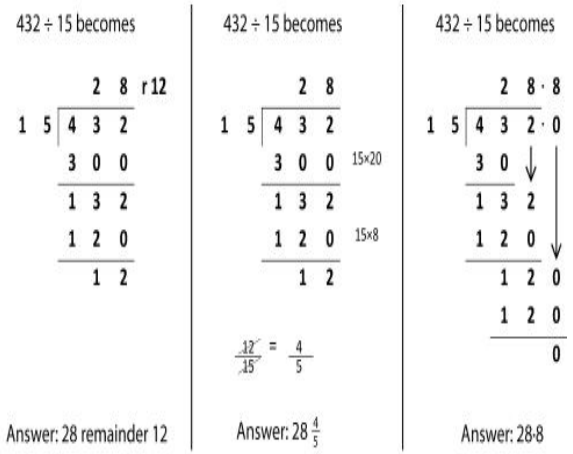
They share the cost equally.

How much does each child pay?

Show your method

£

Long division



As in previous year groups, children should estimate an answer by rounding.

In the cases above, the remainder is displayed as a number, a fraction and as a decimal – so that the r 12 is actually 12 out of 15.

As in Year 5, if the children are answering word problem with a remainder they may need to round up to the nearest whole number.

In KS2 SATs these questions have traditionally involved numbers of tents (see Year 5) or coaches / minibuses for a (school) trip.

Skill: Divide multi digits by 2-digits (short division)

Year: 6

		0	3	6
	12	4	4_{3}	7_{2}

$$432 \div 12 = 36$$

$$7{,}335 \div 15 = 489$$

	0	4	8	9
15	7	7_{3}	13_{3}	13_{5}

15	30	45	60	75	90	105	120	135	150

When children begin to divide up to 4-digits by 2-digits, written methods become the most accurate as concrete and pictorial representations become less effective. Children can write out multiples to support their calculations with larger remainders. Children will also solve problems with remainders where the quotient can be rounded as appropriate.

Skill: Divide multi digits by 2-digits (long division)

Year: 6

$372 \div 15 = 24\ r12$

			2	4	r	1	2
1	5	3	7	2			
	−	3	0	0			
			7	2			
	−		6	0			
			1	2			

$1 \times 15 = 15$
$2 \times 15 = 30$
$3 \times 15 = 45$
$4 \times 15 = 60$
$5 \times 15 = 75$
$10 \times 15 = 150$

When a remainder is left at the end of a calculation, children can either leave it as a remainder or convert it to a fraction.
This will depend on the context of the question.

Children can also answer questions where the quotient needs to be rounded according to the context.

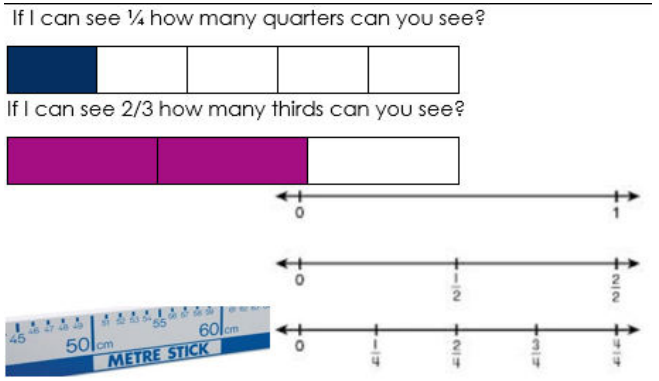
			2	4	$\frac{4}{5}$
1	5	3	7	2	
	−	3	0	0	
			7	2	
	−		6	0	
			1	2	

$372 \div 15 = 24\frac{4}{5}$

DEVELOPING UNDERSTANDING OF FRACTIONS/DECIMALS AND PERCENTAGES IN YEAR 1

Objectives	Examples	Models and Images
• Recognise, find and name a half as one of two equal parts of an object, shape or quantity • Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity	• Children use their knowledge of fractions of shape to find fractions of quantities. • Children should be give practical apparatus to find halves and quarters of quantities within 20. • Record work pictorially.	

DEVELOPING UNDERSTANDING OF FRACTIONS/DECIMALS AND PERCENTAGES IN YEAR 2

Objectives	Examples	Models and Images
• Recognise, find, name and write fractions $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{4}$ and $\frac{3}{4}$ of a length, shape, set of objects or quantity. • Write simple fractions, for example $\frac{1}{2}$ of 6 = 3 and recognise the equivalence of $\frac{2}{4}$ and $\frac{1}{2}$	Children use their knowledge of unit and non-unit fractions of shapes to find fractions of quantities. They relate this to find fractions of a length e.g. 2/4 of 1m = ? • Children need to relate finding a quarter to halving and halving again. *Pupils should count in fractions up to 10, starting from any number and using the1/2 and 2/4 equivalence on the number line (Non Statutory Guidance)*	

DEVELOPING UNDERSTANDING OF FRACTIONS/DECIMALS AND PERCENTAGES IN YEAR 3

Objectives

- Count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one digit numbers or quantities by 10.
- Recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators.
- Recognise and use fractions as numbers: unit fractions and non- unit fractions with small denominators.
- Recognise and show, using diagrams, equivalent fractions with small denominators.
- Add and subtract fractions with the same denominator within one whole.
- Compare and order unit fractions, and fractions with the same denominators.

Examples

- Encourage children to count up and down in tenths.

