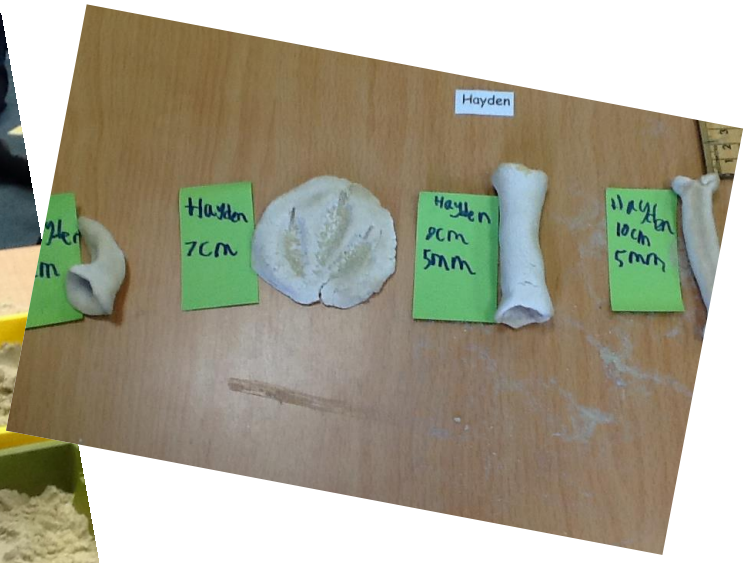
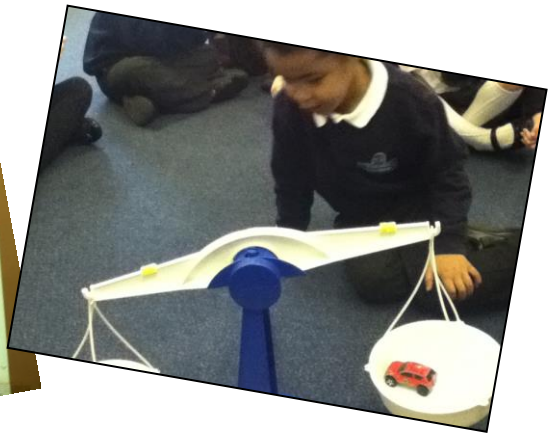
Ellistown Primary School

Calculation Policy

April 2017



Calculation in Reception



Reception children will develop fluency with numbers to 20 using a variety of practical resources and representations. Daily mental maths will support their calculations which will prepare them for strategies used in year one.

Addition

Mental Calculation Strategies

Children should progress through the mental calculation strategies as outlined

Mental recall of number bonds:

6 + 4 = 10 □ + 3 = 10 20 = 19 + □ 25 + 75 = 100

0.8 + 0.2 = 1 0.45 + 0.55 = 1 150 + 850 = 1000 300 + □ = 1000

Use near doubles;

6 + 7 = double 6 + 1 = 13 30 + 40 = double 30 + 10 = 70

Addition using partitioning:

34 + 45 = (30 + 40) + (4 + 5) = 79

Counting on or back in repeated steps of 0.1, 1, 10, 100, 1000:

86 + 57 = '86, 96, 106, 116, 126, 136...137, 138, 139, 140, 141, 142, 143' = 143 (counting on in tens then ones)

460 – 300 = '460, 360, 260, 160' = 160 (counting back in hundreds)

Add the nearest multiple of 10, 100, 1000 and then adjust:

24 + 19 = 24 + 20 – 1 = 43 458 + 71 = 458 + 70 + 1 = 529

Use the relationship between addition and subtraction:

36 + 19 = 55 19 + 36 = 55 55 – 19 = 36 55 – 36 = 19

Many calculation strategies will continue to be used. They are not replaced by written methods. Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

Dream, believe, achieve the Ellistown Way.

Addition

Year One

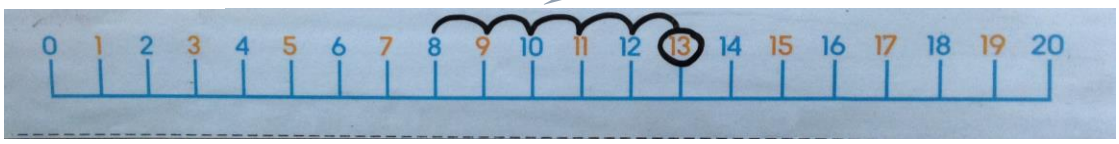
Learning Objectives:

- Read write and interpret mathematical statements involving addition, subtraction and the equals sign
- Add and subtract one digit and two digit numbers to 20, including 0
- Solve one step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = ☐ - 9

Use a numbered number line to add by counting on in ones.

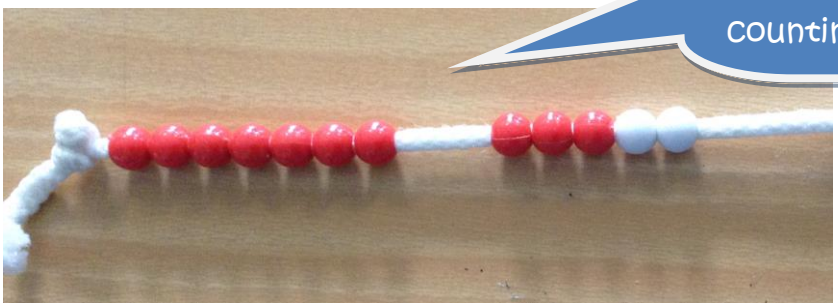
8 + 5 = 13

Encourage the children to start with the larger number and count on.



Move on to using an empty number line but with intervals.

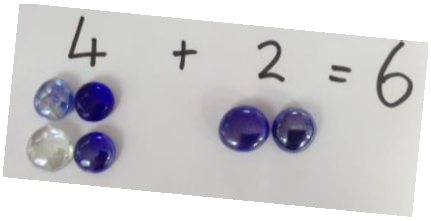
Bead strings can be used to illustrate addition and bridging through tens e.g. counting on 3 then counting on 2.

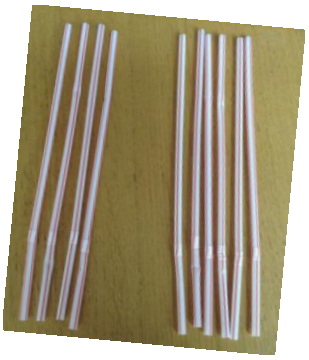


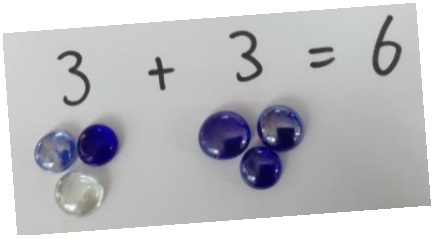
Vocabulary: add, more, plus, and, make, altogether, total, equal to,

Solve missing number problems using concrete objects and number lines e.g.

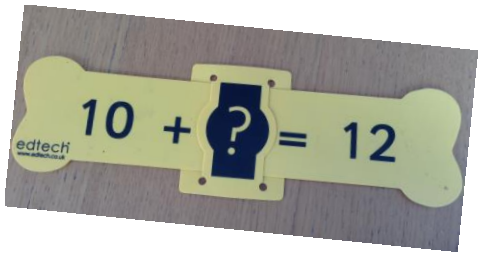
13 + ☐ = 17 6 + 2 + 1 = ☐ ☐ + ☐ = 6 ☐ = 5 + 12







Counting equipment and everyday objects should be used to support addition.



Children to become familiar with the addition (+) and equals (=) signs and use these when writing number sentences.

Vocabulary: equals, double, most, count on, number line

Addition

Year Two

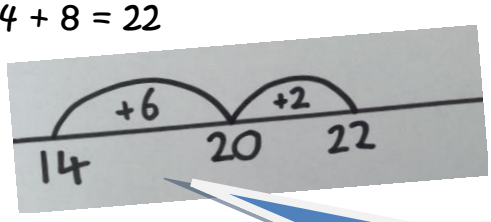
Learning Objectives:

- add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; adding three one-digit numbers
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- apply their increasing knowledge of mental and written methods

Use empty number lines to:

Add 2-digit numbers and ones

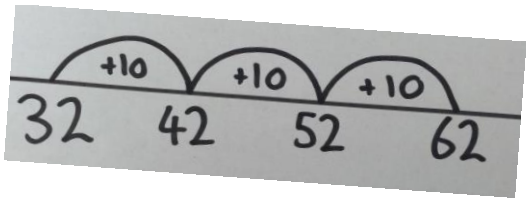
14 + 8 = 22



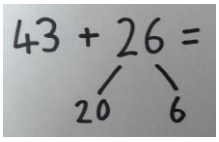
Encourage children to use their knowledge of number bonds to add efficiently.

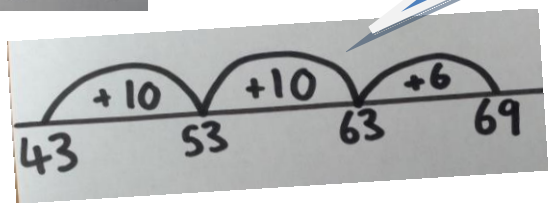
Add 2-digit numbers and tens

32 + 30 = 62



Add pairs of 2-digit numbers



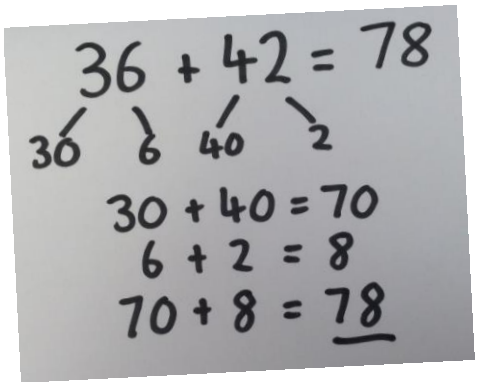


Partition the smaller number into tens and ones. Discuss what happens to the tens digit when adding 10.

Make jumps in multiples of 10 once children are secure with place value.

Vocabulary: add, more, plus, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, partition, tens boundary,

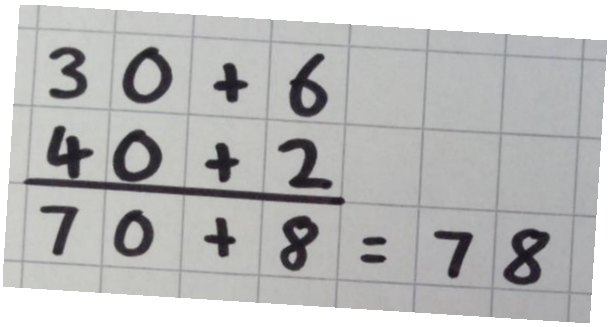
Also use the partitioning method to add pairs of 2-digit numbers



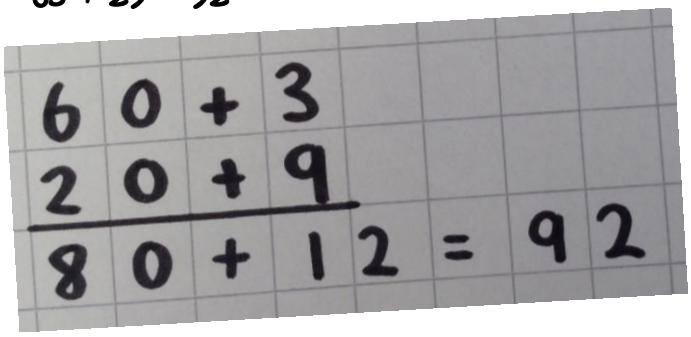
Initially, only provide questions that do not cross the tens boundary.

36 + 42 = 78

Move on to setting it out using the partitioned column method



63 + 29 = 92



Once children are confident in adding a multiple of 10 to a 2-digit number mentally (50 + 13), provide them with additions that do cross the tens boundary e.g. 63 + 29.

Use concrete equipment and hundred squares to build children's confidence and fluency in addition and to aid their understanding of written methods.

Vocabulary: addition, column

Addition

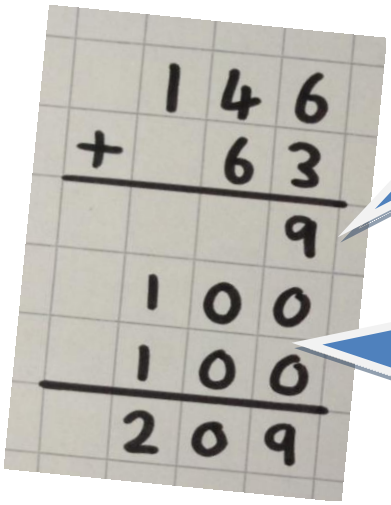
Year Three

Learning Objectives:

- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction
- estimate the answer to a calculation and use inverse operations to check answers
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction
- add and subtract fractions with the same denominator within one whole

Continue to use the <u>partitioned column method</u> (as set out in year 2) with larger numbers containing up to 3-digits.

Once children are secure in using the <u>partitioned column method</u>, move on to using the <u>expanded column addition</u> method.



Teach the children to add the ones first.

Remind them of the importance of lining up the digits in each column accurately.

When teaching this method, ensure that children are secure in their understanding of place value without needing to show partitioning. Remind them that when they are adding the tens and hundreds, they are adding 4 tens and 6 tens, not 4 add 6.

Vocabulary: add, more, plus, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens, ones, partition, plus, addition, column, tens boundary,

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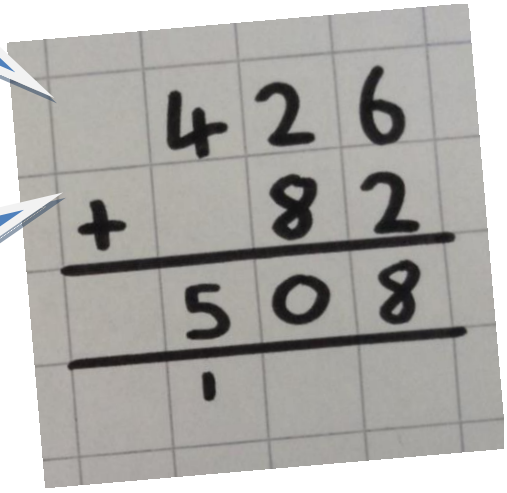
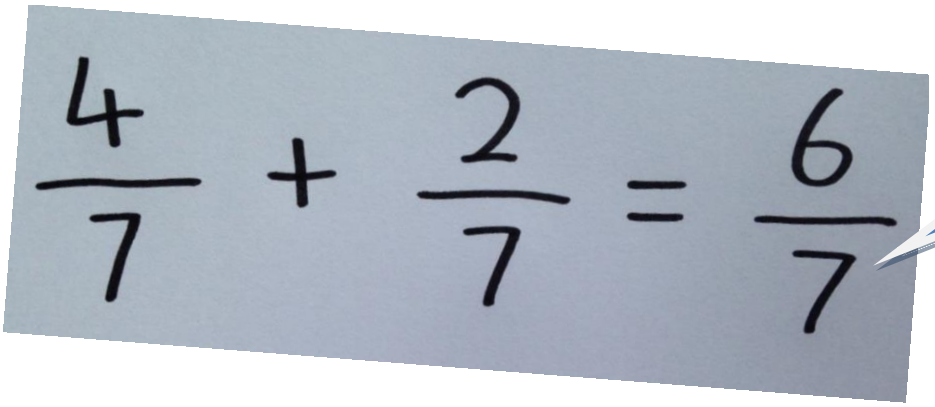
Compare this method to the expanded column addition to help the children understand the process. Introduce carrying for the first time reminding the children to carry the numbers underneath the bottom line.

