

Dropmore Infant School Mental Calculation Policy

Mental Calculation

Calculating mentally may involve children 'seeing' objects, images or quantities that help them manage the process. A feature of mental calculation is that it often can be worked out in different ways.

Teaching Mental Calculation Strategies

Children will not be able to visualise how something works if they have not had any practical experiences. We need to provide suitable equipment for children to manipulate and explore how and why a calculation strategy works.

Flexibility in Calculation

Children need to be able to do the following:

- Build up knowledge of number facts
- Build up skill in counting
- Build up the use of reasoning inferences based on knowledge of numbers and the structure of the number system.

Selecting an appropriate method

It is important for children to be able to choose how they work out a calculation. It is not always necessary for children to write and record their mathematics. In some situations, it may be simpler and more beneficial to work out mentally. Below are questions that children should be taught and encouraged to ask themselves when faced with a calculation:

- Do I know the answer?
- Can I work it out in my head?
- Do I need to use a jotting?
- Do I need to use a written method?

Mental Calculation with different operations

In developing a progression through mental calculation strategies for addition, subtraction, multiplication and division, it is important that children understand the relevant concepts.

Addition is:

- combining two or more groups to give a total or sum
- increasing an amount

Subtraction is:

- removal of an amount from a larger group (take away)
- comparison of two amounts (difference)

They also need to understand and work with certain principles, that :

- addition and subtraction are inverses
- addition is commutative i.e. $5 + 2 = 2 + 5$ but subtraction is not $5 - 2$ is not the same as $2 - 5$
- addition is associative i.e. $5 + 2 + 4 = 5 + (2 + 4)$ but subtraction is not $9 - 3 - 1$ is not the same as $9 - (3 - 1)$

Multiplication is:

- Repeated Addition

Division is:

- Repeated Subtraction

They also need to understand and work with certain principles that :

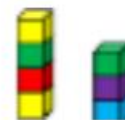
- Multiplication and division are inverses
- Multiplication is commutative e.g. $3 \times 4 = 12$ and $4 \times 3 = 12$ but division is not e.g. $12 \div 4 \neq 4 \div 12$



Mental Calculation Skills – EYFS - Addition

Early learning Goal:

Using quantities and objects, children add and subtract two single digit numbers and count on or back to find the answer.

Example resources:



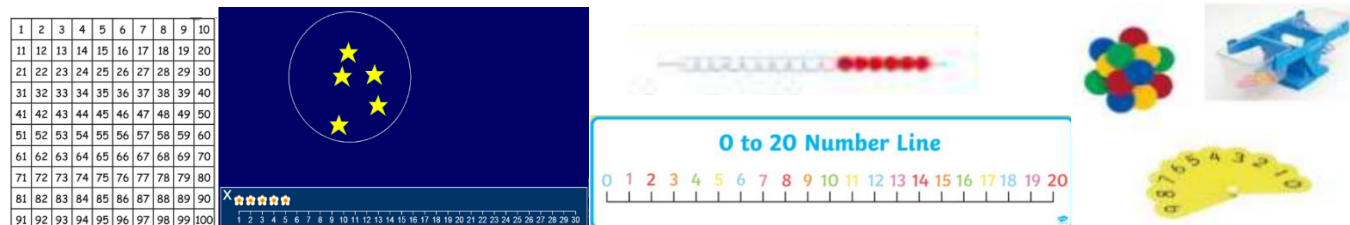
Mental Calculation Skills	Examples	Pre-requisite Skills
Count all (1:1 correspondance)	<p>How many counters are here?</p>  <p>1 2 3 4 = 4</p> <p>This can be carried out with any objects such as, unifix, lego, counting objects, numicon</p>	
Count on	<p>$4 + 2 =$</p>  <p>Cover over the greater number and then count on using touch counting.</p>	<p>Knowing values of amounts e.g recognising the 4 piece of numicon is 4 without counting each of the holes. Being able to subitise numbers</p>

Mental Calculation Skills – Year 1 - Addition

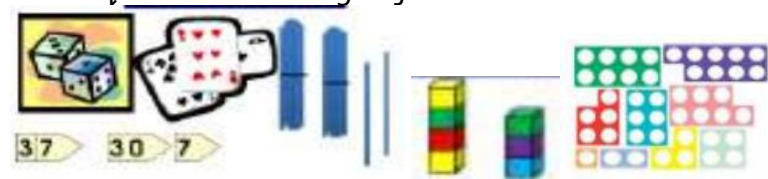
End of Year 1 Objective:




