# MATHS PARENT WORKSHOP

January 2020

# Progression of learning key mathematical concepts Year 1-6

# Number, Place Value, Addition and Subtraction

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|
| **Counting** | Counting to and across 100 forwards and backwards | Counting in steps of 2,3 and 5 from 0 and 10s from any number | Counting from 0 in multiples of 4,8, 50 and 100 | Counting in multiples of 6,7,9,25 and 1000 | Counting in steps of powers of 10 to 100,000 | Counting in steps of powers of 10 to 1,000,000 |
| **Place Value** | Numbers form 1 to 20 | 2 digits numbers (10s , 1s) | 3-digit number (100s, 10s, 1s) | 4-digit numbers (1000s, 100s, 10s, 1s) | Numbers to at least 1,000,000 | Numbers up to 10,000,000 |
| **Addition and subtraction (mental methods)** | 1digit and 2digit numbers to 20, including zero. | A 2-digit numbers and ones.<br>A 2-digit number and tens.<br>Two 2- digit numbers.<br>Three 1-digit numbers. | A 3-digit number and 1s.<br>A 3 digit number and 10s.<br>A 3-digit number and 100s. | Increasingly large numbers. | Increasingly large numbers (12,462-2,300=10,162). | Increasingly large numbers and more complex calculations. |
| **Addition and subtraction (formal written methods)** | | | Numbers with up to 3 digits. | Numbers with up to 4-digits. | Whole numbers with more than 4 digits. | Large numbers. |

# Multiplication and Division

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|
| **Multiplication and division tables** | | 2,5 and 10 tables. | 2,3,4,5,8 and 10 table . | 2,3,4,5,6,7,8,9, 10,11 and 12 tables. | 2,3,4,5,6,7,8,9, 10,11 and 12 tables. | 2,3,4,5,6,7,8,9, 10,11 and 12 tables. |
| **Multiplication and division (mental methods)** | Solve simple 1-step problems, using concrete objects, pictorials representations and arrays with teacher support. | Calculate and write mathematical statements within the 2,5 and 10 tables using multiplication, division and equals symbols. | 2-digit numbers times 1-digit numbers. | Multiplying by 0 and 1.<br><br>Dividing by 1.<br><br>Multiplying together 3 numbers. | Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000. | Increasing large numbers and more complex calculations. |
| **Multiplication and division (formal written methods)** | | | 2-digit numbers times 1-digit numbers, progressing to efficient written methods | Multiply 2-digit and 3-digit numbers by a 1- digit number | Multiply up to 4-digit numbers by a 1- or 2-digit number, including long multiplication for 2-digit numbers .<br><br>Divide up to 4-digit numbers by a 1-digit number, using short division. | Multiply up to 4-digit numbers by a 2-digit number, using long multiplication.<br><br>Divide up to 4-digit numbers by a 2-digit whole number, using long division. |

# Fractions, Decimals and Percentages

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|
| **Fractions** | A half and a quarter of an object, shape or quantity. | 1/3, 1/4, 2/4 and 3/4 of length, shape, set of objects or quantity.<br><br>Equivalent fractions.<br><br>Write simple fractions (1/2 of 6= 3). | Tenths<br>Unit fractions and non unit fractions with small denominators.<br><br>Fractions as numbers.<br><br>Equivalent fractions.<br><br>Add and subtract fractions with the same denominator within one whole. | Hundredths<br><br>Equivalent fractions.<br><br>Add and subtract fractions with the same denominator. | Mixed numbers and improper fractions.<br><br>Add and subtract fractions with the same denominator and related fractions.<br><br>Write mathematical statements > 1 as a mixed number.<br><br>Multiply proper fractions and mixed numbers by whole numbers. | Simplifying fractions.<br><br>Equivalent fractions.<br><br>Add and subtract fractions with different denominators and mixed numbers.<br><br>Multiply proper fractions writing answers in simplest form.<br><br>Divide proper fractions by whole numbers. |
| **Fractions, decimals and percentages** | | | | Decimal equivalents of tenths and hundredths.<br><br>Decimal equivalents of ¼, ½ and ¾ .<br>Round numbers to 1 dp to the nearest whole number.<br><br>Compare numbers with the same number of decimal places up to 2dp . | Decimal equivalents of thousandths, hundredths and tenths.<br><br>Round decimals to 2 dp to the nearest 1dp and whole number.<br><br>Compare numbers with up to 3 dp.<br><br>Write percentage as a fraction and a decimal. | Multiply 1-digit numbers with up to 2 dp whole numbers.<br><br>Use written division methods where answers has up to 2dop.<br><br>Calculate percentages of whole numbers or measure (15% of 360) .<br><br>Equivalents between simple fractions, decimals and percentages. |

# Measurement

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|
| **Measurement** | -Compare, describe and solve practical problems for length, height, mass, weight, capacity/ volume and time.<br>-Measure and begin to record measurements.<br>-Different denominations of coins and notes.<br>-Use language of time.<br>-Tell the time to the hour and half past. | -Standard units for length, height, mass, temperature and capacity.<br>-Recognise and use symbols £ and p<br>-Add and subtract money including giving change.<br>-Tell and write the time to 5 minutes, including quarter past and quarter to. | -Measure, compare, add and subtract lengths, mass, volume/ capacity.<br>-Perimeter of simple 2D shapes<br>-Add and subtract money, using both £ and p.<br>-Tell the time, including Roman numerals from I to XII, and on 12 hour and 24 hour clocks. | -Convert between units of measure.<br>-measure and calculate perimeter of rectilinear shapes.<br>-Find area of rectilinear shapes by counting.<br>-Convert time between analogue and digital 12 hour and 24 hour clocks.<br>-Convert between units of time. | -Convert between units of measure.<br>-Equivalent metric and imperial measures.<br>- Measure and calculate perimeter of composite rectilinear shapes.<br>-Calculate area of squares and rectangles.<br>-convert between units of time.<br>-Volume and capacity. | -Convert between units of measure, using decimal notation to 3 dp.<br>-convert between miles and kilometres.<br>-Shapes with the same perimeter have different areas.<br>-Calculate area of parallelograms and triangles.<br>-Use formulae for area and volume.<br>-Volume standard units. |