For children who are very confident in using <u>expanded column addition</u> and have a secure understanding of place value, move on to using the <u>compact column addition</u> method.



Ensure correct vocabulary is used e.g. 6 + 2, 20 + 80, 400 + 0 to reinforce the place value of each digit.

Adding fractions:



Add fractions with the same denominator within one whole.

Practical resources should be used to support pupils until they are fluent.

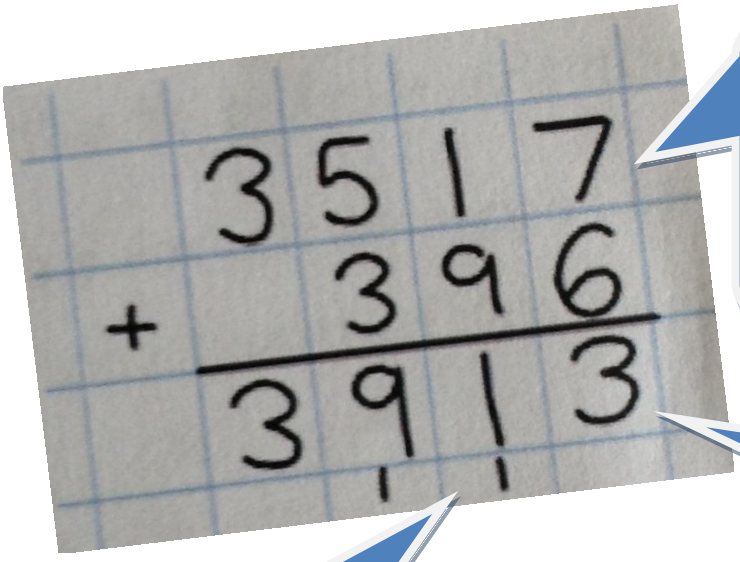
Vocabulary: hundreds boundary, increase, vertical, 'carry', expanded, compact

Addition

Year Four

Learning Objectives:

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why
- add and subtract fractions with the same denominator



Reinforce the correct place value by reminding them the actual value is 5 hundreds add three hundreds, not 5 add 3, for example.

Add ones first.

'Carry' numbers **underneath** the bottom line.

Introduce the compact column addition method by asking children to add the two given numbers together using the method that they are familiar with (see year 3). Teacher models the compact method with carrying, asking children to discuss the similarities and differences to establish how it is carried out.

Vocabulary: add, more, plus, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens boundary, hundreds boundary, tens, ones, partition, plus,

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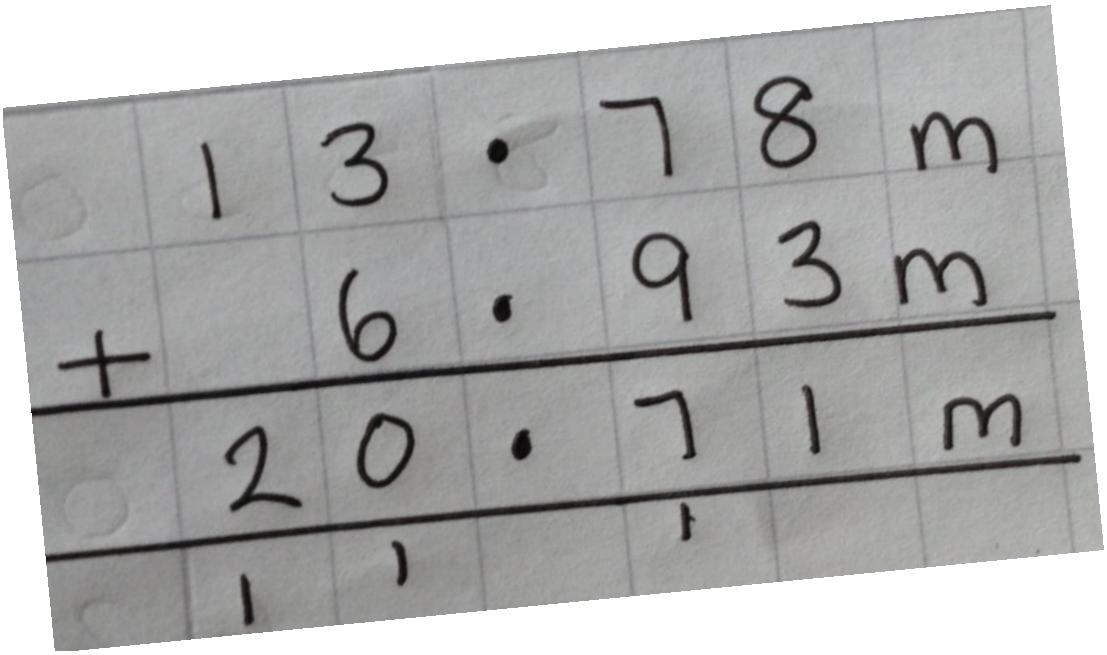
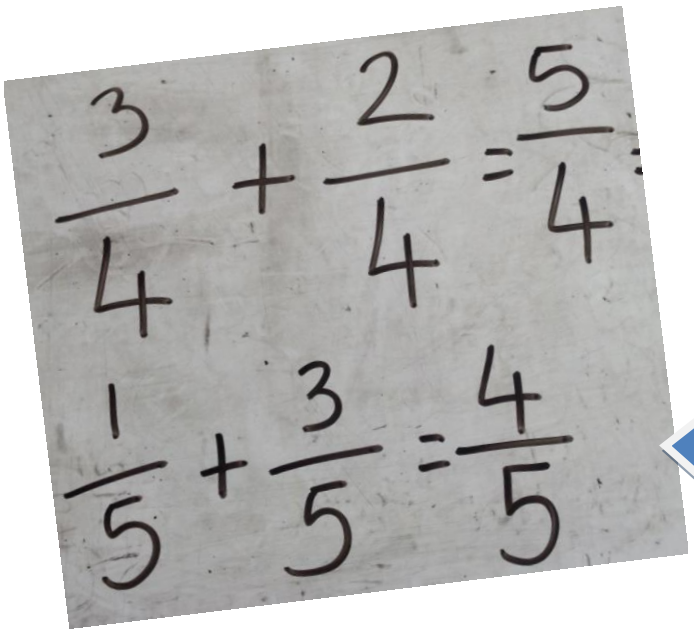
Use and apply this method to money and measurement values.



Adding Fractions:



Add fractions with the same denominator. Use practical resources to support the concept until children have developed a secure understanding.

Progress to finding equivalent fractions and writing answers in its lowest form e.g. 6/8 = 3/4

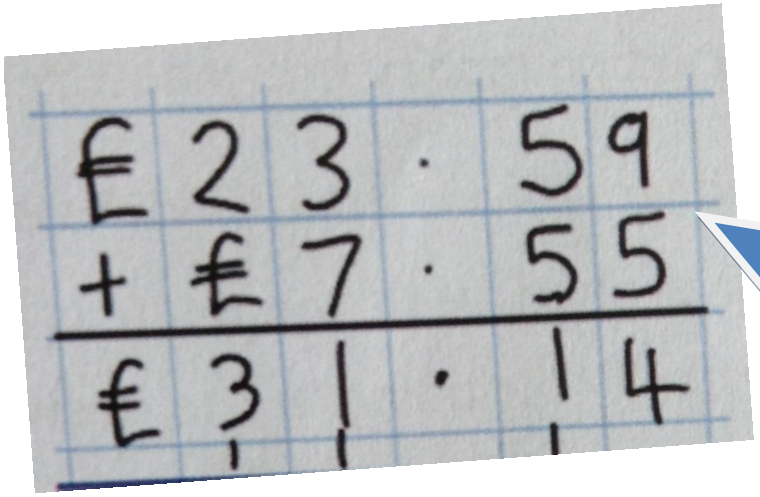
Vocabulary: addition, column, increase, 'carry', expanded, compact, vertical & thousands, hundreds, digits, inverse

Addition

Year Five

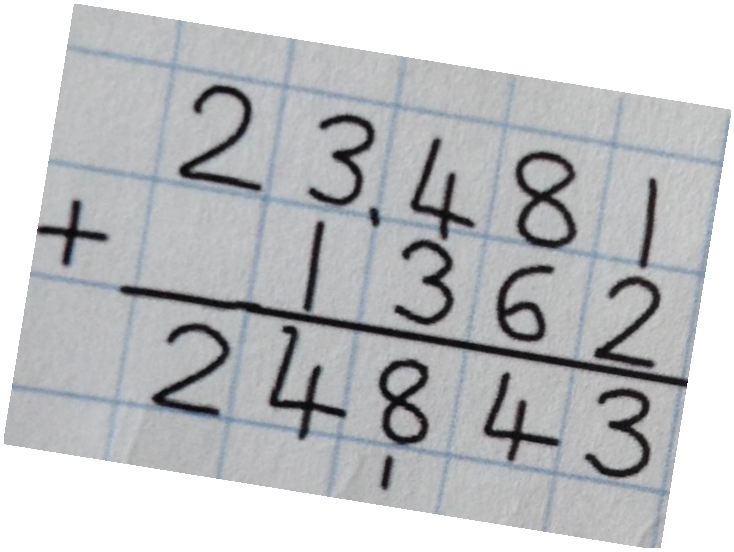
Learning Objectives:

- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number [for example, 2/5 + 4/5 = 6/5 = 1 1/5]
- add and subtract fractions with the same denominator and denominators that are multiples of the same number



The decimal point should be aligned in the same way as the other place value columns, and must be in the same column in the answer.

Numbers should begin to exceed four digits.



Vocabulary: add, more, plus, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens boundary, hundreds boundary, tens, ones, partition, plus,

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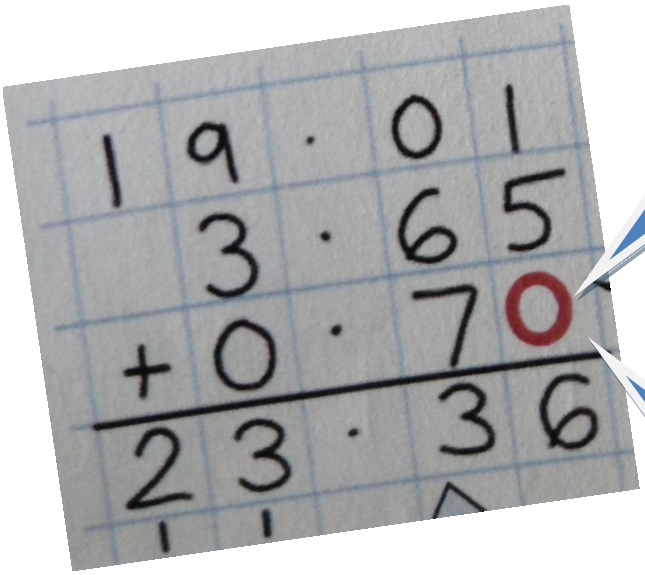
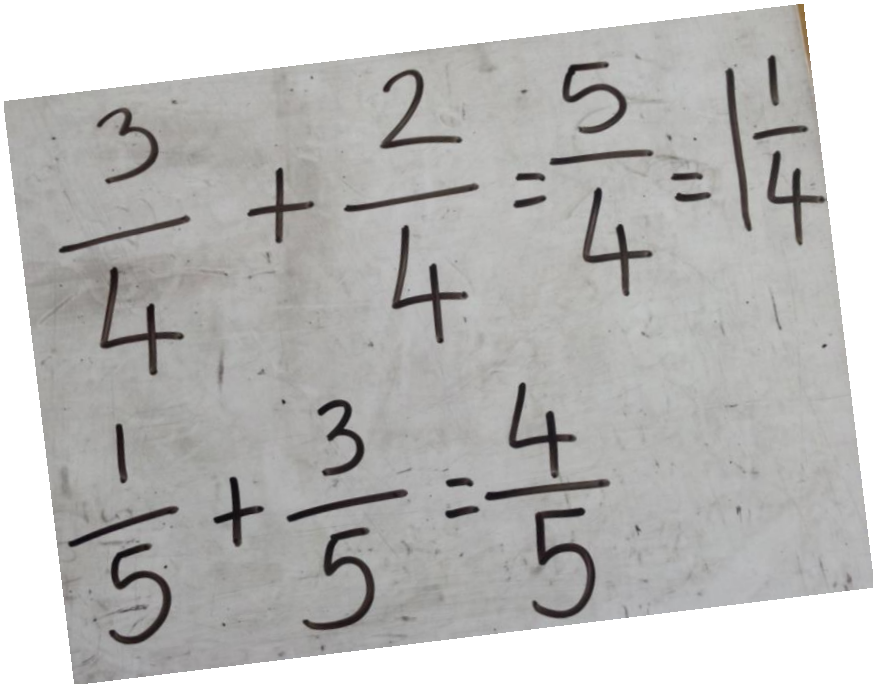


Say '6 tenths add 7 tenths' to reinforce place value.

Empty decimal places should be filled with zero to show place value in each column.