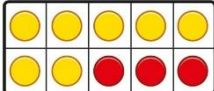
Add and subtract one -digit and two- digit numbers to 20, including 0

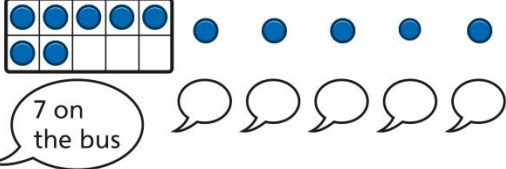
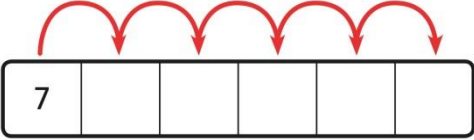

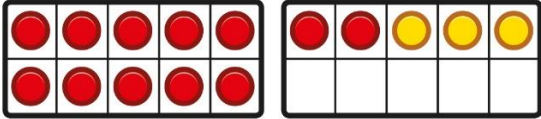
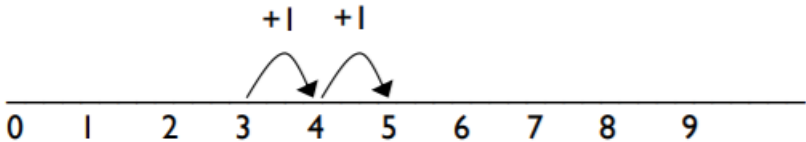
Example resources: practical equipment, models and images to support children with mental addition.


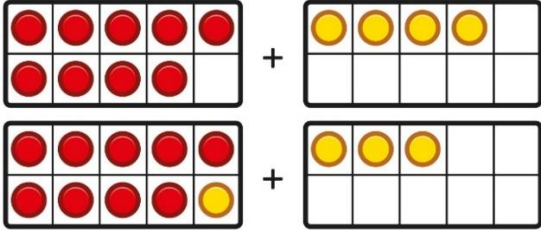
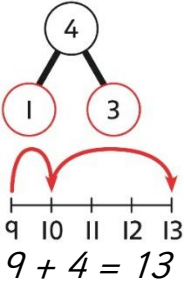
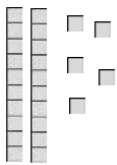



100 square Counting software



Mental Calculation Skills	Examples	Pre-requisite Skills
<p>Represent and use number bonds and related subtraction facts within 20</p>	<p>Unifix: Break apart a group and put back together to find and form number bonds.</p>  <p>$3 + 4 = 7$</p> <p><i>Beadstring</i></p>  <p>$6 = 2 + 4$</p> <p><i>Five and ten frame:</i> Use five and ten frames to represent key number bonds.</p>  <p>$5 = 4 + 1$</p>  <p>$10 = 7 + 3$</p> <p>Using and applying What is $5 + 4$? How can this help with $15 + 4$? Or $25 + 4$?</p> <ul style="list-style-type: none"> • What do you do to 6 to make 10? How will this help with that to do with 16 to make 20? 	<p>Understanding 3ness of 3 etc Beginning to see patterns. Being able to subatise numbers</p>
<p>Counting on or back in ones</p>	<p>Children can count on by either using equipment/ objects/ pictorial representations to support them or by using number knowledge.</p>	<p>Count forwards and Backwards in ones Count</p>

	<p>4 + 5 - count on in ones from 4 (or in ones from 5) 8 - 3 - count back in ones from 8</p> <p>10 + 7 - count on in ones from 10 (or use place value)</p> <p>13 + 5 - count on in ones from 13 17 - 3 - count back in ones from 17</p>	<p>in one to one correspondence</p>
<p>Add a pair of single digit numers/ single digit nubers and teen number</p>	<p>Counters: Children use counters to support and represent their counting on strategy.</p>  <p>Number tracks: Children use number lines or number tracks to support their counting on strategy.</p>  <p>$7 + 5 = \square$</p> <p>Bead strings: Children use bead strings to recognise how to add the 1s to find the total efficiently.</p>  <p>$2 + 3 = 5$ $12 + 3 = 15$</p> <p>Ten frame: Children represent calculations using ten frames to add a teen and 1s.</p>  <p>$2 + 3 = 5$ $12 + 3 = 15$</p> <p>Number line Children may use number line to support their counting</p>  <p>Using and applying</p>	<p>Understand amounts, symbols and words Have an understanding of number bonds to 20. Place Value – identifying largest number to count on from</p>