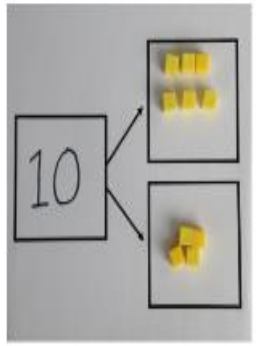
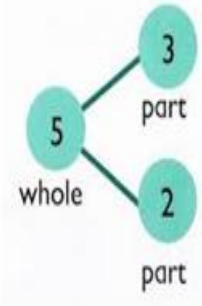
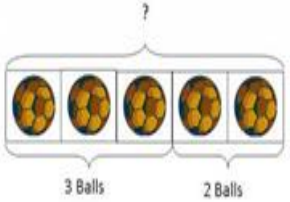
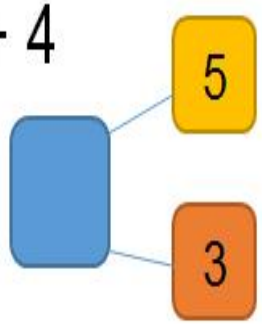
# Geometry

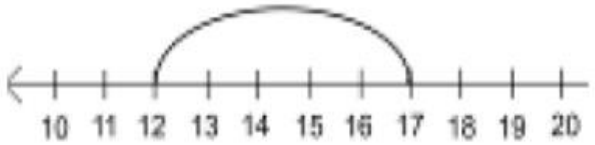
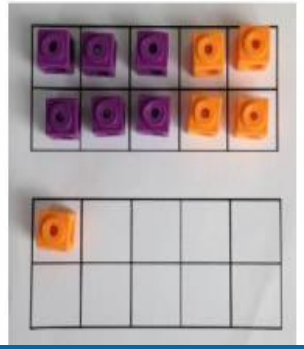
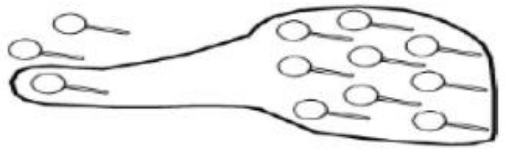
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|
| Geometry | -Common 2D and 2D shapes.<br>-Objects and shapes in patterns.<br>-Half, quarter and 3-qurater turns. | Properties of 2D shapes (including symmetry) and 3D shapes.<br>-Objects and shapes in patterns.<br>-half, quarter and 3 quarter turns (clockwise and anti0clockwise) and movement in a straight line. | -Draw 2D and make 3D shapes.<br>-Angles as a property of shape.<br>-Right angles<br>-Identify whether angles are greater or less than a right angle .<br>-Horizontal, vertical, perpendicular and parallel lines. | -Classify quadrilaterals and triangles.<br>-Identify acute and obtuse angles.<br>-Identify lines of symmetry in 2D shapes.<br>-Complete a simple symmetric shape.<br>-Coordinate grid ( 1st quadrant)<br>-Translation | -Identify 3D shapes from 2D representation.<br>-Measure and draw angles in degrees.<br>-identify: multiples of 90%; angles at a point: reflex angles.<br>-regular and irregular polygons<br>-reflect or translate a shape on a coordinate grid ( 1st quadrant) | -Build 3D shapes, including making nets .<br>-Classify shapes<br>-Find unknown angles in triangles, quadrilaterals and regular polygons<br>-Circles: circumference, radius and diameter.<br>-Find unknown angles at a point, on a straight line, vertically opposite.<br>-Coordinates (all four quadrants)<br>-translate and reflect shapes on coordinate grid |

# Mental Strategies in KS1

- Count in 2s, 5s, 10s. Count forwards and backwards, from 1 to 20, then later on 1 to 100.
- Count objects or groups of objects.
- Rehearsing concepts and skills already taught i.e. one more/less.
- Practising recall of number facts i.e. number bonds to 10 then 20, multiples of 10 number bonds to 100, and 2x, 5x and 10x tables.
- Rehearsing the days of the week and months of the year.
- Beginning to learn the name of 2D and 3D shapes.

# Addition

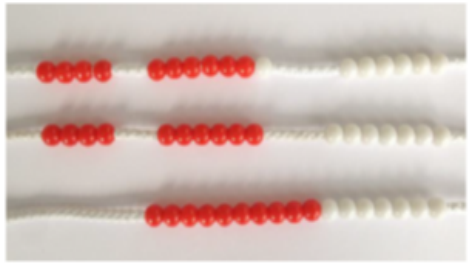
| Objective and Strategies | Concrete | Pictorial | Abstract |
| --- | --- | --- | --- |
| Combining two parts to make a whole: part-whole model |     Use cubes to add two numbers together as a group or in a bar.  |       3 Balls 2 Balls Use pictures to add two numbers together as a group or in a bar.   | 4 + 3 = 7 10= 6 + 4   Use the part-part whole diagram as shown above to move into the abstract |

| | | | |
|---|---|---|---|
| Starting at the bigger number and counting on |  <br>Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer. | 12 + 5 = 17<br>  <br><br>Start at the larger number on the number line and count on in ones or in one jump to find the answer. | 12 + 5 = 17<br>Place the larger number in your head and count on the smaller number to find your answer. |
| Regrouping to make 10. |  <br>6 + 5 = 11<br>  <br>Start with the bigger number and use the smaller number to make 10. |  <br>3 + 9 =<br>Use pictures or a number line. Regroup or partition the smaller number to make 10.<br>9 + 5 = 14<br>1 4<br>+1 +4<br> | 7 + 4= 11<br>If I am at seven, how many more do I need to make 10. How many more do I add on now? |