Adding Fractions:



Add fractions with the same denominator and progress to those with multiples of the same denominator e.g. 3/4 + 7/8 = 13/8 = 1 5/8

Vocabulary: addition, column, increase, 'carry', expanded, compact, vertical, thousands, hundreds, digits, inverse & decimal places, decimal point, tenths, hundredths, thousandths

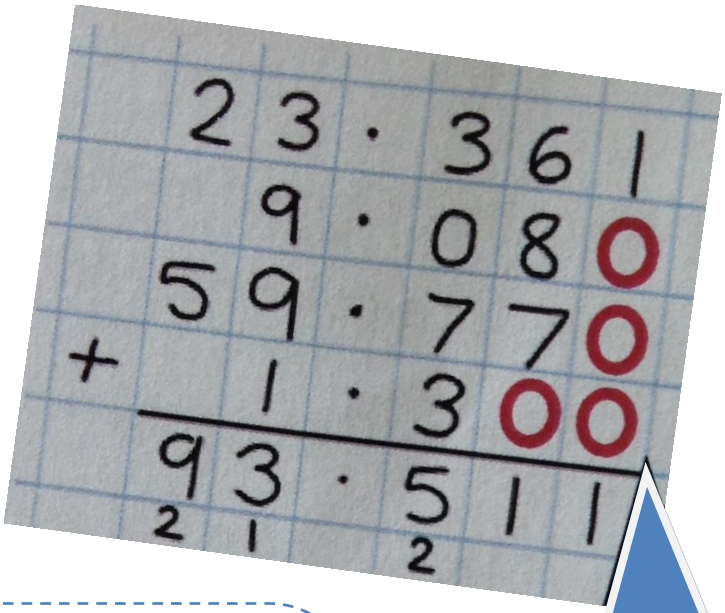
Addition

Year Six

Learning Objectives:

- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- add and subtract several numbers of increasing complexity including decimals
- add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions

Adding numbers with increasing complexity

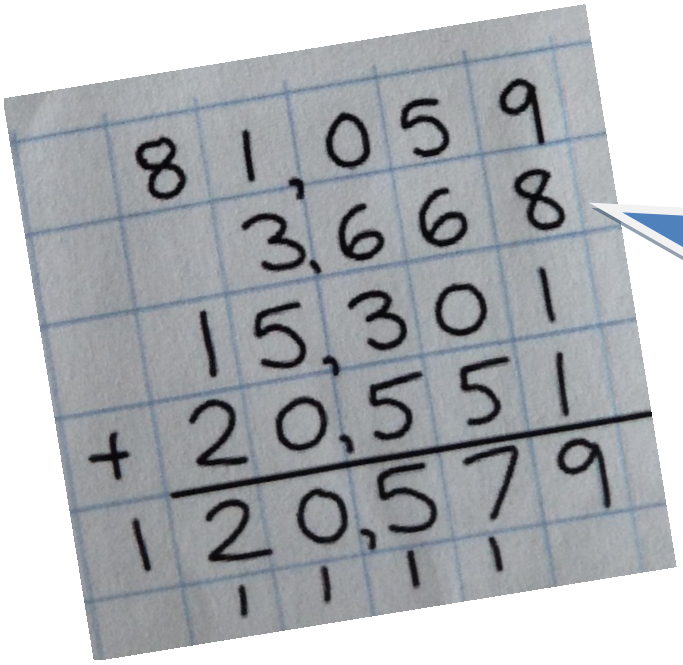


Empty decimal places should be filled with zero to show the place value in each column.

Adding several numbers with different numbers of decimal places (including money and measures):

- Tenths, hundredths and thousandths should be correctly aligned, with the decimal point lined up vertically including in the answer row.

Vocabulary: add, more, plus, make, altogether, total, equal to, equals, double, most, count on, number line, sum, tens boundary, hundreds boundary, tens, ones, partition, plus,



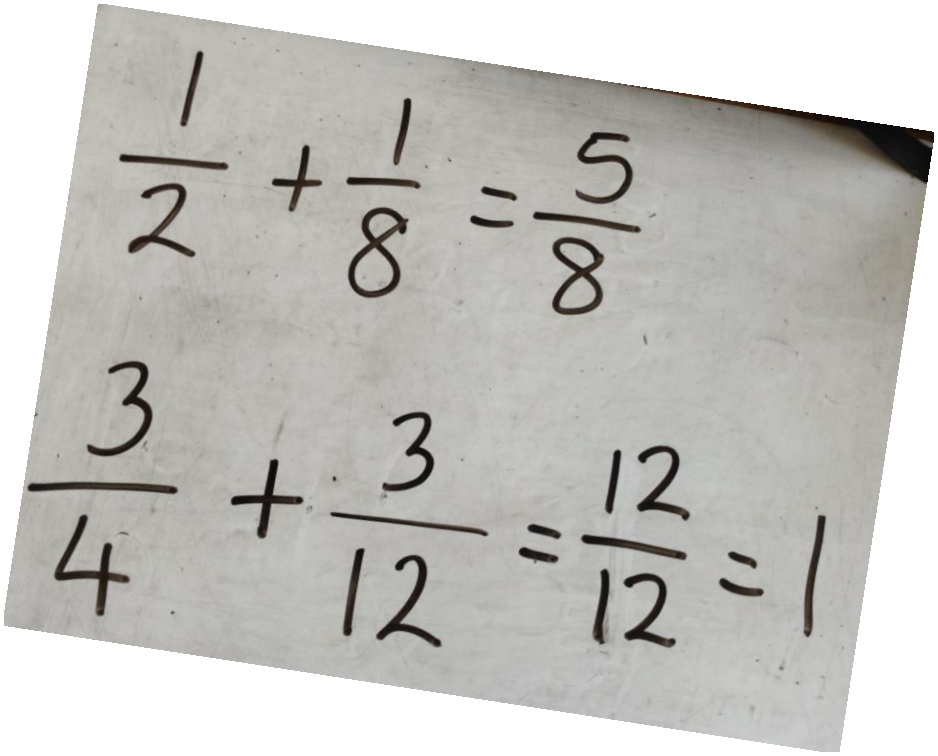
Ensure digits are in the correct place value column.

Ten Thousands, Thousands, Hundreds, ones.

Practical resources should be used to support adding fractions and finding equivalents where necessary.

Adding Fractions:

An understanding of equivalent fractions will support this concept.



addition, column, increase, 'carry', expanded, compact, vertical, thousands, hundreds, digits, inverse, decimal places, decimal point, tenths, hundredths, thousandths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the Ellistown Way.

Subtraction

Mental Calculation Strategies

Children should progress through the mental calculation strategies as outlined

Mental recall of addition and subtraction facts

10 – 6 = 4 17 - □ = 11 20 – 17 = 3 10 - □ = 2

Find a small difference by counting on

82 – 79 = 3

Counting on or back in repeated steps of 1, 10, 100, 1000

86 – 52 = 34 (by counting on/back in tens and then in ones)

460 – 300 = 160 (by counting on/back in hundreds)

Subtract the nearest multiple of 10, 100 and 1000 and adjust

24 – 19 = 24 – 20 +1 = 5

458 – 71 = 458 – 70 – 1 = 387

Use the inverse relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55 55 – 19 = 36 55 – 36 = 19

Many calculation strategies will continue to be used. They are not replaced by written methods. Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

Dream, believe, achieve the Ellistown Way.

Subtraction

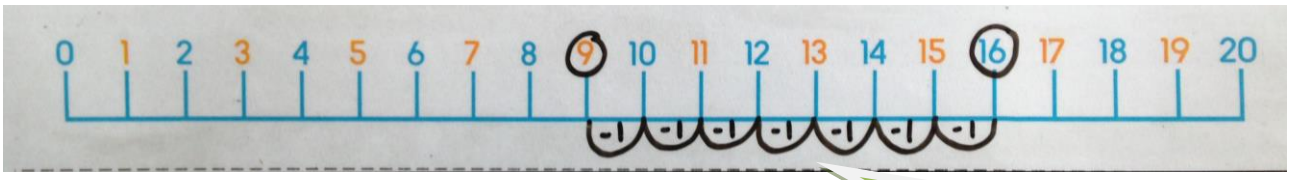
Year One

Learning Objectives:

- read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs
- add and subtract one-digit and two-digit numbers to 20, including zero
- solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = □ 9.

Use a labelled number line to count back.

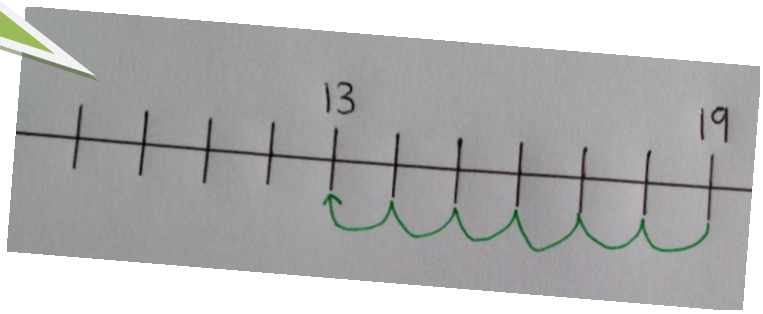
16 – 7 = 9



Count backwards in ones making jumps below the line.

Once children are confident in counting backwards, move onto using an empty number line with intervals.

19 – 6 = 13



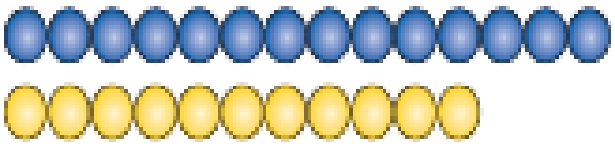
Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more,

15 – 7 = 8

Use a beadstring to subtract. Encourage children to recognise bridges through 10.

Use models and images to find a small difference between numbers.

14 – 11 = 3



11 is 3 less than 14.

14 is 3 more than 11.

Provide opportunities throughout the day for children to subtract e.g. if there are 3 children away today, how many are present? How many more boys than girls are there in this group?

Use resources such as number squares and everyday objects to support children's understanding of subtraction.

Vocabulary: how many fewer/less than, most, least, count back, how many left, how much less is...?

Subtraction

Year Two

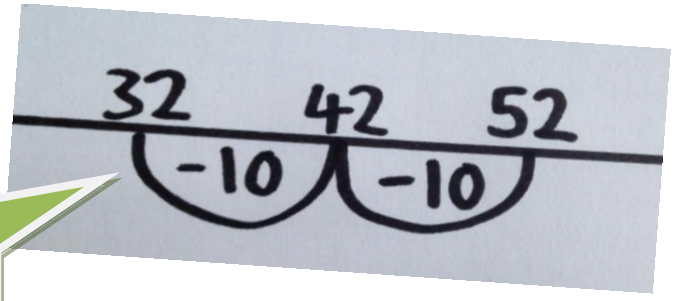
Learning Objectives:

- solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures; apply their increasing knowledge of mental and written methods
- add and subtract numbers using concrete objects, pictorial representations, and mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; adding three one-digit numbers
- recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

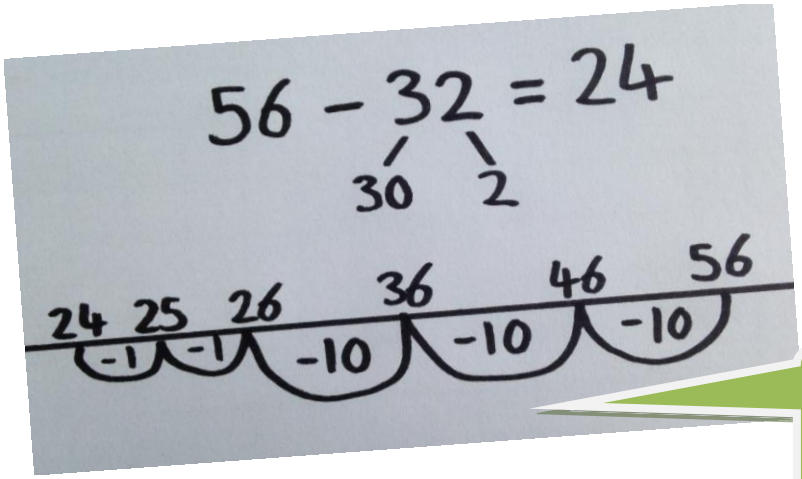
Use an empty number line to:

Subtract multiples of 10 from a 2-digit number.

52 – 20 - 32



Begin by subtracting 10 then move onto making larger jumps of 30, 40 etc.

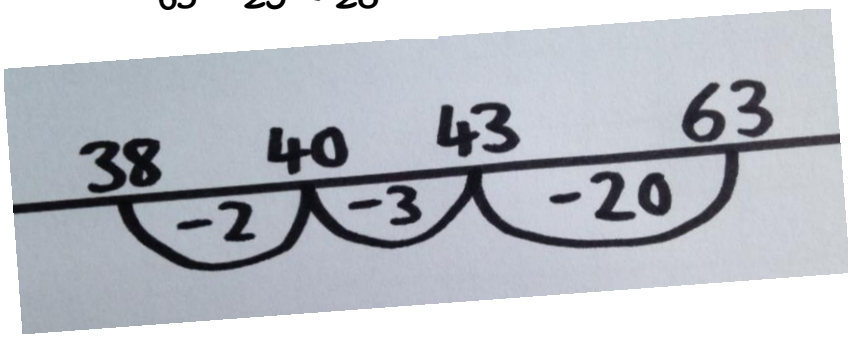


Subtract a 2-digit number from a 2-digit number.

Partition the smaller number. Subtract the tens first then subtract the ones.

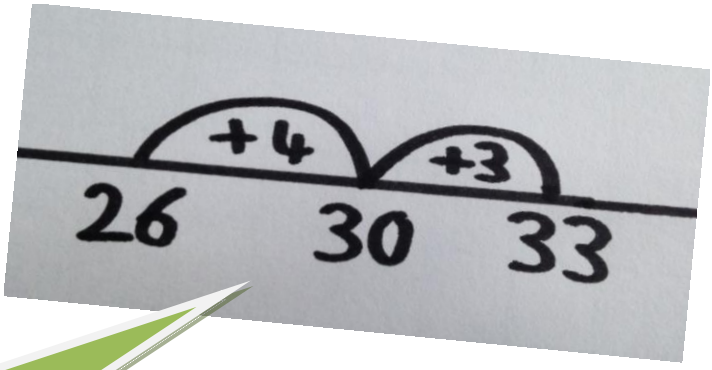
Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least, count back, how many left,

63 – 25 = 28



Teach children to use their knowledge of number facts to bridge through ten. This will enable them to solve subtraction more

Teach the relationship between addition and subtraction and encourage children to count on to find the difference between numbers that have a small difference e.g. 33 – 26.
Children should choose the most efficient method for their subtraction using their knowledge of number.



Use number bonds to count on when finding the difference. Encourage children to do this mentally.

Encourage children to use hundred squares and other practical resources to support their understanding of place value and number order until confident.

Vocabulary: how much less is...? difference, count on, strategy, partition, tens, ones

Subtraction

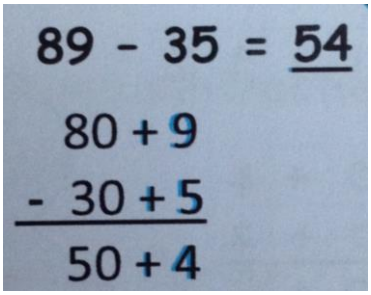
Year Three

Learning Objectives:

- add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction
- solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction
- add and subtract fractions with the same denominator within one whole [for example, 5/7 + 1/7 = 6/7]

Introduce **Partitioned column subtraction** method.

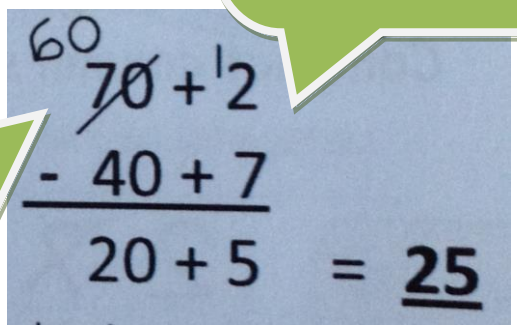
Step 1: introduce this method with examples where no exchanging is required.