	<p>• If $3 + 2 = 5$, what else do you know? (e.g. $13 + 2 = 15$, or $30 + 20 = 50$ etc)</p> <p>BEAD STRING: Children use a bead string to complete a 10 and understand how this relates to the addition.  <i>7 add 3 makes 10.</i> <i>So, 7 add 5 is 10 and 2 more.</i></p> <p>TENS FRAME: Children use counters to complete a ten frame and understand how they can add using knowledge of number bonds to 10. </p> <p>PART WHOLE MODEL AND NUMBERLINE :Use a part-whole model and a number line to support the calculation.  $9 + 4 = 13$</p> <p>Using and applying : Being able to visualise and understand that $8 + 5 = (8+2) + 3 = 10 + 3 = 13$</p>	<p>Knowledge and understanding of number bonds. Understanding of partitioning</p>
<p>Add a single digit number to a ten or to a multiple of 10</p>	<p>Base 10: Children use base ten to represent numbers to add to multiples of 10. $20 + 5$  = 25</p> <p>Arrow cards: Children use these to instil the place value of each digit that they are adding. $20 + 5$ </p>	<p>Know and use addition facts. Place Value – understand what each digit means in a two digit number (tens, ones)</p>

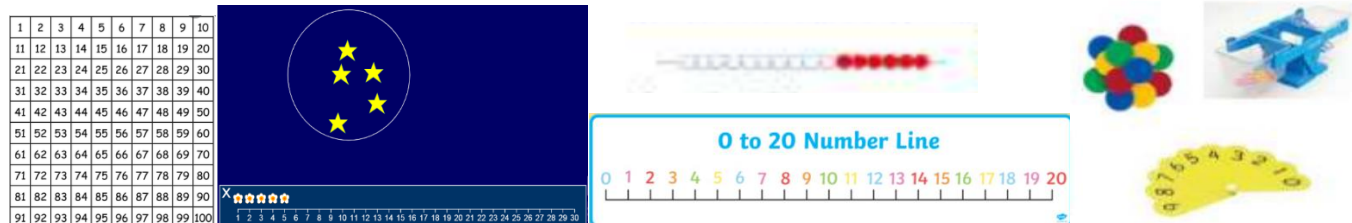
Mental Calculation Skills – Year 2 - Addition

End of Year 2 Objective:

Add and subtract numbers mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; three one-digit numbers

Example resources:

practical equipment, models and images to support children with mental addition.



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Mental Calculation Skills

Examples

Pre-requisite Skills

Rapid recall of number bonds to 100

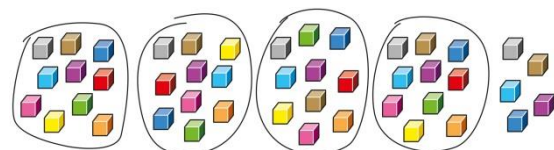
Beadstrings:



Known number facts to 20

Partition and combine multiples of ten and ones

Group objects into 10s and 1s.



$40 + 37$ 40 add 30 and 7 =

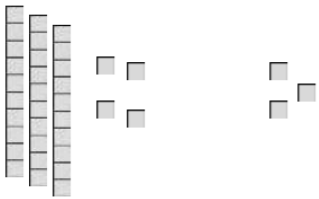
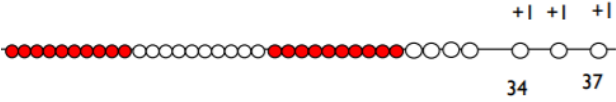


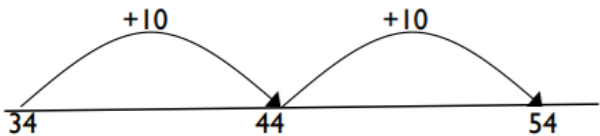
$5 + 14$ 10 and 5 add 10 and 4 = 10 add 10 add 5 add 4 or 15 add 10 add 4 $37 + 12$

37 add 10 and 2 = 37 add 10 add 2

$78 - 42$ 78 take away 40 and 2 = 78 take away 40 take away 2

$80 - 35$ 80 take away 30 and 5 = 80 take away 30 take away 5

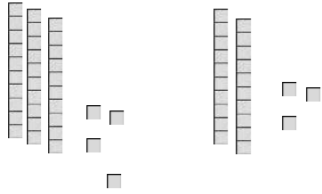
Counting using one to one correspondence count forwards and backwards in ones and tens. Understand place value, understand which digit represents tens and ones. Partition numbers into tens and ones

