Key Stage 1 Mental Strategies

Supporting children's learning at home

Thank you for continuing to support your child's learning

In case of a fire alarm, please exit the building via your nearest door and gather on the junior playground

I will be taking photos throughout the session, I will try and take these of your backs but if you don't want to be in the photo, please let me know

I will be attaching all relevant paper work, including the PowerPoint for this workshop on the school website. Go to 'Curriculum' and 'Maths'. ladbrooke.herts.sch.uk

- Mathematics is foremost an activity of the mind, and written calculations are an aid to that mental activity.

- At Ladbrooke, we aim to develop children's mental strategies. We then focus on written methods that derive from and support mental methods.

We want children to ask themselves:

Can I do this in my head?

Can I do this in my head using drawings or jottings?

Do I need to use an expanded/shortened written method?

Have I checked my answers using a different method?

As a school, the scheme we follow is called WhiteRose. This may be supplemented with other relevant activities.

WhiteRose is based on three aspects –

Fluency Reasoning Problem Solving

Fluency –knowing mathematical facts and being able to recall them quickly and accurately.
Varied fluency – talking about and explaining concepts with mathematical language and vocabulary
Reasoning – the process of applying logical and critical thinking to mathematical problems. Talking and explaining ideas
Problem Solving – enables children to use developed skills towards working through a problem. Children will be working thinking through a problem.

These help the children to become fluent and possess a deeper understanding as they move from KS1 to KS2

Working towards the expected standard

The pupil can:

- read and write numbers in numerals up to 100
- partition a two-digit number into tens and ones to demonstrate an understanding of place value, though they may use structured resources[1] to support them
- add and subtract two-digit numbers and ones, and two-digit numbers and tens, where no regrouping is required, explaining their method verbally, in pictures or using apparatus (e.g. 23 + 5; 46 + 20; 16 – 5; 88 – 30)
- recall at least four of the six[2] number bonds for 10 and reason about associated facts (e.g. 6 + 4 = 10 , therefore 4 + 6 = 10 and 10 – 6 = 4)
- count in twos, fives and tens from 0 and use this to solve problems
- know the value of different coins
- name some common 2-D and 3-D shapes from a group of shapes or from pictures of the shapes and describe some of their properties (e.g. triangles, rectangles, squares, circles, cuboids, cubes, pyramids and spheres).

Working at the expected standard

The pupil can:

- read scales* in divisions of ones, twos, fives and tens
- partition any two-digit number into different combinations of tens and ones, explaining their thinking verbally, in pictures or using apparatus
- add and subtract any 2 two-digit numbers using an efficient strategy, explaining their method verbally, in pictures or using apparatus (e.g. 48 + 35; 72 – 17)
- recall all number bonds to and within 10 and use these to reason with and calculate bonds to and within 20, recognising other associated additive relationships (e.g. If 7 + 3 = 10, then 17 + 3 = 20; if 7 – 3 = 4, then 17 – 3 = 14; leading to if 14 + 3 = 17, then 3 + 14 = 17, 17 – 14 = 3 and 17 – 3 = 14)
- recall multiplication and division facts for 2, 5 and 10 and use them to solve simple problems, demonstrating an understanding of commutativity as necessary
- identify $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{4}$, of a number or shape, and know that all parts must be equal parts of the whole
- use different coins to make the same amount
- read the time on a clock to the nearest 15 minutes
- name and describe properties of 2-D and 3-D shapes, including number of sides, vertices, edges, faces and lines of symmetry.

Working at greater depth

The pupil can:

- read scales* where not all numbers on the scale are given and estimate points in between
- recall and use multiplication and division facts for 2, 5 and 10 and make deductions outside known multiplication facts
- use reasoning about numbers and relationships to solve more complex problems and explain their thinking (e.g. 29 + 17 = 15 + 4 + □; 'together Jack and Sam have £14. Jack has £2 more than Sam. How much money does Sam have?' etc.)
- solve unfamiliar word problems that involve more than one step (e.g. 'which has the most biscuits, 4 packets of biscuits with 5 in each packet or 3 packets of biscuits with 10 in each packet?')
- read the time on a clock to the nearest 5 minutes
- describe similarities and differences of 2-D and 3-D shapes, using their properties (e.g. that two different 2-D shapes both have only one line of symmetry; that a cube and a cuboid have the same number of edges, faces and vertices, but different dimensions).