1 ÷ 10 = 1/10
2 ÷ 10 = 2/10
3 ÷ 10 = 3/10

- Continue the pattern. What do you notice? What's the same? What's different?
- Children can use fractions as an operator e.g.

1/4 of 12 = 12 ÷ 4 = 3

- Children can relate fractions to the division of integers

1 ÷ 4 = ¼
4 x ¼ = 1
3 ÷ 4 = ¾
¾ x 4 = 3 (12/4 or ¾ + ¾ + ¾ + ¾)

- Children need to relate and reason about why their diagrams are equivalent to a half – make connections between the numerator and the denominator

e.g. ½ = 4/ 8

- The numerator will be half of the denominator. Children should be encouraged to make the connection between their multiplication tables and equivalents

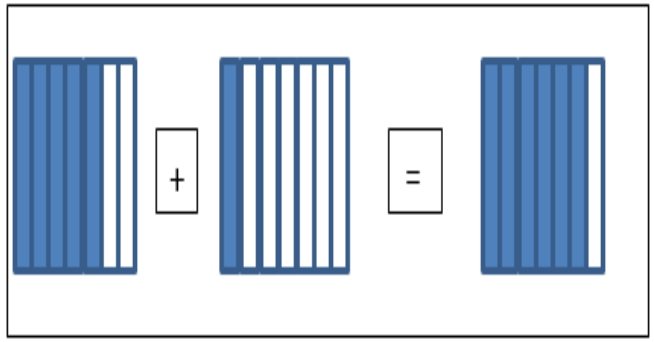
e.g. 1/3 = 3/9 because 3 x 3 = 9.

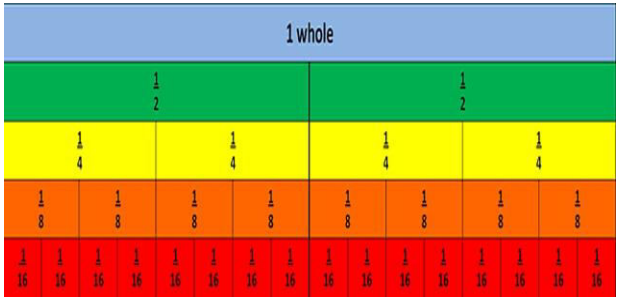
- Children need to use practical resources/visual representations to support the comparison of fractions

e.g. 1/3 > ¼

- Children should also be taught how to order fractions on a number line

Models and Images





DEVELOPING UNDERSTANDING OF FRACTIONS/DECIMALS AND PERCENTAGES IN YEAR 4

Objectives

- Recognise and show using diagrams, families of common equivalent fractions.
- Count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by tenths.
- Solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number.
- Add and subtract fractions with the same denominator.
- Recognise and write decimal equivalents of any number of tenths or hundredths recognise and write decimal equivalents to $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$
- Find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths.
- Round decimals with one decimal place to the nearest whole number.
- Compare numbers with the same number of decimal places up to two decimal places.
- Solve simple measure and money problems involving fractions and decimals to two decimal places

Examples

1 ÷ 100 = 1/100
2 ÷ 100 = 2/100

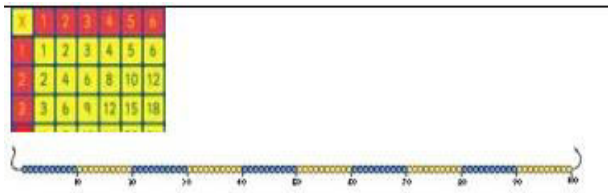
3/7 of 56 = 24
3/10 of 120 = 36
¼ = 12
¾ = __

3/10 + 4/10 = 7/10
9/100 – 7/100 = 2/100

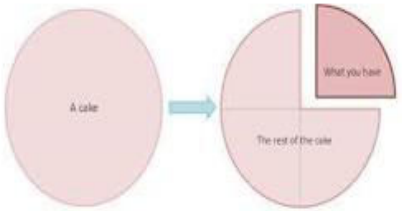
Children can record on a number line equivalents between 1/10 and 0.1 Count on and back in tenths as decimals and relate to counting on/back in 10ths (fractions).

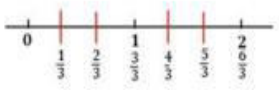
25 ÷ 10 = 2.5
2 ones and 5 tenths
25 ÷ 100 = 0.25
0 ones, 2 tenths and 5 hundredths or 25 hundredths

Models and Images

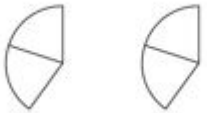


Count back in 1 and 1/10 from 101.





DEVELOPING UNDERSTANDING OF FRACTIONS/DECIMALS AND PERCENTAGES IN YEAR 5

Objectives	Examples	Models and Images
• Add and subtract fractions with the same denominator and denominators that are multiples of the same number. • Multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams.	$\frac{3}{4} - \frac{1}{4} =$ $\frac{1}{10} + \frac{2}{5} =$ $\frac{2}{5} \times 2 =$	 I eat one more piece of this cake. What fraction would be left? 

DEVELOPING UNDERSTANDING OF FRACTIONS/DECIMALS AND PERCENTAGES IN YEAR 6

Objectives	Examples	Models and Images
• 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. • Divide proper fractions by whole numbers.	$\frac{1}{4} \times \frac{1}{2} = \_\_$ $\_\_ \div 2 = \_\_$