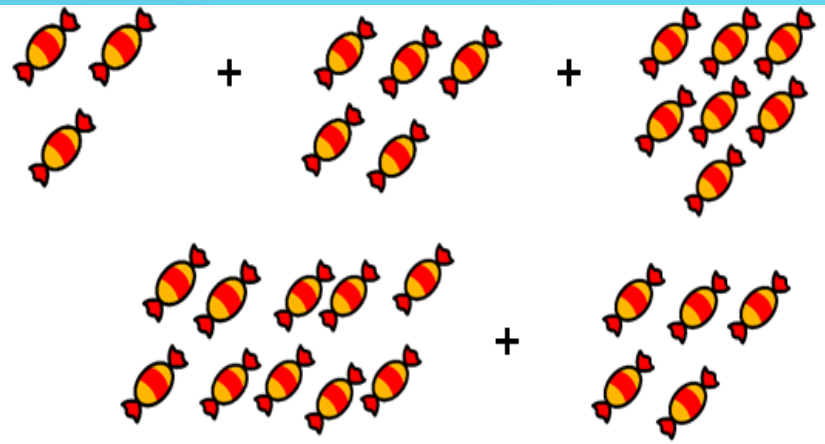
## Adding three single digits

4 + 7 + 6= 17

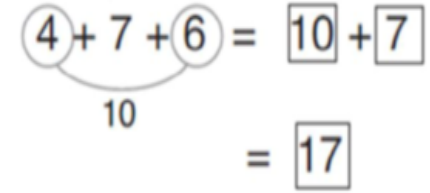
Put 4 and 6 together to make 10. Add on 7.



Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.



Add together three groups of objects. Draw a picture to recombine the groups to make 10.

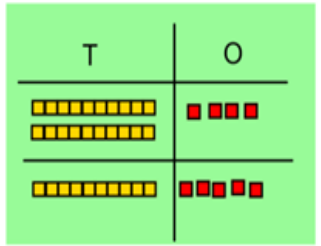


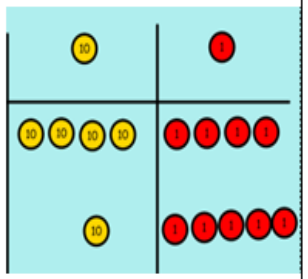

Combine the two numbers that make 10 and then add on the remainder.

## Column method- no regrouping

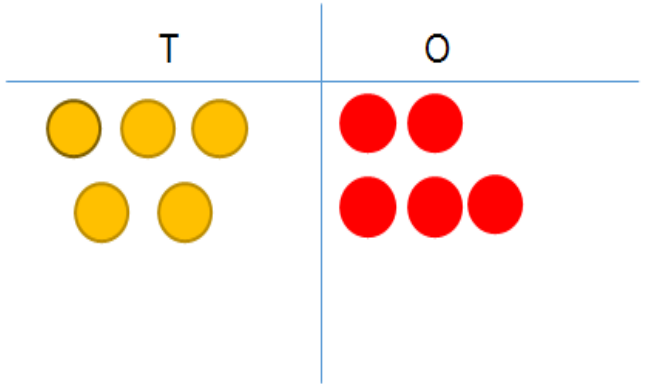
24 + 15=

Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.



After practically using the base 10 blocks and place value counters, children can draw the counters to help them to solve additions.




Calculations

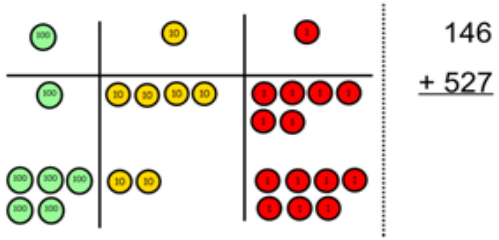
21 + 42 =

21

+ 42

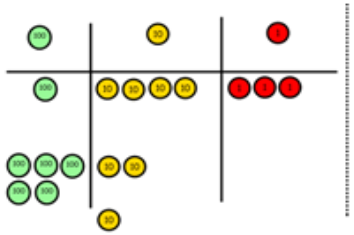
# Column method- regrouping

Make both numbers on a place value grid.



146
+ 527

Add up the units and exchange 10 ones for one 10.



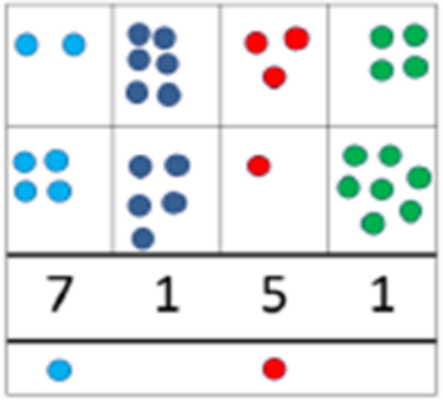
146
+ 527

Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.

This can also be done with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100.

As children move on to decimals, money and decimal place value counters can be used to support learning.