Year 1 programme of study (statutory requirements)

Number and place value	Addition and subtraction	Multiplication and division
Pupils should be taught to: ▪ count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number ▪ count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens ▪ given a number, identify one more and one less ▪ identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least ▪ read and write numbers from 1 to 20 in numerals and words	Pupils should be taught to: ▪ read, write and interpret mathematical statements involving addition (+), subtraction (-) and equals (=) signs ▪ represent and use number bonds and related subtraction facts within 20 ▪ add and subtract one-digit and two-digit numbers to 20, including zero ▪ solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = □ - 9	Pupils should be taught to: ▪ 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

Year 2 programme of study (statutory requirements)

Number and place value	Addition and subtraction	Multiplication and division
Pupils should be taught to: ▪ count in steps of 2, 3, and 5 from 0, and in tens from any number, forward or backward ▪ recognise the place value of each digit in a two-digit number (tens, ones) ▪ identify, represent and estimate numbers using different representations, including the number line ▪ compare and order numbers from 0 up to 100; use <, > and = signs ▪ read and write numbers to at least 100 in numerals and in words ▪ use place value and number facts to solve problems	Pupils should be taught to: ▪ solve problems with addition and subtraction: - using concrete objects and pictorial representations, including those involving numbers, quantities and measures - applying their increasing knowledge of mental and written methods ▪ recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 ▪ add and subtract numbers using concrete objects, pictorial 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 ▪ show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot ▪ recognise and use the inverse relationship between addition and subtraction and use this to check calculations and missing number problems	Pupils should be taught to: ▪ recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers ▪ calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs ▪ show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot ▪ solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts

Key facts

Year One Recall

- Number bonds within 10 including a + b + c = d, the effect of adding zero and missing number calculations
- Reordering to find tens and some more e.g. 4 + 5 + 6 =
- Doubles within 10 including subtraction e.g. 6 - 3 = 3 and missing numbers e.g. 6 - □ = 3
- Structured subitisation on tens frame to 20

Year Two Recall

- Addition and subtraction facts to 20
- Multiplication and division facts 2, 5 and 10 x tables
- Multiplication facts for 3 x tables
- Number of minutes in an hour; number of hours in a day
- Coin recognition up to £2
- Doubles to 20

Skills to be practised

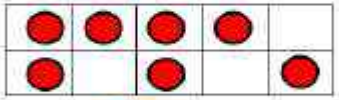
Subitising	the ability to see number as pattern, such as dice patterns. This supports pupils to see numbers within numbers and better regrouping (partitioning).
Regrouping (partitioning)	the ability to break numbers up and recombine them flexibly
Counting on and counting back	in a variety of interval steps
Reordering	knowing when and how to reorder to make calculations easier
Finding complements	links to reordering, identifying useful complements pairs or trios of 1, 10, 60 etc.
Applying the inverse	use of fact family knowledge to 'undo'
Rounding	to a range of benchmark numbers
Estimation	both linear estimation on number lines and scales, and of quantities and calculations to support an increasing sense of what is reasonable
Compensation	to use rounding to add or subtract too much or too little and adjust accordingly
Rebalancing	to adjust the parts of addition and subtraction facts to make a calculation easier
x ÷ by powers of 10	
Doubling and halving	
Rearranging	to adjust the groups in multiplication and division to make a calculation easier

Year 1

Core concept: COUNTING and COMPARISON

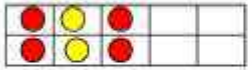
Core skill: SUBITISING

Numbers to 10 recognising dot patterns on dice / dominoes and tens frames.



I can see three and three and one makes seven.
Four and one and one and one makes seven.

Equal grouping drawing out understanding of repeated addition.



and

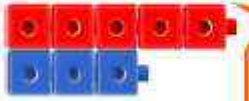
2 + 2 + 2 = 6

There are three groups of two teddies.
Three groups of two equals six.

Core concept: COMPARISON

Core skill: COUNTING ON and BACK

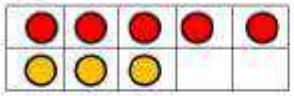
Pupils count on to find the total and difference.

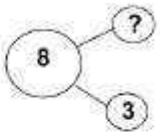


Three and two more equals five.
Two fewer than five equals three.

