St John's Green Primary School
Learn to Live, Live to Learn

We ♥ Maths

Calculation policy

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Rationale

The aim of this document is to provide information on how our school promotes conceptual understanding through a concrete-pictorial-abstract approach. The policy documents a consistent approach using the concrete manipulatives readily available at St John's Green Primary. It also ensures consistency and progression in calculation methods.

Teachers should examine the methods of the previous year group as well as their current class when designing lessons.

The school welcomes a use of a range of manipulatives; however, teachers should refer to this document as starting point for planning learning.

'If learners do not use concrete materials, they cannot understand the mathematics. If they only use concrete materials, they are not doing mathematics'

Gu (2015)

 Bar model diagrams from Herts for Learning

Also adapted from Hamilton Trust

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Year 1 Addition

Using Place value

Count in ones / Counting in tens, *e.g. knowing 45 + 1 or 45 + 10 without counting on in ones*

23 + 10

1	2	3	4	5	6	7	8
11	12	13	14	15	16	17	18
21	22	23	24	25	26	27	
31	32	33	34	35	36	37	
41							

Counting on

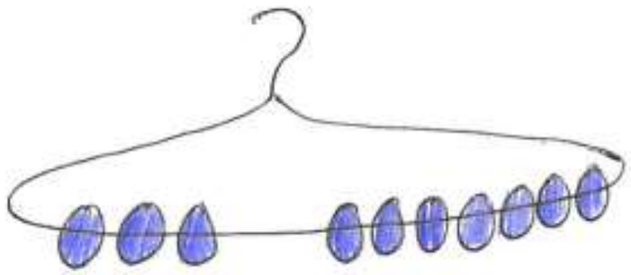
Count on in ones, *e.g. 11 + 2 =* *7 + 4 =*

Count on in tens, *e.g. 45 + 20 as 45, 55, 65*

Using number facts

'Story' of 4, 5, 6, 7, 8 and 9, *e.g. 7 = 7 + 0 or 6 + 1 or 5 + 2 or 4 + 3*

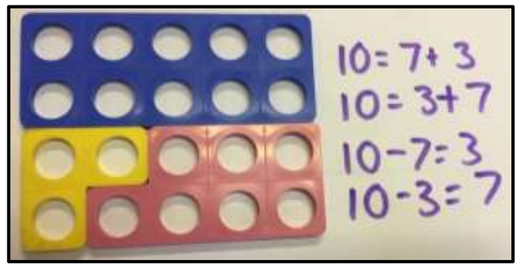
Number bonds to 10, *e.g. 5 + 5, 6 + 4, 7 + 3, 8 + 2, 9 + 1, 10 + 0*



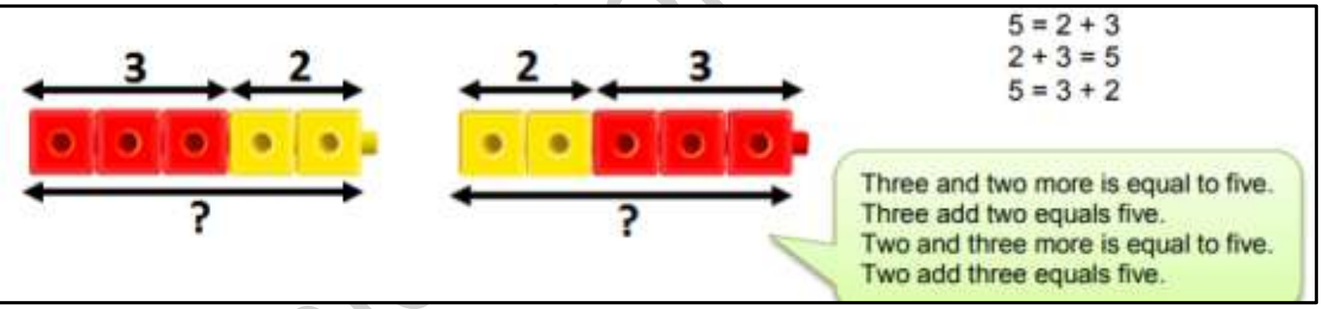
Patterns using known facts, *e.g. 4 + 3 = 7 so we know 24 + 3, 44 + 3, 74 + 3, etc.*

We would also expect year 1 children to have some experience creating groups of ones, using straws or sticks (bundling)

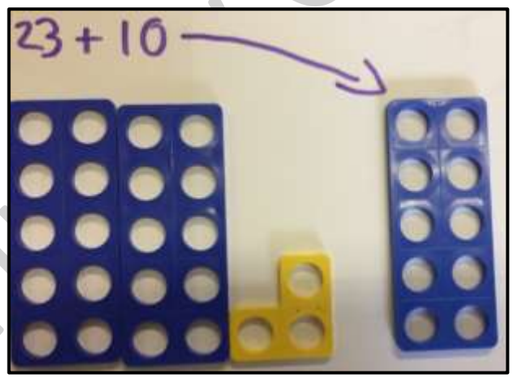
10 = 10 ones = 1 ten



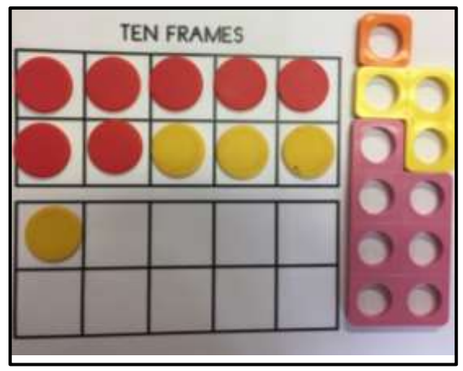
Understanding the relationship between addition and subtraction



Adding 10 to number

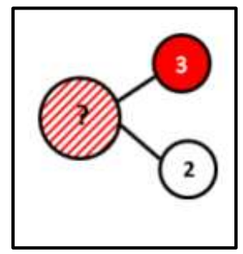


11+4 = 11+3+1

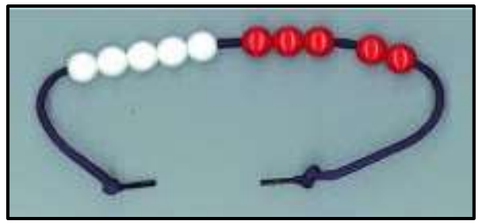


The story of 7

Part – whole model. Objects used as well as numerals



What is 2 more than 3?



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 Bar model diagrams from Herts for Learning

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Year 1 Subtraction

Using Place value

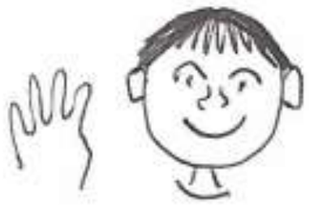
Count back in ones / Count back in tens, *e.g. knowing 53 – 1 or 53 – 10 without counting back in ones*

33 – 10

1	2	3	4	5	6
11	12	13	14	15	16
21	22	23	24	25	26
31	32	33	34	35	

Taking away

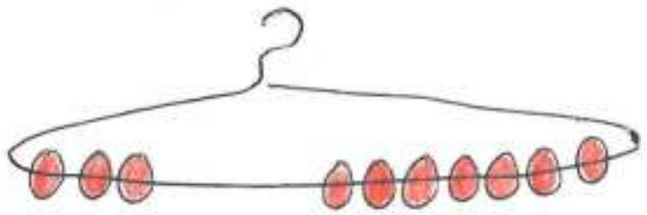
Count back in ones, *e.g. 11 – 3 = 15 – 4 =*



Count back in tens, *e.g. 53 – 20 as 53, 43, 33*

Using number facts

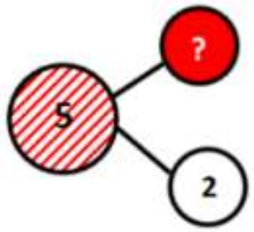
'Story' of 4, 5, 6, 7, 8 and 9, *e.g. 7 – 1 = 6, 7 – 2 = 5, 7 – 3 = 4, etc.*
Number bonds to 10, *e.g. 10 – 1 = 9, 10 – 2 = 8, 10 – 3 = 7, etc.*

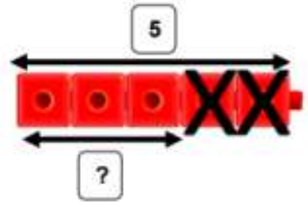


Patterns using known facts, *e.g. 7 – 3 = 4 so we know 27 – 3 =, 47 – 3 =, 77 – 4 =, etc.*

Take away (One quantity is decreased by a provided amount)

Five sweets were on the table. Tom ate two sweets. How many sweets are on the table now?



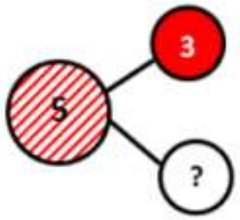


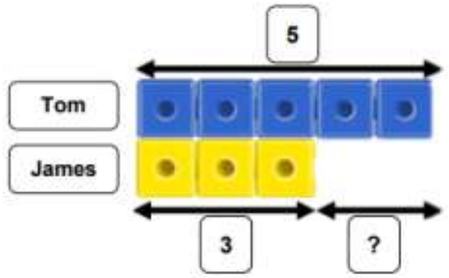
5 - 2 = 3
3 = 5 - 2

Two fewer than five is three.
Three is two fewer than five.

Comparison (Find the difference) *Key model showing the relationship between addition and subtraction

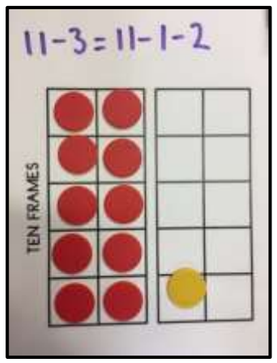
Tom has five sweets and James has three sweets. How many more sweets does Tom have than James?

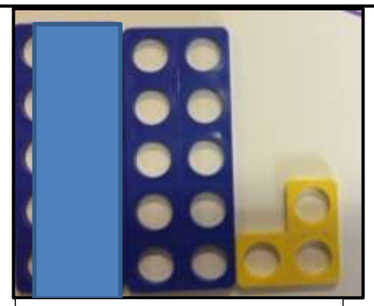




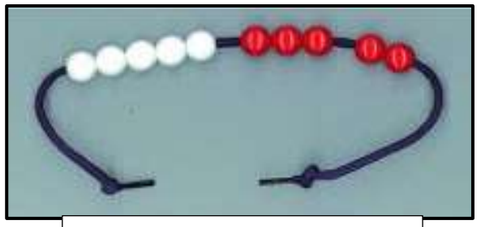
5 - 3 = 2
2 = 5 - 3

Five is two more than three.
Three is two fewer than five.





23 – 10



5 count back 2

5-1

5-2

5-3 etc Subtraction covers may also be used

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 Bar model diagrams from Herts for Learning

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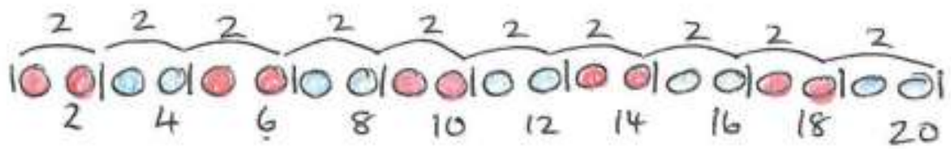
Year 1 Multiplication

Counting in steps ('Clever' counting)

Count in 2s and 10s

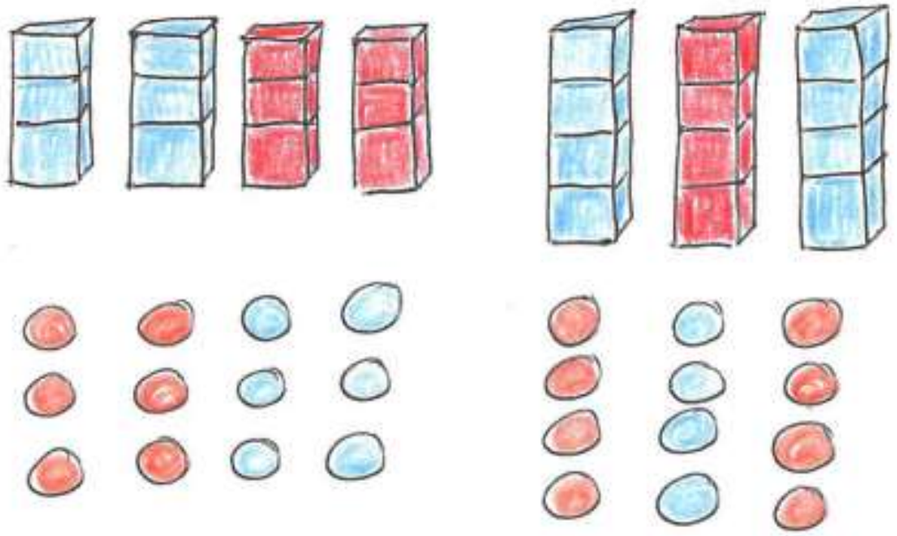


Doubling and halving

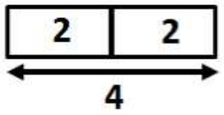
Find doubles to double 6 using fingers

Grouping

Begin to use visual and concrete arrays and 'sets of' objects to find the answers to '3 lots of 4' or '2 lots of 5', etc.



Doubling and halving

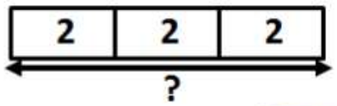


Two and two makes four.
Double two is equal to four.
Half of four is two.

2 + 2 = 4
2 x 2 = 4
4 - 2 - 2 = 0
4 ÷2 = 2

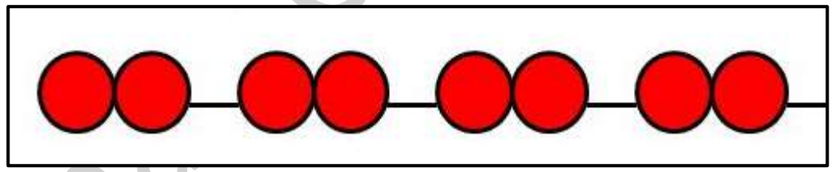
Multiplication – Equal groups

Amber wants to give her three friends two lollies each. How many lollies does she need?

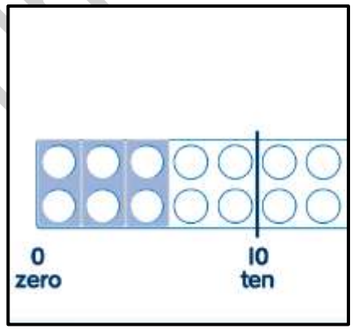


Two and two and two makes six.
Three groups of two make six.

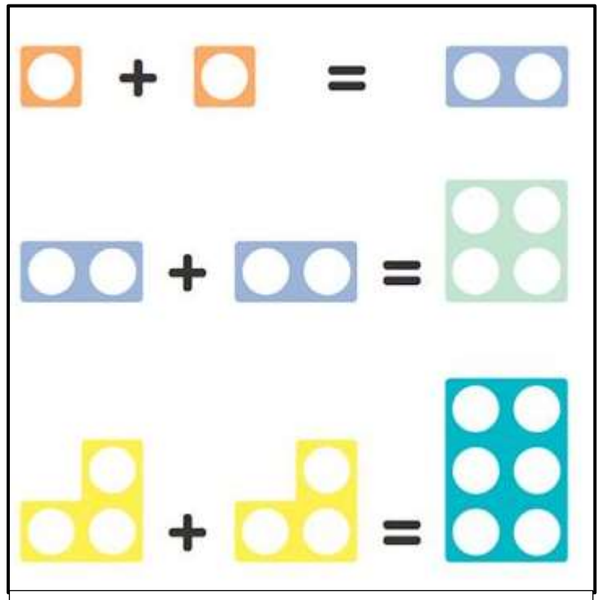
2 + 2 + 2 = 6
3 x 2 = 6



Counting in 2s on a beadstring



3 groups of 2 with a number line



Knowing all doubles to double 6

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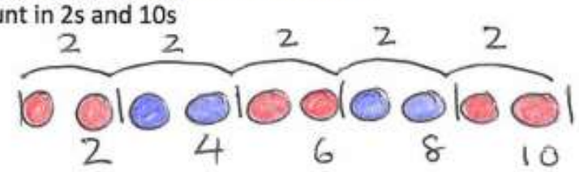
Year 1 Division

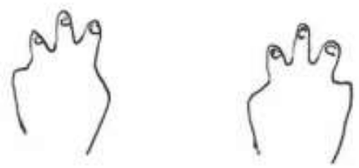
Counting in steps ('Clever' counting)

Count in 2s and 10s



Doubling and halving

Find half of even numbers up to 12 including realising that it is hard to halve an odd number

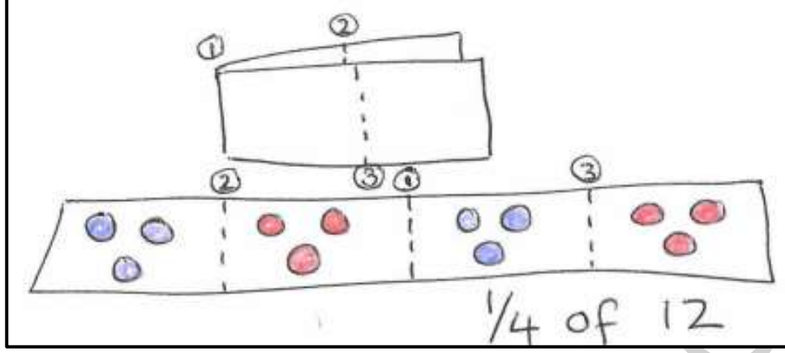


Grouping

Begin to use visual and concrete arrays and 'sets of' objects to find the answers to *'how many towers of 3 can I make with 12 cubes?'*

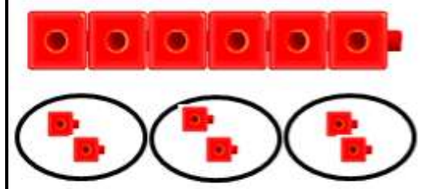
Sharing

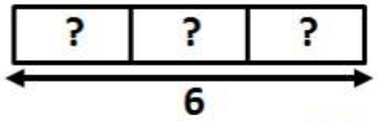
Begin to find half of a quantity using sharing, *e.g. half of 16 cubes by giving one each repeatedly to two children*



Division – Sharing

Amber has six lollies. She wants to share them equally between her three friends. How many lollies does each of her friends get?



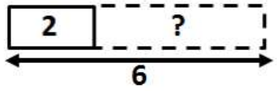


6 ÷ 3 = 2

Six shared into three equal groups is two in each group.

Division – Grouping

Amber has six lollies. She wants to give each of her friends two lollies. How many friends can she give lollies to?



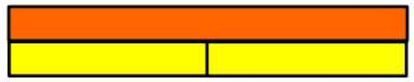
6 ÷ 2 = 3

Six grouped into twos equals three

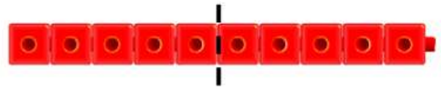
Fractions

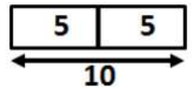
- Recognise, find and name a half as one of two equal parts of an object, shape or quantity
- Recognise, find and namea a quarter as one of four equal parts of an object, shape or quantity

Cuisenaire rods can be used to explorore generalisation in fractions.

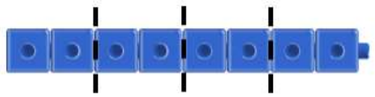


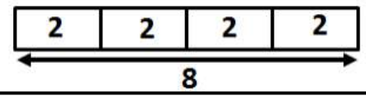
Orange is double the yellow.
Yellow is half of the orange.
Yellow add yellow equals orange.
Orange subtract yellow equals orange.





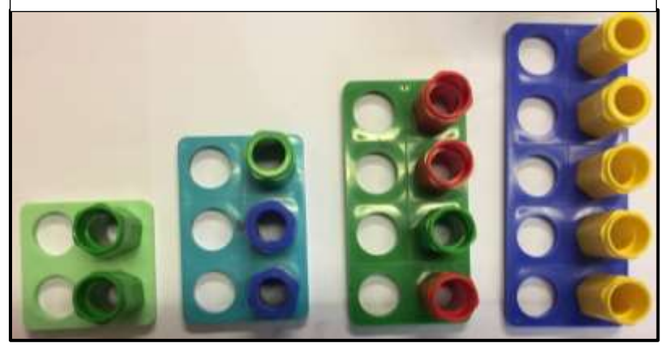
Four reds are equal to brown.
A quarter of brown is one red.
Red add red add red add red equals brown.





How many sets of 2 make 6?