Step 2: introduce 'exchanging' through practical subtraction. Make the larger number with practical resources representing tens and ones, then subtract the smaller number from it.

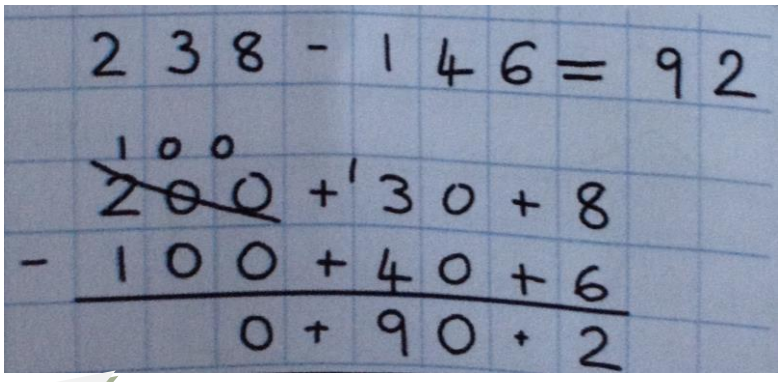
When children try to do 2 – 7, check that they don't swap the numbers: 7 – 2. Use straws to model exchanging a ten for 10 ones to make 12. Then they will be able to do 12 – 7.

When learning to 'exchange' explore partitioning in different ways so pupils understand the VALUE is the SAME e.g. 72 = 70 +2 = 60 + 12 = 50 + 22



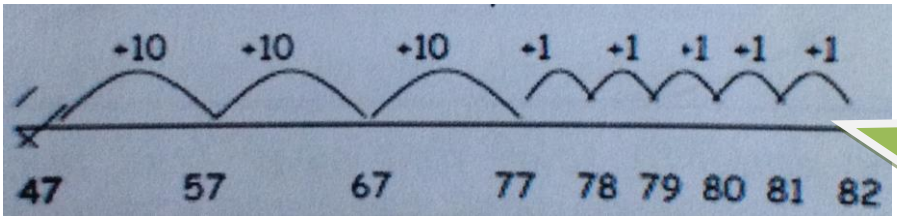
Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least, count back, how many left,

Step 3: once pupils are secure with the understanding of 'exchanging', they can use the partitioned column method to subtract any 2 and 3 digit numbers.



Subtracting money: partition into e.g. £1 + 30 + 8

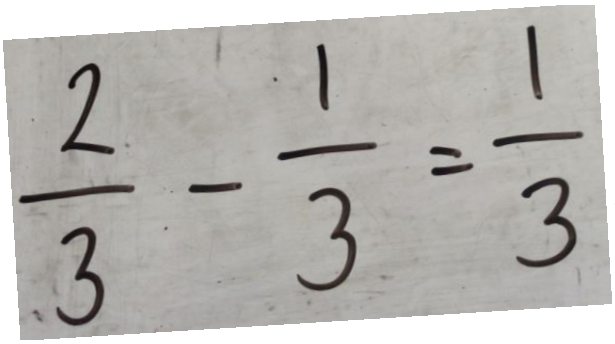
Continue to reinforce counting on as a strategy for numbers close together (e.g. 121-118), and also for numbers that are nearly multiples of 10, 100, 1000 or £'s, which make it easier to count on (e.g. 102 – 89, 131 – 79, or calculating change from £1 etc)



Children should use their knowledge of number bonds to help them count on and bridge tens barriers.

Start at the smaller number and count on in tens first, then in ones to find the rest of the difference.

Subtracting Fractions:



Subtract fractions with the same denominator within one whole.

Vocabulary: how much less is...? difference, count on, strategy, partition, tens, ones, exchange, decrease, hundreds, value, digit

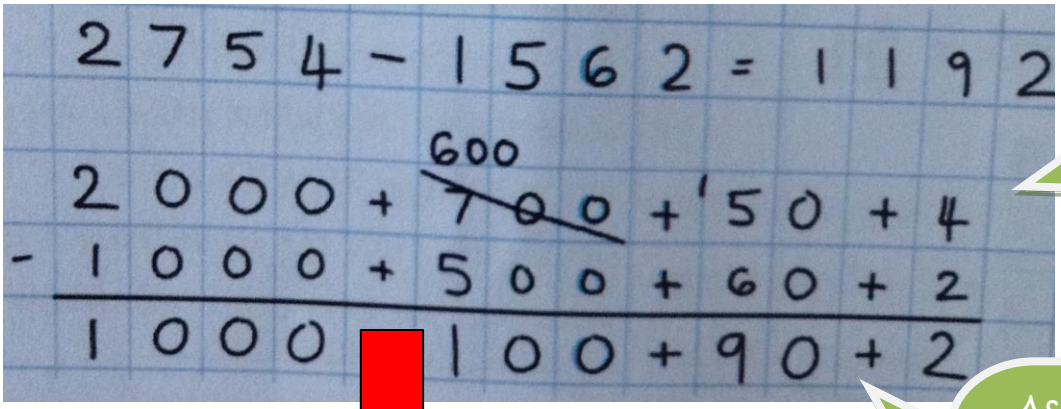
Subtraction

Year Four

Learning Objectives:

- add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate
- estimate and use inverse operations to check answers to a calculation
- solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why
- add and subtract fractions with the same denominator

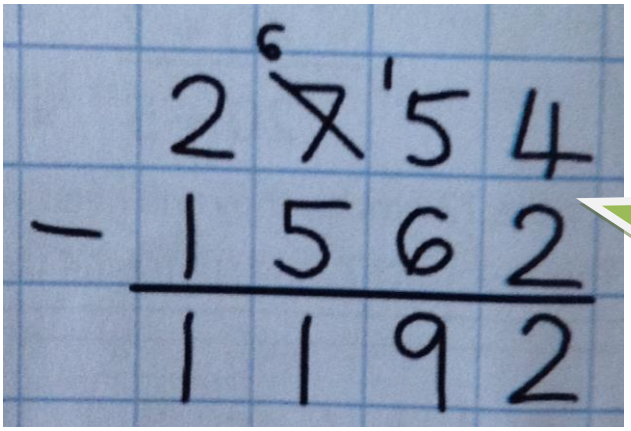
Partitioned column subtraction with 'exchanging' (decomposition):



Subtracting money: e.g. partition into £1 + 30 + 5

As introduced in year 3, but moving towards more complex numbers and values. Use practical resources e.g. counters on a place value chart to reinforce 'exchanging'.

Compact column subtraction



Give plenty of opportunities to apply this to money and measures.

Reinforce place value e.g. 600 – 500 not 6 – 5.

Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least, count back, how many left,

To introduce the compact method, ask children to perform a subtraction calculation with the familiar partitioned column subtraction then display the compact version for the calculation they have done. Ask pupils to consider how it relates to the method they know, what is similar and what is different, to develop an understanding of it.

Always encourage children to consider the best method for the numbers involved – mental, counting on, counting back or written method to ensure that they are being efficient.

Subtracting Fractions:

Subtract fractions with the same denominator.

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

$$\frac{7}{8} - \frac{3}{8} = \frac{4}{8} = \frac{1}{2}$$

When ready progress to reducing the answer to its simplest form.

Practical resources should be used to support pupils until fluent.

Vocabulary: how much less is...? difference, count on, strategy, partition, tens, ones, exchange, decrease, hundreds, value, digit, inverse

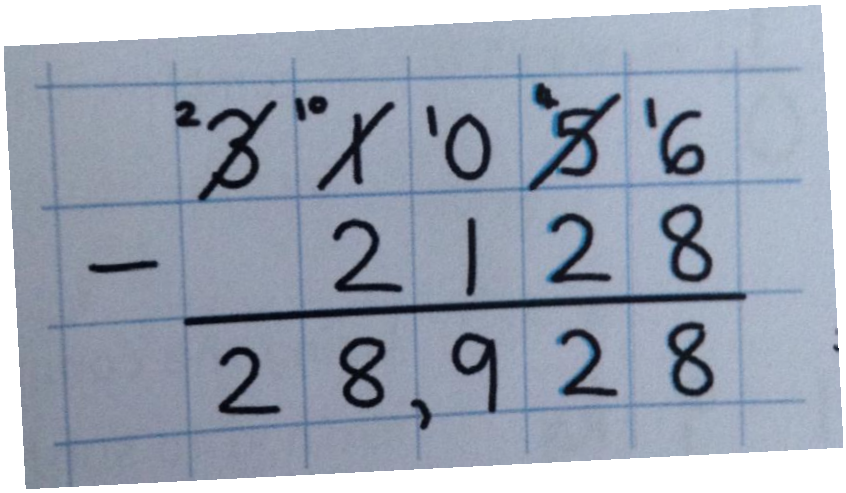
Subtraction

Year Five

Learning Objectives:

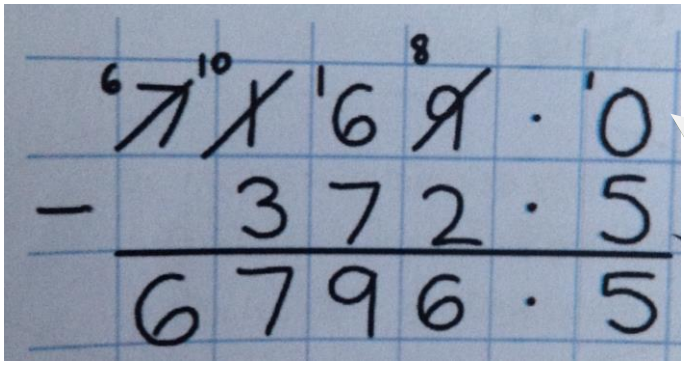
- add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction)
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- add and subtract fractions with the same denominator and denominators that are multiples of the same number

Compact Column subtraction (with exchanging):



Children who are still not secure with number facts and place value will need to remain on the partitioned column method until ready for the compact method.

Create Lots of opportunities for subtracting and finding differences with money and measures.



Add a 'o' in any empty decimal places to aid understanding of what to subtract in that column.

Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least, count back, how many left, decimal,

Subtracting Fractions:

$$\frac{7}{8} - \frac{3}{8} = \frac{4}{8}$$

Begin with subtracting fractions with the same denominator. Use practical resources to reinforce this concept.

Continue to use practical resources to support calculations until fluent.

Subtract using fractions with multiples of the same denominator e.g. 4 is a multiple of 8 – find the equivalent.

$$\frac{7}{8} - \frac{1}{4} = \frac{5}{8}$$

Vocabulary: how much less is...? difference, count on, strategy, partition, tens, ones, exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point

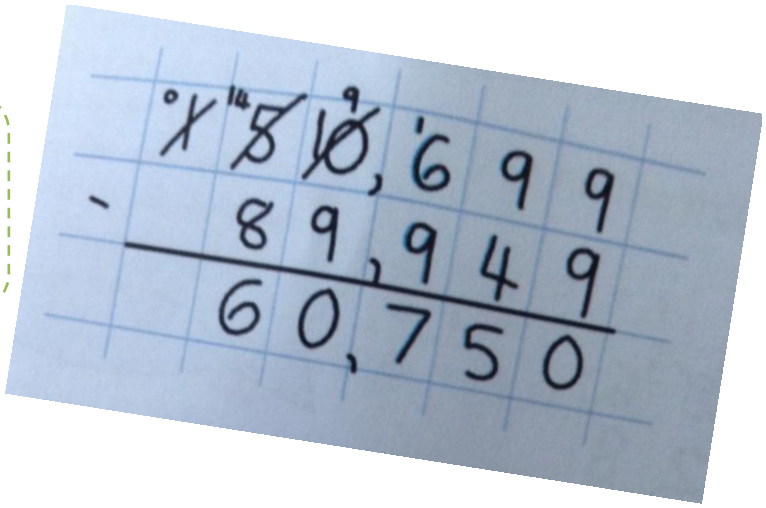
Subtraction

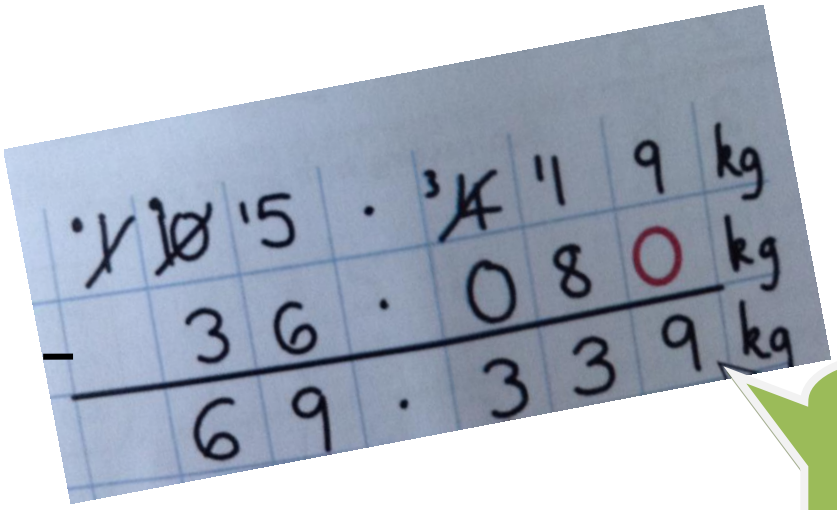
Year Six

Learning Objectives:

- use their knowledge of the order of operations to carry out calculations involving the four operations
- solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why
- solve problems involving addition, subtraction, multiplication and division
- add and subtract several numbers of increasing complexity including decimals
- add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions

Using the compact column method to subtract more complex integers.





Include the unit of measure when subtracting with money or measures.

Empty decimal places can be filled with Zero to show the place value in each column.

Vocabulary: equal to, take, take away, less, minus, subtract, leaves, distance between, how many more, how many fewer/less than, most, least, count back, how many left, decimal,

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Subtracting fractions:

Begin by identifying equivalent fractions before subtracting.

$$\frac{8}{12} - \frac{1}{4} = \frac{5}{12}$$

$$\frac{14}{15} - \frac{1}{3} = \frac{9}{15} = \frac{3}{5}$$

Answers should be recorded with the lowest common denominator.

Practical resources should be used to support pupils until fluent in identifying equivalent fractions.

Vocabulary: how much less is...? difference, count on, strategy, partition, tens, ones, exchange, decrease, hundreds, value, digit, inverse, tenths, hundredths, decimal point

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Multiplication

Mental Calculation Strategies

Children should progress through the mental calculation strategies as outlined

Doubling and halving:

Applying the knowledge of doubles and halves to known facts e.g. 8 x 4 is double 4 x 4

Recall multiplication and division facts – daily practice:

Year 1:	**Year 2:**	**Year 3:**	**Year 4, 5 & 6:**
Count in multiples of 2's, 5's and 10's.	2 times table 5 times table 10 times table (Also count in multiples of 3)	3 times table 4 times table 8 times table	Derive and recall all multiplication facts up to 12 x 12

Using and applying division facts:

Children should be able to utilise their tables knowledge to derive other facts.

e.g. If I know 3 x 7 = 21, what else do I know?