Think addition to solve subtraction – leading to greater understanding that if we know one part we can use that to find the unknown part.

8 - 3



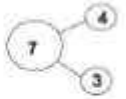


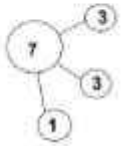
I can see that eight can be split into three and five.

I know that five and three are eight.

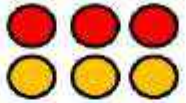
I can see that five more than three is eight.

Part part whole model drawing out an understanding of commutativity.

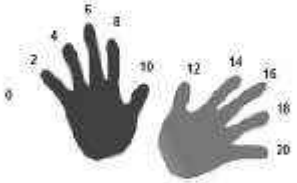


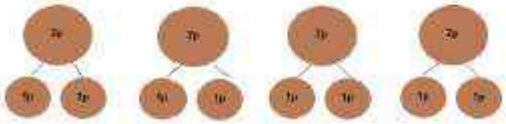


Skip counting
Counting groups of objects with two hands (drawing out understanding of doubles).



To include opportunities to count in 2s in several ways

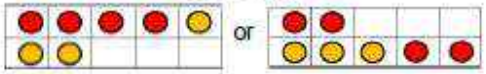


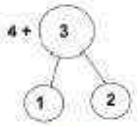


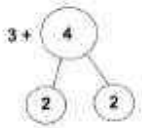
Think 5 for addition using five as a benchmark number.

4 + 3 =

can become







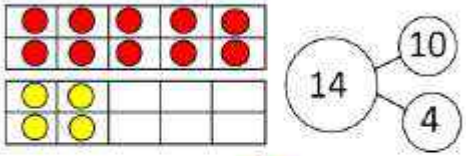
4 + 1 + 2 =
5 + 2 =

3 + 2 + 2 =
5 + 2 =

I know that four and one more is five.
I can see that three can be split into one and two.
Five and two more is seven.

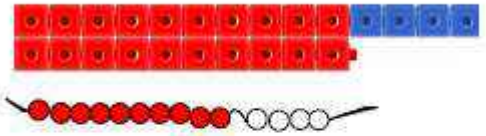
I know that three and two more is five.
I can see that four can be split into two and two.
Five and two more is equal to seven.

Regrouping numbers into ten and some more drawing out understanding that ten ones are equal to one ten.



I made 14 into 10 and 4 more.
There is 1 ten and 4 ones in the number 14.
Here is the ten and here are the 4 more.

Comparing numbers using ten as a benchmark number.



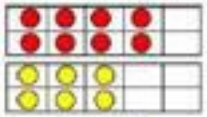
14 - 4 = 10
4 + 10 = 14
10 = 14 - 4
4 = 14 - 10

14 is 4 more than 10.
4 more than 10 is 14.
10 is 4 fewer than 14.
10 fewer than 14 is 4.

Explore the language of 'more than' and 'less than' through measures and bar charts.

Regrouping numbers to 20 leading to **'think 10 for addition'**. Pupils should experience regrouping either addend.

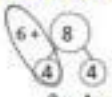
8 + 6



can become

or

8 + 2 + 4 =
10 + 4 =



6 + 4 + 4 =
10 + 4 =

I know that eight and two more is ten. Four and two make six. So 8 + 6 can become 8 + 2 + 4.

I know that six and four more is ten. Four and four make ten. So 6 + 8 can become 6 + 4 + 4.

Core skill: COUNTING ON and BACK

Comparison model
Pupils to count on to find total and difference.

14 + ☐ = 16

☐ + 14 = 16

16 - 14 = ☐

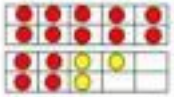
16 - ☐ = 14

14 and 2 more equals 16.
2 fewer than 16 equals 14.

'Think 10 for subtraction' using the minuend or the subtrahend.
First with numbers where no bridging through ten is required.