Finding half of even numbers



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 Bar model diagrams from Herts for Learning

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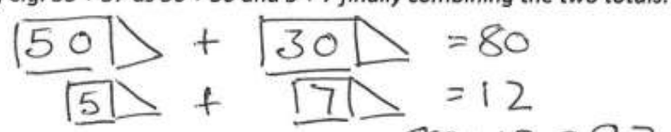
Children should have experience of creating tens by grouping straws/cubes/sticks

Year 2 Addition

Using Place value

Know 1 more or 10 more than any number, *e.g. 1 more than 67 or 10 more than 85*

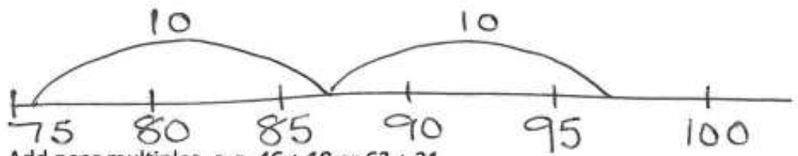
Partitioning, e.g. *55 + 37 as 50 + 30 and 5 + 7 finally combining the two totals: 80 + 12*



Counting on

Add ten and multiples of ten, *e.g. 76 + 20 as 76, 86, 96 or in one hop 76 + 20*

Add two 2-digit numbers by counting on in tens then in ones, *e.g. 55 + 37 as 55 add 30 (85) add 7 (92)*



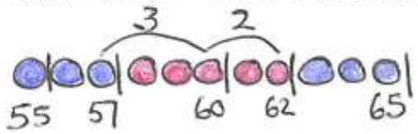
Add near multiples, e.g. *46 + 19 or 63 + 21*

Using number facts

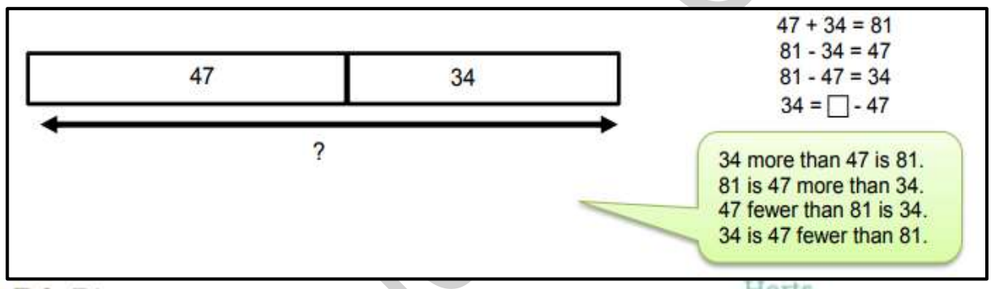
Know pairs of numbers which make the numbers up to and including 10, *e.g. 8 = 4&4, 3&5, 2&6, 1&7 and 10 = 5&5, 4&6, 3&7, 2&8, 1&9, 0&10*

Patterns of known facts, *e.g. 6 + 3 = 9, so we know 36 + 3 = 39, 66 + 3 = 69, 53 + 6 = 59*

Bridging ten, e.g. *57 + 5 as 57 add 3 then add 2 more*



Adding three or more single-digit numbers, spotting bonds to 10 or doubles, *e.g. 6 + 7 + 4 + 2 as 10 + 7 + 2*



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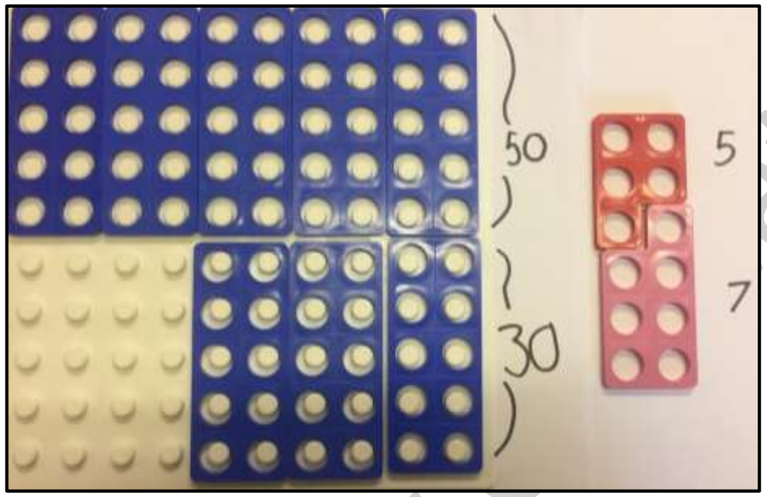
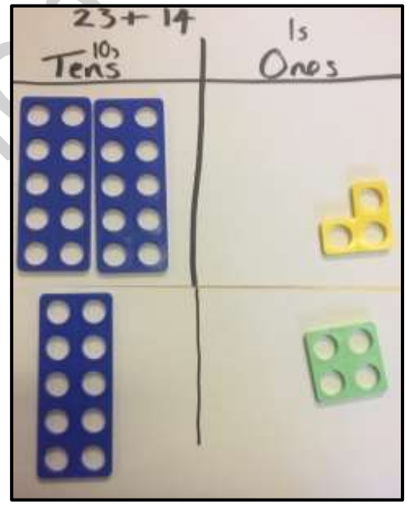
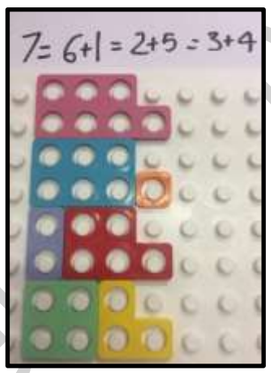
Partitioning into tens and ones to add



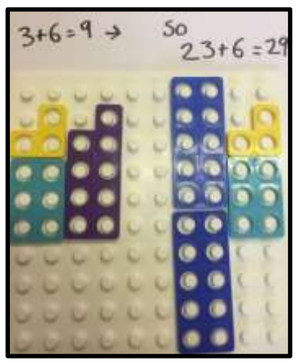


Understanding the relationship between addition and subtraction

Knowing addition facts



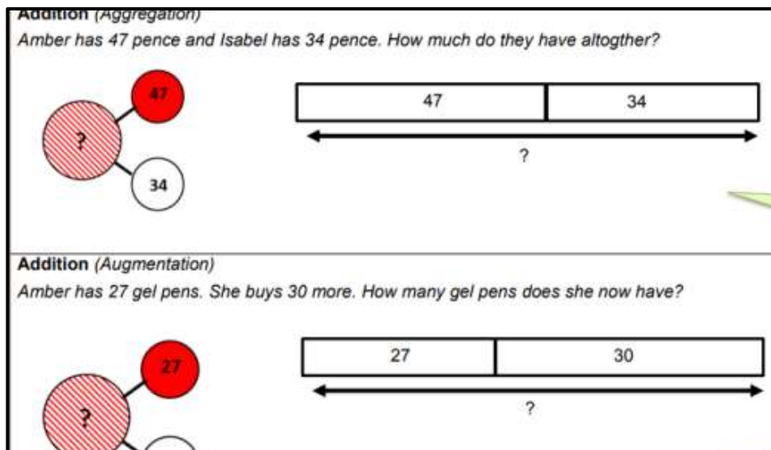
Patterns of known facts



Using addition facts to fill and bridge ten

Addition *(Aggregation)*

Amber has 47 pence and Isabel has 34 pence. How much do they have altogther?



Addition *(Augmentation)*

Amber has 27 gel pens. She buys 30 more. How many gel pens does she now have?

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Year 2 Subtraction

Using Place value

Know 1 less or 10 less than any number, *e.g. 1 less than 74 or 10 less than 82*

Partitioning, *e.g. 55 – 32 as 50 – 30 and 5 – 2 combining the answers: 20 + 3*

50 − 30 = 20

5 − 2 = 3

23

Taking away

Subtract ten and multiples of ten, *e.g. 76 – 20 as 76, 66, 56 or in one hop 76 – 20 = 56*

Subtract two 2-digit numbers by counting back in tens then in ones, *e.g.* 67 – 33 as 67 subtract 30 (37) then count back 3 (34)

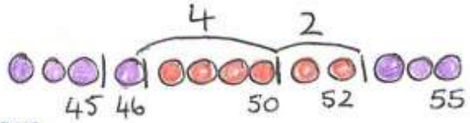
Subtracting near multiples, *e.g. 74 – 21 or 57 – 19*

Using number facts

Know pairs of numbers which make the numbers up to and including 10, *e.g. 10 – 6 = 4, 8 – 3 = 5, 5 – 2 = 3, etc.*

Patterns of known facts, *e.g. 9 – 6 = 3, so we know 39 – 6 = 33, 69 – 6 = 63, 89 – 6 = 83*

Bridge ten, *e.g. 52 – 6 as 52 subtract 2 then subtract 4 more*

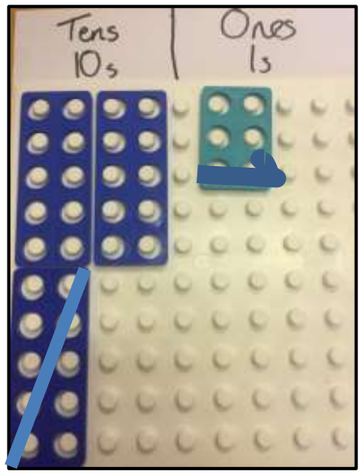


Counting up

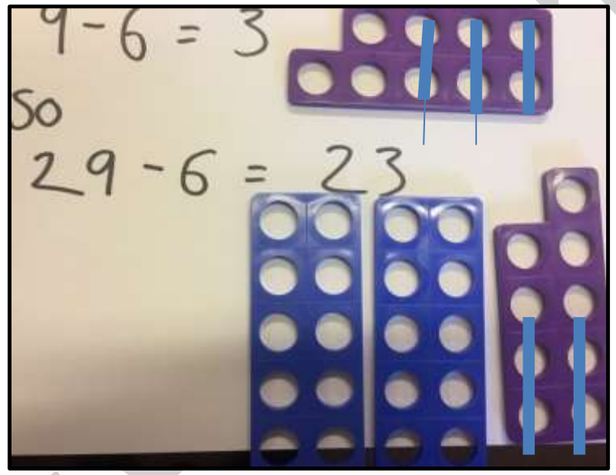
Find a difference between two numbers on a line, *e.g. 51 – 47*

36 – 12

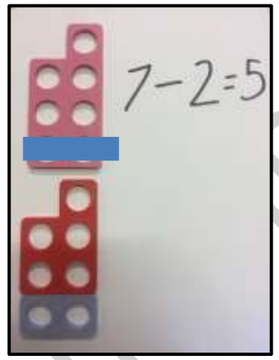
Using place value



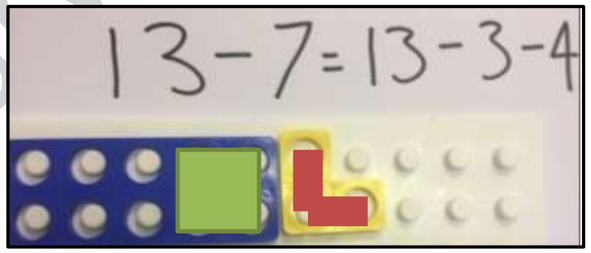
Using number facts



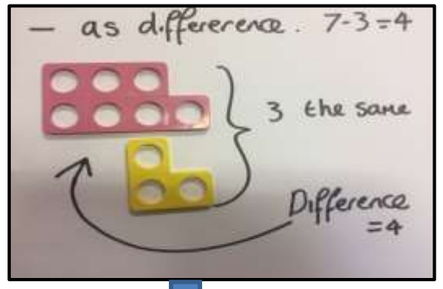
Knowing number facts to 10



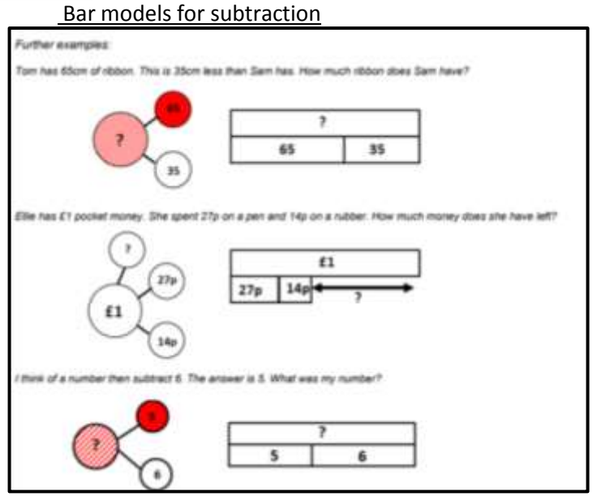
Using known facts for bridging ten

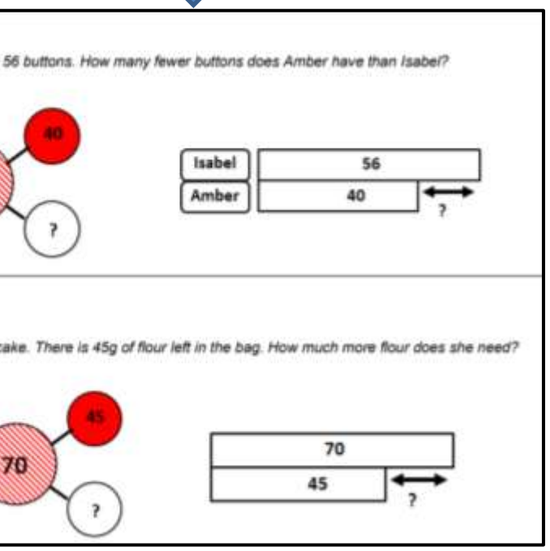


Subtraction as difference (counting up)



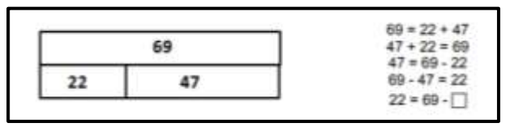
Bar models for subtraction





The bar model can be used to explore the relationship between addition and subtraction.

It also shows that addition is commutative (can be done in any order) but subtraction is not.



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Bar model diagrams from Herts for Learning

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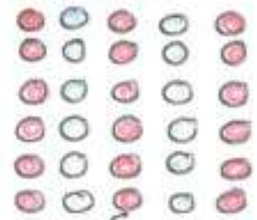
Year 2 Multiplication

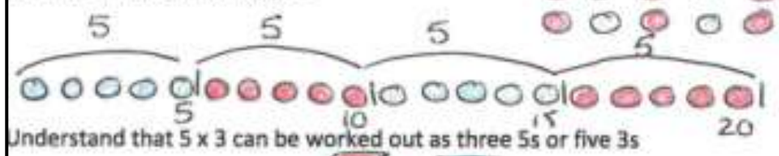
Counting in steps ('Clever' counting)
Count in 2s, 5s and 10s

Begin to count in 3s

Doubling and halving
Begin to know doubles of multiples of 5 to 100, *e.g. double 35 is 70*

Grouping
Use arrays to find answers to multiplication and relate to 'clever' counting, *e.g. 3 x 4 as three lots of four things and 6 x 5 as six steps in the 5s count as well as six lots of five*





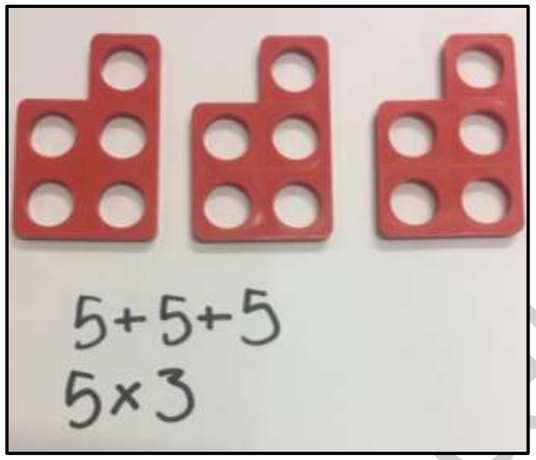
Understand that 5 x 3 can be worked out as three 5s or five 3s

Using number facts
Know doubles to double 20

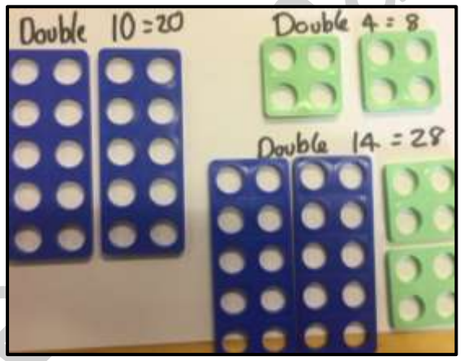
Double 7 = 14

Start learning 2x, 5x, 10x tables, relating these to 'Clever counting' in 2s, 5s, and 10s, *e.g. 5 x 10 = 50, and 10, 20, 30, 40, 50 is five steps in the tens count*

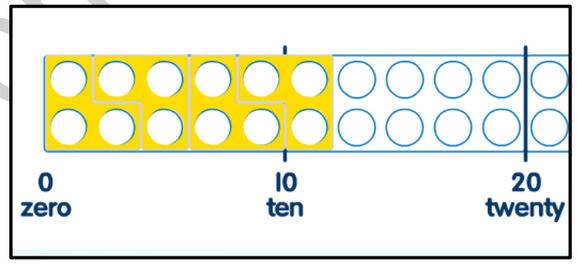
Multiplication as repeated addition



Knowing doubles to double 20

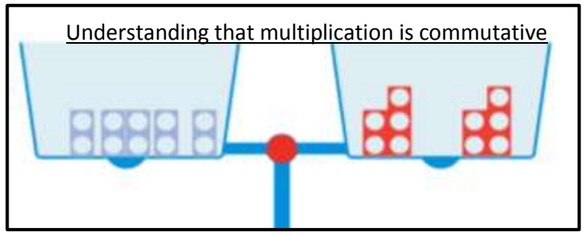


4 groups of 3 using repeated addition and a number line

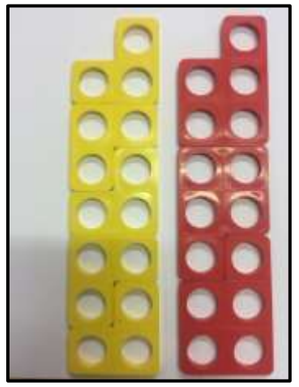


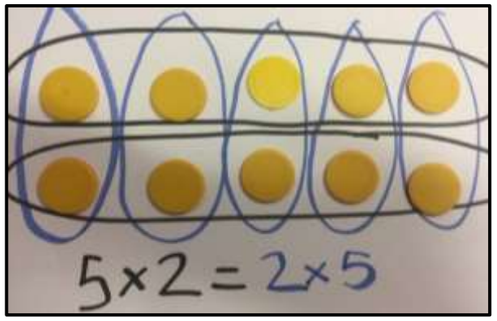
Understanding the commutative law

Understanding that multiplication is commutative

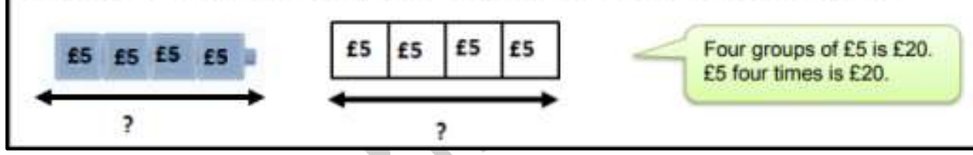


Understanding the commutative law





Multiplication - Equal groups
(It is important that children start to understand unitisation at this point)
James buys four tickets for the football match. Each ticket costs £5. How much does he spend?



£5 + £5 + £5 + £5 = £20
4 x £5 = £20

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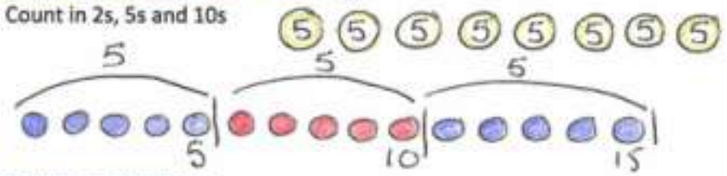
Year 2 Division

Counting in steps ('Clever' counting)

Count in 2s, 5s and 10s



Doubling and halving

Find half of numbers up to 40, including realising that half of an odd number gives a remainder of 1 or an answer containing a ½

Begin to know half of multiples of 10 to 100, *e.g. half of 70 is 35*

Grouping

Relate division to multiplication by using arrays or towers of cubes to find answers to division, *e.g. how many towers of five cubes can I make from 20 cubes as ☐ x 5 = 20 and also as 20 ÷ 5 = ?*

Relate to division to 'clever' counting and hence to multiplication, *e.g. how many 5s do I count to get to 20?*

Sharing

Begin to find half or a quarter of a quantity using sharing, *e.g. ¼ of 16 cubes by sorting the cubes into four piles*

Find ¼, ½, ¾ of small quantities

Children learn that division is not commutative

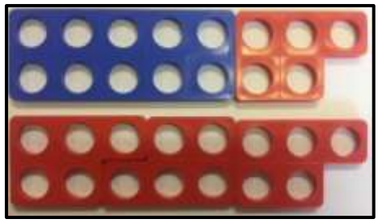
Using number facts

Know halves of even numbers to 24

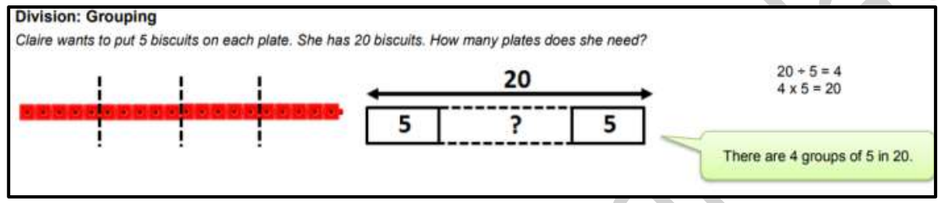
Know 2x, 5x and 10x division facts

Begin to know 3x division facts

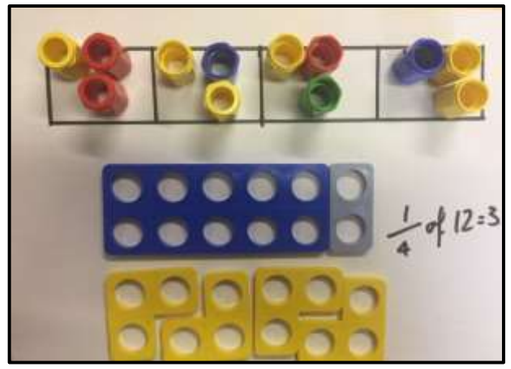
15 divided by 3 as grouping

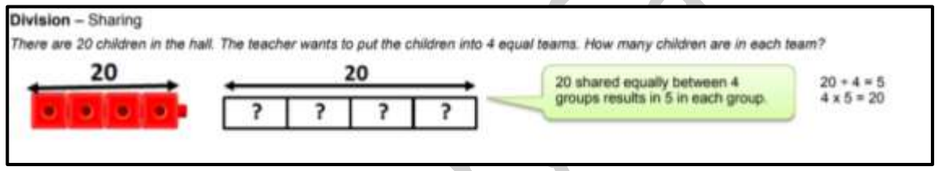


18 divided by 5 as grouping showing remainders

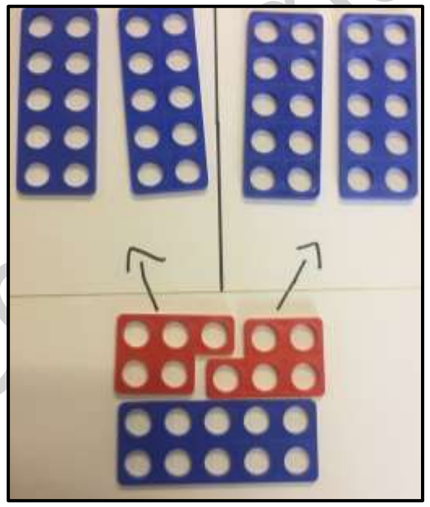


Division as sharing, linked to fractions

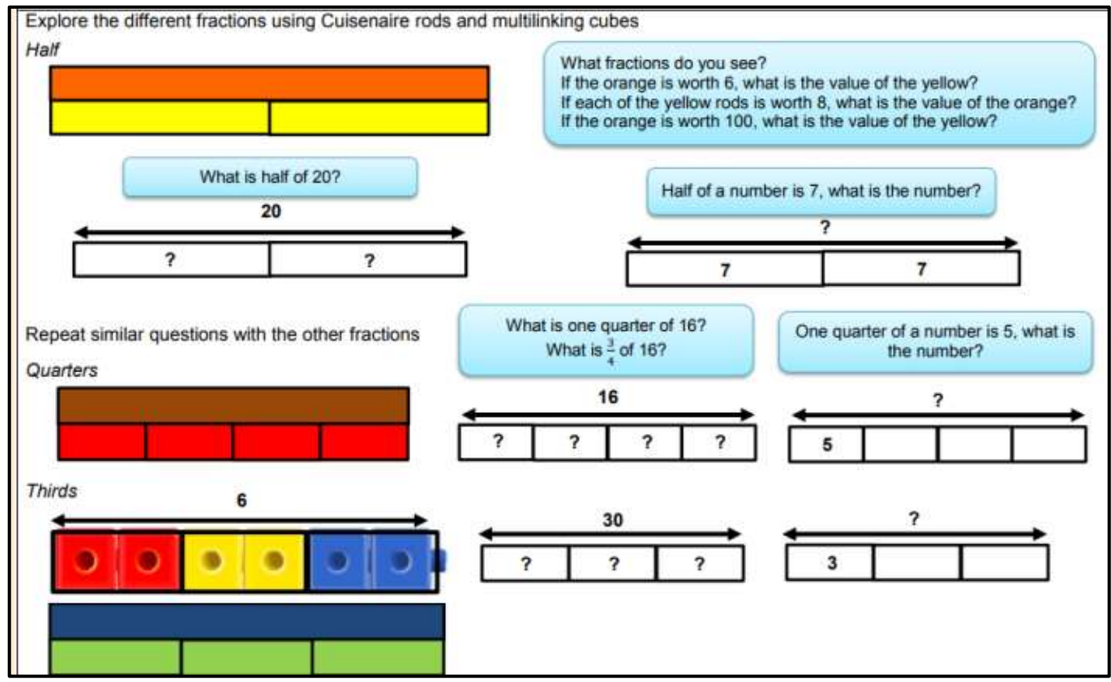




Halving multiples of 10 (50)



The bar model and fractions



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Children first experience dienes blocks in KS2. Children will gain experience of how these blocks relate to each other and other representations of number.