Children can draw a pictoral representation of the columns and place value counters to further support their learning and understanding.




Start by partitioning the numbers before moving on to clearly show the exchange below the addition.

$$\begin{array}{rcrl} 20 & + & 5 & \\ 40 & + & 8 & \\ \hline 60 & + & 13 & = 73 \end{array}$$

As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.

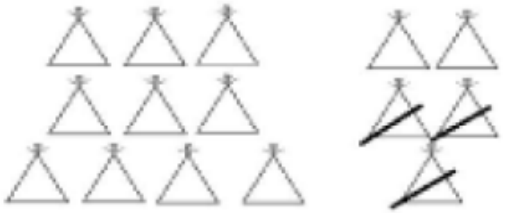
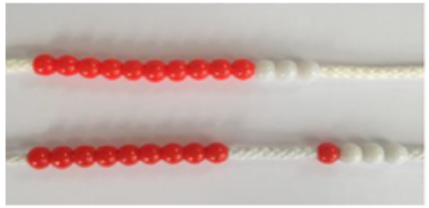
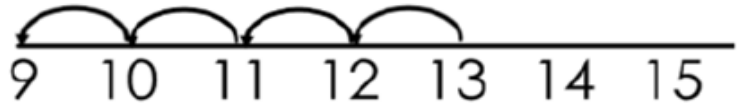
$$\begin{array}{r} 536 \\ +\ 85 \\ \hline 621 \\ 1\ 1 \end{array}$$

$$\begin{array}{r} 72.8 \\ +\ 54.6 \\ \hline 127.4 \\ 1\ 1 \end{array}$$

$$\begin{array}{rr} & £23.59 \\ + & £7.55 \\ \hline & £31.14 \\ & {\scriptstyle 1\ 1\ \ \ 1} \end{array}$$

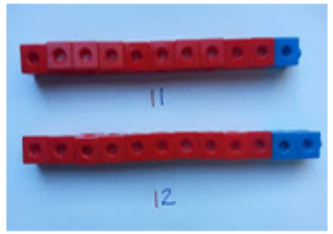
$$\begin{array}{rr} & 23.361 \\ & 9.080 \\ & 59.770 \\ + & 1.300 \\ \hline & 93.511 \\ & {\scriptstyle 2\ 1\ \ \ 2} \end{array}$$

# Subtraction

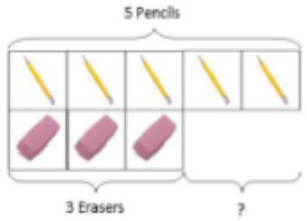
| Objective and Strategies | Concrete | Pictorial | Abstract |
|---|---|---|---|
| Taking away ones | Use physical objects, counters, cubes etc to show how objects can be taken away.<br>  6 – 2 = 4<br>  <br>  | Cross out drawn objects to show what has been taken away.<br>  <br>15 – 3 = 12 | 18 -3= 15<br><br>8 – 2 = 6 |
| Counting back | Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones.<br>  <br>13 – 4<br><br>Use counters and move them away from the group as you take them away counting backwards as you go.<br>  | Count back on a number line or number track<br>  <br>9 10 11 12 13 14 15<br><br>Start at the bigger number and count back the smaller number showing the jumps on the number line.<br>  <br>-1 -1 -1 -10 -10<br>34 35 36 37 47 57<br><br>This can progress all the way to counting back using two 2 digit numbers. | Put 13 in your head, count back 4. What number are you at? Use your fingers to help. |

## Find the difference

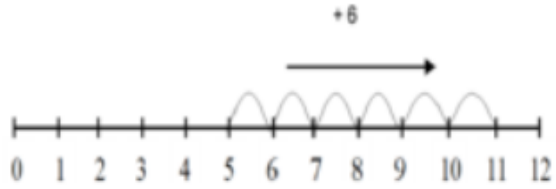
Compare amounts and objects to find the difference.




Use cubes to build towers or make bars to find the difference




Use basic bar models with items to find the difference

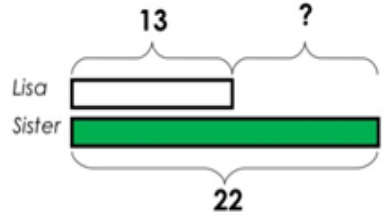



Count on to find the difference.

Draw bars to find the difference between 2 numbers.

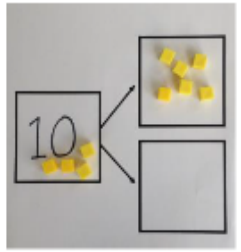
**Comparison Bar Models**

*Lisa is 13 years old. Her sister is 22 years old. Find the difference in age between them.*




Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.

## Part Part Whole Model

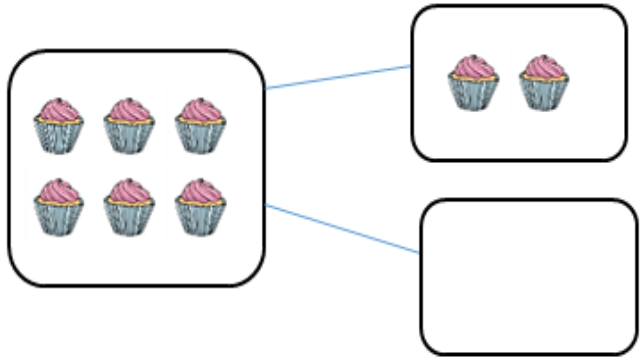


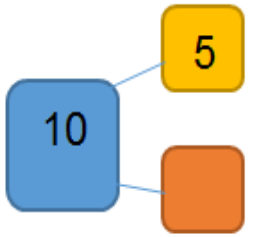

Link to addition- use the part whole model to help explain the inverse between addition and subtraction.