30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

☐ x 7 = 21 300 x △ = 2100 ☐ x O = 2.1

Use closely related facts already known:

13 x 11 = (13 x 10) + (13 x 1)
= 130 + 13
= 143

Multiplying by 10 or 100:

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

Partitioning:

23 x 4 = (20 x 4) + (3 x 4)
= 80 + 12
= 102

Use of factors:

8 x 12 = 8 x 4 x 3

Many calculation strategies will continue to be used. They are not replaced by written methods. Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

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Multiplication

Year One

Learning Objectives:

- solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- Group small quantities, begin to understand: multiplication; doubling numbers and quantities
- Make connections between arrays, number patterns, and counting in twos, fives and tens.

Use objects and models to represent simple multiplications. Demonstrate multiplying by adding groups.

2 + 2 + 2 + 2 = 8

Explain that this means we have groups of 2, four times.

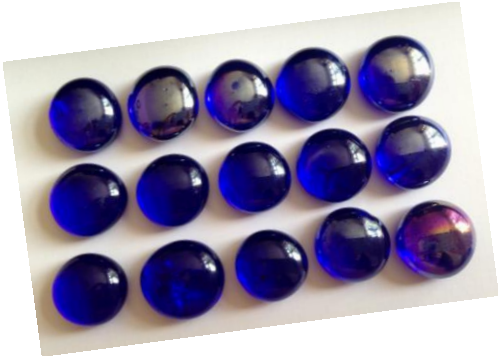
2 + 2 + 2 + 2 + 2 = 10

5 X 4 = 20

Make arrays using pegboards or objects to demonstrate counting in groups of 2, 5 or 10.

Begin to write number sentences containing the multiplication symbol when children are ready.

5 X 3 = 15



Vocabulary: groups of, lots of, times, array, altogether, multiply, count

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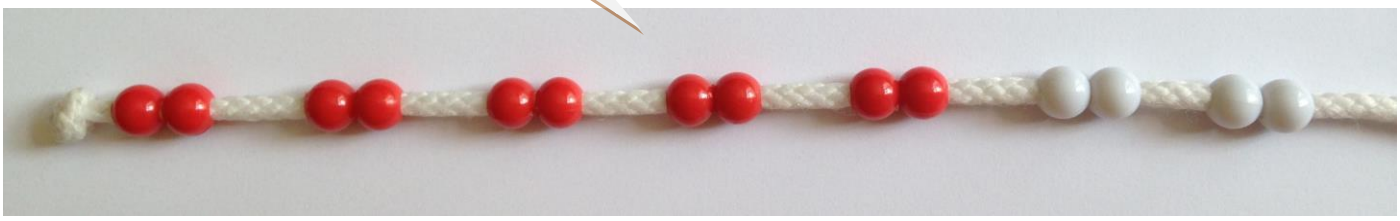
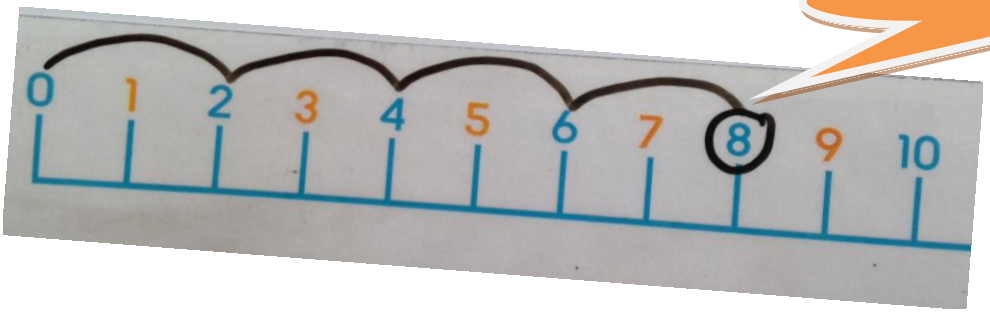
Use a beadstring to demonstrate counting in groups and explain how this shows multiplication.

$2 \times 7 = 14$



Progress onto using a number line.

$2 \times 4 = 8$



Use objects and drawings to demonstrate doubling and explain how this links to multiplying by 2 once children are confident.

Practise counting in 2's, 5's and 10's throughout the day to reinforce counting in groups.

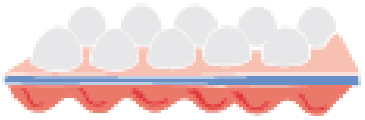
Multiplication

Year Two

Learning Objectives:

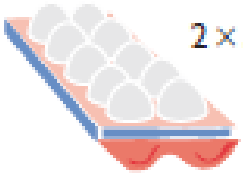
- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.

Continue to use arrays as shown in year 1 to understand and solve multiplication. Record multiplication calculations using the correct symbols.



$5 \times 2 = 10$

$2 \times 5 = 10$



$2 \times 5 = 10$

$5 \times 2 = 10$

3

4

$3 \times 4 = 12$

$4 \times 3 = 12$

Remind children that multiplication is the same as adding groups of the same amount together. Groups of 3's four times or groups of 4's three times.

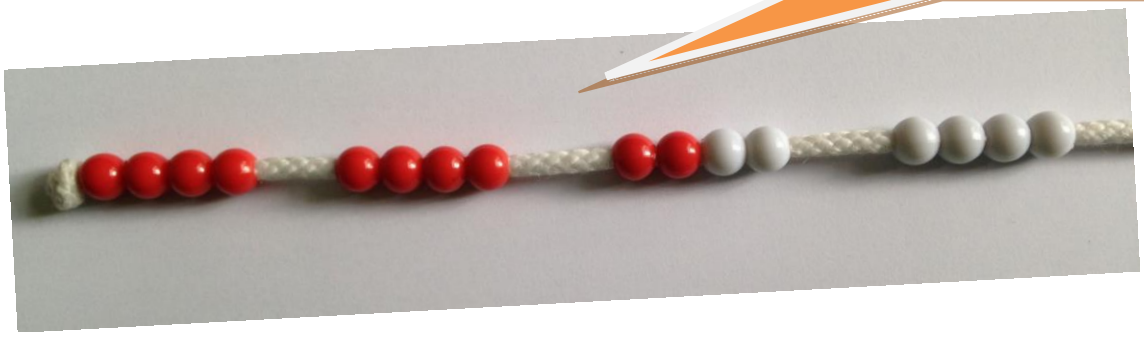
Vocabulary: Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, sets of, equal groups, times as big

Use other practical resources such as beadstrings to demonstrate multiplication as repeated addition.

4 + 4 + 4 + 4 = 16

Which is the same as

4 × 4 = 16

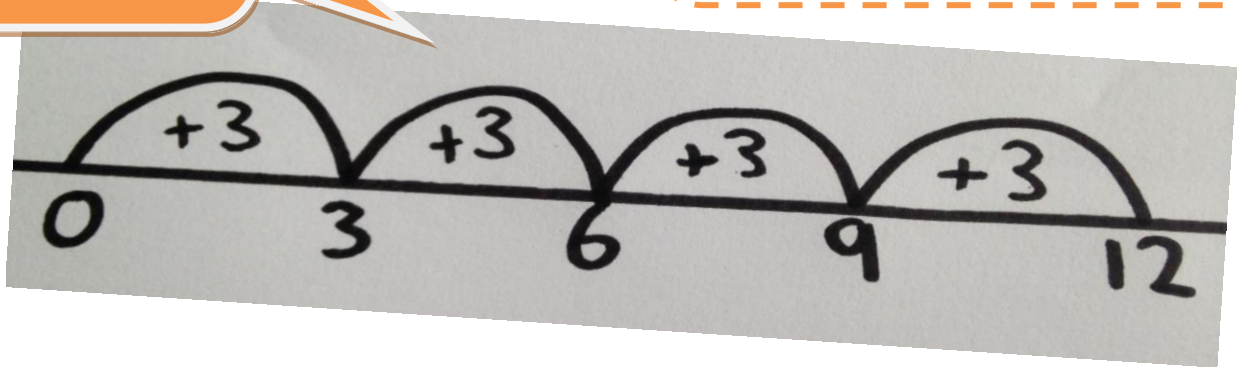


Teach how to use an empty number line to solve multiplication. Start at 0 and make equal jumps along the number line to work out multiplication facts.

3 × 4 = 12

4 lots of 3

3 × __ = 12



Children should be encouraged to investigate and recognise the commutative rule when working out multiplication e.g. they understand that 5 × 3 has the same answer as 3 × 5.

Vocabulary: once, twice, three times...

Multiplication

Year Three

Learning Objectives:

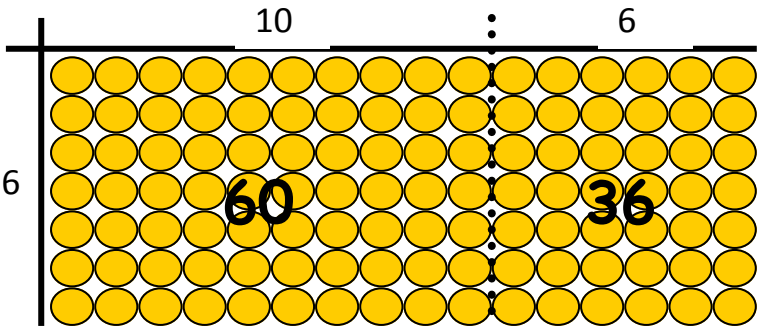
- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- solve problems, including missing number problems.

Introduce the grid method referring to an array to represent the calculation.

16 × 6 = 96

x	10	6
6	60	36

60 + 36 = 96



In order to do carry out the grid method successfully, children must be able to partition numbers into tens and ones and multiply multiples of 10 by a single digit.

Continue to use beadstrings and repeated addition on a number line to work out multiplication facts children are not secure with.

Encourage children to use known facts to work out multiples e.g. to multiply by 4, double then double again, to multiply by 9, work out times 10 then take off one group.

Vocabulary: Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, sets of, equal groups, times as big

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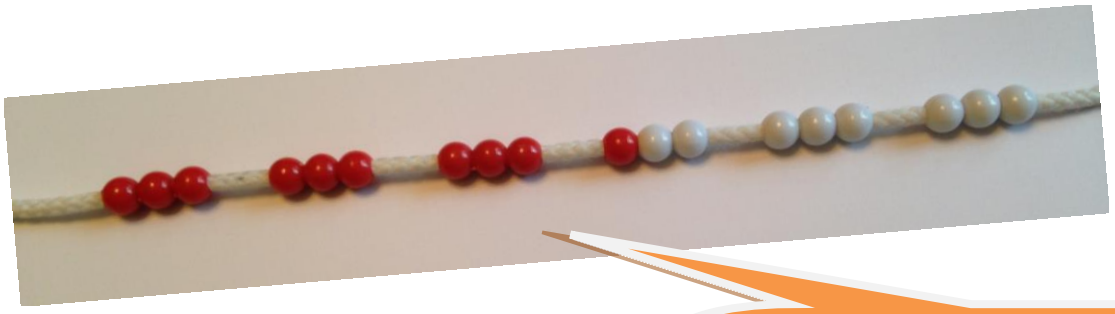
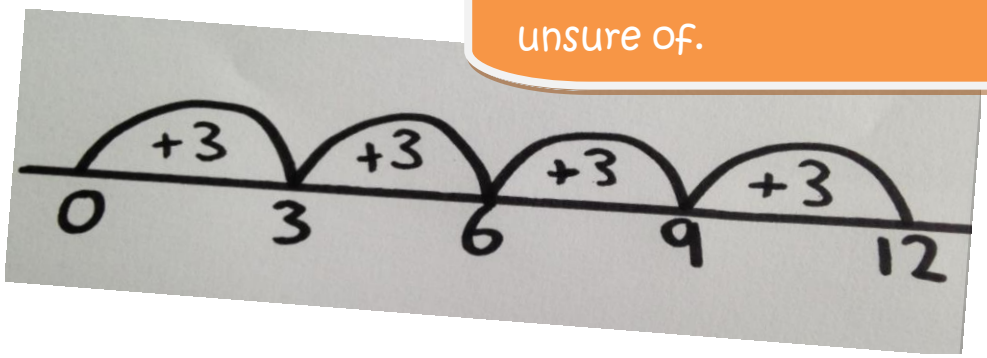
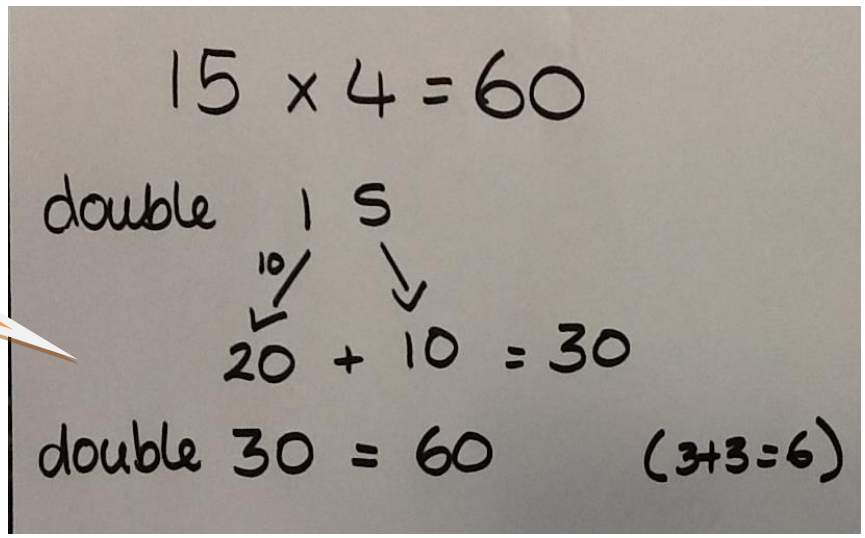


Use beadstrings and number lines to consolidate facts children are unsure of.



Use doubling and related facts to calculate multiplication statements.



Vocabulary: once, twice, three times... partition, grid method, multiple, product, tens, ones, value

Multiplication

Year Four

Learning Objectives:

- multiply two-digit and three-digit numbers by a one-digit number using formal written layout
- solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.

Developing the grid method:

Encourage column addition to add accurately.

Eg. 136 × 5 = 680

X	100	30	6
5	500	150	30

500
150
+ 30
680

Move onto **expanded short multiplication** if and when children are confident and accurate multiplying 2 and 3 digit numbers by a single digit this way, and are already confident in '**carrying**' for written addition.

Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, sets of, equal groups, times as big as,

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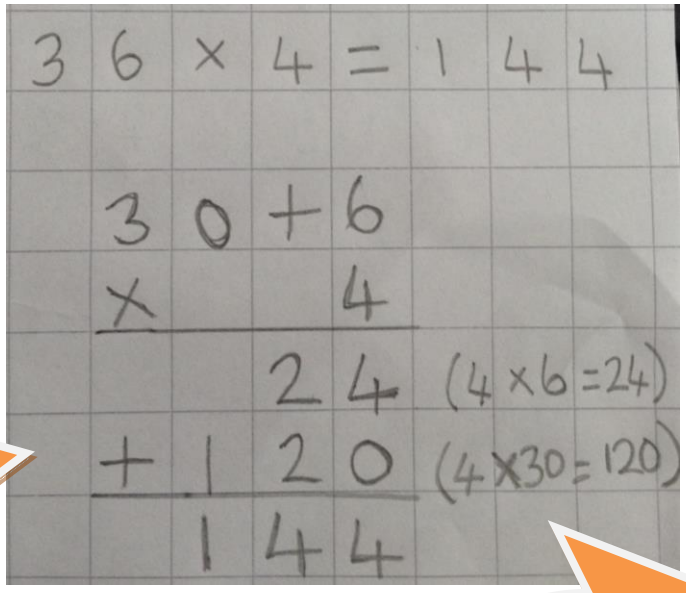
Expanded short multiplication:

Include an addition symbol when adding partial products.



Use times table knowledge to derive related facts.

Children should be able to:

- Approximate before they calculate, and make this a regular part of their calculating, going back to the approximation to check the reasonableness of their answer, e.g: '346 x 9 is approximately 350 x 10 =3500'
- Multiply multiples of ten and one hundred by a single digit, using their multiplication facts knowledge.

Vocabulary: once, twice, three times... partition, grid method, total, multiple, product, inverse

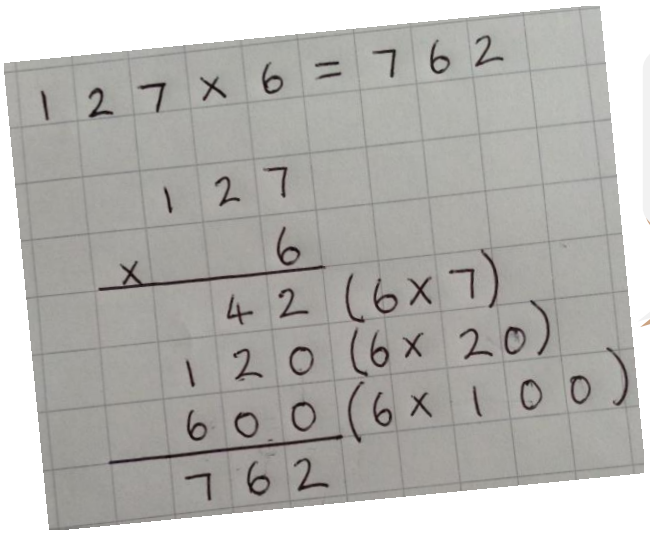
Multiplication

Year Five

Learning Objectives:

- multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers
- solve problems involving addition, subtraction, multiplication and division and a combination of these, including understanding the meaning of the equals sign
- solve problems involving multiplication and division, including scaling by simple fractions and problems involving simple rates
- multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams

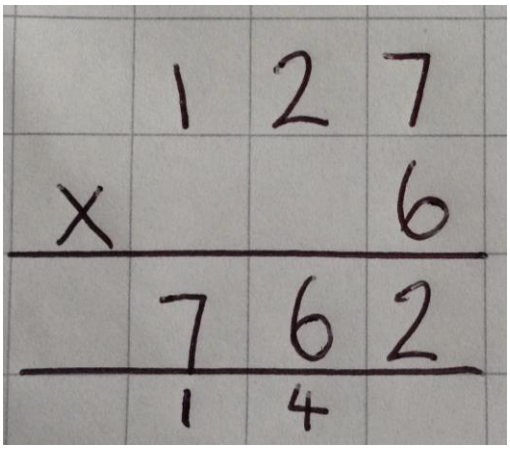
Expanded short multiplication:



Use times table knowledge to derive related facts.

Progress to short multiplication (formal method):

Use the language of place value to ensure understanding.

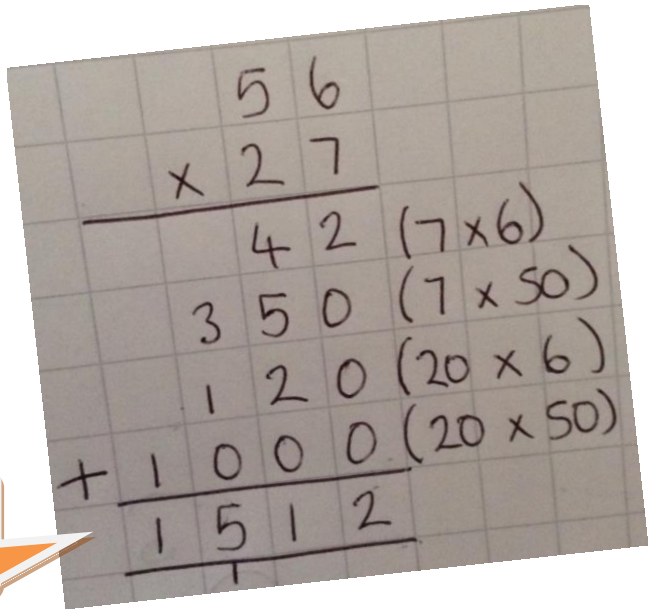


Ensure the digits 'carried over' are written under the line in the correct column.

Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, sets of, equal groups, times as big as,

Expanded long multiplication:

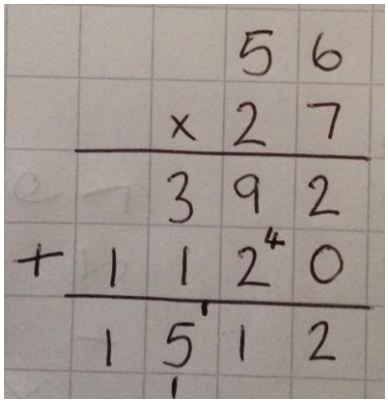
This expanded method is linked to the grid method.



The prompts in brackets can be omitted if no longer needed.

Add the partial products.

Progress to compact long multiplication (formal method):



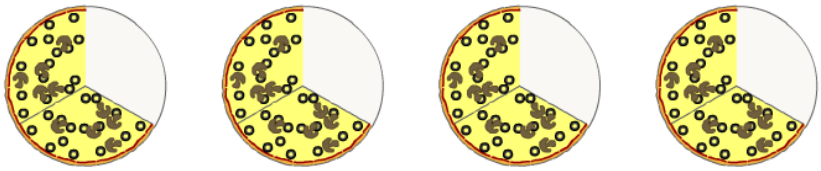
Multiplying Fractions:

Multiplying a Fraction by a Whole Number

What is $4 \times \frac{2}{3}$?

We know that multiply means 'lots of' so...

$4 \times \frac{2}{3}$ means 4 lots of $\frac{2}{3}$



= 8/3 = 2 2/3

See: http://goo.gl/YVtX5C for interactive lesson and guidance.

Vocabulary: once, twice, three times... partition, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short/long multiplication, 'carry'

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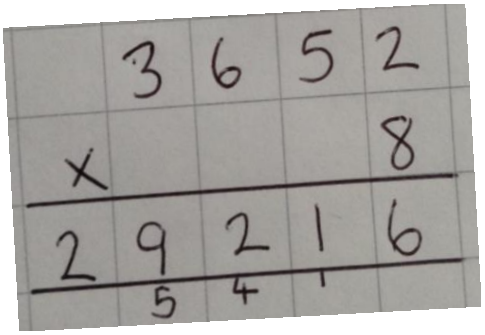
Multiplication

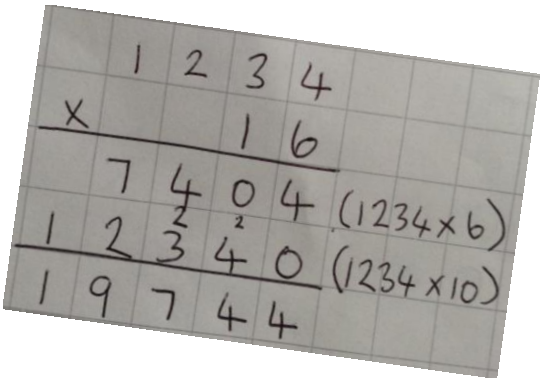
Year Six

Learning Objectives:

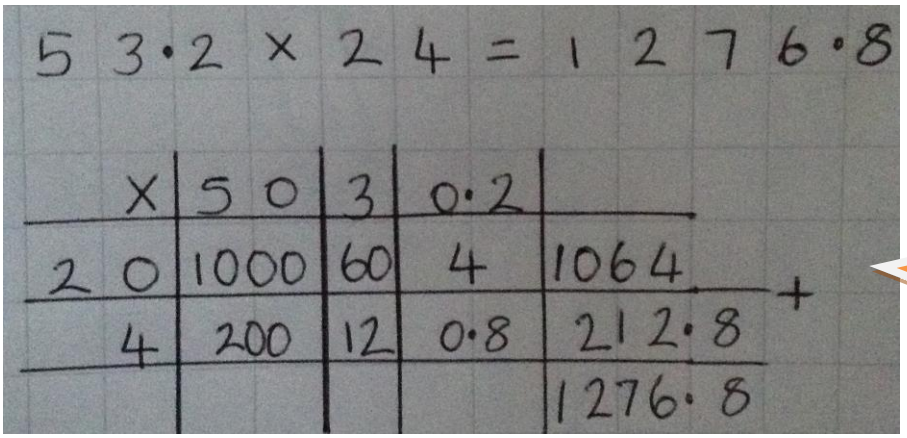
- multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication
- solve problems involving addition, subtraction, multiplication and division
- multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, ¼ x ½ = 1/8]

Develop onto more complex calculations:





Ensure that children are confident with the methods outlined in the previous year's guidance before moving on to multiplying multi digit numbers.



Add the partial products.

Vocabulary: groups of, lots of, times, array, altogether, multiply, count, multiplied by, repeated addition, array, column, row, commutative, sets of, equal groups, times as big as,

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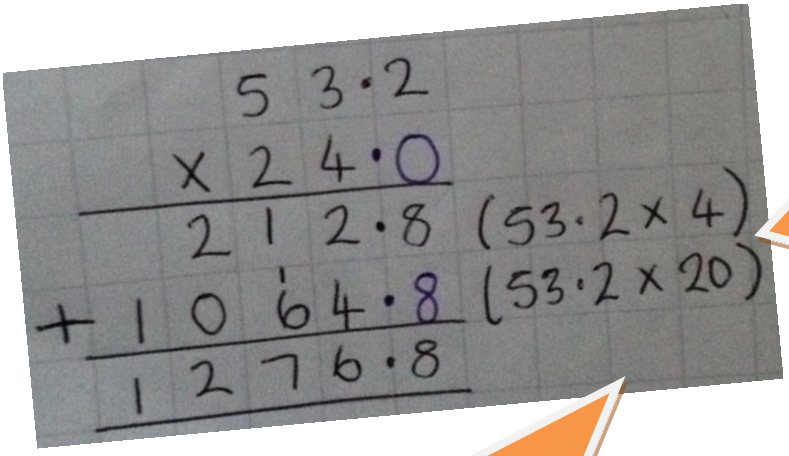
The formal written method of long multiplication:



Line up the decimal points in the question and answer. Add a '0' as a placeholder if necessary.

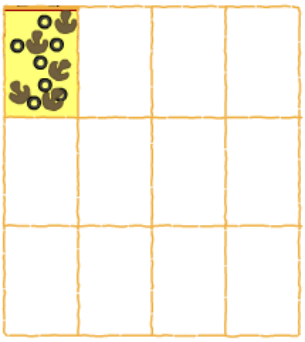
The prompts in brackets can be omitted if no longer needed.

Use rounding and place value to make approximations and use these to check against answers.

Multiplying Fractions:

What is $\frac{1}{3} \times \frac{1}{4}$?

This is $\frac{1}{3}$ of our $\frac{1}{4}$ of pizza



What fraction are we left with?

It is $\frac{1}{12}$ of the total pizza.

Doing $\frac{1}{3} \times \frac{1}{4}$ was like doing $\frac{1}{3}$ of $\frac{1}{4}$

$$\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4} = \frac{1}{12}$$

Use: http://goo.gl/DEOIZU for more guidance and an interactive lesson.

Vocabulary: once, twice, three times... partition, grid method, total, multiple, product, inverse, square, factor, integer, decimal, short/long multiplication, 'carry', tenths, hundredths, decimal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Division

Mental Calculation Strategies

Children should progress through the mental calculation strategies as outlined

Doubling and halving:

Knowing that halving is dividing by 2

Deriving and recalling division facts: practice daily

Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.
E.g. If I know 3 x 7 = 21, what else do I know?

30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

☐ ÷ 2 = 4 80 ÷ △ = 40 ☐ ÷ △ = 40

Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.
Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

Use of factors

72 ÷ 18 → 72 ÷ **6** = 12 → 12 ÷ **3** = 4 → 72÷18=4
(6 and 3 are factors of 18)

Use related facts

Given that 1.4 x 1.1 = 1.54
What is 1.54 ÷ 1.4, or 1.54 ÷ 1.1?

Many calculation strategies will continue to be used. They are not replaced by written methods. Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

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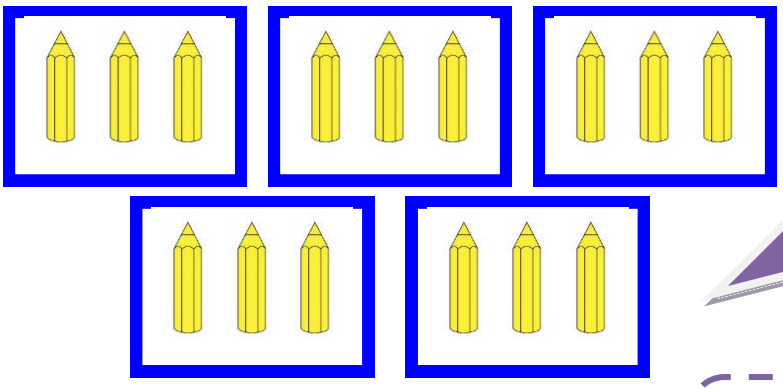
Division

Year One

Learning Objectives:

- solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher (group and share small quantities, begin to understand: division; and finding simple fractions of objects, numbers and quantities)
- recognise, find and name a half as one of two equal parts of an object, shape or quantity and recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.

Children should use objects and drawings to show **sharing** and **grouping** for division.