<p>Add a two digit number and ones</p>	<p>Base ten: $34 + 3 = 37$</p>  <p>Bead string $34 + 3 = 37$</p>  <p>Numberline: $34 + 3 = 37$</p> 	<p>Count using one to one correspondence Count forwards and backwards in ones and tens. Understand place value, understand which digit represents tens and ones Partition numbers into tens and ones</p>
<p>Add a 2 digit number and tens</p>	<p>Base ten: Children use base 10 to calculate this as follows: $34 + 20 = 54$</p> <p>$30 + 20 = 50$ $50 + 4 = 54$</p>  <p>$34 + 20 = 54$</p> <p>Beadstring: Children calculation this my moving sets of ten beads as follows: $34 + 10 = 44$ $44 + 10 = 54$</p> <p>Numberlines $34 + 20 = 54$</p> 	<p>Count using one to one correspondence Count forwards and backwards in ones and tens. Understand place value, understand which digit represents tens and ones Partition numbers into tens and ones</p>

Add two 2 digit numbers

Base ten
Children use base 10 to partition both numbers
 $34 + 23 = 57$

$$30 + 20 = 50$$
$$4 + 3 = 7$$
$$50 + 7 = 57$$



Bead String

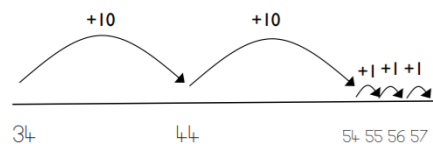
Children use beadstring to calculate this by:

$$34 + 10 = 44$$
$$44 + 10 = 54$$
$$54 + 3 = 57$$

Blank Numberline

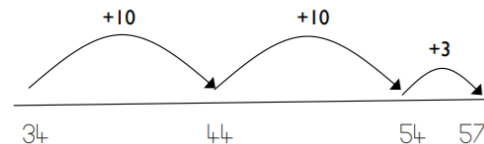
Children use the number line to keep the first number the same and just partition the second (they are also able to use the commutative law to change their first and second number)

$$34 + 23 = 57$$



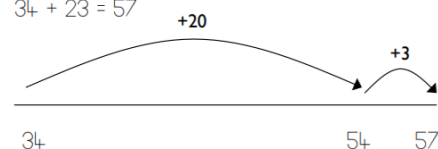
Children are encouraged to become more efficient by adding the units in one jump (by using number facts within 10 $4 + 3 = 7$)

$$34 + 23 = 57$$



This is followed by adding the tens in one jump and the units on one jump

$$34 + 23 = 57$$



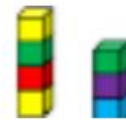
Count using one to one correspondence
Count forwards and backwards in ones and tens.
Understand place value, understand which digit represents tens and ones
Partition numbers into tens and ones



Mental Calculation Skills – EYFS - Subtraction

Early learning Goal:

Using quantities and objects, children add and subtract two single digit numbers and count on or back to find the answer.

Example resources:



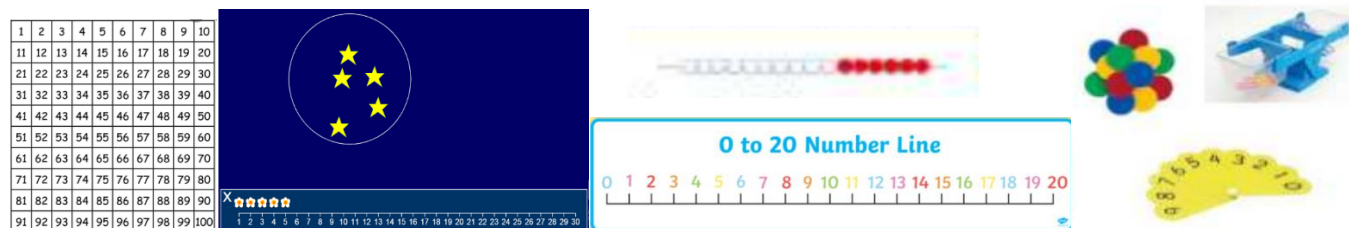
Mental Calculation Skills	Examples	Pre-requisite Skills
Take away	<p>Take amount away Then count how many are left $4 - 2 =$</p>  <p style="text-align: center;">1 2</p>	<p>Knowing values of amounts e.g. recognising that 4 counters/4 numicon is worth 4 without touch counting the holes.</p>
Counting back	<p>Counting back is a very abstract concept for young children so this stage may not be met until Year 1. $6 - 2$</p>  <p style="text-align: center;">5 4</p>	<p>Ability to count forwards and backwards</p>