17 - 3

Regrouping the minuend in two ways and recombining the remaining quantity



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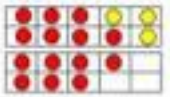
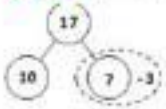
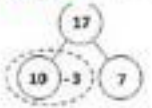




17 - 3 =
7 - 3 + 10 =
4 + 10 = 14



17 - 3 =
10 - 3 + 7 =
7 + 7 = 14

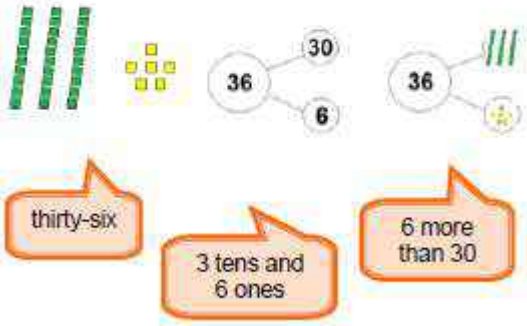
I know that 17 can be regrouped into 10 and 7.
I can take 3 from either 10 or 7.

No multiplication and division

Year 2
Addition and Subtraction

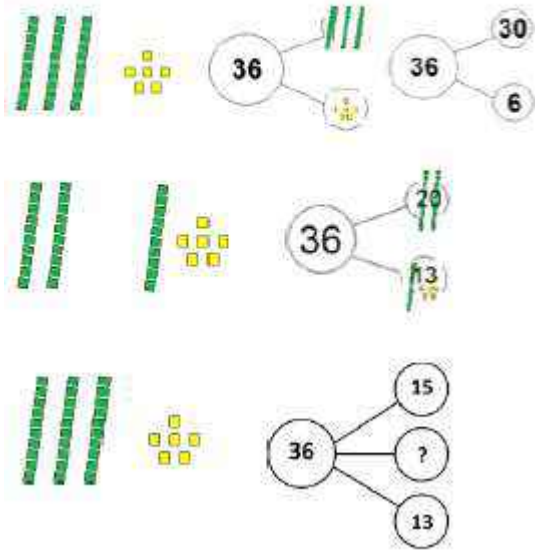
Core skill: COUNTING ON and BACK

Grouping tens and some more drawing out the understanding that ten ones are equal to one ten.



Core skill: REGROUPING

Regroup 2-digit numbers flexibly and in multiple ways.



Core skill: DOUBLING and HALVING

Finding doubles and near doubles

I know that 3 add 3 makes 6.
So 3 + 4 must be 1 more.
3 + 2 must be one less.

How can we use this to add 13 + 14, 23 + 4 or 30 + 40?

Relate to subtraction e.g. 12 - 7 = ☐ and multiplication and division e.g. 3 + 3 = 2 x 3.

Core skill: COUNTING ON and BACK

Skip counting drawing on the concept of repeated groups in multiplication.

3 + 3 + 3 + 3 = 12

I can see 4 groups with 3 cars in each group. There are 12 cars altogether.

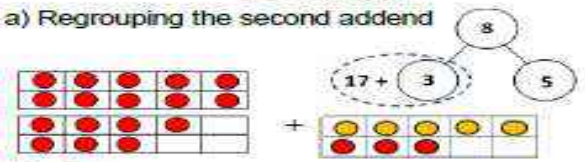
Core skill: REGROUPING

Think 10 for addition (Tens Ones + Ones)

Drawing out the skill of regrouping numbers to allow bridging through tens: Tens Ones + Ones. Exploring that either addend can be regrouped and utilise benchmark numbers.

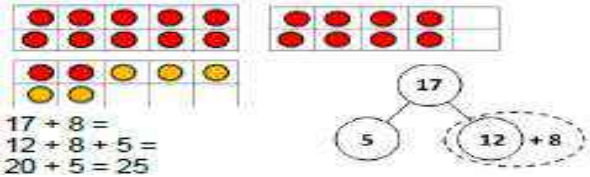
☐ = 17 + 8

a) Regrouping the second addend



17 + 8 =
17 + 3 + 5 =
20 + 5 = 25

b) Regrouping the first addend

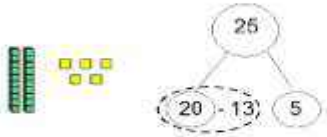


17 + 8 =
12 + 8 + 5 =
20 + 5 = 25

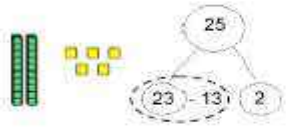
Think 10 for subtraction (Tens Ones - Ones)
Exploring that either the minuend or the subtrahend can be regrouped.

25 - 13 = ☐

Regrouping the minuend (two examples). Taking from a multiple of ten or taking to a multiple of ten.