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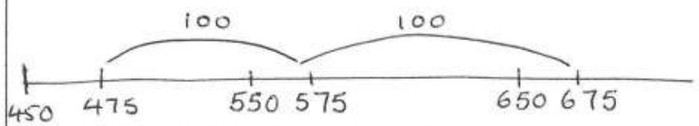
Year 3 Addition

Mental Addition

Using Place value

Count in hundreds, *e.g. knowing 475 + 200 as 475, 575, 675*



Add multiples of 10, 100 and £1, *e.g. 746 + 200 or 746 + 40 or £6.34 + £5 as £6 + £5 and 34p*

Partitioning, e.g. *68 + 74 as 60 + 70 and 8 + 4 and combine the totals: 130 + 12 = 142 or £8.50 + £3.70 as £8 + £3 and 50p +70p and combine: £11 + £1.20*

Counting on

Add two 2-digit numbers by adding the multiple of ten then the ones, *e.g. 67 + 55 as 67 add 50 (117) add 5 (122)*

Add near multiples of 10 and 100, *e.g. 67 + 39 or 364 + 199*

Count on from 3-digit nos, *e.g. 247 + 34 as 247 + 30 (277) then 277 + 4 = 281*

Using number facts

Number bonds to 100, *e.g. 35 + 65, 46 + 54, 73 + 27, etc.*

Add to next ten and next hundred, *e.g. 176 + 4 = 180, 435 + 65 = 500, etc.*

Written Addition

Significant time with expanded methods before compact. Methods demonstrate alongside each other

400	60	6
+300	50	8
700	110	14

Expanded column addition with 'carrying'

Compact column addition with two or more 3-digit numbers or towers of 2-digit numbers

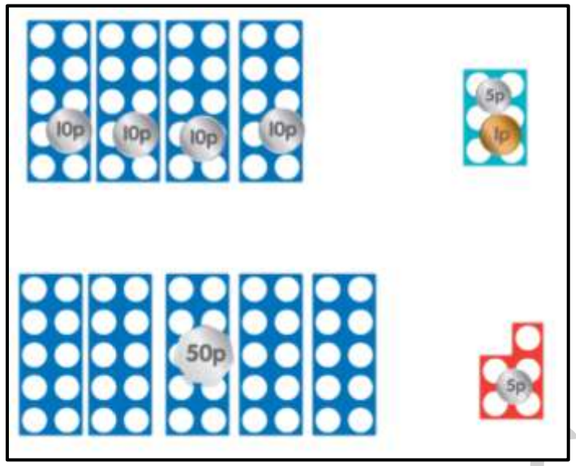
400	60	6
+300	50	8
100	10	
800	20	4

347
286
495
21
1128

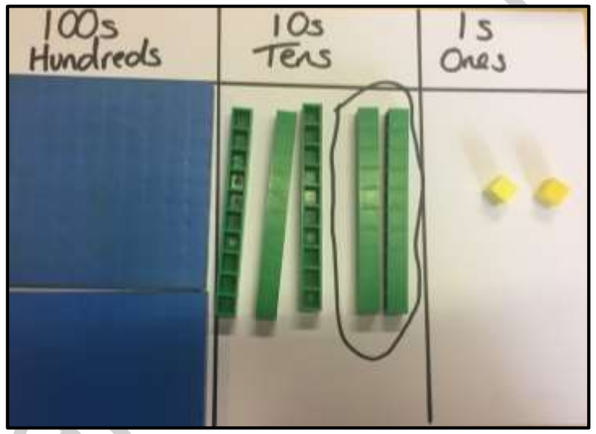
Compact column addition with 3-digit and 4-digit numbers

Recognise fractions which add to 1, *e.g. ¼ + ¾ or $^2/_5 + ^3/_5$*

Use place value and partitioning 46p+55p

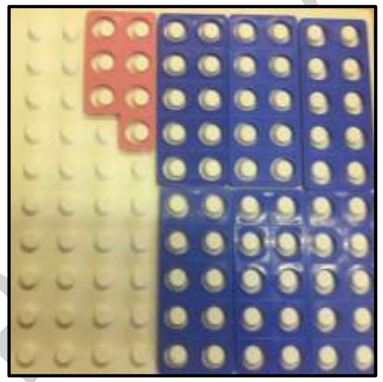


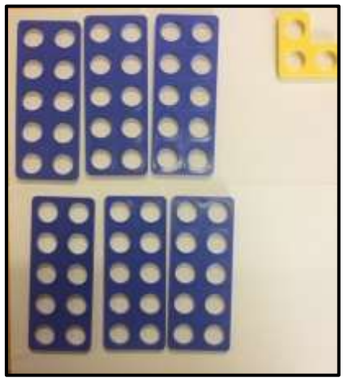
Use place value and partitioning 232 + 20



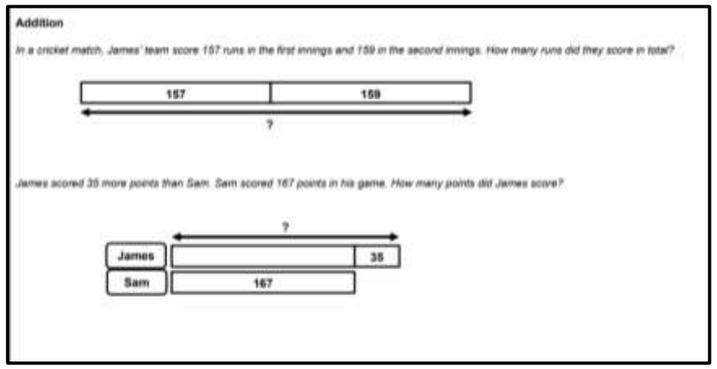
n Fill and bridge ten (revised year 2)

Know number bonds to 100 (33+67)



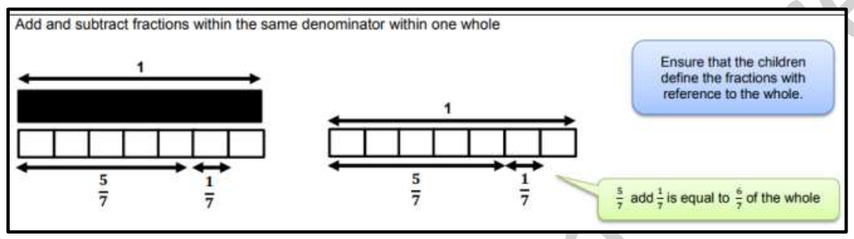


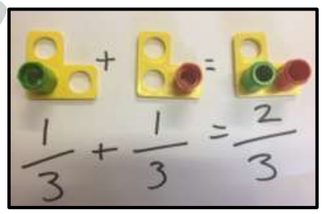
Add and adjust 33+29 = 33 +30 -1



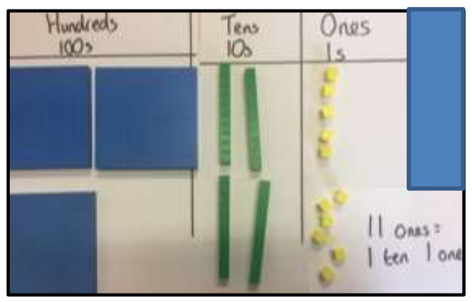
Bar model for addition

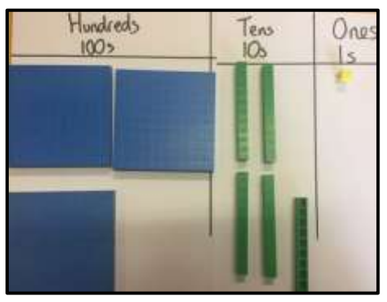
Adding fractions with the same denominator





Build on partitioning to develop expanded column addition





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Year 3 Subtraction

Mental Subtraction

Taking away

Use place value to subtract, *e.g. 348 – 300 or 348 – 40 or 348 – 8*

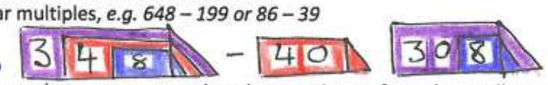
Taking away multiples of 10, 100 and £1, *e.g. 476 – 40 = 436, 476 – 300 = 176, £4.76 – £2 = £2.76*

Partitioning, e.g. *68 – 42 as 60 – 40 and 8 – 2 or £6.84 – £2.40 as £6 – £2 and 80p – 40p*

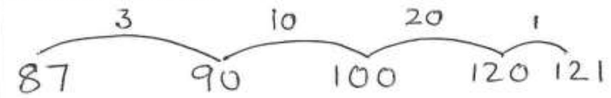
Count back in hundreds, tens then ones, *e.g. 763 – 121 as 763 – 100 (663) then subtract 20 (643) then subtract 1 (642)*

Subtract near multiples, *e.g. 648 – 199 or 86 – 39*

Counting up



Find a difference between two numbers by counting up from the smaller to the larger, *e.g. 121 – 87*



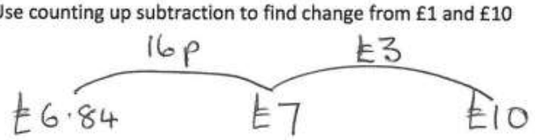
Using number facts

Number bonds to 100, *e.g. 100 – 35 = 65, 100 – 48 = 52, etc.*

Written Subtraction

Develop counting up subtraction

Use counting up subtraction to find change from £1 and £10

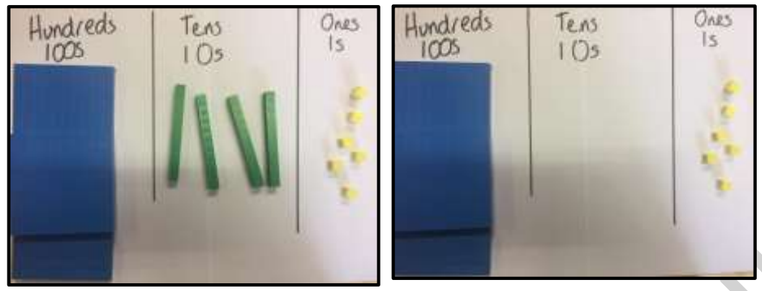


Recognise complements of any fraction to 1, *e.g. 1 – ¼ = ¾ or 1 – ²/₃ = ¹/₃*

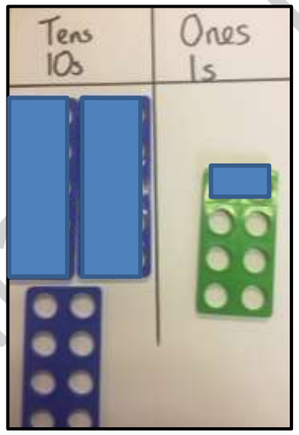
No column subtraction until year 4

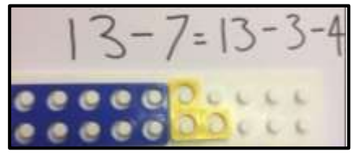
Subtraction of fractions with the same denominator

Using place value to subtract 346 – 40 = 306

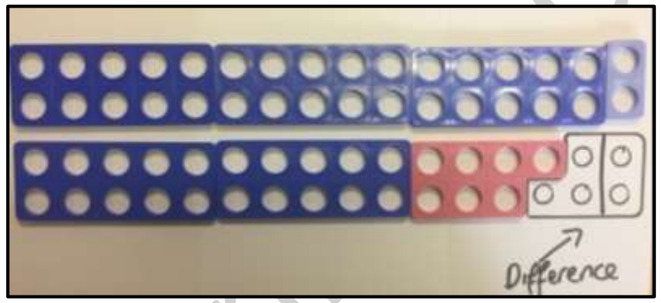


Subtracting by partitioning 38 -22 Using known facts for bridging ten(revise)

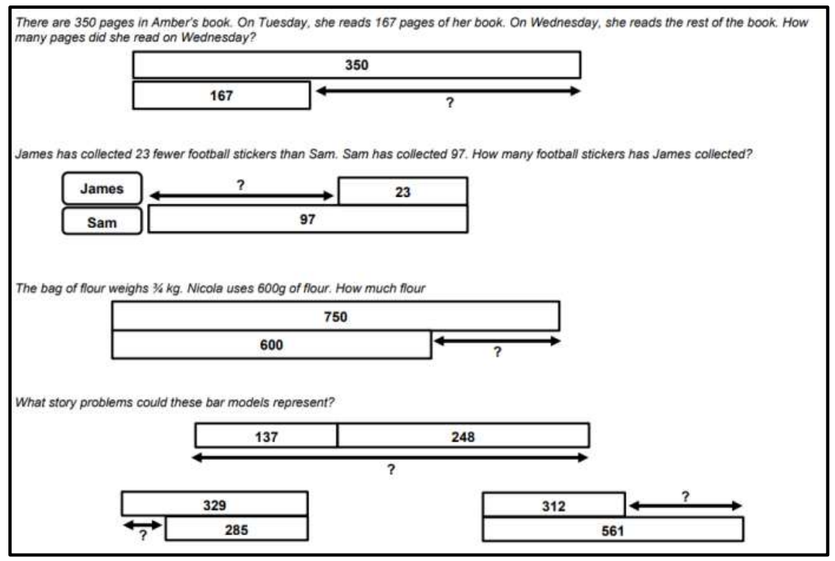


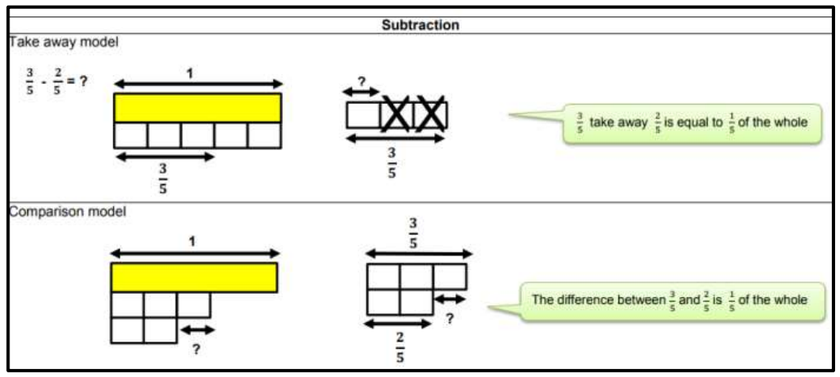


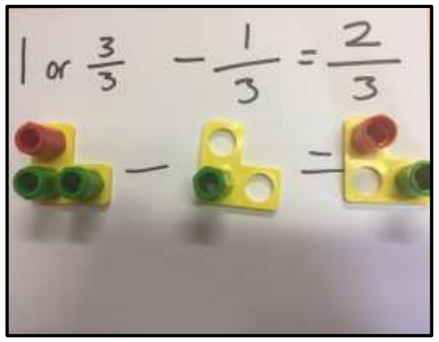
Understanding subtraction as difference by counting up (32-27)



Using the bar model to illustrate the structure of subtraction problems







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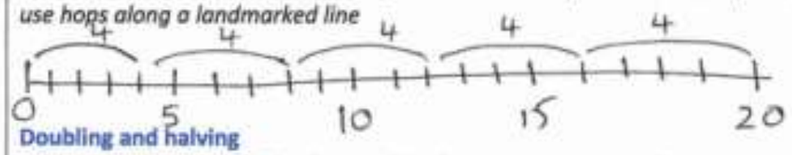
Year 3 Multiplication

Mental Multiplication

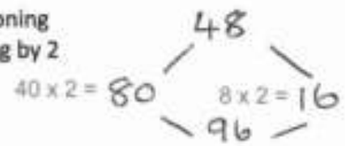
Counting in steps ('Clever' counting)

Count in 2s, 3s, 4s, 5s, 8s and 10s, *e.g. colour the multiples on a 1-100 grid or use hops along a landmarked line*



Doubling and halving

Find doubles to double 50 using partitioning
Use doubling as a strategy in multiplying by 2
E.g. 18 x 2 is double 18 (36)



Grouping

Recognise that multiplication is commutative, *e.g. 4 x 8 ≡ 8 x 4*
Multiply multiples of 10 by single digit numbers, e.g. 30 x 8 = 240
Multiply friendly 2-digit numbers by single digit numbers, *e.g. 13 x 4*

Using number facts

Know doubles to 20 and doubles of multiples of 5 to 100, *e.g. double 45 is 90*
Know doubles of multiples of 5 to 100, *e.g. double 85 is 170*
Know 2x, 3x, 4x, 5x, 8x, 10x tables facts

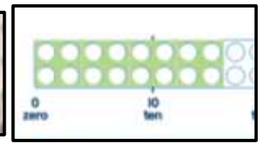
Written Multiplication

Build on partitioning to develop grid multiplication

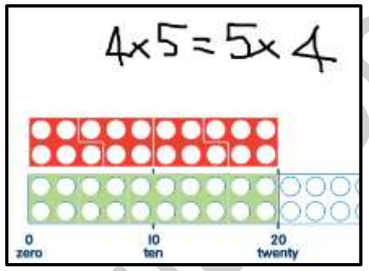
×	20	3	
4	80	12	= 92

Repeated addition

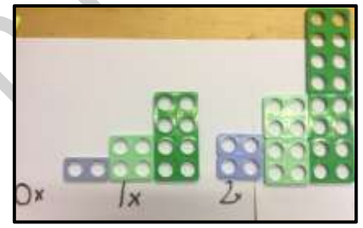
Linked to number line



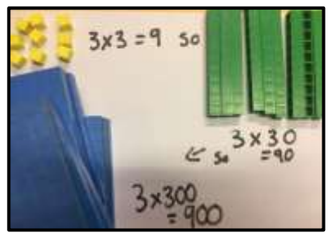
x is commutative (see year)



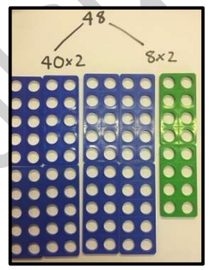
Recognise link between 2,4,8s and 5 and 10s



Use place to multiply multiples of 10/100



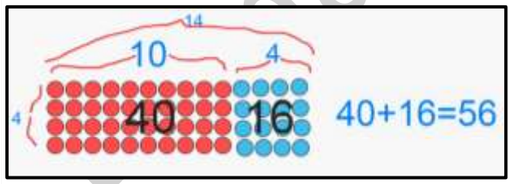
Partitioning to double

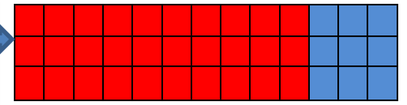


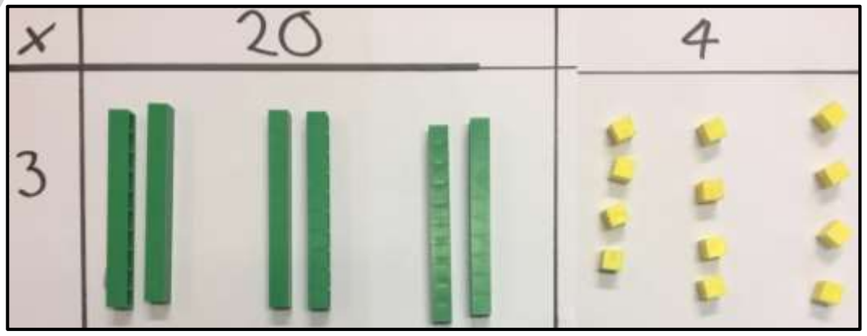
Return to arrays

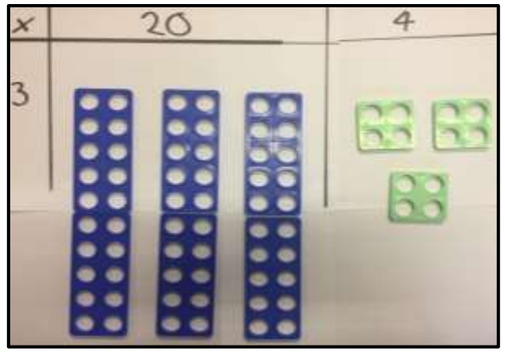
Move on to using groups of 10

Drawing arrays prepares for area in year 4

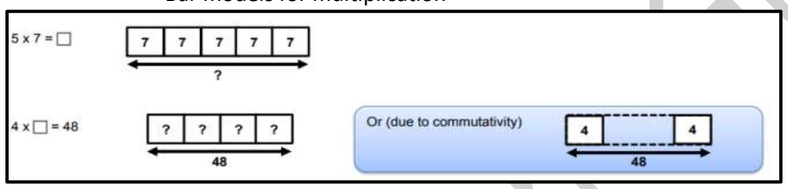








Bar models for multiplication



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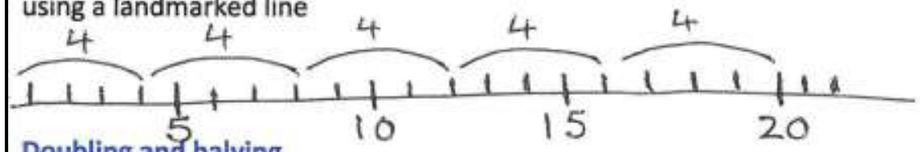
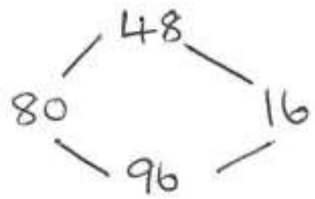
Year 3 Division

Counting in steps ('Clever' counting)
Count in 2s, 3s, 4s, 5s, 8s and 10s by colouring numbers on the 1-100 grid or using a landmarked line



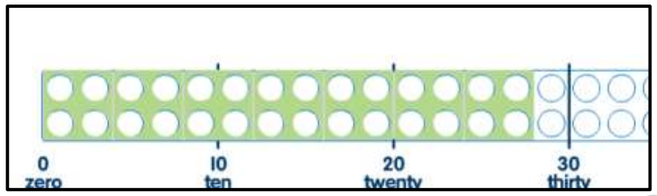
Doubling and halving
Find half of even numbers to 100 using partitioning.
Use halving as a strategy in dividing by 2.
E.g. 36 ÷ 2 is half of 36



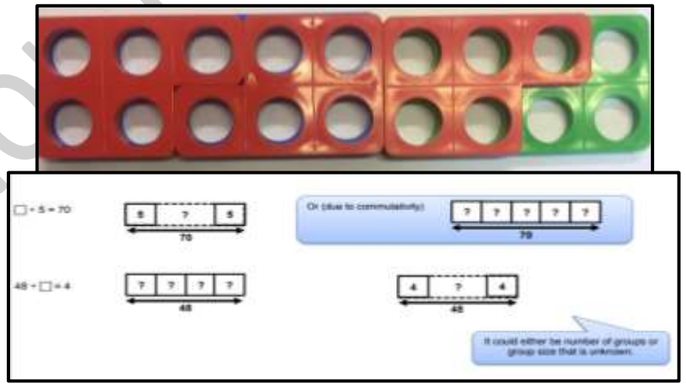
Grouping
Recognise that division is not commutative, *e.g. 16 ÷ 8 does not equal 8 ÷ 16*
Relate division to multiplications 'with holes in', *e.g. ☐ x 5 = 30 is the same calculation as 30 ÷ 5 = ? thus we can count in 5s to find the answer*
Divide multiples of 10 by single digit numbers, *e.g. 240 ÷ 8 = 30*

Using number facts
Know halves of even numbers to 40
Know halves of multiples of 10 to 200, *e.g. half of 170 is 85*
Know 2x, 3x, 4x, 5x, 8x, 10x division facts
Use division facts to find unit and simple non-unit fractions of amounts within the times tables, *e.g. ¼ of 48 is 3 x (48 ÷ 4)*

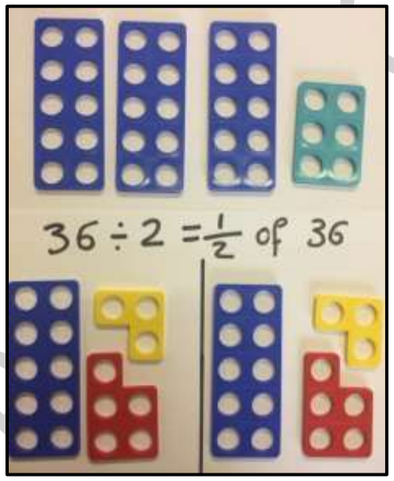
Relative division to multiplication (grouping)