Mental Calculation Skills – Year 1 – Subtraction

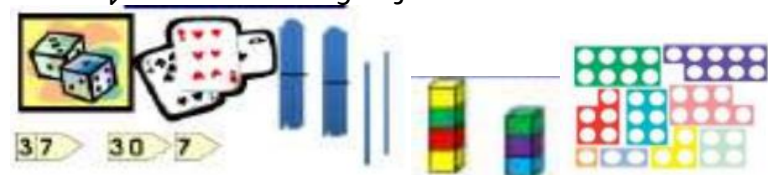
End of Year 1 Objective:




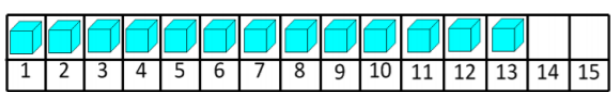
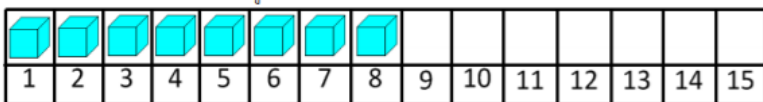
Add and subtract one -digit and two- digit numbers to 20, including 0

Example resources: practical equipment, models and images to support children with mental addition.

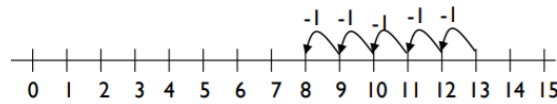


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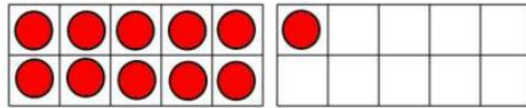
Mental Calculation Skills	Examples	Pre-requisite Skills
Counting Back	<p>Counting back is a very abstract concept for young children so this stage may not be met until Year 1.</p> <p>$6 - 2$</p> 	Ability to count forwards and backwards in ones
Subtracting a one digit number from a two digit number	<p>Bead string - Touch counting</p> <p>$13 - 5 = 8$</p> <p>Touch count and remove the number to be taken away, in this case 5.</p>  <p>Children then touch count to find the number that remains.</p>  <p>Number track</p> <p>Children place the total number on objects on a number track.</p>  <p>They then remove the number of objects they are subtracting and observe how many objects are remaining.</p> 	Ability to count forwards and backwards in ones

Numberline:
Children use number line to count back the number of steps.

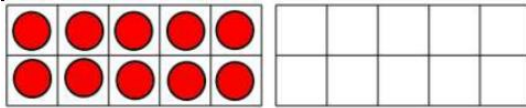


Subtraction using knowledge of partitioning numbers

Ten Frame
 $11 - 3 = 8$
Children place the total number of counters on the ten frame.



Children then take away one of the three to reach the ten boundary.



Children then take away the remaining 2 from the 10 (they can use their numberbond knowledge to support this)

Bead string

Children make the total number on their bead string



Children identify the total amount they with subtract and subtract the amount to the ten boundary (in this case it is 1)

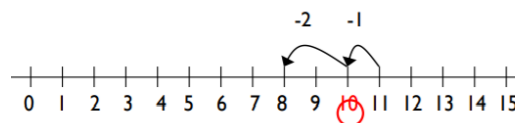


Children then subtract the remainder of the number and count their remainder.



Numberline:

Children count back in groups of numbers to step to the ten boundary and then beyond.



Partitioning numbers

Numbers can be partitioned using part whole models to allow subtraction using number bonds.

$13 - 5$ partitioned as $13 - 3 - 2$

$16 - 8$ partitioned as $16 - 6 - 2$

Partition numbers in different ways, e.g. 5 as 2 +3 to enable $8 + 5$ as $8 + 2 + 3$ Know, or quickly derive, number bonds for numbers up to and including 10.