20 - 13 + 5
= 7 + 5
= 12



23 - 13 + 2
= 10 + 2
= 12

Regrouping the subtrahend – normally to a multiple of ten.

25 - 5 - 8
= 20 - 8
= 12

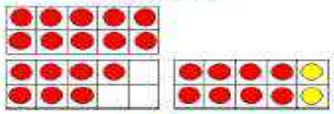
Drawing out complements to benchmark numbers.

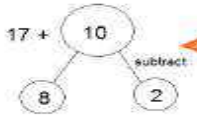
I know there is 7 more to 20 and 5 more to 25.

Core skill: COMPENSATION

Compensation at this stage is a form of **Think 10**, utilising benchmark numbers.

17 + 8 = ☐





Adding 8 is like adding ten and taking 2 away. Subtracting 8 is like subtracting ten and adding 2 back.

Apply this to subtraction.

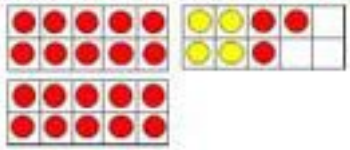
Core skill: FINDING COMPLEMENTS / REORDERING

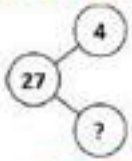
Adding three, one-digit numbers such as 7 + 5 + 6 or 6 + 7 + 4 and drawing out the reasons why pupils may wish to reorder the numbers. Focus upon a range of strategies used.

Core skill: APPLYING THE INVERSE

Think addition to solve subtraction

Tens Ones - Ones = ☐ without regrouping



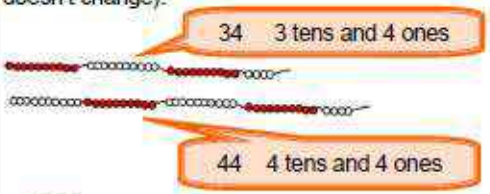


27 - ☐ = 4

4 + ☐ = 27

I know 4 and 3 makes 7 so 4 and 23 make 27.

Counting on and back in ones and tens from any number allowing children to notice in the pattern what changes as a result (and what doesn't change).



I can see that the tens are changing but the ones are staying the same.

Then counting with coins and on scales from any amount.

Year 2
Multiplication and Division

Core skill: DOUBLING and HALVING

Doubles

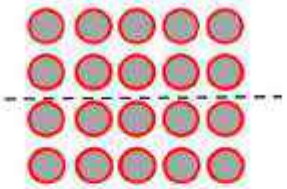
I can also see two groups of six.

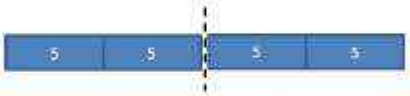
Leading to linear and area models.

There are 4 groups of 3 cars. That is 12 cars altogether. I can see 12 cars with 4 groups of 3 cars.

2 x 5 is equal to double 1 x 5.

Year 2
Numbers to 100





4 x 5 is double 2 x 5.
I can show it as an array and as a linear model.

Think multiplication

Introduction of the array and linear model to explore how the relationship of multiplication and division relate.

In multiplication, explore how multiplier, multiplicand and product interrelate.

In division, explore how dividend, divisor and quotient interrelate and link to multiplication.

4 x 3 = 12

Number in each group
3

Number of groups
4

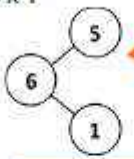
4 x 3 = 12
3 x 4 = 12
12 ÷ 3 = 4
12 ÷ 4 = 3

Core skill: REGROUPING

Applying understanding of benchmark numbers.

Think 5 for multiplication and division

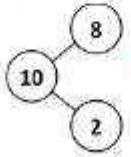
6 x 5 = 5 x 5 + 5 x 1



5 x 5 and one more group of 5 is equal to 6 x 5.

Think 10 for multiplication and division

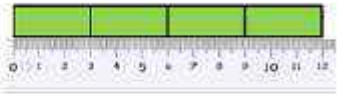
8 x 5 = 10 x 5 - 2 x 5



8 x 5 is two groups of 5 fewer than 10 x 5.

12 ÷ 3 = 4

I can see that 3 can be taken from 12, four times.



I can see that 12 can be shared into 4 equal groups with 3 in each group.