15 ÷ 5 = 3

Sharing: Share 15 crayons between 5 boxes. How many are in each box? = 3 in each box.

Children should use their knowledge of counting in 2, 5 and 10 to help them solve division.

15 ÷ 5 = 3

Grouping: How many groups of 5 can you make with 15 stars? = 3 groups

Vocabulary: share, share equally, one each, two each..., group,

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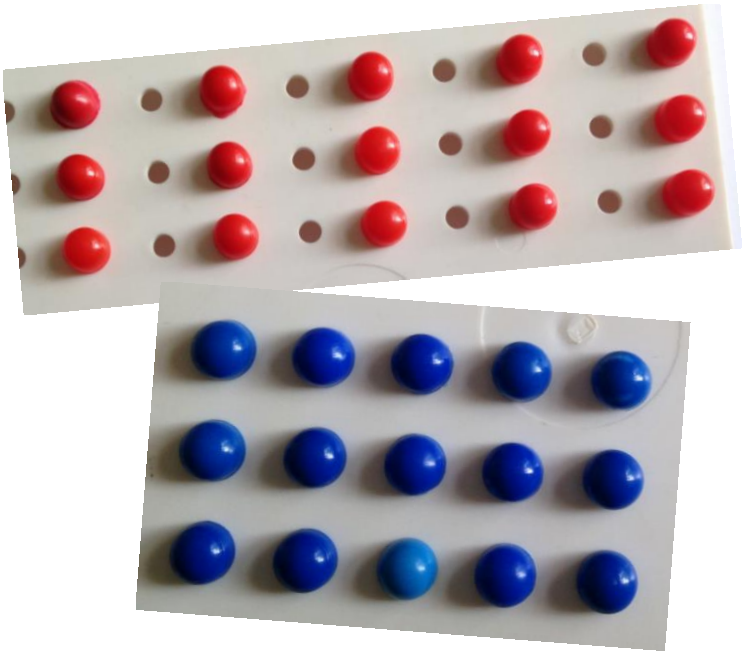
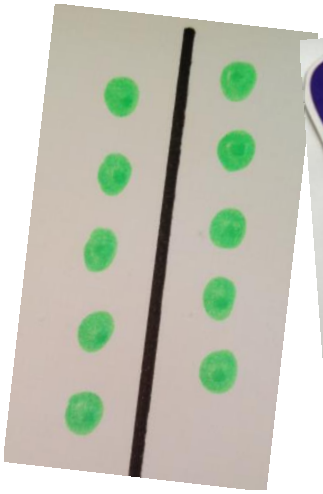


Use pegboards to demonstrate moving between sharing and arrays. Share 15 pegs between 5 groups. How many are in each group? Explain that the pegs can be moved closer together to form an array. This can also show us how many groups of five 15 can be grouped into.

Teach children to find half of an amount and relate this to dividing by 2. Also teach finding a quarter relating this to dividing by 4.



Use objects, models and drawings to find half or a quarter of an amount.

Vocabulary: groups of, lots of, array

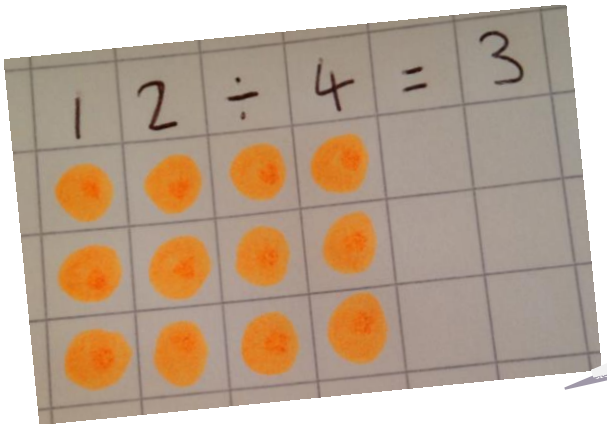
Division

Year Two

Learning Objectives:

- calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs
- solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.
- recognise, find, name and write fractions 1/3, ¼, 2/4, 3/4 of a length, shape, set of objects or quantity and write simple fractions for example, ½ of 6 = 3 and recognise the equivalence of 2/4

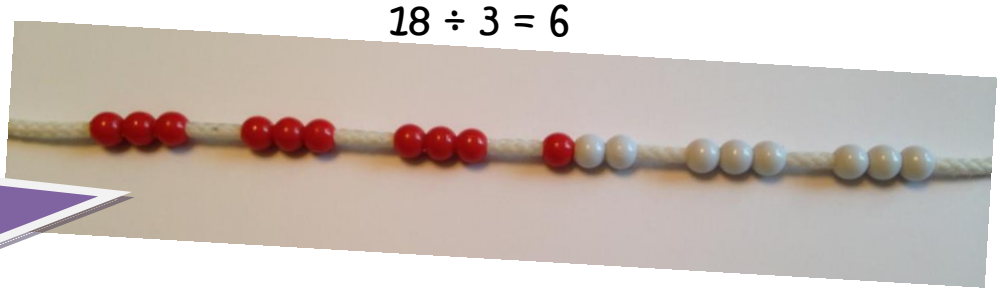
Continue to reinforce children's understanding of the difference between grouping and sharing as outlined in year 1 and encourage children to recognise when they would need to group or share.



Use arrays to solve division statements using pegboards, objects or drawings.

Beadstrings can be used to progress towards grouping on a number line.

18 ÷ 3 = 6



Vocabulary: share, share equally, one each, two each...,group, equal groups of, lots of, array,

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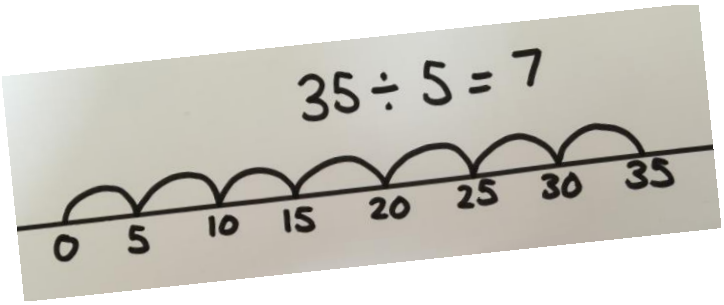
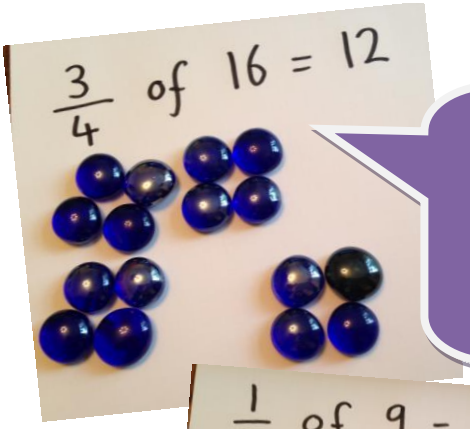
Count forwards in equal jumps of the divisor until you reach the dividend to work out how many groups of 5 are in 35.

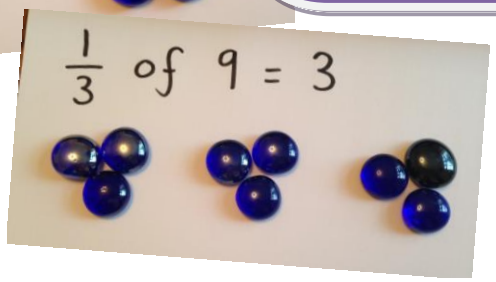


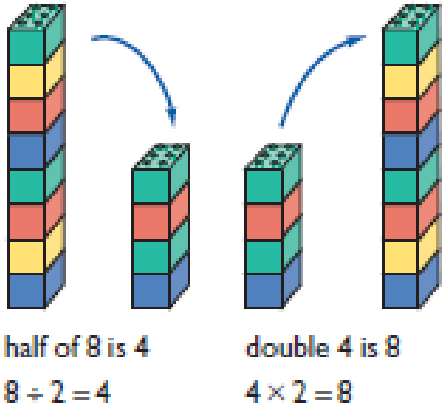
Use a beadstring or a hundred square to support counting on in equal steps.

Use objects to work out fractions of numbers. Teach the children to share the amount equally between the number shown by the denominator and identify how many of these groups they need to look at as shown by the numerator.



Count how many there are altogether in 3 out of the 4 groups.





Encourage children to identify the relationship between doubling and halving reminding them that ½ is the same as dividing by 2.

Vocabulary: divide, divided by, divided into, division, grouping, number line, left, left over

Division

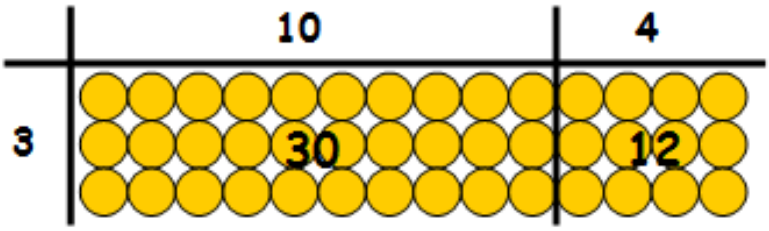
Year Three

Learning Objectives:

- write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods
- recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators

Continue to use written methods taught in year 2.

42 ÷ 3 = 14



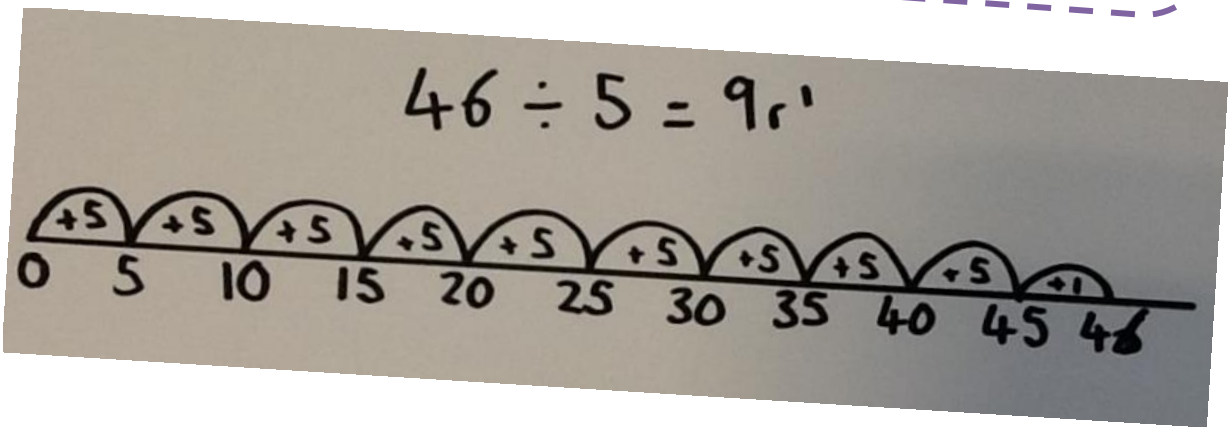
Use arrays for division statements. Model how to use knowledge of multiplication facts e.g. 42 can be split into 30 and 12 (both multiples of 3). Look at division as grouping – How many groups of 3 make 30? 10 How many groups of 3 make 12? 4 So 42 ÷ 3 = 14

Practical resources such as pegboards, counters and ITP's can be used to support division using arrays so that children can make links with times tables facts.

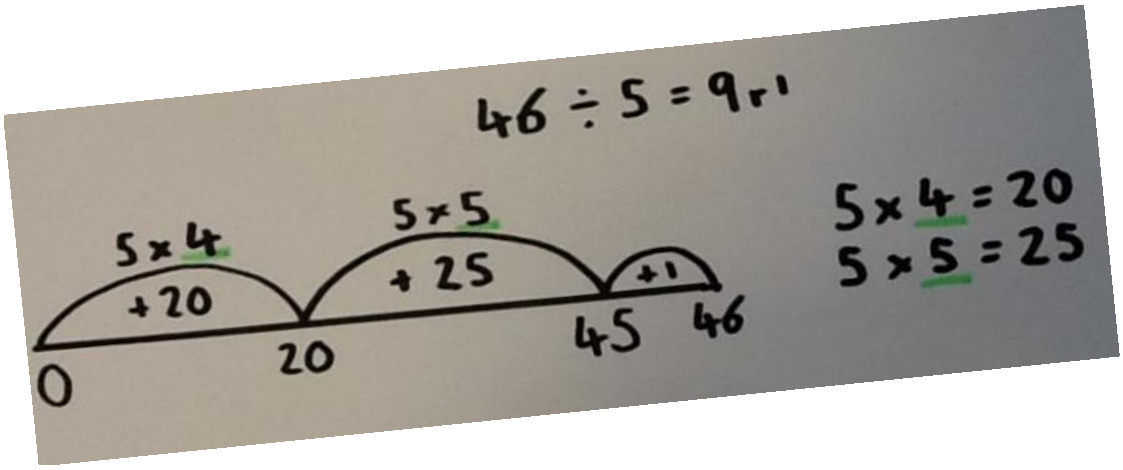
Vocabulary: share, share equally, one each, two each...,group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse,

Progress to using number lines for repeated addition including with remainders.

Remind pupils that division can be done as grouping therefore we need to find out how many groups of 5 are in 46 by counting up.



Becoming more efficient and using knowledge of times tables facts.



Vocabulary: short division, 'carry', remainder, multiple

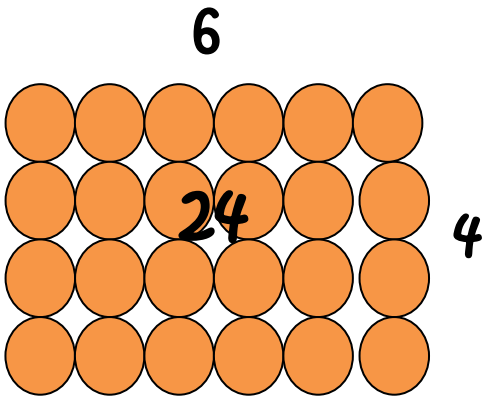
Division

Year Four

Learning Objectives:

- divide two-digit and three-digit numbers by a one-digit number using formal written layout for division
- solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number

Short division with jottings:



$6 \times 4 = 24$

$24 \div 6 = 4$

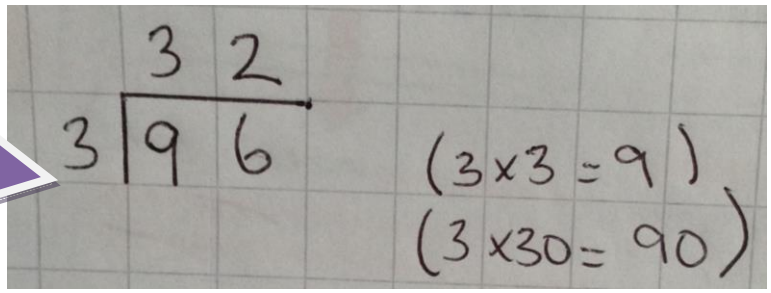
$24 \div 4 = 6$

Use related facts.