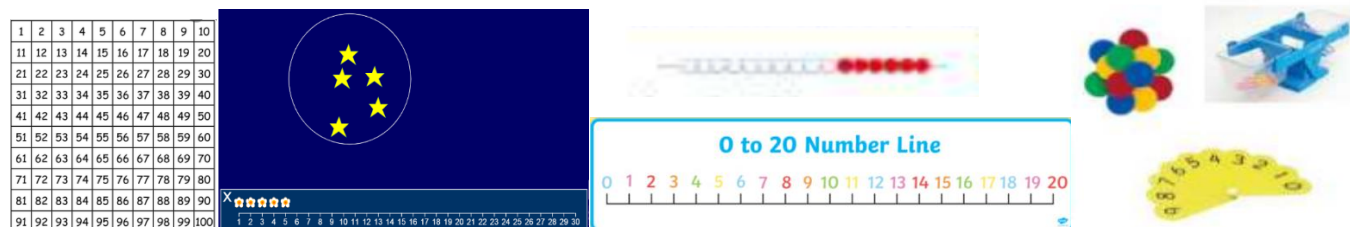
Mental Calculation Skills – Year 2 – Subtraction

End of Year 2 Objective:

Add and subtract numbers mentally, including: a two-digit number and ones; a two-digit number and tens; two two-digit numbers; three one-digit numbers



Example resources:

practical equipment, models and images to support children with mental addition.



100 square Counting software



Mental Calculation Skills	Examples	Pre-requisite Skills
Subtracting a one digit number from a two digit number	<p>Base 10 Children make their first number using base ten, then then remove the amount needed and count the remaining base ten. $47 - 3 = 44$</p>  <p>Blank Numberline: Children count back in steps of the number they are subtracting</p> <p>$47 - 3 = 44$ (shown)</p> 	Counting backwards in ones. Know place value – tens and ones.
Subtracting a two digit number this is a multiple of ten from a two digit number	<p>Base ten Children make their first number using base ten, then then remove the amount needed and count the remaining base ten. $47 - 20 = 27$</p>	Understand partitioning into tens and ones. Use known number facts. Count



Bead String:

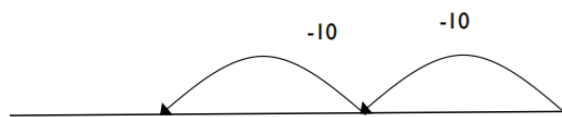
Children can use a bead string to calculate this by subtracting multiples of ten :

$$47 - 10 = 37$$

$$37 - 10 = 27$$

Number line:

Children count back in multiples of 10



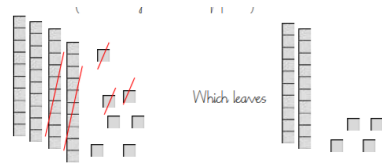
backwards in tens and ones.

Subtracting a two digit number and ones from a two digit number

Base ten:

Children make their first number using base ten, then then remove the amount needed and count the remaining base ten.

$$47 - 23 = 24$$



Bead string

Children can use a bead string to calculate this by subtracting multiples of ten then ones:

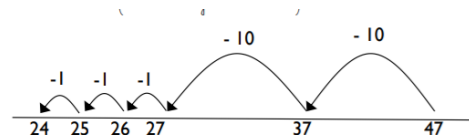
$$47 - 10 = 37$$

$$37 - 10 = 27$$

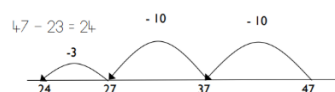
$$27 - 3 = 24$$

Number line:

Children count back in multiples of ten and then ones.



As children become more efficient by subtracting the units in one step.



Understand partitioning into tens and ones. Use known number facts. Count backwards in tens and ones.

Mental Calculation Skills – EYFS – Multiplication

Early learning Goal:
Solve problems including halving and doubling

Example resources:



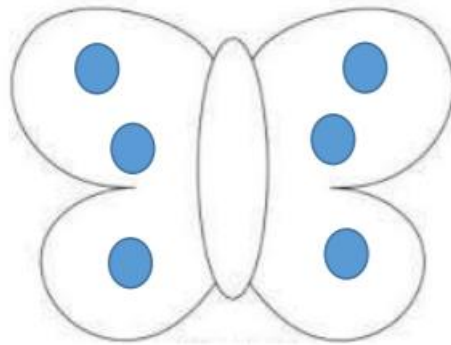
Mental Calculation Skills

Examples

Pre-requisite Skills

Doubling

Practical examples of doubling
e.g dominos or butterflies and ladybirds.
Which replicate the same on both sides.