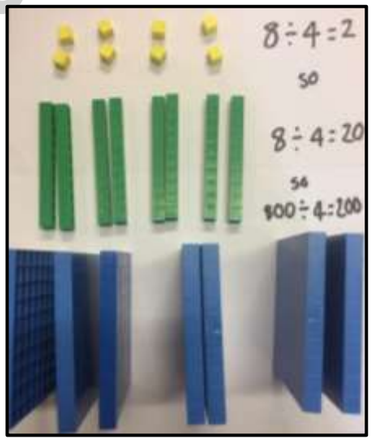
Division as grouping with remainder



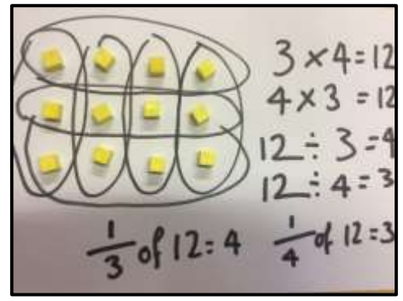
Using partitioning to halve



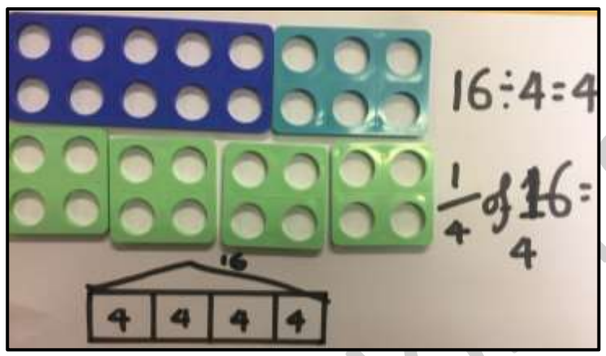
Division with place value sharing numbers greater than 1



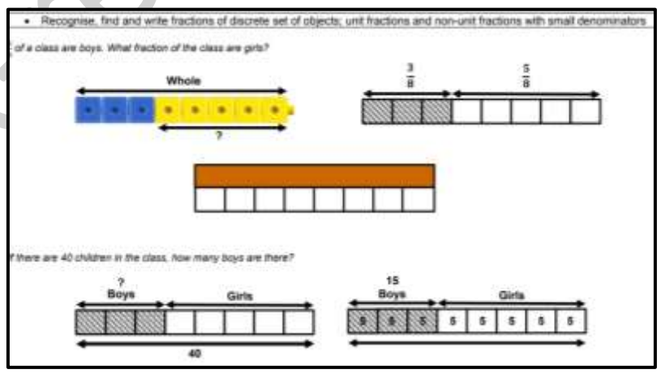
Using arrays to link x and division



No formal written division in year 3



Fractions and division



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Bar model diagrams from Herts for Learning

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Year 4 Addition

Using Place value

Count in thousands, *e.g. knowing 475 + 200 as 475, 575, 675*

Partitioning, *e.g. 746 + 203 as 700 + 200 and 46 + 3*
or 134 + 707 as 130 + 700 and 4 + 7

Counting on

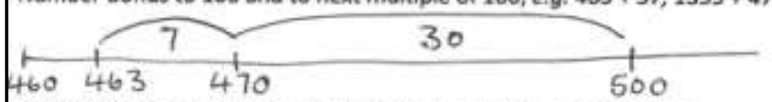
Add two 2-digit numbers by adding the multiple of ten then the ones, *e.g. 67 + 55 as 67 add 50 (117) add 5 (122)*

Add near multiples of 10, 100 and 1000, *e.g. 467 + 199 or 3462 + 2999*

Count on to add 3-digit numbers and money, *e.g. 463 + 124 as 463 + 100 (563) +20 (583) +4 =587 or £4.67 + £5.30 as £9.67 add 30p*

Using number facts

Number bonds to 100 and to next multiple of 100, *e.g. 463 + 37, 1353 + 47*



Number bonds to £1 and to the next whole pound, *e.g. £3.45 + 55p*

Add to next whole number, *e.g. 4.6 + 0.4, 7.2 + 0.8*

Build on expanded column addition to develop compact column addition with larger numbers.

1000	400	60	6
+ 4000	800	60	8
1000	100		
6000	300		

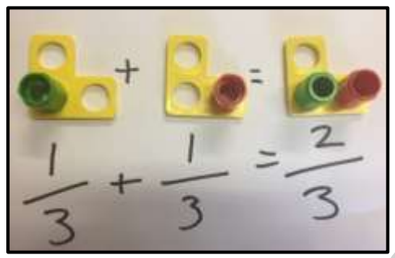
Significant time of expanded methods to consolidate place value. Methods demonstrated side by side

Compact column addition with larger numbers.

Use expanded and compact column addition to add amounts of money.

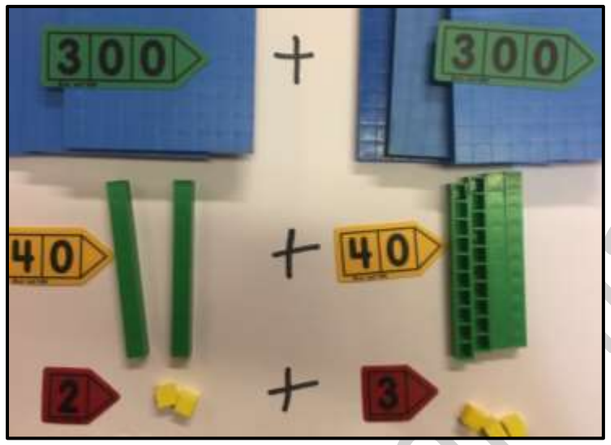
5347
2286
+1495
121
9128

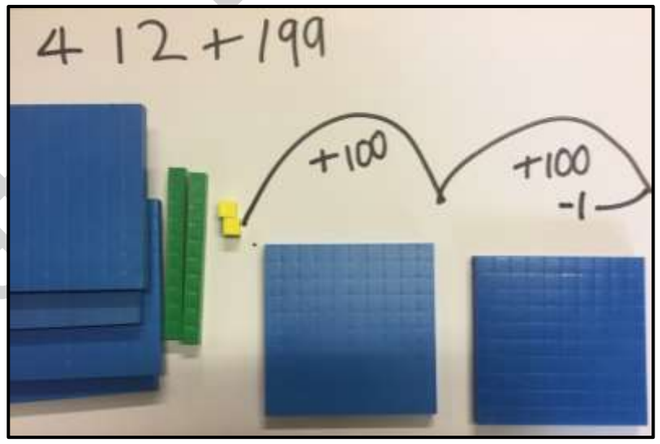
Add like fractions, *e.g.* $\frac{3}{8} + \frac{1}{8} + \frac{1}{8}$



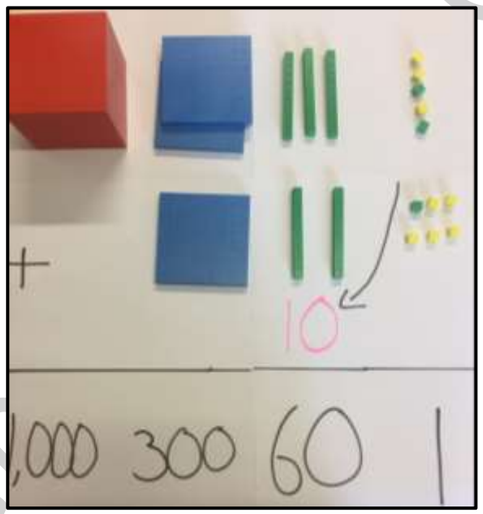
See year 3 bar model for adding fractions

Adding multiples of 10 or 100 and adjusting





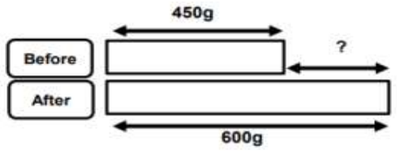
Modelling addition by partitioning



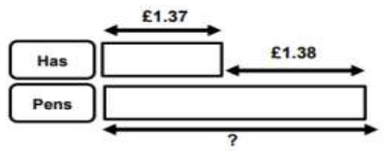
Adding by bridging

Adding decimals using straws/numicon

Emily is making a cake. She puts flour on the scales. How much sugar does she add?



Claire has £1.37. She needs £1.38 more to buy a packet of pens. How much do the pens cost?



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Year 4 Subtraction

Taking away

Use place value to subtract, *e.g. 4748 – 4000 or 4748 – 8, etc.*

Take away multiples of 10, 100, 1000, £1, 10p or 0.1, *e.g. 8392 – 50 or 6723 – 3000 or £3.74 – 30p or 5.6 – 0.2*

Partitioning, e.g. *£5.87 – £3.04 as £5 – £3 and 7p – 4p or 7493 – 2020 as 7000 – 2000 and 90 – 20*

Count back, *e.g. 6482 – 1301 as 6482 – 1000 then – 300 then – 1 (5181)*

Subtract near multiples, *e.g. 3522 – 1999 or £34.86 – £19.99*

Counting up

Find a difference between two numbers by counting up from the smaller to the larger, *e.g. 506 – 387*

Using number facts

Number bonds to 10, 100 and derived facts, *e.g. 100 – 76 = 24, 1.0 – 0.6 = 0.4*

Number bonds to £1 and £10, *e.g. £1.00 – 86p = 14p or £10 – £3.40 = £6.60*

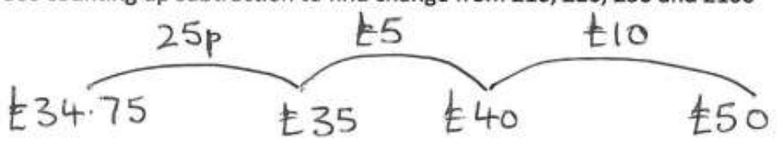
Expanded column subtraction

	600	110	16
	~~700~~	~~20~~	~~8~~
−	300	50	8
	300	60	8

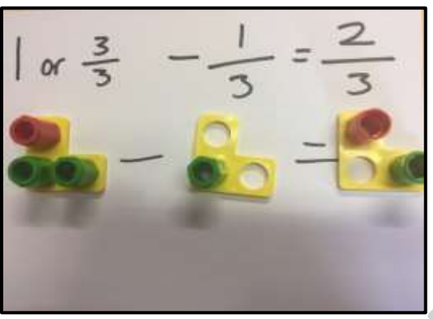
Begin to use compact column subtraction

	6	11	16
	~~7~~	~~1~~	~~6~~
−	3	5	8
	3	6	8

Use counting up subtraction to find change from £10, £20, £50 and £100

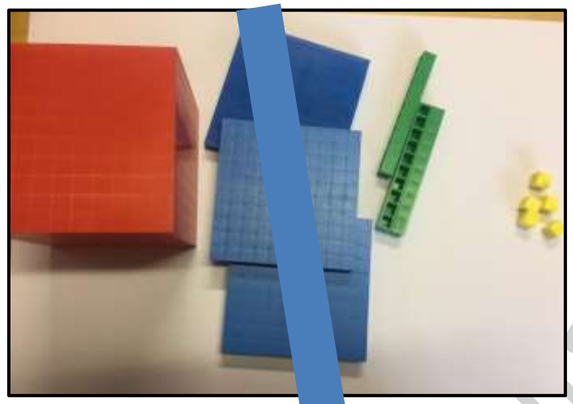


Subtract like fractions, *e.g.* $^3/_8 - {}^1/_8 = {}^2/_8$

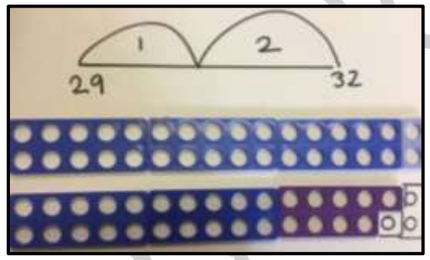


See year 3 bar model for subtracting fractions

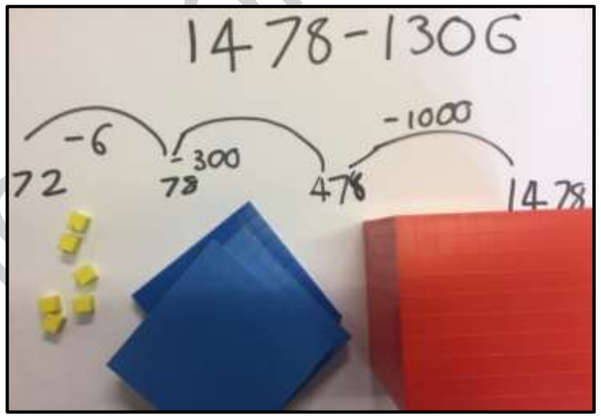
Using place value to subtract

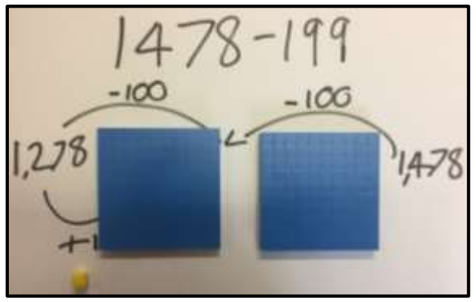


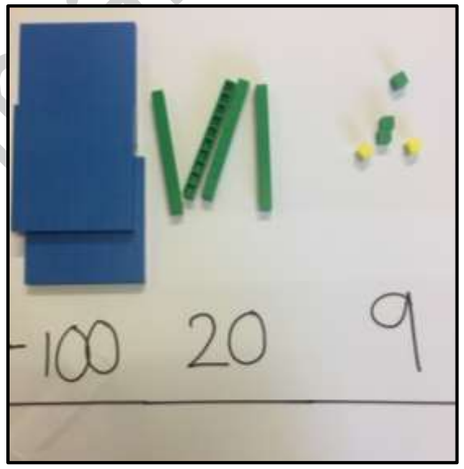
Counting up to find the difference

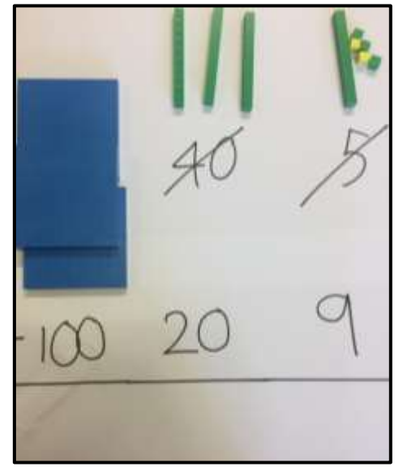


Counting up to the find difference









Modelling subtraction algorithm with dienes blocks

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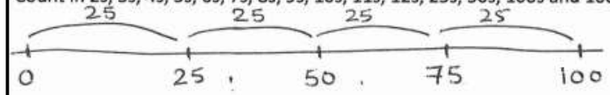
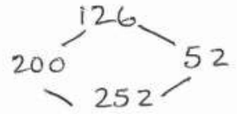
Year 4 Multiplication

Counting in steps – sequences
Count in 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 11s, 12s, 25s, 50s, 100s and 1000s



Doubling and halving
Find doubles to double 100 and beyond using partitioning
Begin to double amounts of money.
E.g. £3.50 doubled is £7
Use doubling as a strategy in multiplying by 2, 4 and 8, *e.g. 34 x 4 = double 34 (68) doubled again (136)*



Grouping
Use partitioning to multiply 2-digit numbers by single-digit numbers
Multiply multiples of 100 by single digit numbers using tables facts, *e.g. 400 x 8 = 3200*
Multiply using near multiples by rounding, *e.g. 24 x 19 as (24 x 20) – 24*

Using number facts - Know times tables up to 12 x 12

Use grid multiplication to multiply 3-digit by 1-digit numbers

x	200	50	3
6	1200	300	18

= 1518

Use a vertical written algorithm (ladder) to multiply 3-digit numbers by 1-digit numbers

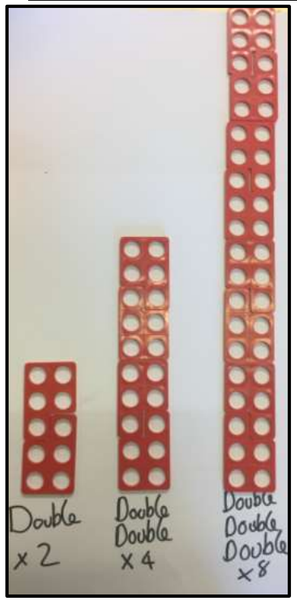
```
 253
X  6
1200
 300
  18
1518
```

Use grid multiplication to multiply 2-digit numbers by 2-digit numbers

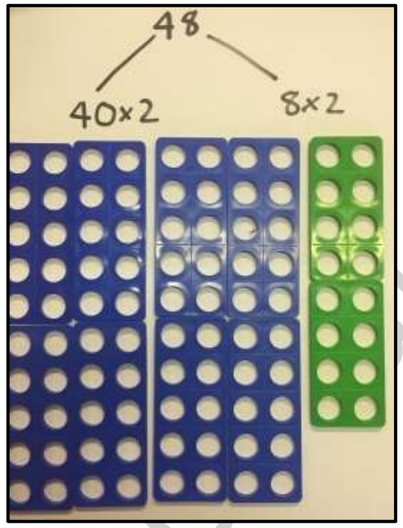
x	40	6
10	400	60
8	320	48
	720	108

= 828

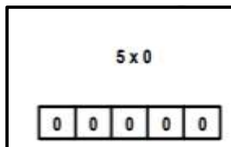
Linked x2 x4 and x8 to doubling



Revise partition for doubling and halving as year 3

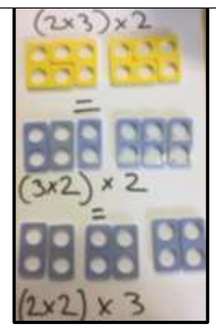


Bar model for multiplication

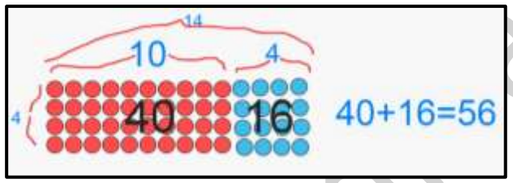


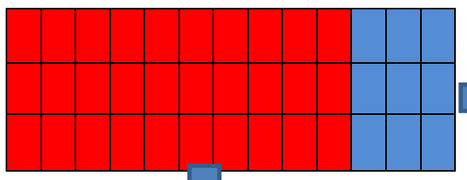
What does this mean?
Use a speaking frame to help support pupils to develop the range of appropriate language.
Number of groups x size of group = total number of objects.
Explore concrete ideas such as 5 plates with no biscuits.
How many biscuits?

Use associative law to x 3 numbers

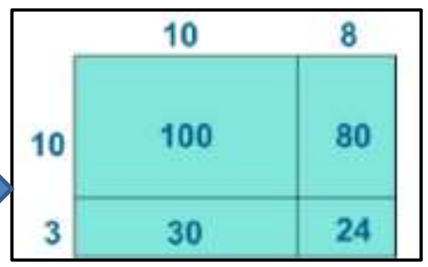


Revise arrays from year 3 (Use Number Gym)

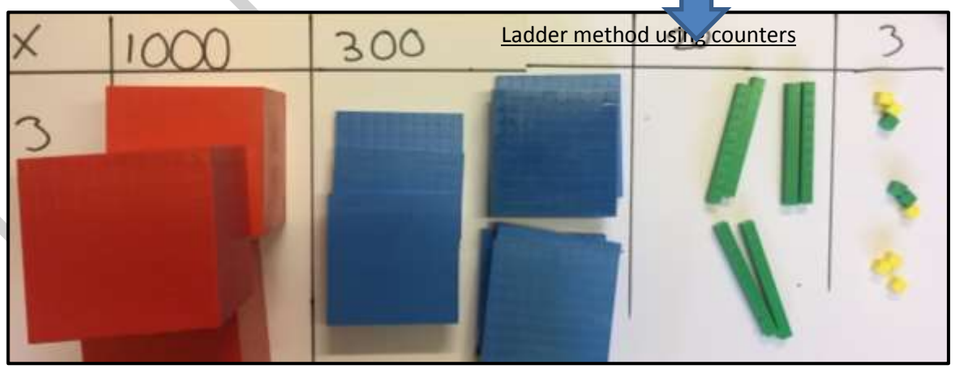


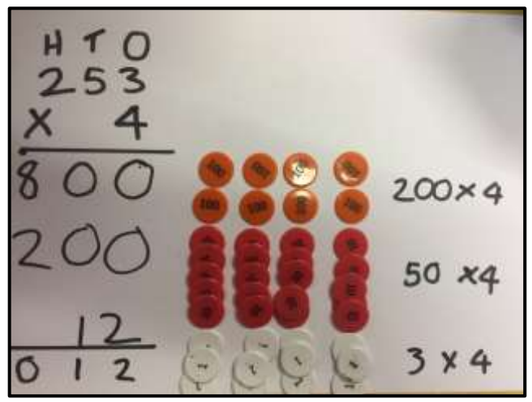


Link knowledge of arrays to area/grid method

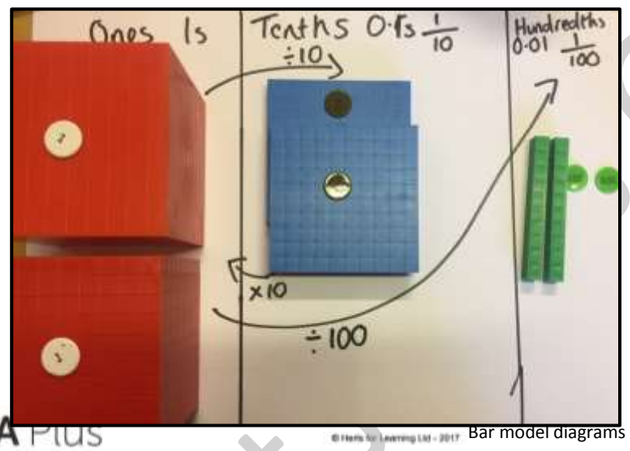


Ladder method using counters





Division/multiplication by 10/100



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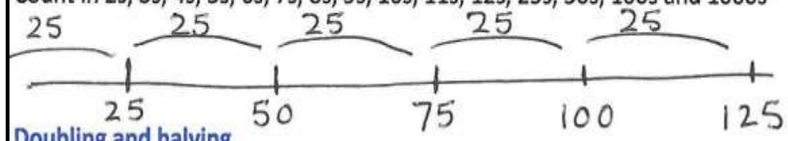
Year 4 Division

Counting in steps – sequences

Count in 2s, 3s, 4s, 5s, 6s, 7s, 8s, 9s, 10s, 11s, 12s, 25s, 50s, 100s and 1000s



Doubling and halving

Find halves of even numbers to 200 and beyond using partitioning.
Begin to half amounts of money.
E.g. £9 halved is £4.50
Use halving as a strategy in dividing by 2, 4 and 8, *e.g. 164 ÷ 4 is half of 164 (82) halved again (41)*

Grouping

Use multiples of 10 times the divisor to divide by number ≤9 above the tables facts, *e.g. 45 ÷ 3*
Divide multiples of 100 by single digit numbers using division facts, *e.g. 3200 ÷ 8 = 400*

45 ÷ 3 = □

□ x 3 = 45
10 x 3 = 30
15
5 x 3 = 15

Using number facts

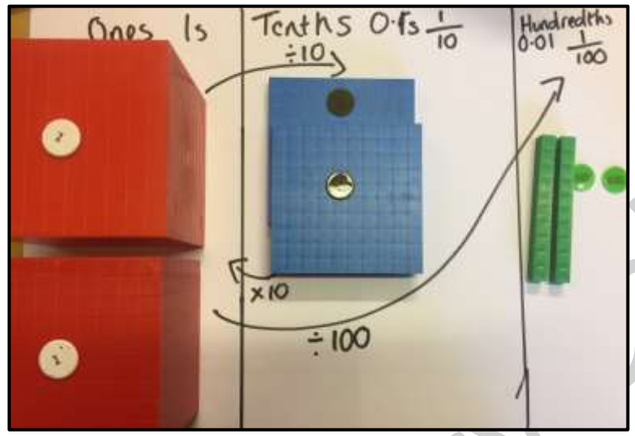
Know times tables up to 12 x 12 and all related division facts
Use division facts to find unit and non-unit fractions of amounts within the times tables, *e.g. 7/8 of 56 is 7 x (56 ÷ 8)*