Initially with carefully selected numbers which require no remainders at all, start by introducing the layout of short division by comparing it to an array.

Progress to larger 2 digit numbers.

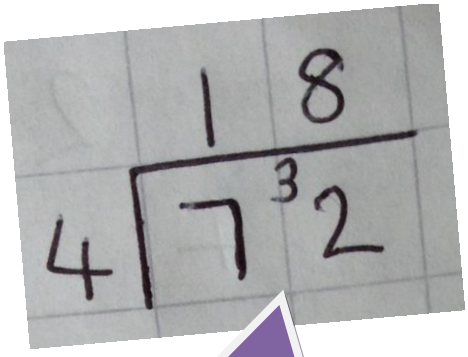
Remind children of correct place value.

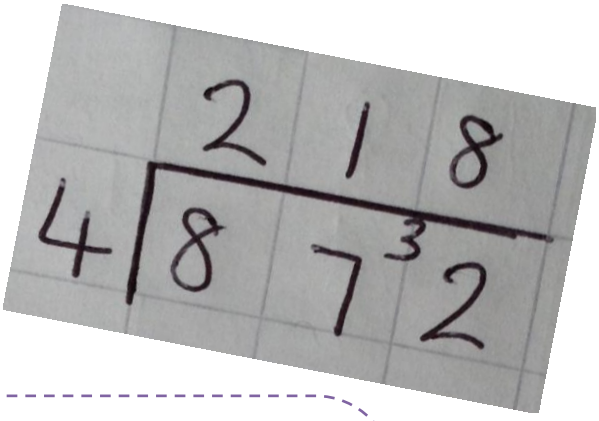


Jottings should support calculation.

Vocabulary: share, share equally, one each, two each...,group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse ,

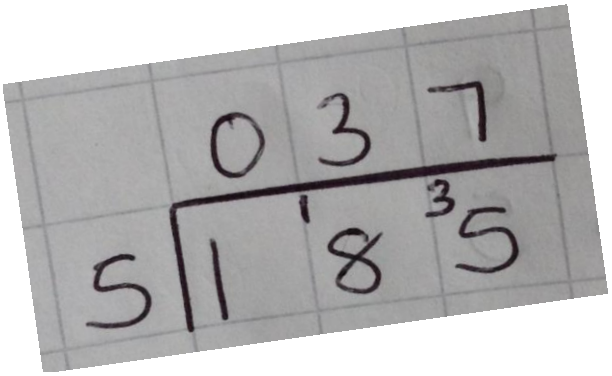
Refine to the method for short division when children have a secure understanding of times table facts and have secured the skill of calculating 'remainders'.





Reinforce place value e.g. 'how many 4's in 70?' as opposed to 7.

Response should not result in a final remainder but there must be an understanding of how to calculate remainders to 'carry' within the calculation process.



When the answer for the first column is 0, children should initially write a 0 above to acknowledge it's place and must always 'carry' the number over to the next digit as a remainder.

Times table jottings should be encouraged to support if needed.

Vocabulary: short division, 'carry', remainder, multiple, divisible by, factor

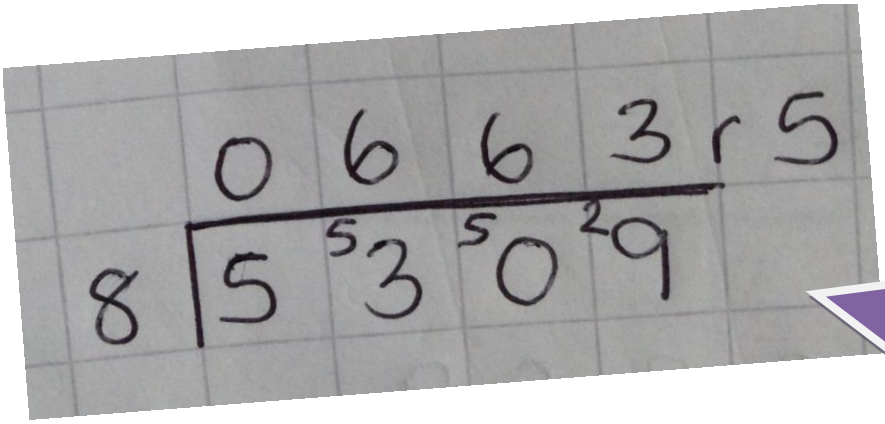
Division

Year Five

Learning Objectives:

- divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context
- identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths

Short division, including remainder answers:



The reminder could be expressed as 663 5/8, as a decimal, 663 r5 or rounded as appropriate to the problem involved.

Short division with remainders: now that pupils re introduced to examples that give rise to reminder answers, division needs to have a real life problem solving context, **where pupils consider the meaning of the remainder and how to express it**, depending on the context of the problem.

Vocabulary: share, share equally, one each, two each...,group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse,

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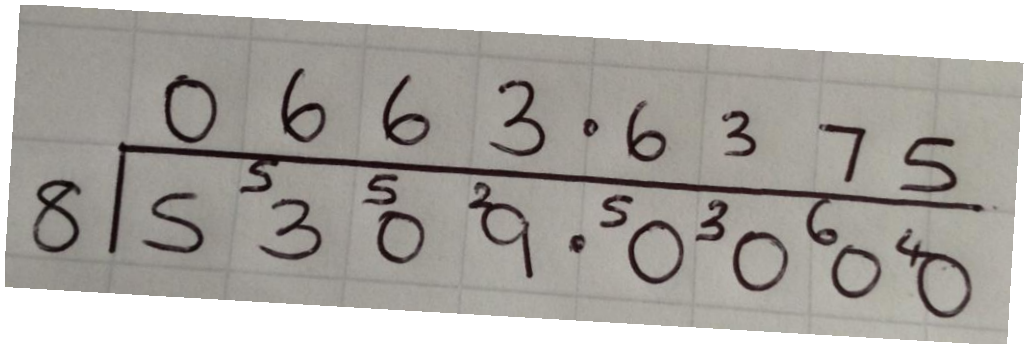
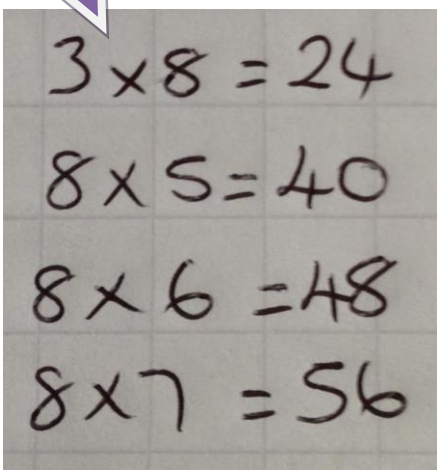
Remainders as decimals:

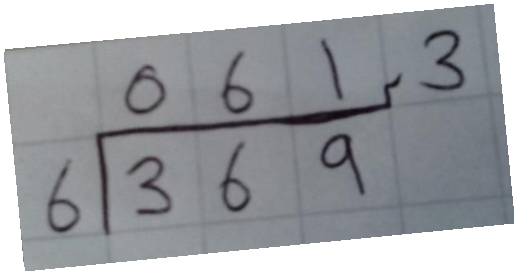
Generate a list of useful times table facts to support calculations.



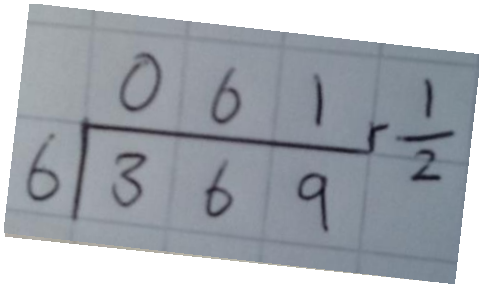


Decimal Remainders: In this example rather than expressing the remainder as **r5**, a decimal point is added after the units because there is still a remainder, and the five remainder is carried onto the zero's after the decimal point (to show there was no decimal value in the original number). Keep dividing to an appropriate degree of accuracy for the problem being solved.

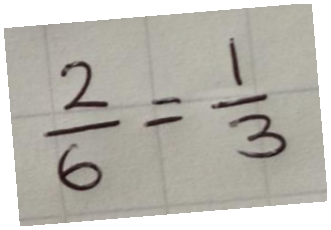
Using equivalent fractions for remainders:



Becomes



Because:



Use practical resources to support finding equivalents

Vocabulary: short division, 'carry', remainder, multiple, divisible by, factor, quotient, prime number, prime factors, composite number (non-prime)

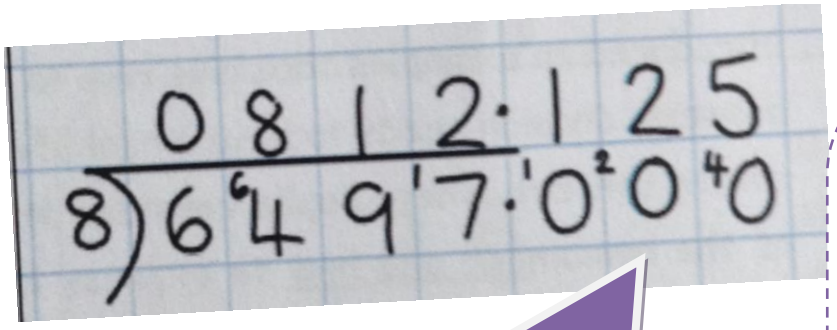
Division

Year Six

Learning Objectives:

- divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context
- divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context
- divide proper fractions by whole numbers [for example, 1/3 ÷ 2 = 1/6]
- associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 3/8]

Short division, for dividing by a single digit: e.g. 6497 ÷ 8



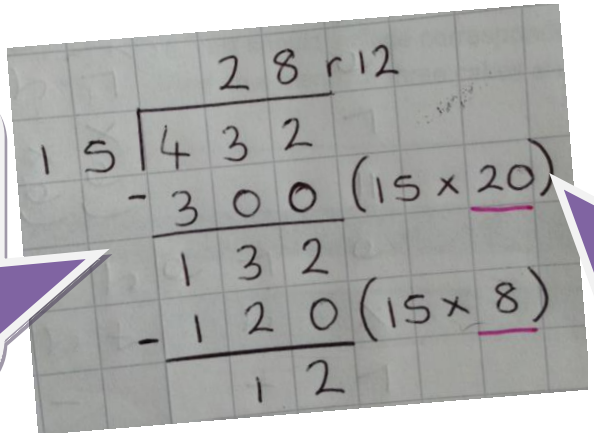
A decimal point is added after the ones because there is still a reminder, and the one reminder is carried onto zeros after the decimal point (to show there was no decimal value in the original number). Keep dividing to an appropriate degree of accuracy for the problem being solved.

Short division with remainders: pupils should continue to use this method, but with numbers to at least 4 digits, and understand how to express remainders as fractions, decimals, whole round numbers, or rounded numbers. Real life problem soving contexts need to be the starting point, where pupils have to consider the most appropriate way to express the remainder.

Vocabulary: share, share equally, one each, two each...,group, equal groups of, lots of, array, divide, divided by, divided into, division, grouping, number line, left, left over, inverse ,

Long division by chunking for dividing by 2 digits:

Place value must be aligned for subtraction



Subtract 'chunks' of 15, until 0 is reached. Pupils should write a 'useful list' of times tables facts to support them with subtracting efficient 'chunks'

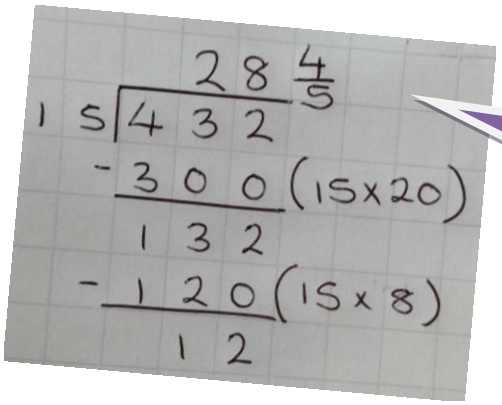
Useful list:

1 X 15 = 15

10 X 15 = 150

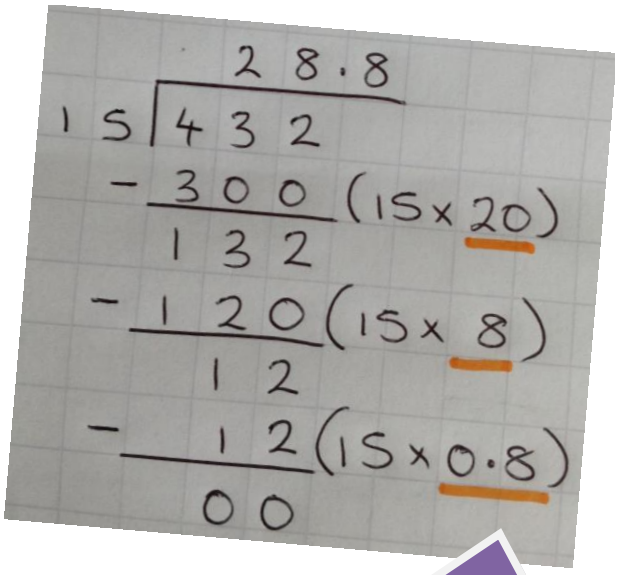
2 X 15 = 30

Remainders as fractions:



The answer becomes 28 4/5 because 12/15 = 4/5.

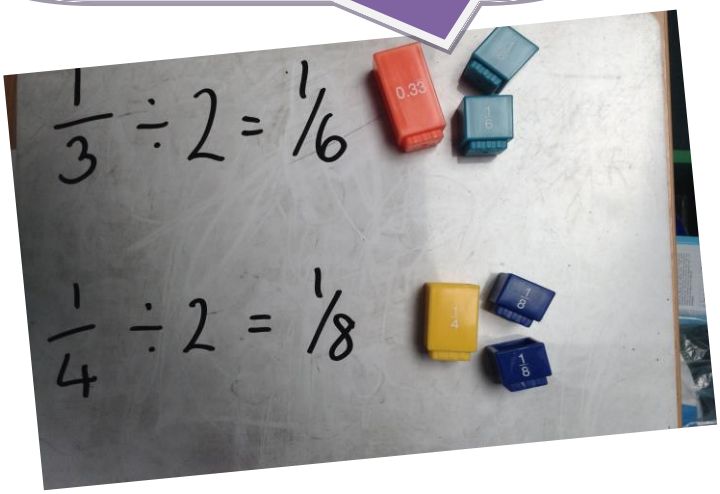
Remainders as decimals.



Use related facts to support calculations.

Dividing Fractions:

Use practical resources to support where necessary.



Vocabulary: short division, 'carry', remainder, multiple, divisible by, factor, quotient, prime number, prime factors, composite number (non-prime), common factor