Language of the same.
Basic understanding of equivalence

Mental Calculation Skills – Year 1 – Multiplication

End of Year 1 Objective:

To solve one step problems involving multiplication and division by calculating the answer using concrete objects, pictorial representations and arrays.

Example resources: practical equipment, models and images to support children with mental addition.



Mental Calculation Skills	Examples	Pre-requisite Skills
<p>Counting on in ones, twos, fives and tens</p>	<ul style="list-style-type: none"> Count on in ones from any number to 100. -Counting stick could be used to support this or counting equipment. Counting on in twos from 0 – what will the first 6 numbers be? Use groups of objects or coins to support counting. Part of childrens bodies can also be used e.g eyes, arms and legs Counting in 5s and 10s from 0 – using coins or counters. Counting objects can also be used as well as picture representations. 	<p>Understanding of 2's 5's and 10's (pattern, what numbers end in etc)</p>

Mental Calculation Skills – Year 2 – Multiplication

End of Year 2 Objective:

To solve one step problems involving multiplication and division by calculating the answer using concrete objects, pictorial representations, calculating mentally and arrays.

Example resources: practical equipment, models and images to support children with mental addition.

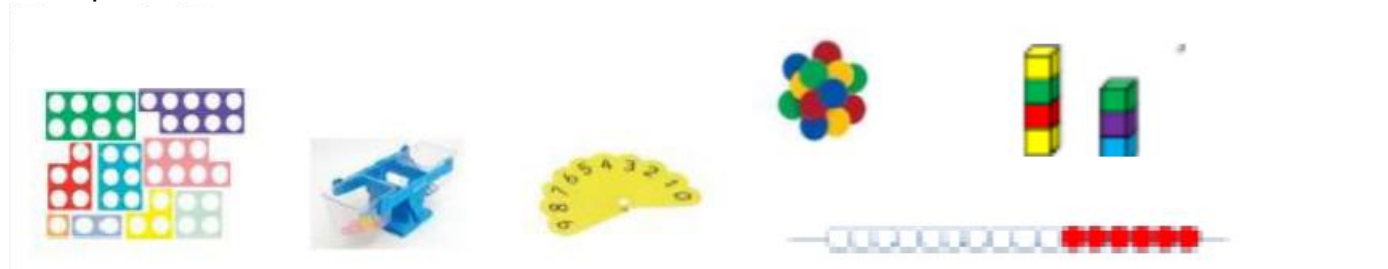


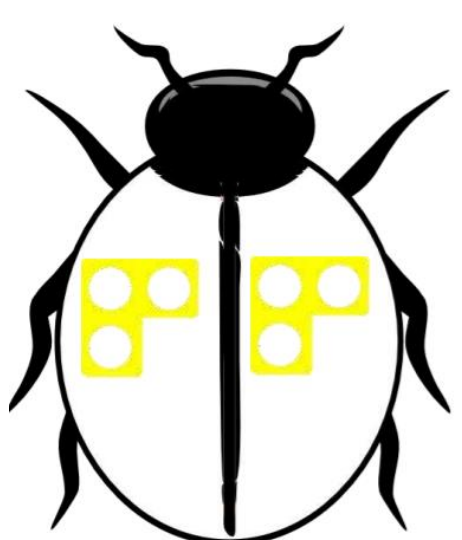
Mental Calculation Skills	Examples	Pre-requisite Skills
<p>Double any multiple of 10 up to 100</p>	<p>Double 15</p> $30 + 30 =$ <p>Explaining how they could work out doubles e.g 45</p> <p>Using vocabulary for double e.g twice, multiplied by 2</p> <p>Equipment can be used to support mathematical understanding.</p>	<p>Double single digit numbers. Double multiples of 10. Partition two-digit numbers into T and U and recombine T and U (by adding components). Understand that doubling is adding the same number to itself. Understand that doubling is multiplying by 2.</p>
<p>Find the total number of objects when they are organised in groups of 2, 5 or 10</p>	<p>Counting groups of objects e.g fingers, tallies and coins</p> <p>They can also calculate these are repeated addition</p>	<p>Count on from zero in twos, fives and tens. Relate 'groups of' to repeated addition. Understand that the last number said in the count is the total of the group. Learn and apply 2x table, 10x table and 5x table. Understand and use commutativity (multiplication can be done in any order). Use estimation to predict and check answers.</p>
<p>Know the 2, 5 and 10 times table facts</p>	<p>Learn rhymes, songs and patterns for these times tables</p>	