If 10 is the whole and 6 is one of the parts. What is the other part?

10 - 6 =

Use a pictorial representation of objects to show the part part whole model.

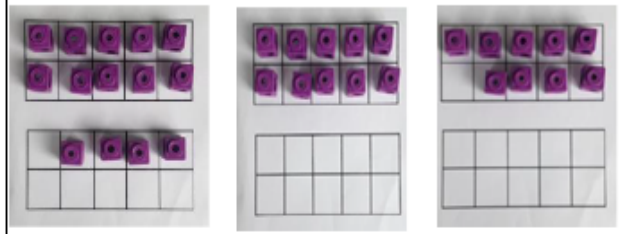




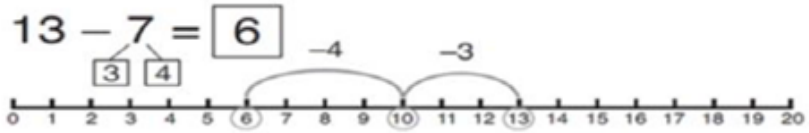

Move to using numbers within the part whole model.

## Make 10

14 – 5 =



Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.



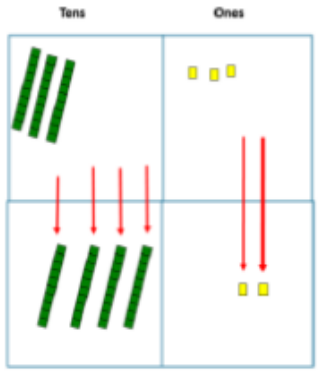

Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.

16 – 8=

How many do we take off to reach the next 10?

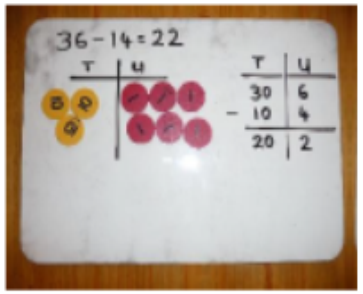
How many do we have left to take off?

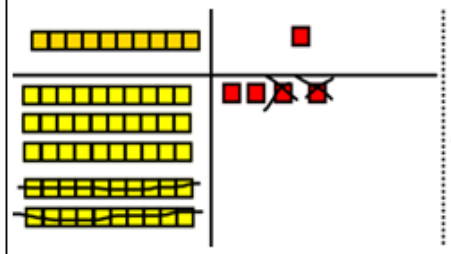
## Column method without regrouping

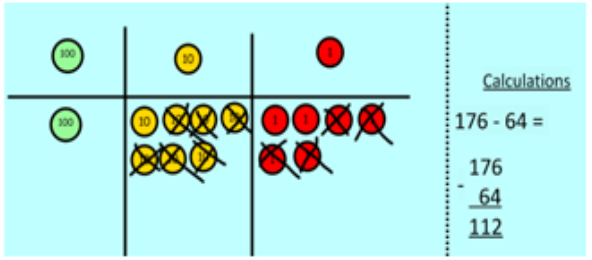



Use Base 10 to make the bigger number then take the smaller number away.

Show how you partition numbers to subtract. Again make the larger number first.



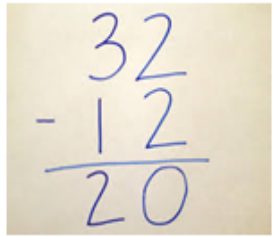




Draw the Base 10 or place value counters alongside the written calculation to help to show working.

47 – 24 = 23

40 + 7
– 20 + 4
20 + 3

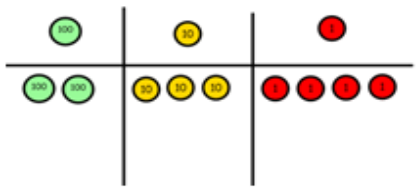
This will lead to a clear written column subtraction.



# Column method with regrouping

Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges.

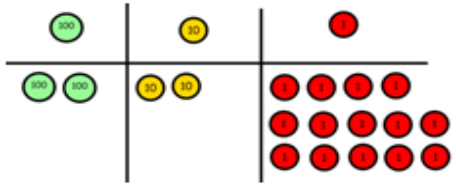
Make the larger number with the place value counters



Calculations

234
- 88

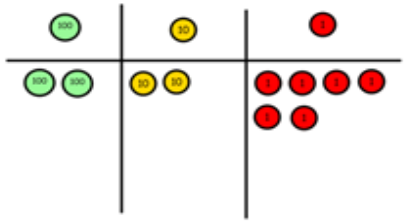
Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



Calculations

234
- 88

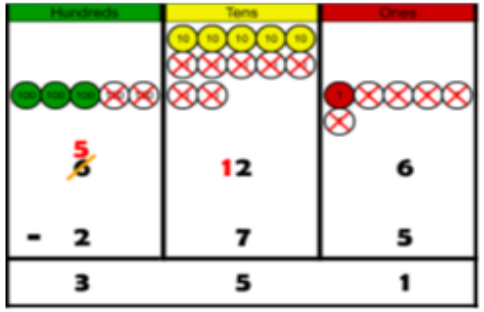
Now I can subtract my ones.



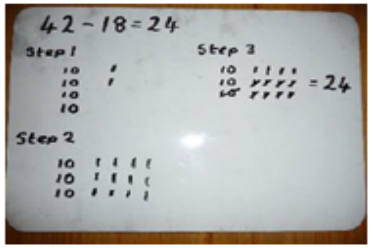
Calculations

234
- 88

Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.