Written version of a mental method

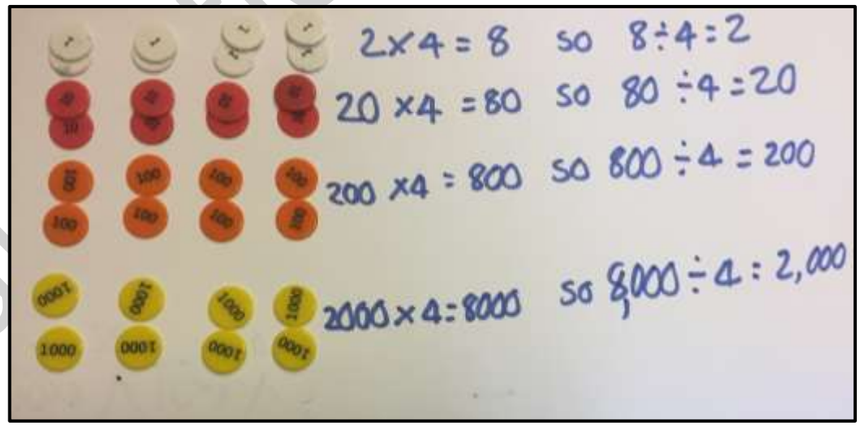
□ x 3 = 86
20 x 3 = 60
26
8 x 3 = 24
2

84 ÷ 3 = 28 r2

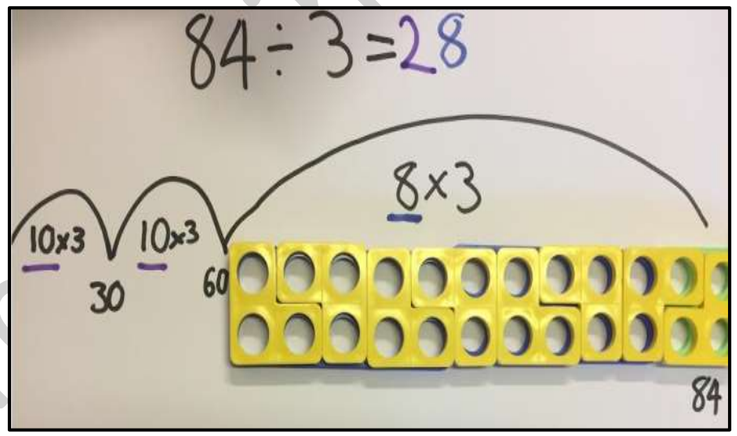
Division/multiplication by 10/100



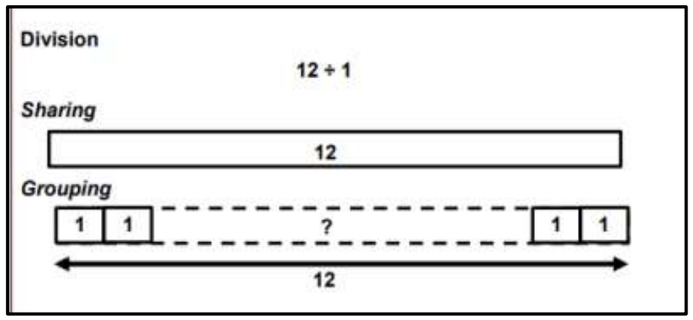
Using place value knowledge to divide



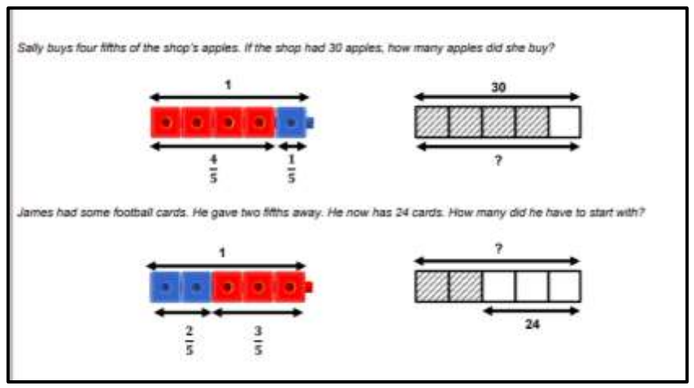
Grouping and using multiples of ten of the divisor



Bar model to show sharing and grouping (sharing leads to fractions)



Bar model for find fractions of a number



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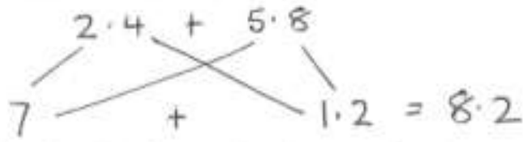
Year 5 Mental Addition

Using Place value

Count in 0.1s, 0.01s, *e.g. knowing what 0.1 more than 0.51 is*

100s	10s	1s	0·1s	0·01s	0·001s
			·5	1	
			·1		
			·6	1	

Partitioning, *e.g. 2.4 + 5.8 as 2 + 5 and 0.4 + 0.8 and combine the totals: 7 + 1.2 = 8.2*



Counting on

Add two decimal numbers by adding the ones then the tenths/hundredths, *e.g. 5.72 + 3.05 as 5.72 add 3 (8.72) then add 0.05 (8.77)*

Add near multiples of 1, *e.g. 6.34 + 0.99 or 5.63 + 0.9*

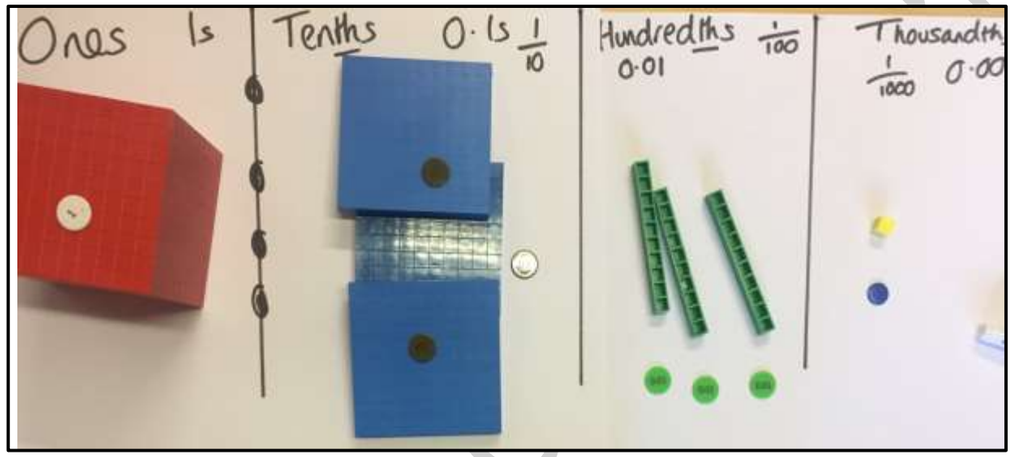
Count on from large numbers, *e.g. 6834 + 3005 as 9834 + 5*

Using number facts

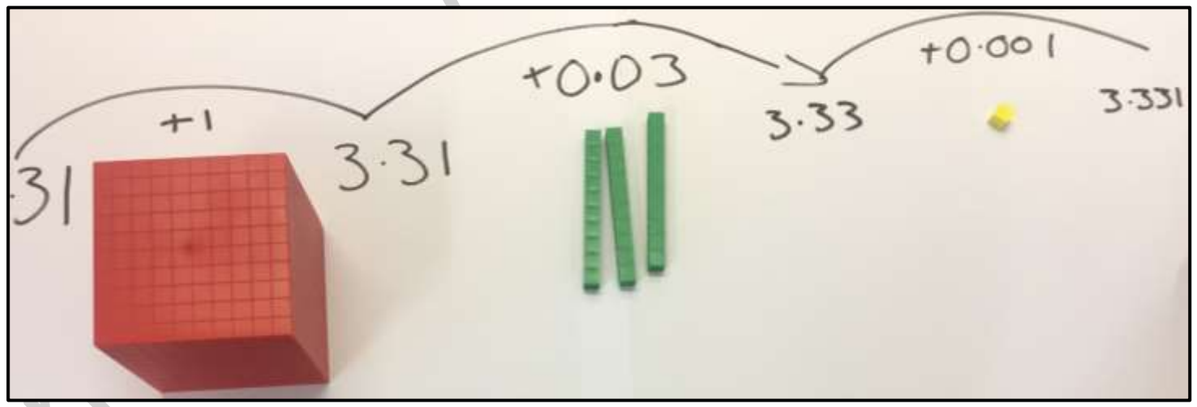
Number bonds to 1 and to the next whole number, *e.g. 0.4 + 0.6 or 5.7 + 0.3*

Add to next ten from a decimal number, *e.g. 7.8 + 2.2 = 10*

Add 0.01 to 1.331



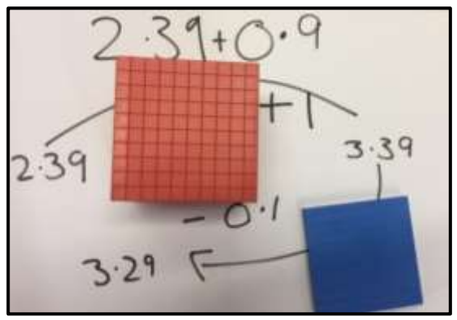
Adding by counting on



Revising understanding of addition from year 4 with year 5

place value expectations

Adding and adjusting 2.39 _ + 1 -0.1= 2.39 + 0.9



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Year 5 Written Addition

Expanded column addition for money leading to compact column addition for adding several amounts of money

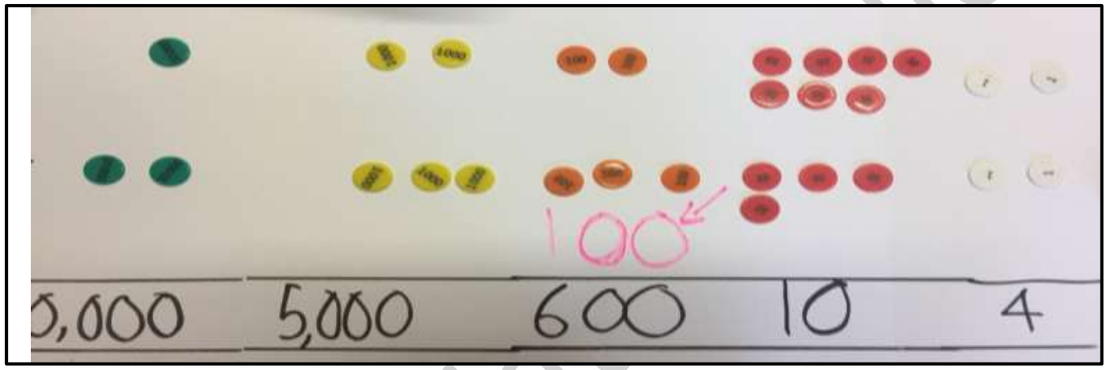
Compact column addition to add Pairs of 5-digit numbers

Continue to use column addition to add towers of several larger numbers.

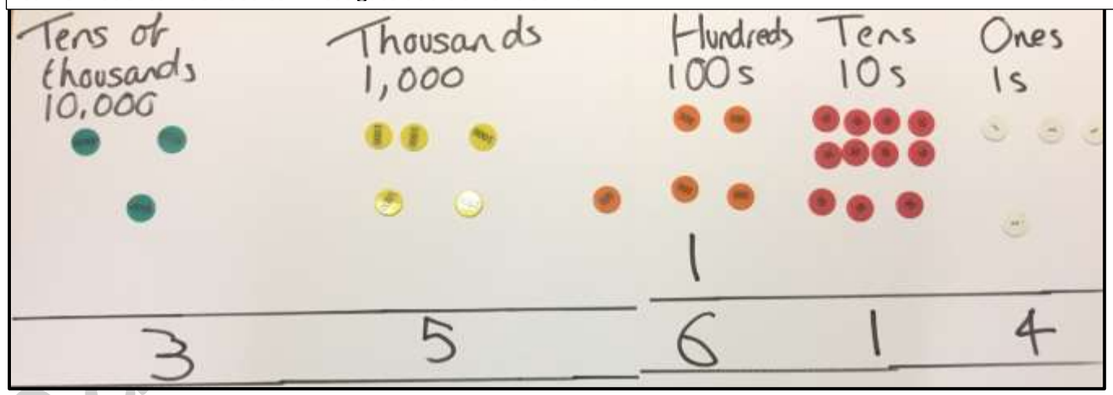
Use compact addition to add decimal numbers with up to two places

£14	60p	4p
£28	70p	8p
+ £12	20p	6p
£1	10p	
£55	60p	8p

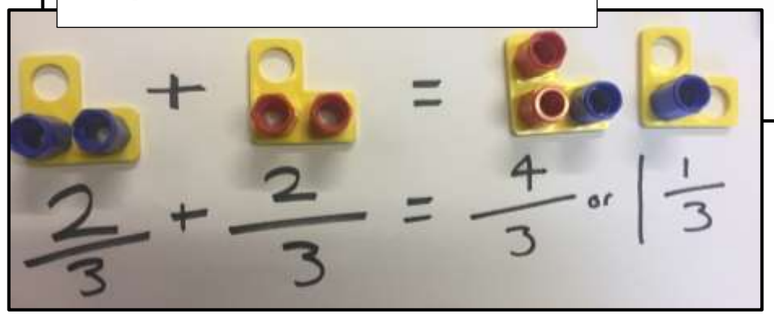
15.68
+27.86
11.1
43.54



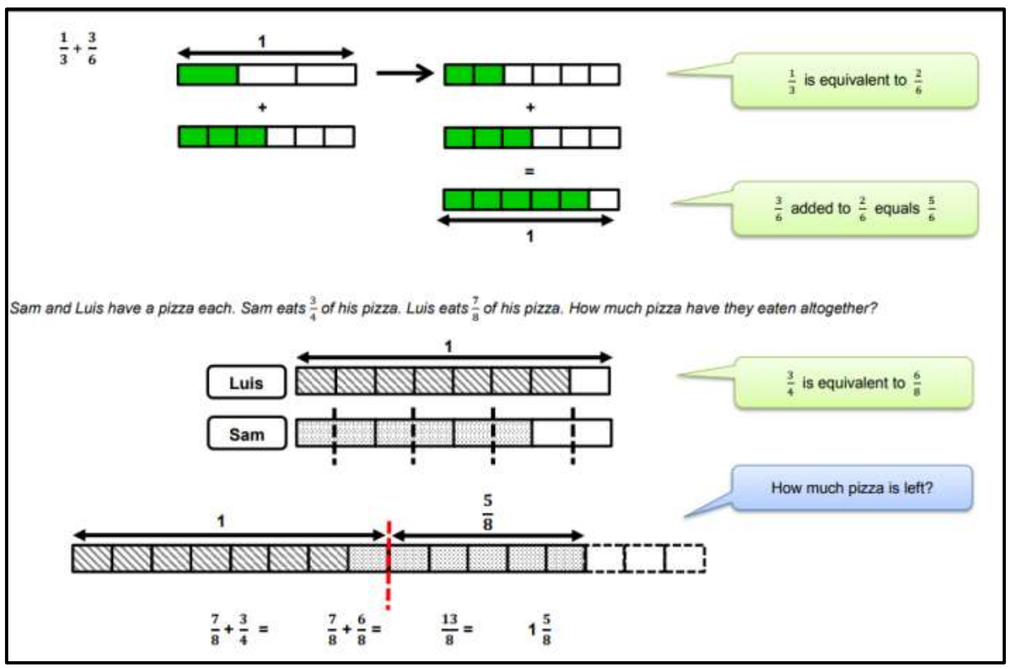
Expanded models consolidate place value up to 1 million in year 5. Similar models to be used with dienes blocks. The same model can be used to investigate addition of decimals



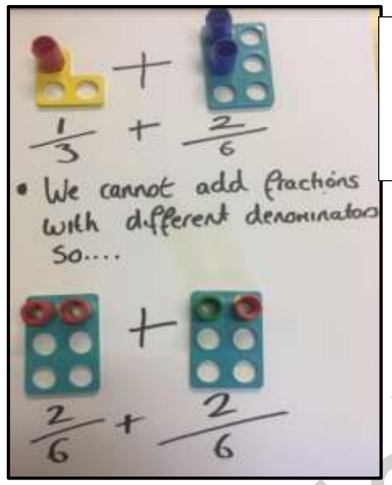
Adding fractions with same denominators

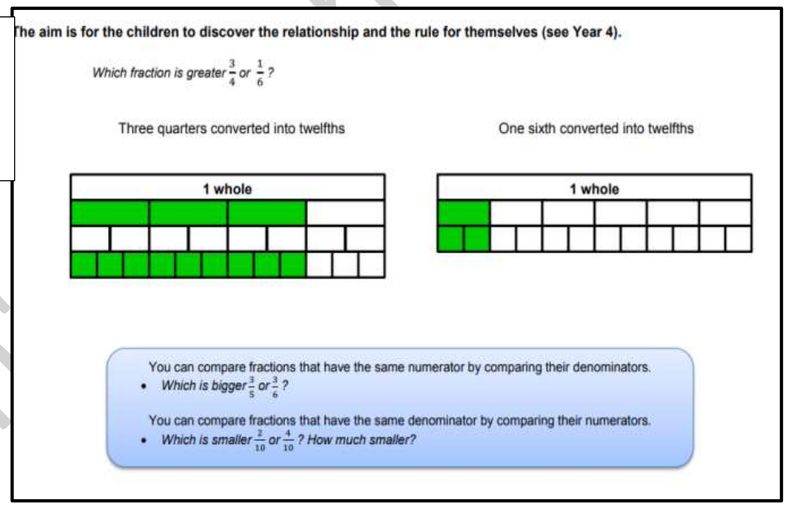


Using the bar model for ordering and adding fractions with different denominators



Adding fractions with different denominators





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Year 5 Mental Subtraction

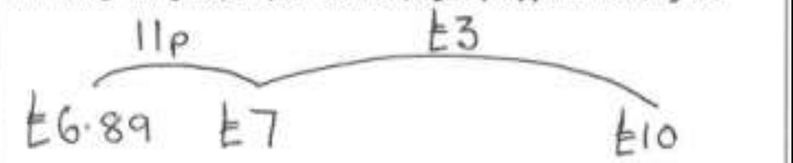
Taking away

Use place value to subtract decimals, *e.g. 4.58 – 0.08 or 6.26 – 0.2, etc.*
Take away multiples of powers of 10, *e.g. 15,672 – 300 or 4.82 – 2 or 2.71 – 0.5 or 4.68 – 0.02*
Partition or count back, *e.g. 3964 – 1051 or 5.72 – 2.01*
Subtract near multiples, *e.g. 86,456 – 9999 or 3.58 – 1.99*

Counting up

Find a difference between two numbers by counting up from the smaller to the larger, *e.g. 2009 – 869*

Find change using shopkeepers' addition, *e.g. buy toy for £6.89 using £10*

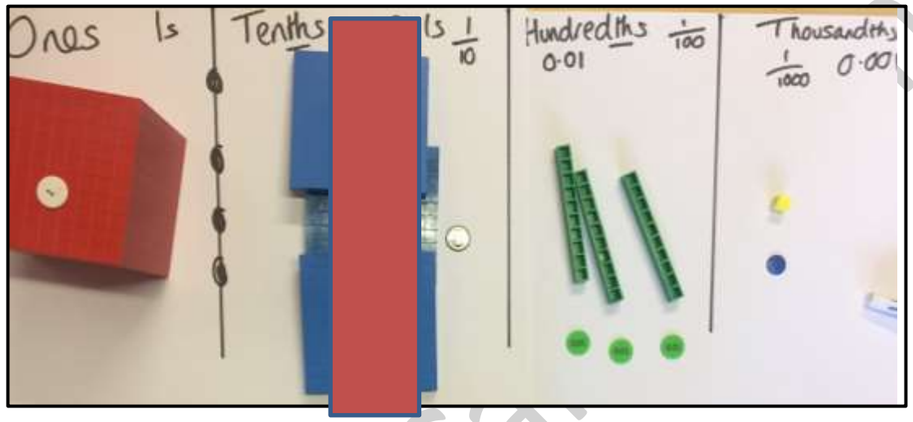


Using number facts

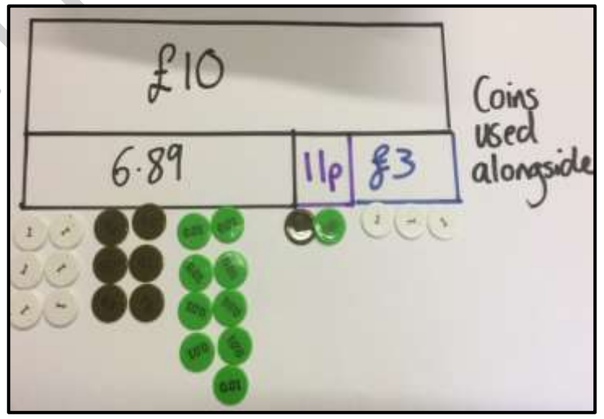
Derived facts from number bonds to 10 and 100, *e.g. 2 – 0.45 using 45 + 55 = 100 or 3.00 – 0.86 using 86 + 14 = 100*

Number bonds to £1, £10 and £100, *e.g. £4.00 – £3.86p = 14p or £100 – £66*

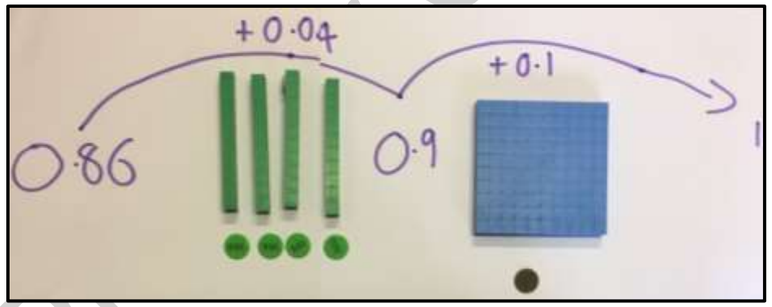
Using place value to subtract decimals



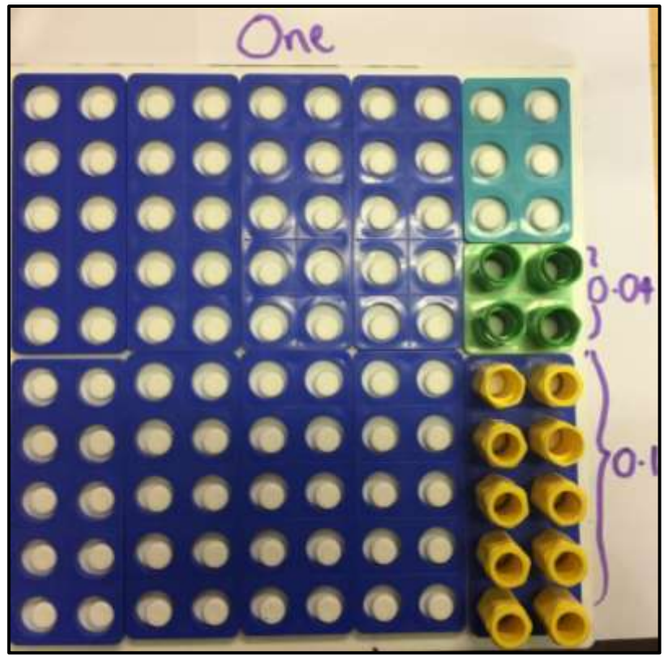
Using counters/coins to count up/find the difference