Mental Calculation Skills – EYFS – Division

Early learning Goal:
Solve problems including halving and doubling

Example resources:



Mental Calculation Skills	Examples	Pre-requisite Skills
Halving	<p>Practica examples of halving e.g ladybirds and butterflies, dominos can also be used.</p> 	<p>Understanding of equivalence and Equal groups Halving means splitting down the middle.</p>

Mental Calculation Skills – Year 1 – Division

End of Year 1 Objective:

To solve one step problems involving multiplication and division by calculating the answer using concrete objects, pictorial representations and arrays.

Example resources: practical equipment, models and images to support children with mental addition.



Mental Calculation Skills	Examples	Pre-requisite Skills
<p>Counting back in ones, twos, fives and tens</p>	<ul style="list-style-type: none"> Count back in ones from any number to 0. -Counting stick could be used to support this or counting equipment. Counting back in twos to 0 – what will the first 6 numbers be? Use groups of objects or coins to support counting. Part of children's bodies can also be used e.g. eyes, arms and legs Counting back 5s and 10s to 0 – using coins or counters. Counting objects can also be used as well as picture representations. 	<p>Begin to understand the link between division and repeated subtraction. Cross tens boundaries when counting in ones and twos by understanding the base 10 number system. Understand the amounts the symbols and words represent.</p>

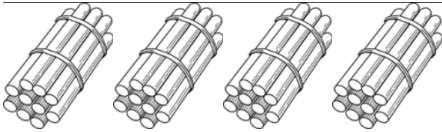

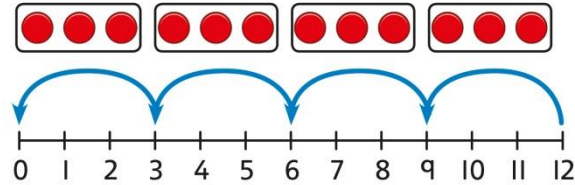
Mental Calculation Skills – Year 2 – Division

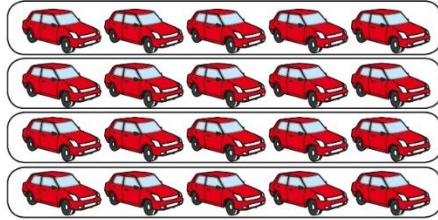
End of Year 2 Objective:

To solve one step problems involving multiplication and division by calculating the answer using concrete objects, pictorial representations, mental calculations and arrays.

Example resources: practical equipment, models and images to support children with mental addition.

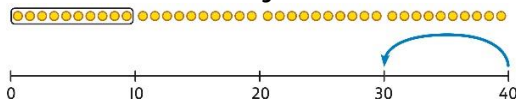


Mental Calculation Skills	Examples	Pre-requisite Skills
<p>Halve any multiple of 10 up to 100, where the answer is even</p>	<p>$40 \div 2$</p> <p>Use these bundles of straws to help halve numbers</p> 	<p>Know multiples of 10. Halve even numbers to 20. Understand that halving is dividing by 2 and half as one of two equal parts. Understand and use knowledge of base 10 number system to relate $8 \div 2$ to $80 \div 2$.</p>
<p>Find half of even numbers up to 40.</p>	<p>Be able to recall these instantly by also use sharing equally to support their understanding</p>   <p>There are 4 groups now.</p>	<p>As above plus: Know even numbers. Partition numbers in different ways e.g. when finding half of 36 partitioning 36 into 20 + 16.</p>
<p>Use times table facts to divide even numbers by 2, 5 or 10.</p>	<p>Understand the relationship between multiplication and division</p>	<p>Know and use division facts related to the 2x table, 5x table and 10x table</p>



4 groups of 5 cars is 20 so 20 divided by 4 is 5

Using repeated subtraction and known times table facts.



Knowing times tables

- $1 \times 10 = 10$
- $2 \times 10 = 20$
- $3 \times 10 = 30$**
- $4 \times 10 = 40$
- $5 \times 10 = 50$
- $6 \times 10 = 60$
- $7 \times 10 = 70$
- $8 \times 10 = 80$

I used the 10 times-table to help me.
 $3 \times 10 = 30$.