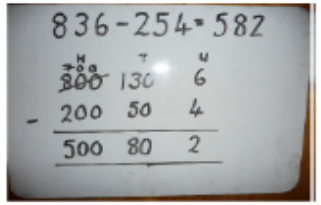



Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make.

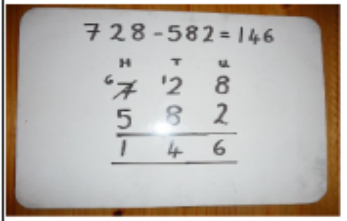



When confident, children can find their own way to record the exchange/regrouping.

Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.



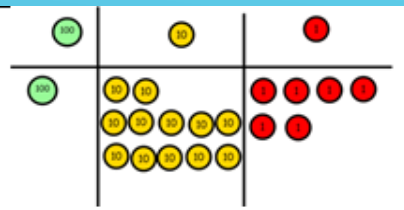

Children can start their formal written method by partitioning the number into clear place value columns.




Moving forward the children use a more compact method.

This will lead to an understanding of subtracting any number including decimals.

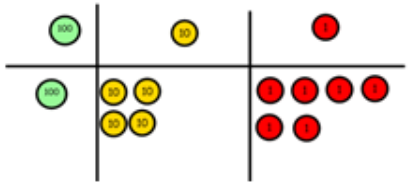
```
      5  12      1
   2  6  3  .  0
-     2  6  .  5
   2  3  6  .  5
```



Calculations

234
- 88

Now I can take away eight tens and complete my subtraction

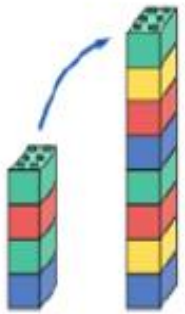
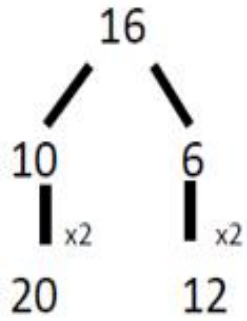
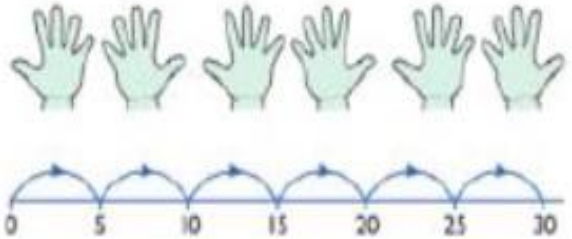


Calculations

~~2~~ ~~3~~ 4
- 88
146

Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.

# Multiplication

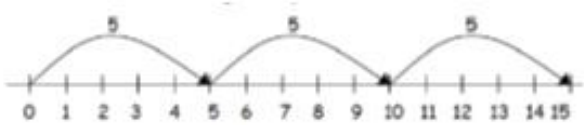
| | | | |
|---|---|---|---|
| Doubling | Use practical activities to show how to double a number.<br>  <br>double 4 is 8<br>4 × 2 = 8 | Draw pictures to show how to double a number.<br>Double 4 is 8<br>  |  <br>Partition a number and then double each part before recombining it back together. |
| Counting in multiples |  <br>  <br>Count in multiples supported by concrete objects in equal groups. |  <br>Use a number line or pictures to continue support in counting in multiples. | Count in multiples of a number aloud.<br><br>Write sequences with multiples of numbers.<br><br>2, 4, 6, 8, 10<br><br>5, 10, 15, 20, 25 , 30 |

## Repeated addition


Use different objects to add equal groups.

There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?

2 add 2 add 2 equals 6



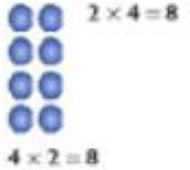

5 + 5 + 5 = 15

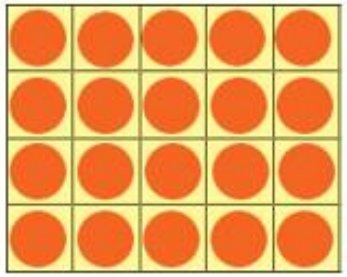
Write addition sentences to describe objects and pictures.


## Arrays- showing commutative multiplication

Create arrays using counters/ cubes to show multiplication sentences.

Draw arrays in different rotations to find **commutative** multiplication sentences.

Link arrays to area of rectangles.

Use an array to write multiplication sentences and reinforce repeated addition.

5 + 5 + 5 = 15

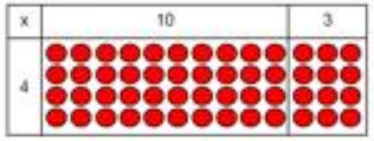
3 + 3 + 3 + 3 + 3 = 15

5 x 3 = 15

3 x 5 = 15

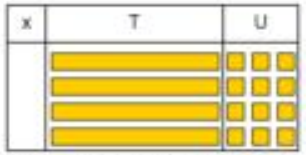
# Grid Method

Show the link with arrays to first introduce the grid method.



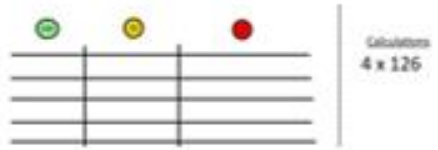

4 rows of 10
4 rows of 3

Move on to using Base 10 to move towards a more compact method.