Counting up to find the difference 1-0.86



Applying number facts to decimals.0.86 + 0.04 + 0.1 =1



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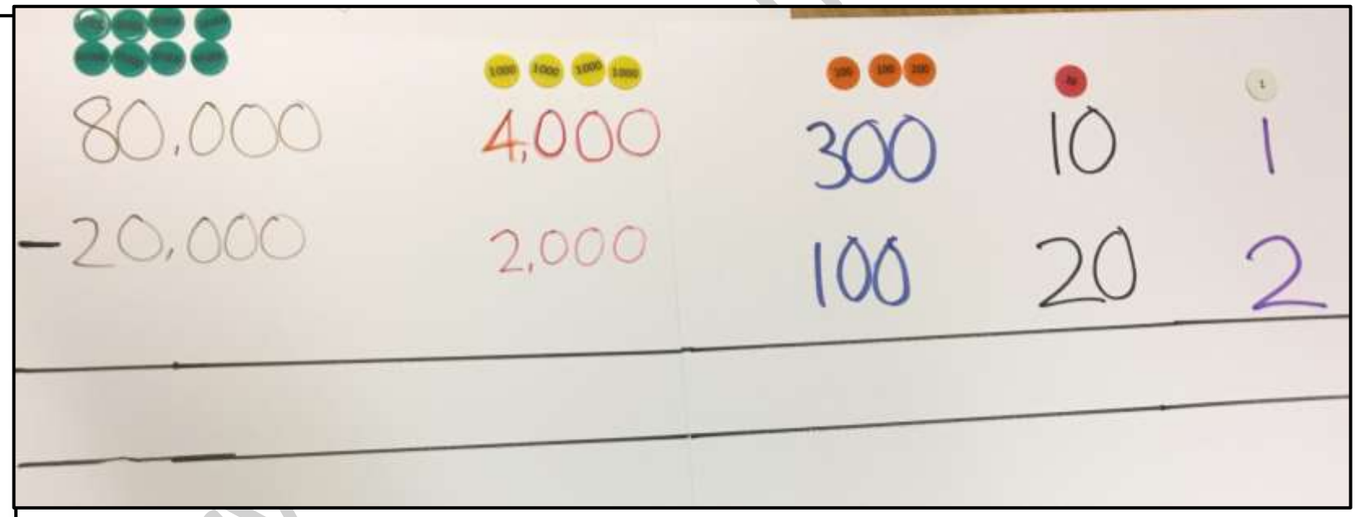
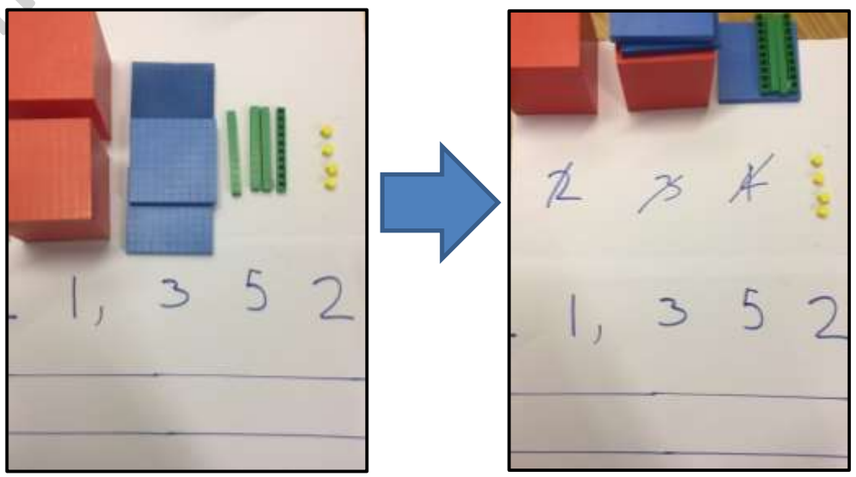
Year 5 Written Subtraction

Expanded models consolidate place value up to 1 million in year 5. Similar models to be used with dienes blocks. The same model can be used to investigate subtraction of decimals



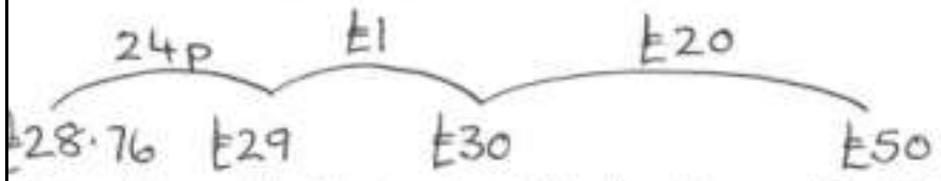
Using dienes to model column subtraction



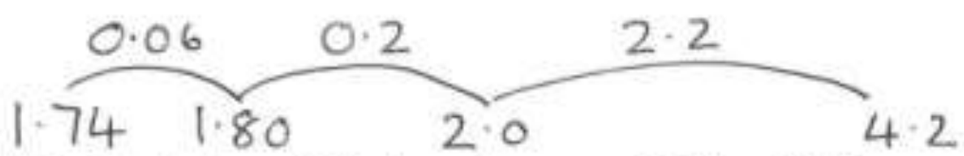
Compact column subtraction for numbers with up to 5 digits

	0	15	13	1	14
	~~7~~	~~8~~	~~3~~	~~2~~	~~4~~
-		8	5	1	6
		7	8	0	8

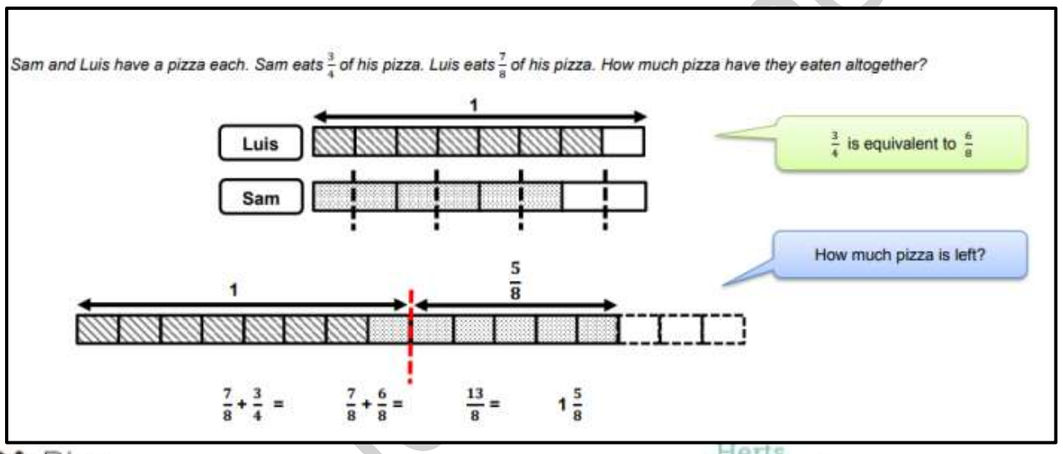
Continue to use counting up subtraction for subtractions involving money, including finding change or, *e.g. £50 - £28.76*



Use counting up subtraction to subtract decimal numbers, *e.g. 4.2 – 1.74*



Subtracting fractions with like denominators, *e.g. 1¼ - ³/₈ as 1²/₈ - ³/₈ or ¹⁰/₈ – ³/₈ = ⁷/₈*



See addition page for concrete models of fractions for subtraction of fractions

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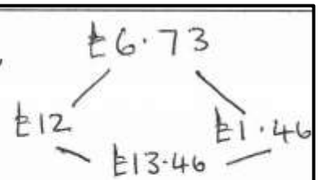
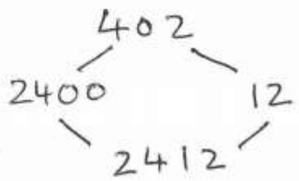
Year 5 Mental Multiplication

Doubling and halving
Double amounts of money using partitioning, *e.g. £6.73 doubled is double £6 (£12) plus double 73p (£1.46)*
Use doubling and halving as a strategy in multiplying by 2, 4, 8, 5 and 20.
E.g. 58 x 5 = ½ of 58 (29) X 10 (290)



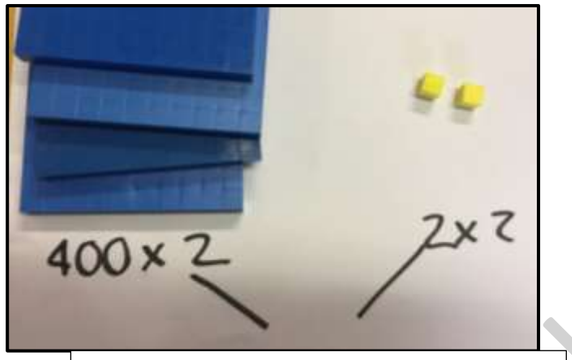
Grouping
Multiply decimals by 10, 100, 1000,
e.g. 3.4 x 100 = 340
Use partitioning to multiply friendly 2-digit and 3-digit numbers by single-digit numbers.
E.g. 402 x 6 as 400 x 6 (2400) and 2 x 6 (12)



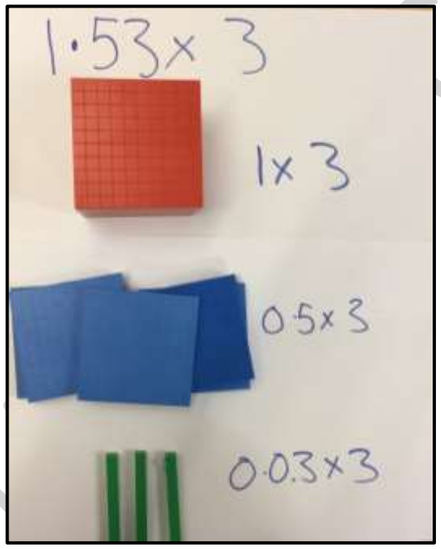
Use partitioning to multiply decimal numbers by single-digit numbers, *e.g. 4.5 x 3 as (4 x 3) + (4 x 0.5)*
Multiply using near multiples by rounding, *e.g. 32 x 29 as (32 x 30) – 32*

Using number facts
Use times tables facts up to 12 x 12 to multiply multiples of the multiplier, *e.g. 4 x 6 = 24 so 40 x 6 = 240 and 400 x 6 = 2400*
Know square numbers and cube numbers

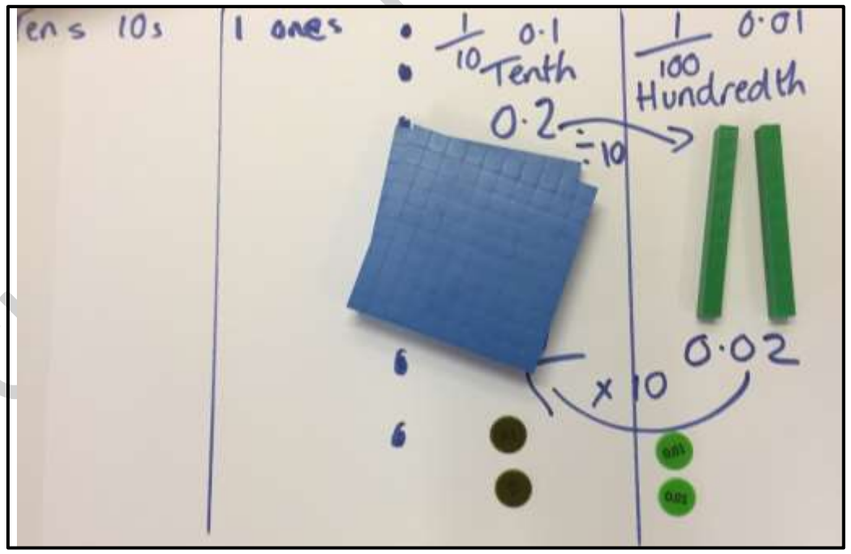
Multiplication by partitioning



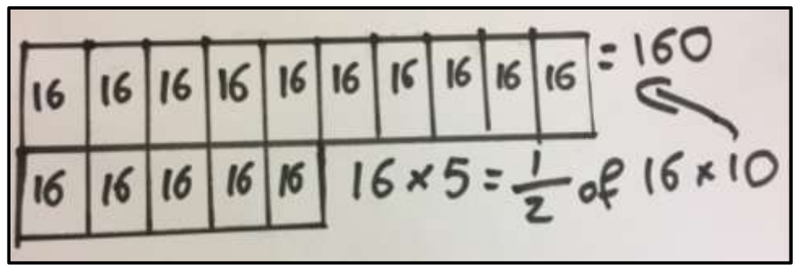
Multiplying decimals by partitioning

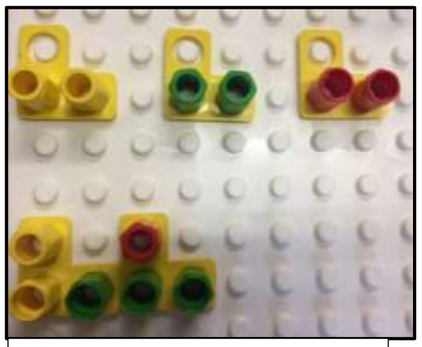


Multiplying and dividing by 10,100

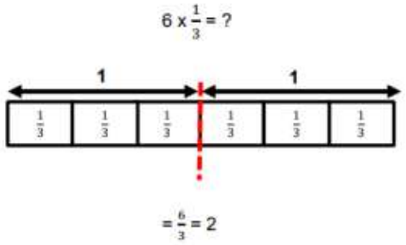


Multiplying by 5 by times 10 and halve





Two thirds x 3



How could you say this?
Refer the children back to the speaking frame.
Number of groups x size of each group = product.

Using times tables facts and place value

2 100 000		700 000 x 3	70 000 x 30	7000 x 300	700 x 3000	70 x 30 000	7 x 300 000
210 000		70 000 x 3	7000 x 30	700 x 300	70 x 3000	7 x 30 000	
21 000		7000 x 3	700 x 30	70 x 300	7 x 3000		
2100		700 x 3	70 x 30	7 x 300			
210		70 x 3	7 x 30				
21	=	**7 x 3**					
2.1		0.7 x 3	7 x 0.3				
0.21		0.07 x 3	0.7 x 0.3	7 x 0.03			
0.021		0.007 x 3	0.07 x 0.3	0.7 x 0.03	7 x 0.003		

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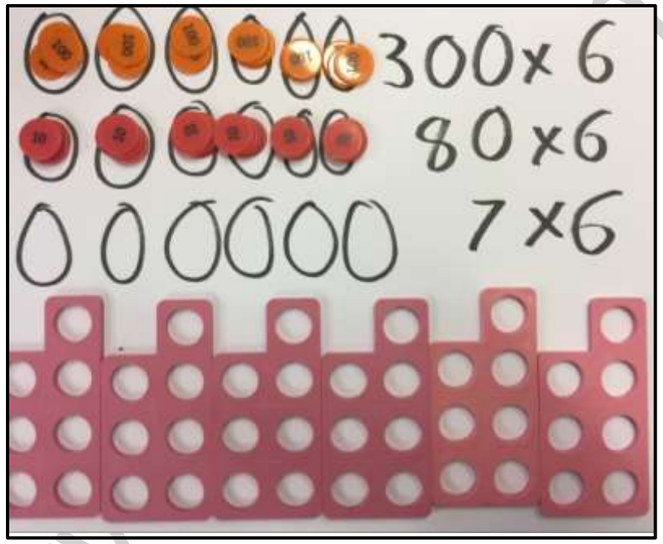
Year 5 Written Multiplication

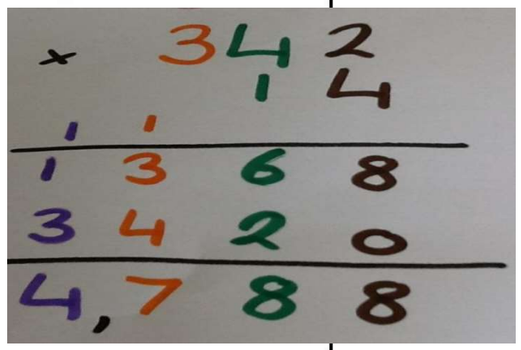
Use equipment to model short multiplication



Short multiplication of 2-digit, 3-digit and 4-digit numbers by 1-digit numbers

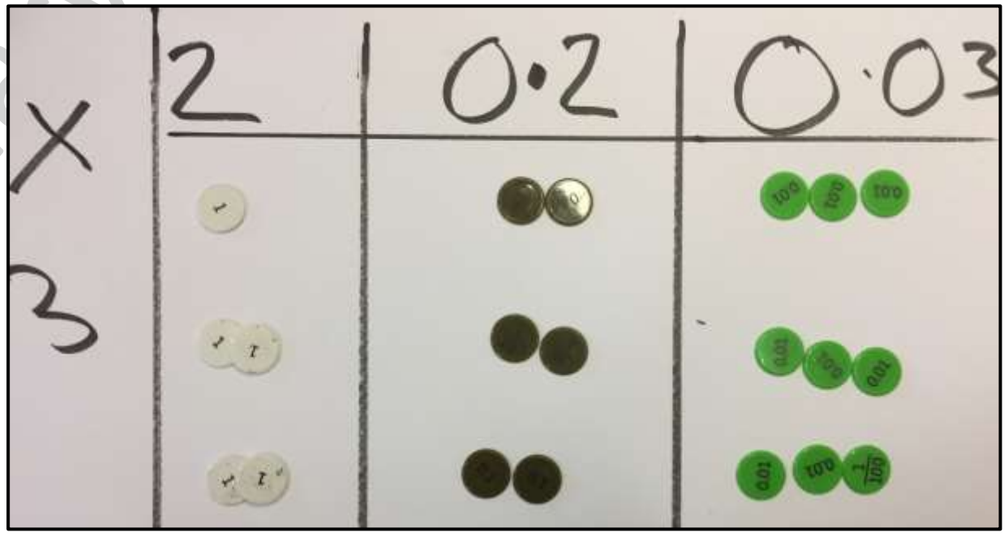
```
  387
x   6
 2322
```

Long multiplication of 2-digit, 3-digit and 4-digit numbers by teen numbers



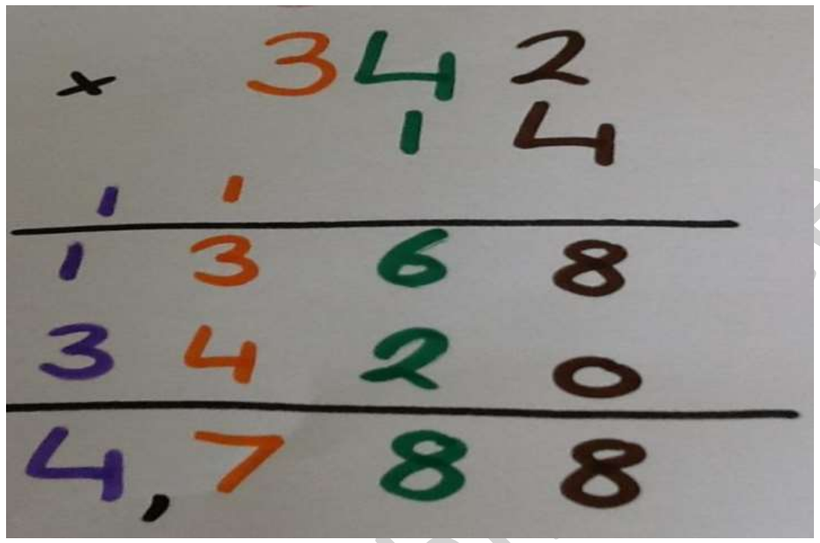
Grid multiplication of numbers with up to 2 decimal places by single digit numbers

Multiplying fractions by single digit numbers
E.g. ¾ x 6 = $^{18}/_{4}$ which is 4 $^{2}/_{4}$ = 4½



Grid method taught alongside other multiplication methods provides an effective way of consolidating place value knowledge and developing fluency short and long algorithms

Long multiplication



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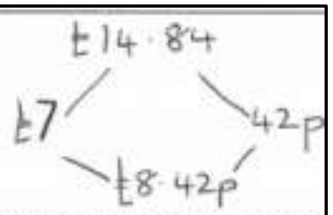
Year 5 Mental division

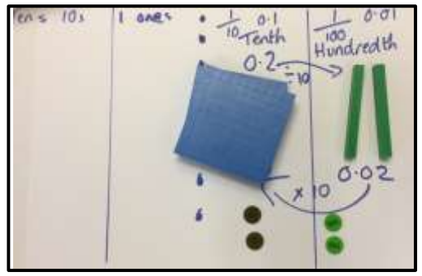
Doubling and halving
Halve amounts of money using partitioning,
e.g. half of £14.84 as half of £14 and half of 84p



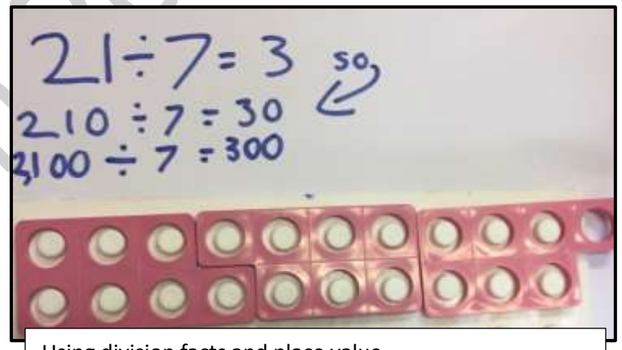
Use doubling and halving as a strategy in dividing by 2, 4, 8, 5 and 20, *e.g. 115 ÷ 5 as double 115 (230) ÷ 10*

Grouping
Divide numbers by 10, 100, 1000 to obtain decimal answers with up to three places, *e.g. 340 ÷ 100 = 3.4.*
Use the 10th, 20th, 30th... multiple of the divisor to divide friendly 2-digit and 3-digit numbers by single-digit numbers, *e.g. 186 ÷ 6 as 30 x 6 (180) and 1 x 6 (6)*
Find unit & non-unit fractions of large amounts, *e.g. 3/5 of 265 is 3 x (265 ÷ 5)*

Using number facts
Use division facts from the times tables up to 12 x 12 to divide multiples of powers of ten of the divisor, *e.g. 3600 ÷ 9 using 36 ÷ 9*
Know square numbers and cube numbers

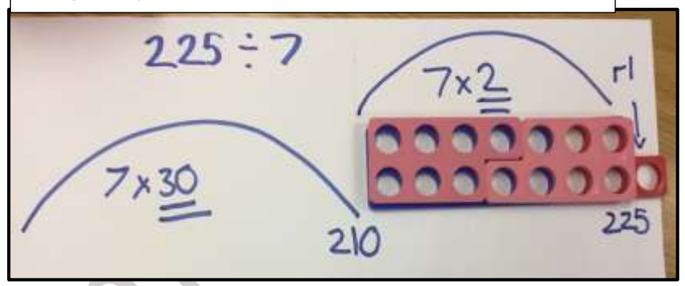


Dividing by 10 and 100

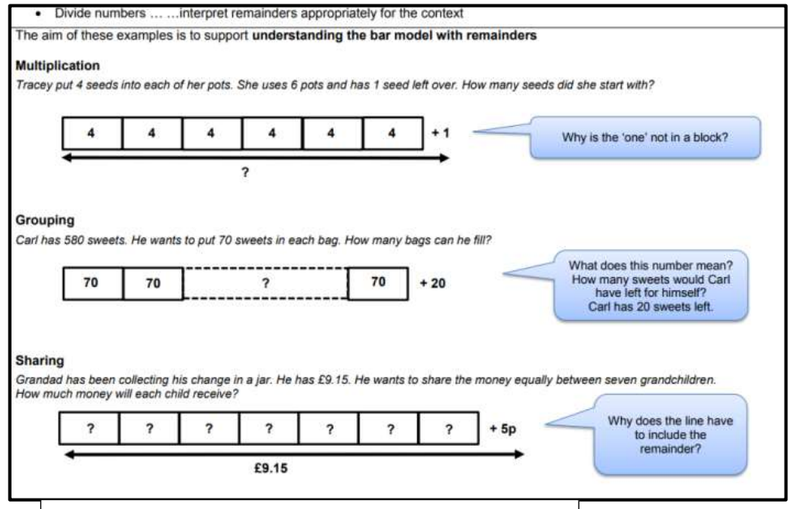


Using division facts and place value

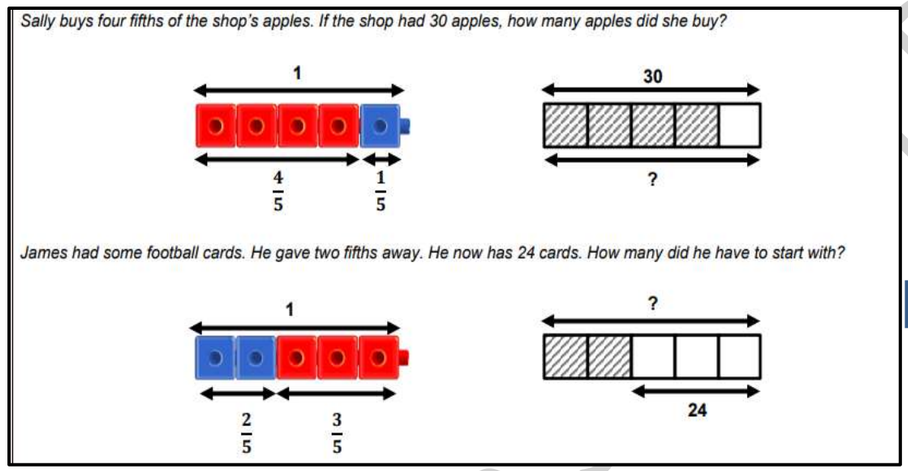
Using multiples of ten of the divisor

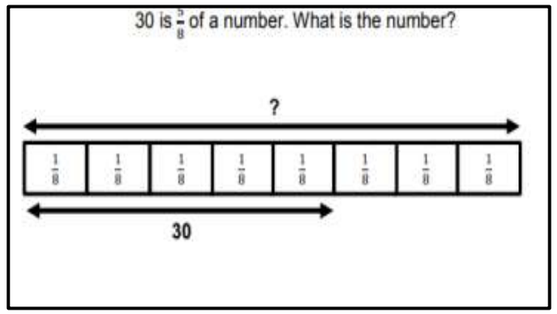


Bar modelling division as grouping and sharing

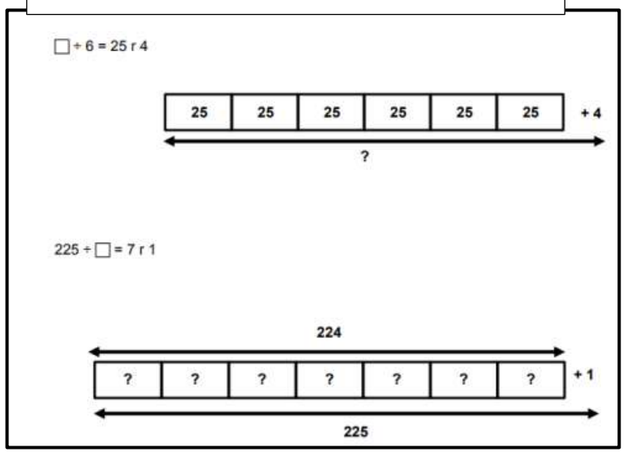


Find fractions of an amount using a bar model





Deeper understanding of division



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Year 5 Written division

Mental strategy of division linked to written version. 'How many 6s in 326?