I know that I can use 4 x 3 = 12 to answer 12 ÷ 3 or 12 ÷ 4.

2017 national curriculum tests

Key stage 1

Mathematics

Paper 1: arithmetic

First name	
Middle name	
Last name	

1

$6 - 4 =$ ☐

1 mark

3

$7 + 8 =$ ☐

1 mark

5

$\square = 15 - 2$

1 mark

7

$6 \times 2 =$ ☐

1 mark

16

$8 \times 3 =$ ☐

1 mark

9

$43 - 5 =$ ☐

1 mark

12

$97 + 5 =$ ☐

1 mark

10

$84 + 12 =$ ☐

1 mark

14

$\frac{1}{2}$ of 14 = ☐

1 mark

24

$\frac{1}{3}$ of 12 = ☐

1 mark

17

$3 + \square + 6 = 16$

1 mark

19

$85 - 21 =$ ☐

1 mark

21

$52 + 29 =$ ☐

1 mark

23

$\square - 12 = 36$

1 mark

25

$91 - 48 =$ ☐

1 mark

Reasoning and Probing Questions for Year 1

Numbers and the number system

- Show me (find/ write) the number that will label this group of objects. And Another.
- Show me (find/write) a number with 2 tens and another… and another. Which of your numbers is the greatest?
- Can you change this pot so that it has enough pencils for 8 children?
- Convince me that 13 is less than 20.
- Always/Sometimes/Never: A number with 9 in the units is always bigger than one with 6 in the units.

Addition & Subtraction

- I'm thinking of a number. It is 1 more / less than 36. What number am I thinking of?
- Convince me that 1 more / less than 24 is 25/23.
- Kenny says that one less than 55 is 52. Is he correct?
- I will clap where a number is missing: 78, 79, 80 … clap … 82, 83, 84. What number did I miss?
- If I know that 3 + 7 = 10, what else do I know?
- Always / Sometimes / Never: The equals sign always comes at the end of the mathematical statement
- Convince me that 5 = 9 – 4
- Convince me that 12 + 7 = 19
- Show me a calculation which is equal to 7. And another, and another…

Reasoning and Probing Questions for Year 2

Numbers and the number system

- Show me a number that has more/ less tens/units than this number. And Another. And Another.
- Convince me that 53 is less than 58
- Kenny says that 67 is greater than 97. Is he correct?
- What is the same and what is different about these two numbers: 16 and 61?
- Always/Sometimes/Never: A number with 7 in the units will always be greater than a number with 5 in the units?

Counting and comparing

- Kenny thinks 17 is a multiple of 3. Do you agree with Kenny?
- Jenny thinks that all multiples of 2 are even numbers. Do you agree with Jenny?
- Benny says that the multiples of 3 will make a diagonal pattern on the number grid. Is he correct?
- Show me a number that is < 100. And Another. And Another.
- Show me a number with a 3 in the units that is less than 50 but greater than 25. And Another.
- Convince me that 67 will not be in this sequence: 5,10,15,20 .....
- Lenny starts at 94 and counts back in tens. He thinks that he will land on the number 49. Is he correct?
- Using the following 6 digits, (5,7,8,2,1,9) can you make three two-digit numbers with the greatest/ lowest value? What do you notice?

Addition & Subtraction

- If I know that 13 + 7 = 20, what else do I know?
- Convince me that 36 + 7 = 43
- Sam says that it doesn't matter which way round you put the numbers when you subtract. Is he correct?
- Show me a calculation that is equal to 17. And another. And another.
- Show me a subtraction calculation where it is easier to count on (use addition) to find the difference in value.

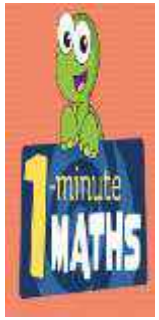
Multiplication and Division

- Show me an odd (even) number. And another. And other
- Convince me that the product of two even (odd) numbers is even (odd)
- If 2 × 6 = 12 then ....
- Convince me 0 is even

Show me an odd (even) number. And another. And other

- Convince me that the product of two even (odd) numbers is even (odd)
- If 2 × 6 = 12 then ....
- Convince me 0 is even

Further support:



1 minute maths app from WhiteRose

Please find on the table some activities to work through/play with your child

Thank you for coming to my workshop. I hope it has been helpful.