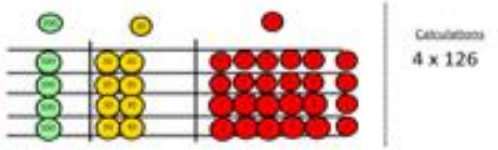



4 rows of 13

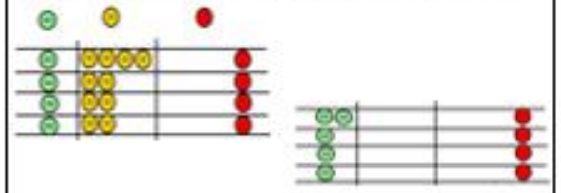
Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.




Fill each row with 126.



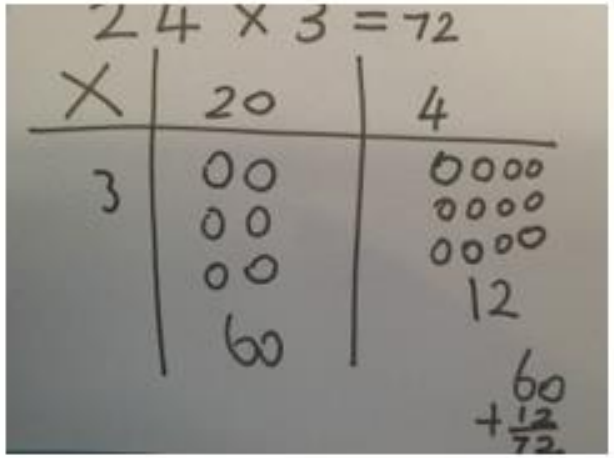

Add up each column, starting with the ones making any exchanges needed.



Then you have your answer.

Children can represent the work they have done with place value counters in a way that they understand.

They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.




Start with multiplying by one digit numbers and showing the clear addition alongside the grid.

| × | 30 | 5 |
|---|---|---|
| 7 | 210 | 35 |

210 + 35 = 245

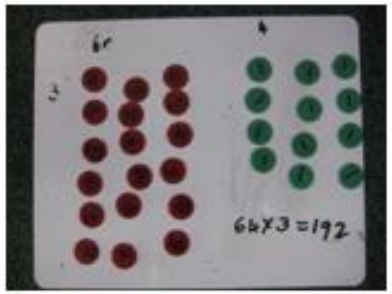
Moving forward, multiply by a 2 digit number showing the different rows within the grid method.

| | 10 | 8 |
|---|---|---|
| 10 | 100 | 80 |
| 3 | 30 | 24 |

| X | 1000 | 300 | 40 | 2 |
|---|---|---|---|---|
| 10 | 10000 | 3000 | 400 | 20 |
| 8 | 8000 | 2400 | 320 | 16 |

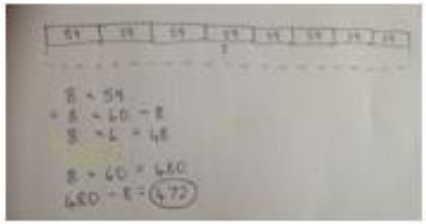
## Column multiplication

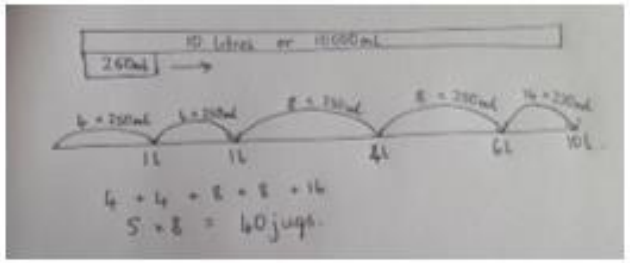
Children can continue to be supported by place value counters at the stage of multiplication.




It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.

Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.



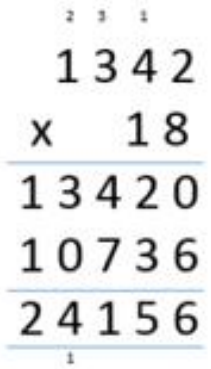



Start with long multiplication, reminding the children about lining up their numbers clearly in columns.

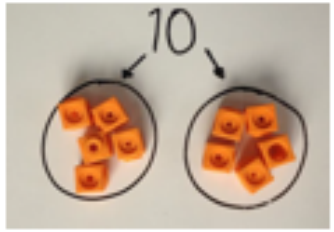
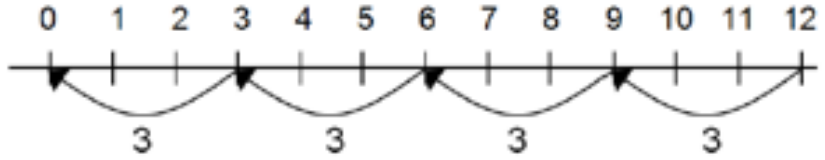
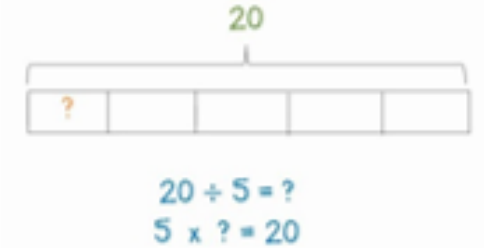
If it helps, children can write out what they are solving next to their answer.