Written version of a mental strategy for 3-digit ÷ 1 digit numbers

Short division of 3-digit and 4-digit numbers by single-digit numbers

$$\begin{array}{r} 1\ 2\ 6\ 4 \\ 6\overline{)7\ ^{1}5\ ^{3}8\ ^{2}4} \end{array}$$

□ x 6 = 326 326 ÷ 6 = 54 r2

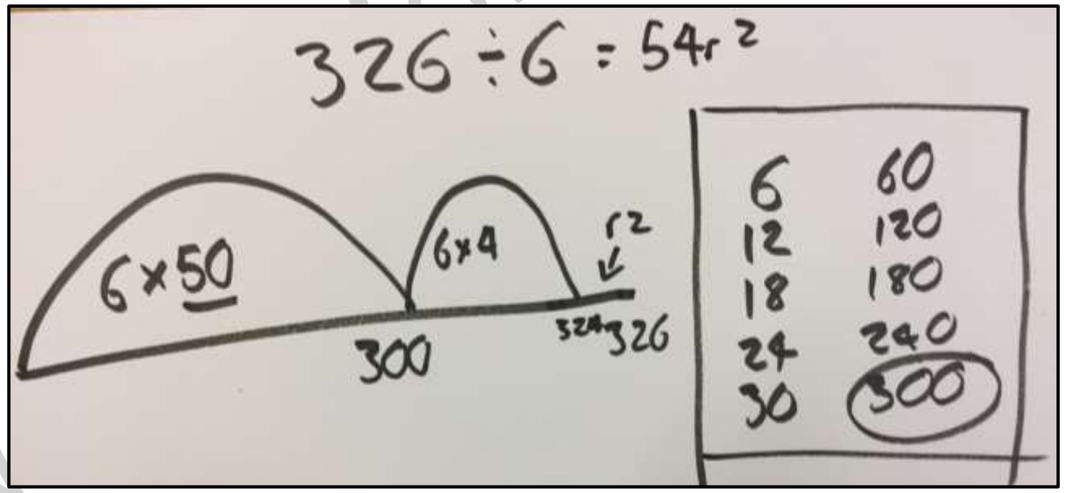
50 x 6 = 300

26

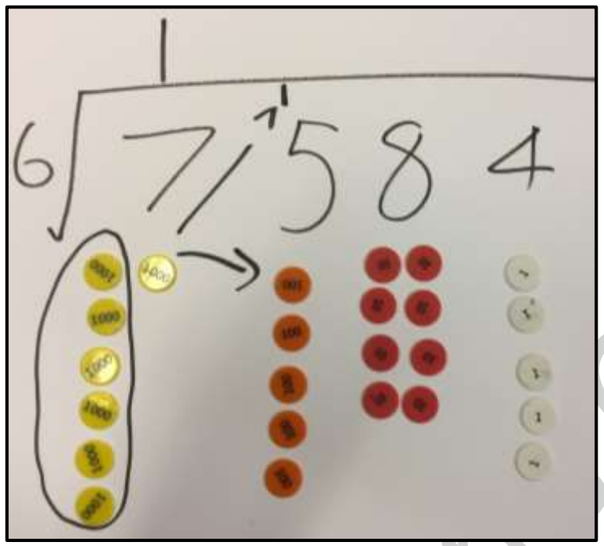
4 x 6 = 24

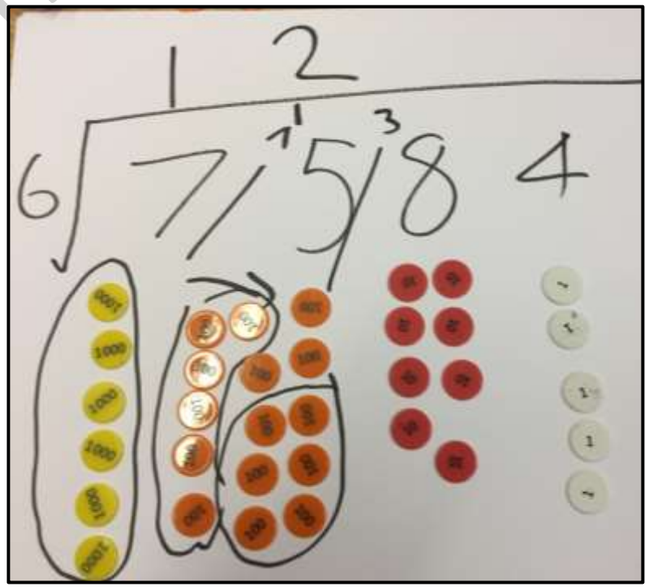
2

54 r2



Grouping and exchanging of counters helps to model short division





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Year 6 Mental Addition

Revision of addition strategies from year 5 up to 3 decimal places

Using Place value

Count in 0.1s, 0.01s, 0.001s, *e.g. knowing what 0.001 more than 6.725 is*

Partitioning, *e.g. 9.54 + 3.25 as 9 + 3 and 0.5 + 0.2 and 0.04 + 0.05 to get 12.79*

100s	10s	1s	0.1s	0.01s	0.001s
		6.	7	2	5
		,	0	0	1
		6.	7	2	6

Counting on

Add two decimal numbers by adding the ones then the tenths/hundredths or thousandths, *e.g. 6.314 + 3.006 as 6.314 add 3 (9.314) then add 0.006 (9.32)*

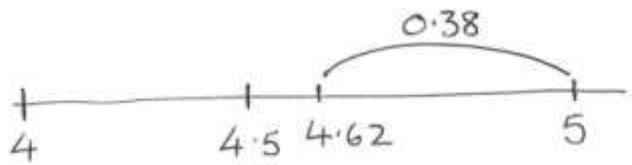
Add near multiples of 1, *e.g. 6.345 + 0.999 or 5.673 + 0.9*

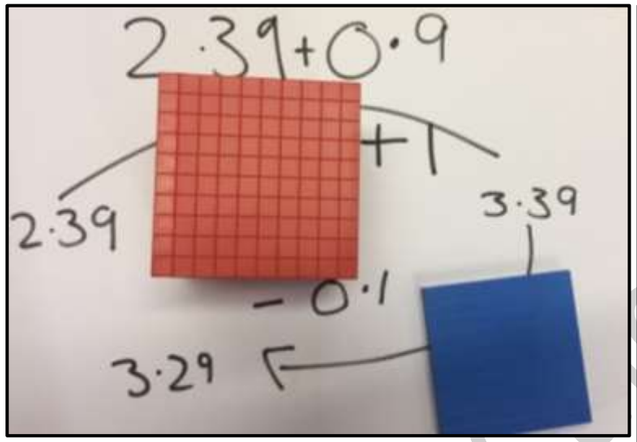
Count on from large numbers, *e.g. 16,375 + 12,003*

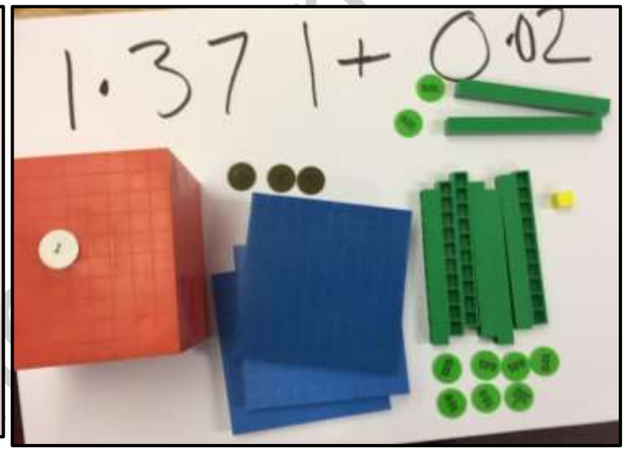
Using number facts

Number bonds to 1 and to next multiple of 1, *e.g. 0.63 + 0.37 or 2.355 + 0.645*

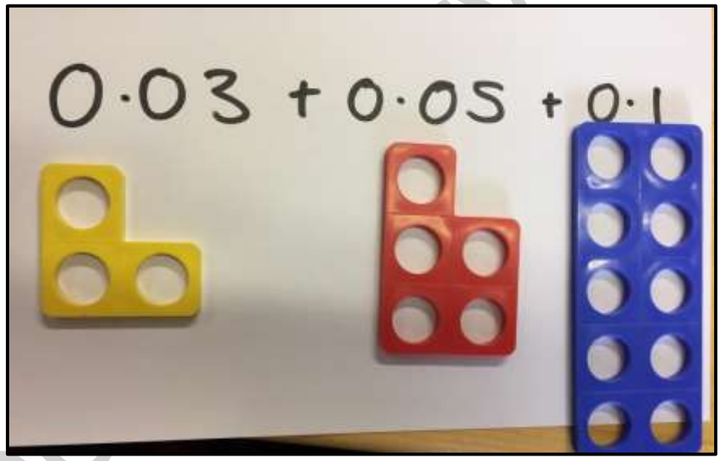
Add to next ten, *e.g. 4.62 + 0.38*

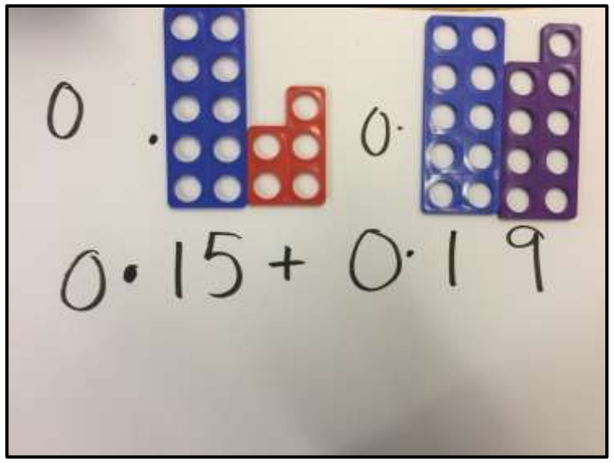






Revising of number facts with decimals 0.05 + 0.05 does not = 0.010





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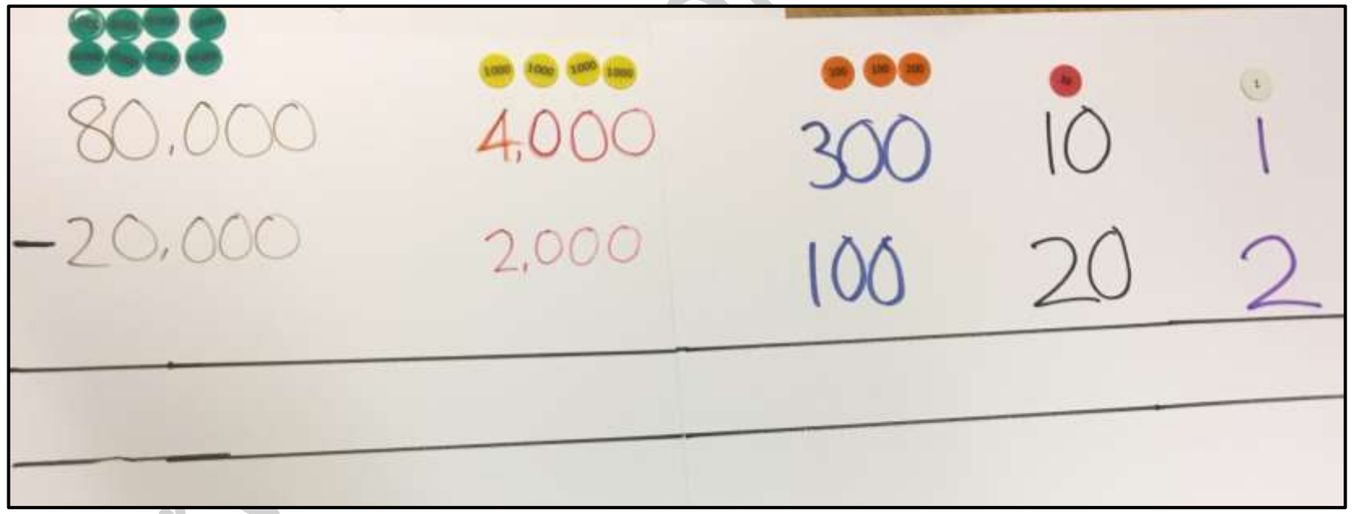
Year 6 Written Addition

Compact column addition
for adding several large numbers
and decimal numbers with up
to two places

£14·64
+ £28·78
£12·26
11·1
£55·68

Compact column addition with
money

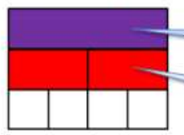
Add fractions with unlike denominators, e.g. ¼ + 1/3 = 1 1/12 or 13/12
2 ¼ + 1 1/3 = 3 7/12



Expanded model helps to consolidate place value up to 10 million in year 6. The same model can be used to investigate addition of decimals

- $\frac{1}{2} + \frac{1}{4} = ?$

In order to be able to add these fractions, the children need to convert them into equivalent fractions. Using Cuisenaire rods can support them in refreshing their knowledge of equivalent fractions.

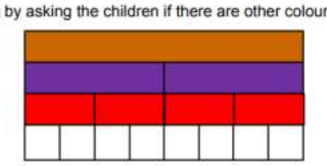


The purple rod has been selected as this will allow the children to see one half and one quarter on the same model

If purple is the whole, what colour shows us half? (red)
What colour rod would show us quarters?
Can we rename half? Yes, two quarters.

$\frac{1}{2} + \frac{1}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$

Deepen understanding by asking the children if there are other colour rods which would allow us to show halves and quarters on the same model.



$\frac{1}{2} + \frac{1}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$

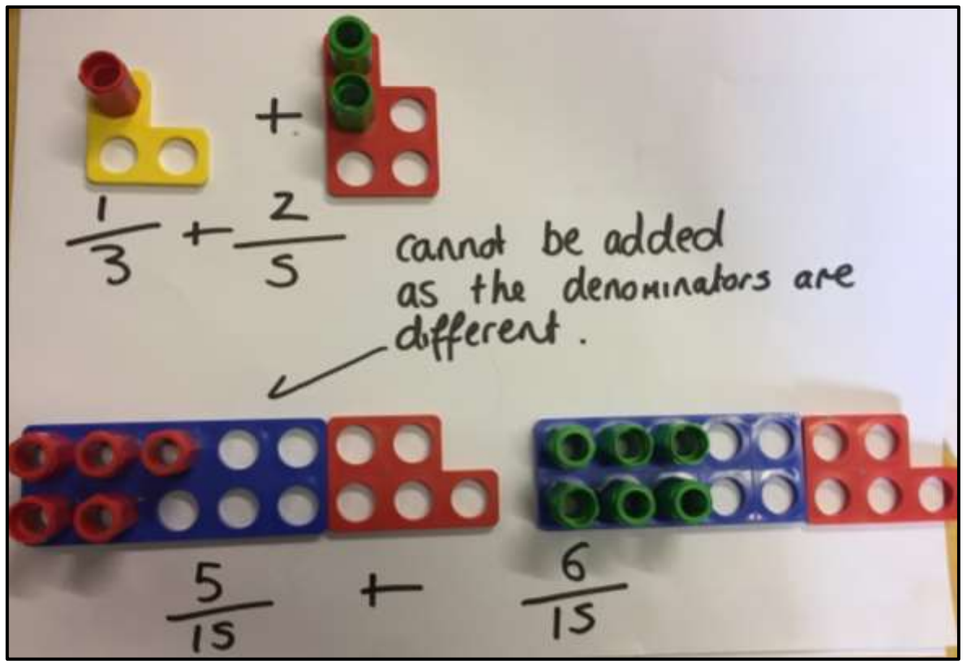
- $\frac{1}{2} + \frac{1}{3} = ?$

$\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6}$

$= \frac{5}{6}$

Which colour rods will allow us to represent halves and thirds on the same model?
Can you explain why?
If the children need to allow them to explore.

Adding fractions with different denominators



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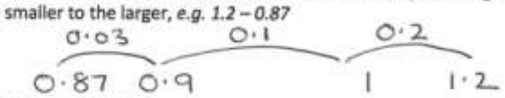
Year 6 subtraction

Taking away
Use place value to subtract decimals, *e.g. 7.782 – 0.08 or 16.263 – 0.2, etc.*
Take away multiples of powers of 10, *e.g. 132,956 – 400 or 686,109 – 40,000 or 7.823 – 0.5*
Partition or count back, *e.g. 3964 – 1051 or 5.72 – 2.01*
Subtract near multiples, *e.g. 360,078 – 99,998 or 12.831 – 0.99*

Counting up
Count up to subtract numbers from multiples of 10, 100, 1000, 10,000
Find a difference between two decimal numbers by counting up from the smaller to the larger, *e.g. 1.2 – 0.87*



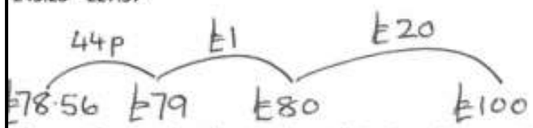
Using number facts
Derived facts from number bonds to 10 and 100, *e.g. 0.1 – 0.075 using 75 + 25 = 100 or 5 – 0.65 using 65 + 35 = 100*

Number bonds to £1, £10 and £100, *e.g. £7.00 – £4.37 or £100 – £66.20 using 20p + 80p = £1 and £67 + £33 = £100.*

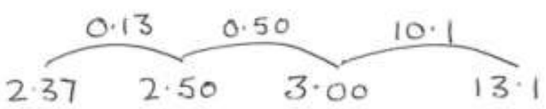
Compact column subtraction for large numbers

	2	14		7	15
	~~3~~	~~4~~	6	~~8~~	~~5~~
–	1	6	4	5	8
	1	8	2	2	7

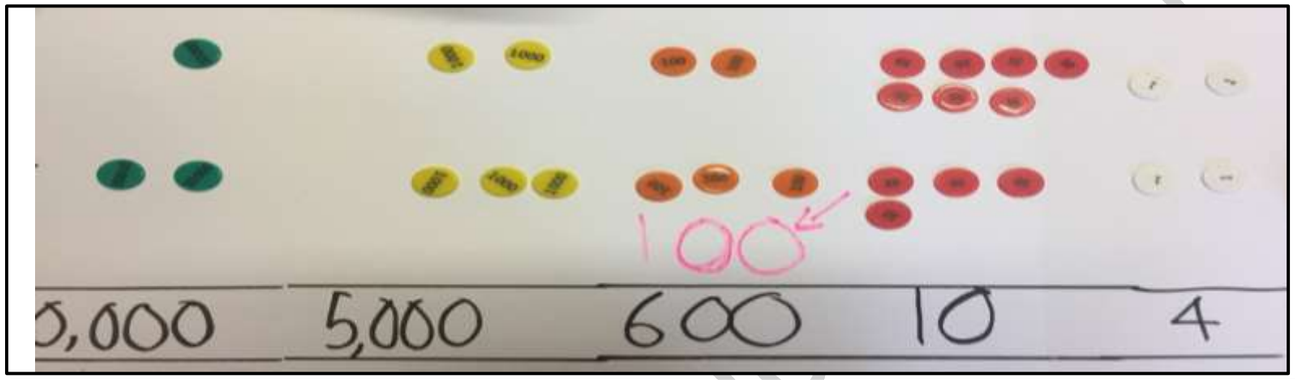
Use counting up subtraction when dealing with money, *e.g. £100 – £78.56 or £45.23 – £27.57*



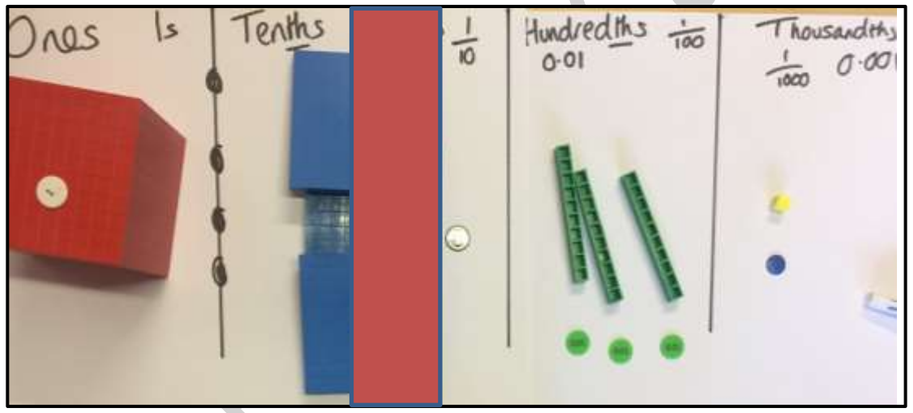
Use counting up subtraction to subtract decimal numbers, *e.g. 13.1 – 2.37*