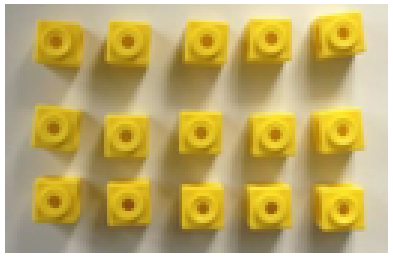
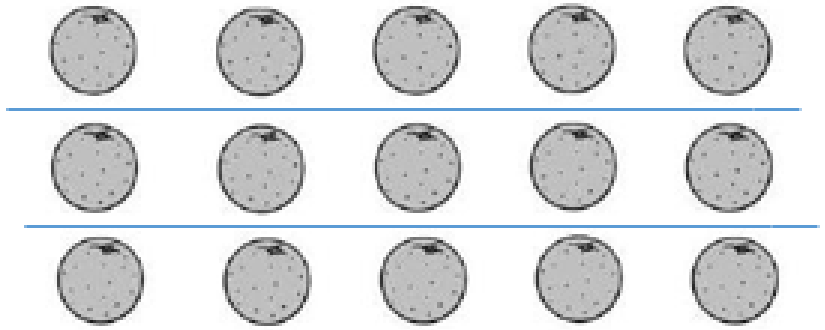
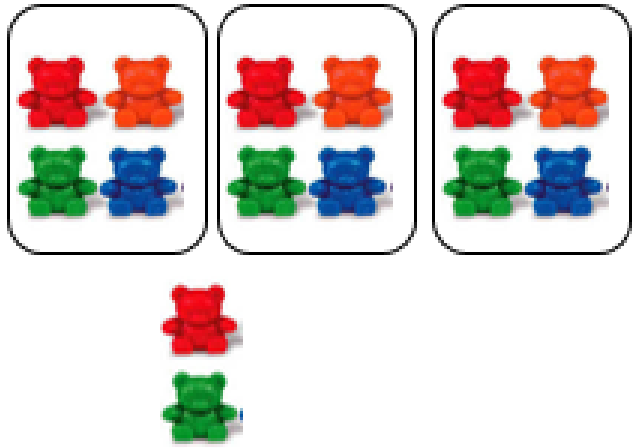
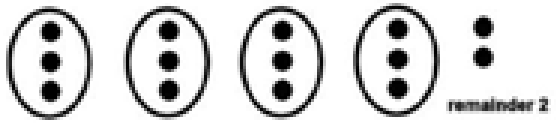
```
  32
x 24
   8   (4 x 2)
 120   (4 x 30)
  40   (20 x 2)
 600   (20 x 30)
 768
```

This moves to the more compact method.



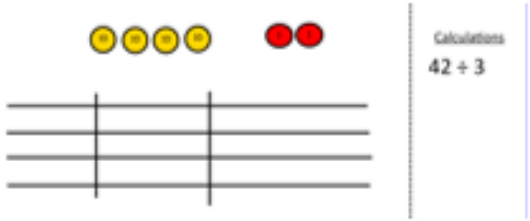
# Division

| | | | |
|---|---|---|---|
| **Sharing objects into groups** |     I have 10 cubes, can you share them equally in 2 groups? | Children use pictures or shapes to share quantities.  $8 \div 2 = 4$ | Share 9 buns between three people. $9 \div 3 = 3$ |
| **Division as grouping** | Divide quantities into equal groups. Use cubes, counters, objects or place value counters to aid understanding.     $96 \div 3 = 32$  | Use a number line to show jumps in groups. The number of jumps equals the number of groups.   Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group.   | $28 \div 7 = 4$ Divide 28 into 7 groups. How many are in each group? |

| | | | |
|---|---|---|---|
| **Division within arrays** |  Link division to multiplication by creating an array and thinking about the number sentences that can be created.<br><br>Eg 15 ÷ 3 = 5 5 x 3 = 15<br>15 ÷ 5 = 3 3 x 5 = 15 |  Draw an array and use lines to split the array into groups to make multiplication and division sentences. | Find the inverse of multiplication and division sentences by creating four linking number sentences.<br><br>7 x 4 = 28<br>4 x 7 = 28<br>28 ÷ 7 = 4<br>28 ÷ 4 = 7 |
| **Division with a remainder** | 14 ÷ 3 =<br>Divide objects between groups and see how much is left over<br>  | Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.<br>  <br>Draw dots and group them to divide an amount and clearly show a remainder.<br>  | Complete written divisions and show the remainder using r.<br>  |

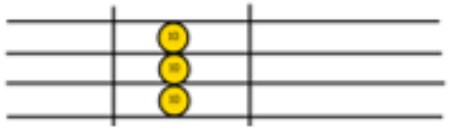
# Short division


Use place value counters to divide using the bus stop method alongside

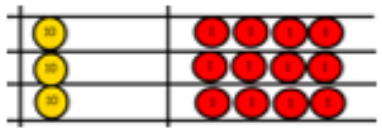



42 ÷ 3=

Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.

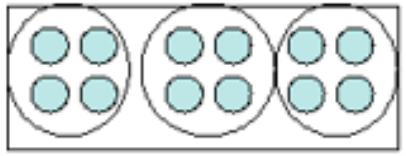


We exchange this ten for ten ones and then share the ones equally among the groups.



We look how much in 1 group so the answer is 14.

Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.



Encourage them to move towards counting in multiples to divide more efficiently.

Begin with divisions that divide equally with no remainder.

$$\begin{array}{r} 218 \\ 4\overline{)872} \\ -\,3 \end{array}$$

Move onto divisions with a remainder.

$$\begin{array}{r} 86\ r\ 2 \\ 5\overline{)432} \\ -\,3 \end{array}$$

Finally move into decimal places to divide the total accurately.

$$\begin{array}{r} 14.6 \\ 35\overline{)511.0} \\ -\,16 \\ \quad\ 21 \end{array}$$

There are some examples of questions on tables at the back if you'd like to have a look and ask staff any questions.