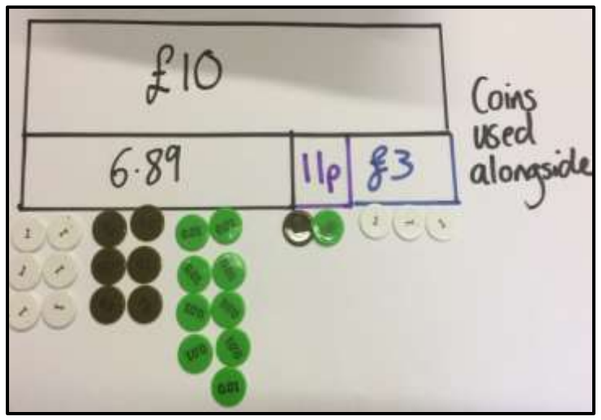


Subtracting fractions with unlike denominators, *e.g. 1¼ - ²/₃ as 1³/₁₂ - ⁸/₁₂ or ¹⁵/₁₂ – ⁸/₁₂ = ⁷/₁₂*

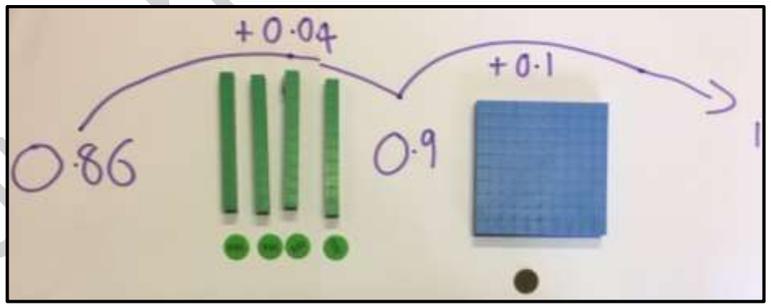


Expanded model helps to consolidate place value up to 10 million in year 6. The same model can be used to investigate subtraction of decimals

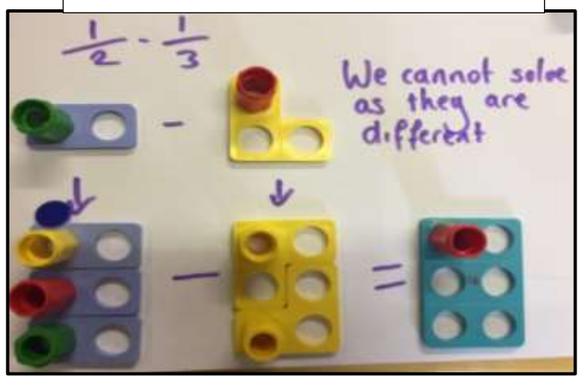




Revision of subtraction strategies from year 5 with numbers up to 10 million and 3dp



Subtraction of fractions with different denominators



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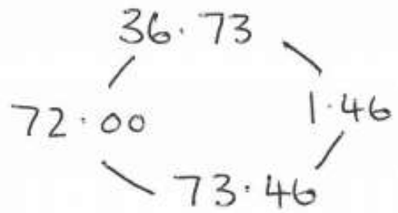
Year 6 Multiplication

Doubling and halving
Double decimal numbers with up to 2-places using partitioning, *e.g. 36.73 doubled is double 36 (72) plus double 0.73 (1.46)*

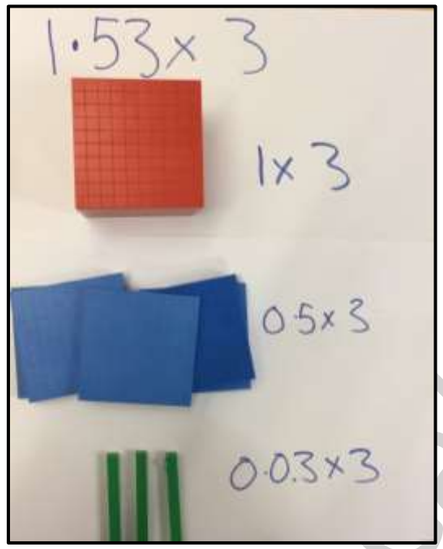


Use doubling and halving as strategies in mental multiplication

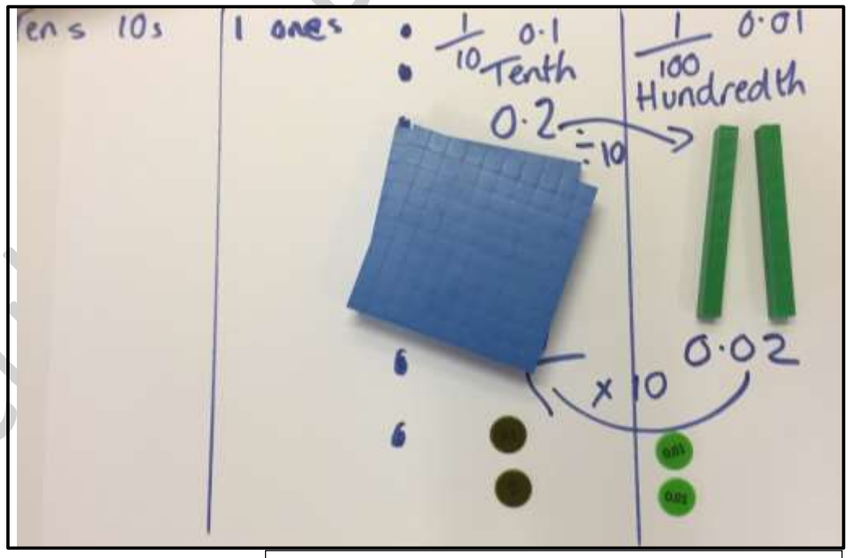
Grouping
Use partitioning as a strategy in mental multiplication, as appropriate, *e.g. 3060 x 4 as (3000 x 4) + (60 x 4) or 8.4 x 8 as 8 x 8 (64) and 0.4 x 8 (3.2)*
Use factors in mental multiplication, *e.g. 421 x 6 as 421 x 3 (1263) doubled (2526) or 3.42 x 5 as half of (3.42 x 10)*
Multiply decimal numbers using near multiples by rounding, *e.g. 4.3 x 19 as 4.3 x 20 (86 – 4.3)*

Using number facts
Use times tables facts up to 12 x 12 in mental multiplication of large numbers or numbers with up to two decimal places, *e.g. 6 x 4 = 24 and 0.06 x 4 = 0.24*

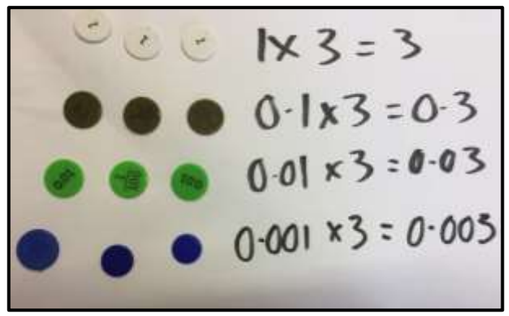
Multiplication of decimals by partitioning



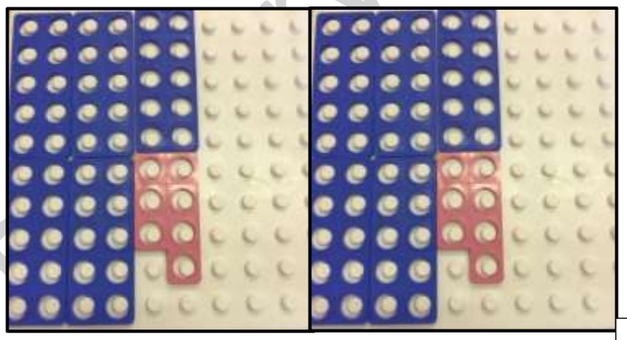
Multiplication of numbers by 10,100,1000



Linking place value and number facts



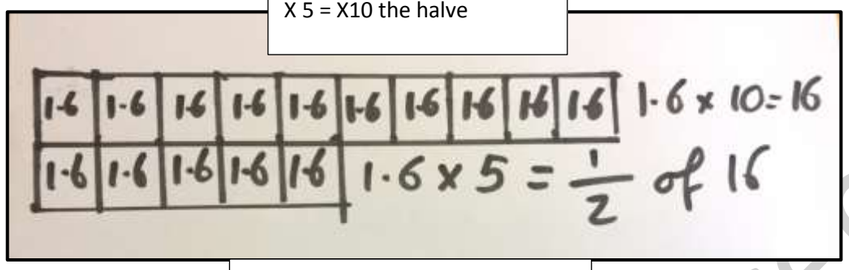
Double 0.59



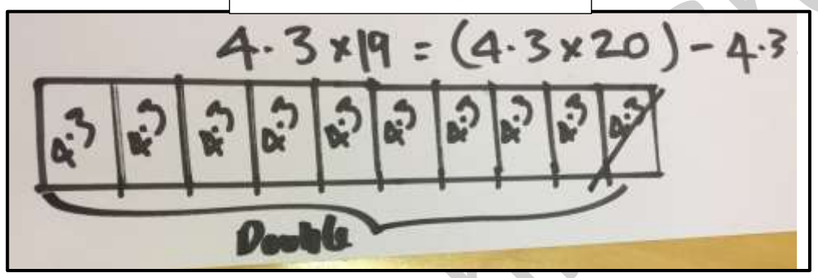
Linking place value and number facts

2 100 000		700 000 x 3	70 000 x 30	7000 x 300	700 x 3000	70 x 30 000	7 x 300 000
210 000		70 000 x 3	7000 x 30	700 x 300	70 x 3000	7 x 30 000	
21 000		7000 x 3	700 x 30	70 x 300	7 x 3000		
2100		700 x 3	70 x 30	7 x 300			
210		70 x 3	7 x 30				
21	=	**7 x 3**					
2.1		0.7 x 3	7 x 0.3				
0.21		0.07 x 3	0.7 x 0.3	7 x 0.03			
0.021		0.007 x 3	0.07 x 0.3	0.7 x 0.03	7 x 0.003		

X 5 = X10 the halve



X19 = x20 then – one group



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Year 6 Written Multiplication

Short multiplication of 2-digit, 3-digit and 4-digit numbers by 1-digit numbers

```
  3875
x    6
 -----
 23250
```

Long multiplication of 2-digit, 3-digit and 4-digit numbers by 2-digit numbers

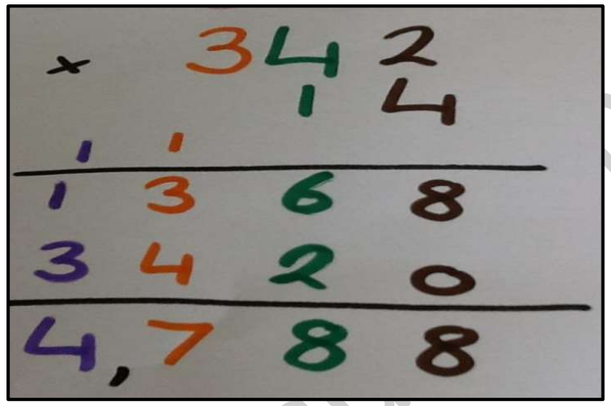
Short multiplication of decimal numbers using x100 and ÷100, e.g. 13.72 x 6 as 1372 x 6 ÷ 100

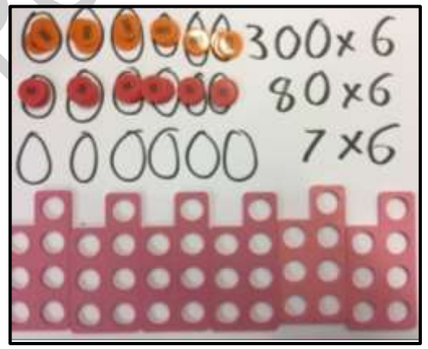
Short multiplication of money, £13.72 x 6

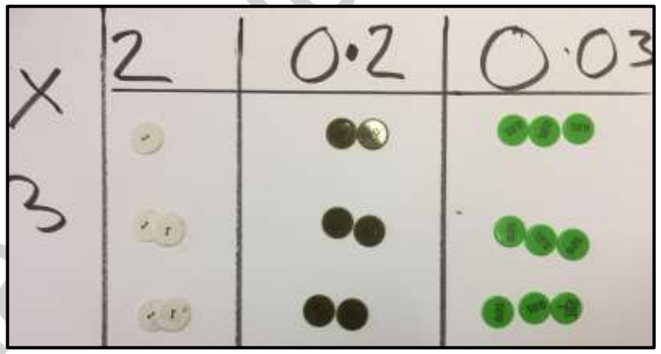
Grid multiplication of numbers with up to 2 decimal places by single digit numbers

Multiplying proper and improper fractions, e.g. ¾ x $^{2}/_{3}$

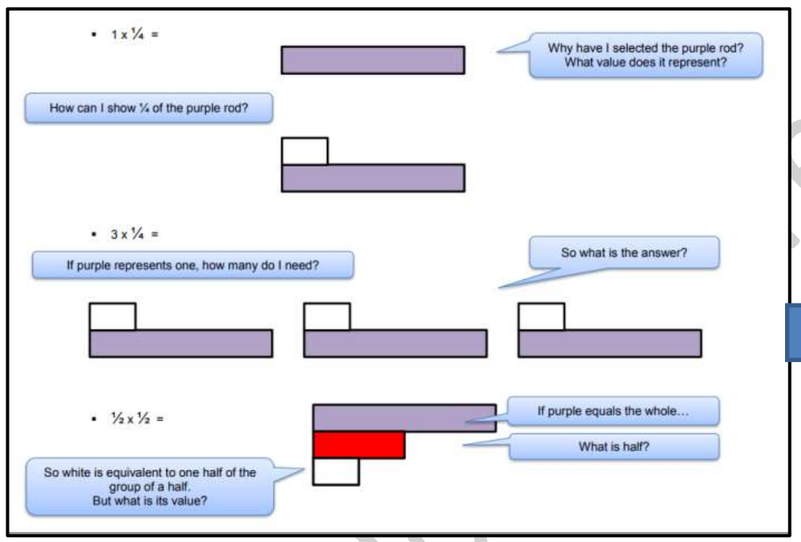
NB Grid multiplication provides a default method for ALL children

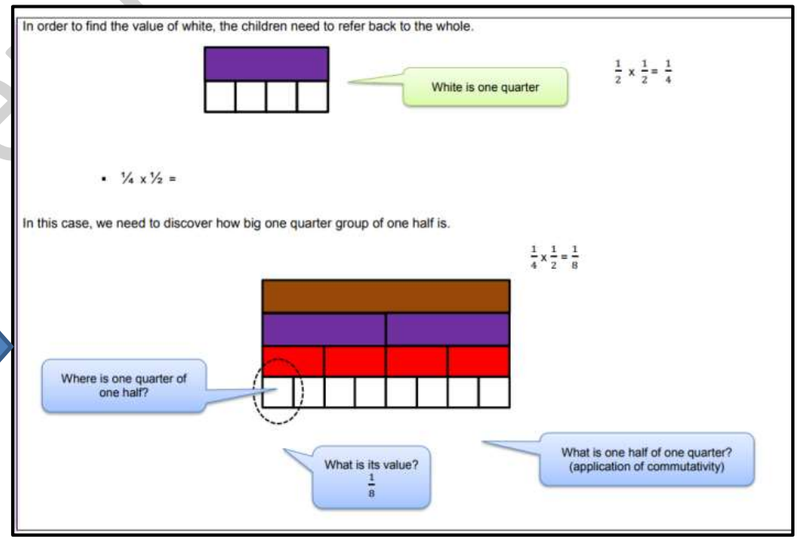


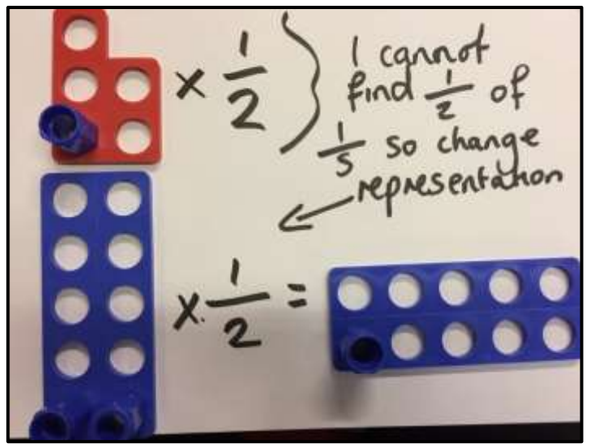




When multiplying fractions by fractions, it is crucial that learners understand x as (lots) of







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Bar model diagrams from Herts for Learning

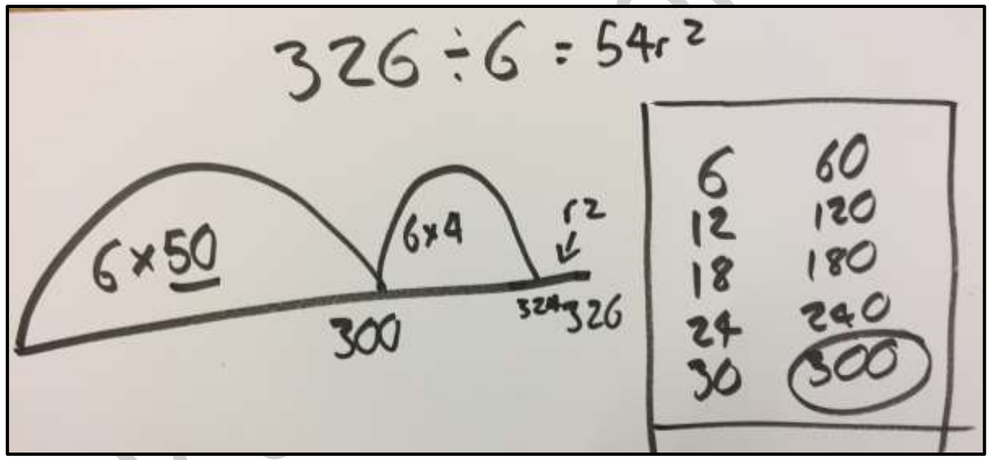
Also adapted from Hamilton Trust

St John's Green Primary School
Learn to Live, Live to Learn

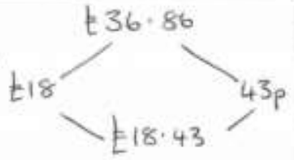
We ♥ Maths

Year 6 Division

Revising division methods from year 5



Doubling and halving
Halve decimal numbers with up to 2-places using partitioning, *e.g. half of 36.86 is half of 36 (18) plus half of 0.86 (0.43)*

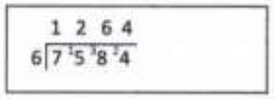


Use doubling and halving as strategies in mental division, *e.g. 216 ÷ 4 is half of 216 (108) and half of 108 (54)*

Grouping
Use 10th, 20th, 30th, ... or 100th, 200th, 300th.... multiples of the divisor to divide large numbers, *e.g. 378 ÷ 9 as 40 x 9 = 360 and 2 x 9 = 18 so the answer is 42*
Use tests for divisibility, *e.g. 135 divides by 3 as 1 + 3 + 5 = 9 and 9 is in the 3x table*

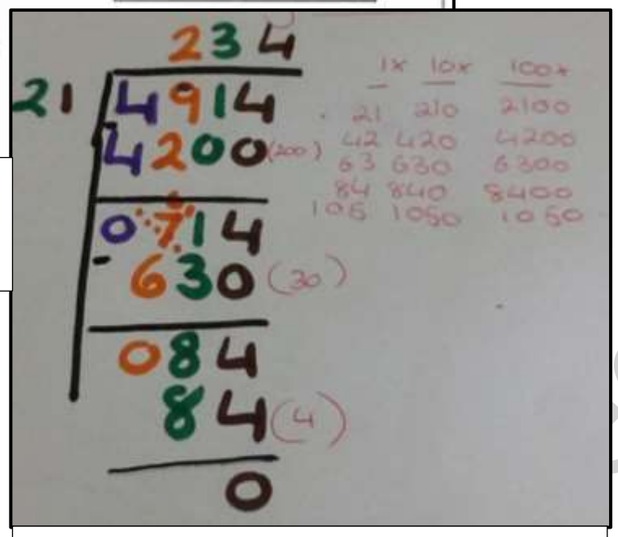
Using number facts
Use division facts from the times tables up to 12 x 12 to divide decimal numbers by single-digit numbers, *e.g. 1.17 ÷ 3 is $^{1}/_{100}$ of 117 ÷ 3 (0.39)*

Short division of 3-digit and 4-digit numbers by single-digit numbers

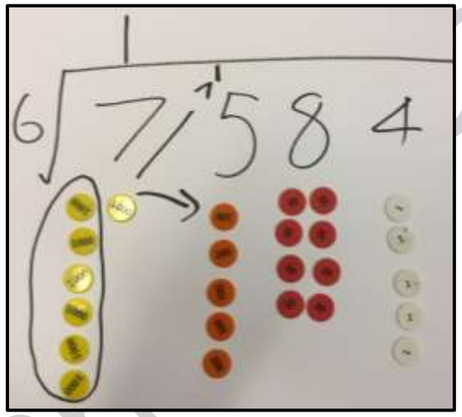


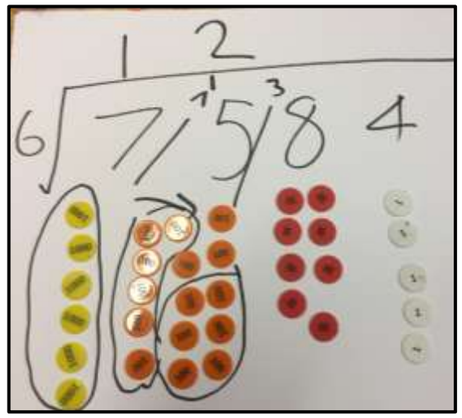
Long division of 3-digit and 4-digit numbers by two-digit numbers

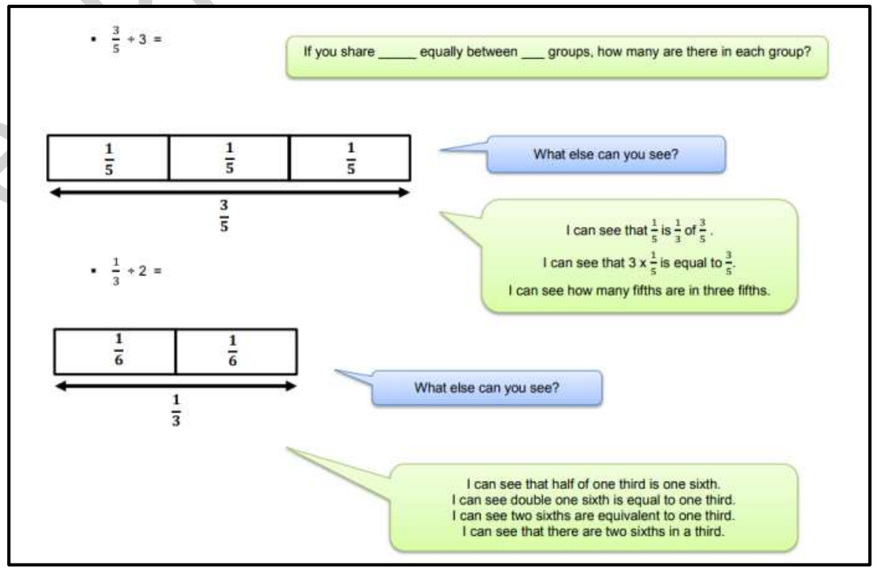
Divide fractions by whole numbers



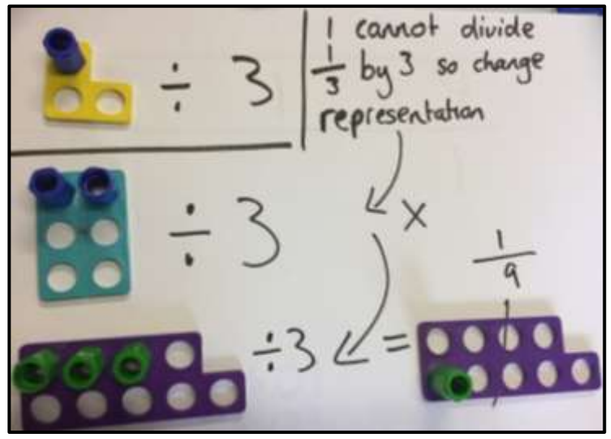
Long division. Note: Multiples of divisor on the right hand side







Division of fractions by whole numbers



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