

**Girnhill  
Infant  
School  
Mental  
Calculation  
Policy for  
Mathematics**



**November 2016**

## **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 :**

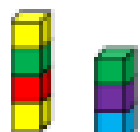
- Multiplication and division are inverses
- Multiplication is commutative e.g.  $3 \times 4 = 12$  and  $4 \times 3 = 12$  but division is not e.g.  $12 \div 4 \neq 4 \div 12$

## Addition – EYFS

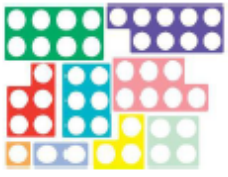
### Early Learning Goal:

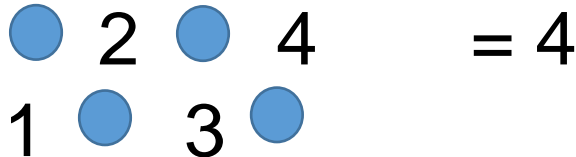
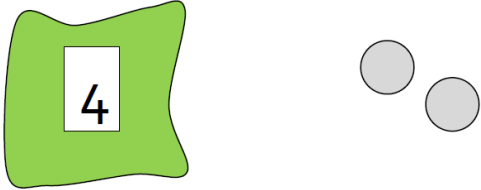
Using quantities and objects, children add and subtract two single digit numbers and count on or back to find the answer.

### Example Equipment:







<b>Mental Calculation Skills</b>	<b>Examples</b>	<b>Pre-requisite skills</b>
Count All	How many counters are here?  $2 + 4 = 4$	
Count On	$4 + 2 = ?$ 	Knowing values of amounts e.g. recognising the 4 piece of numicon is 4 without touch counting

		the holes.
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## Addition – Year One

### End of Year Objective

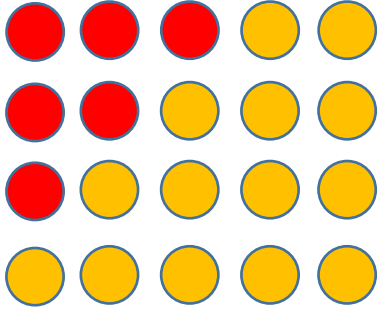
Add and subtract one-digit and two-digit numbers including zero.

### Example Equipment

Practical equipment, models and images to support children with mental addition:

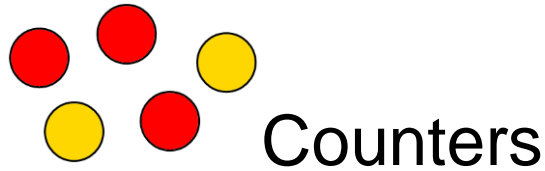


<p><b>Mental Calculation Skills</b></p>	<p><b>Examples</b></p>	<p><b>Pre-requisite skills</b></p>																						
<p>Represent and use number bonds and related</p>	<p>Ten Frames:</p> <table border="1" style="margin-left: 20px;"> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>●</td> </tr> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>●</td> </tr> </table> <p>Double Sided Counters:</p> <table style="margin-left: 20px;"> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>●</td> <td style="padding-left: 20px;"><math>= 5 + 0</math></td> </tr> <tr> <td>●</td><td>●</td><td>●</td><td>●</td><td>●</td> <td></td> </tr> </table>	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	$= 5 + 0$	●	●	●	●	●		<p>Understand 3 ones Begin to see p</p>
●	●	●	●	●																				
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●	●	●	●	●	$= 5 + 0$																			
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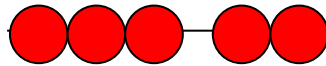
<p>subtraction facts within 20</p>	 <p> <math>= 4 + 1</math>  <math>= 3 + 2</math>  <math>= 2 + 3</math>  <math>= 1 + 4</math>  <math>= 0 + 5</math> </p> <p>(Same can be done with two colours of unifix)</p> <p><b>Using and Applying:</b></p> <ul style="list-style-type: none"> <li>• What is <math>5 + 4</math>? How can this help with <math>15 + 4</math>? Or <math>25 + 4</math>?</li> <li>• What do you do to 6 to make 10? How will this help with that to do with 16 to make 20?</li> </ul>	
<p>Counting on or back in ones</p>	<p><b>4 + 5</b> - count on in ones from 4 (or in ones from 5)</p> <p><b>8 - 3</b> - count back in ones from 8</p> <p><b>10 + 7</b> - count on in ones from 10 (or use place value)</p>	<p>Counting on and back in ones</p> <p>Counting on one</p> <p>correct</p>

**13 + 5** - count on in ones from 13  
**17 - 3** - count back in ones from 17

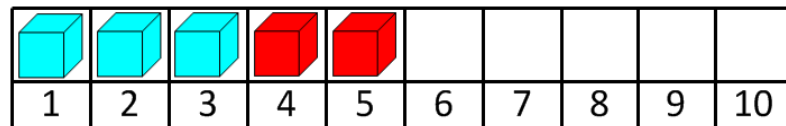
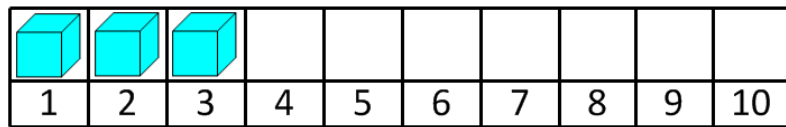
Add a pair of single digit numbers/ single digit number and teen number



Beadstrings:



Number Tracks:



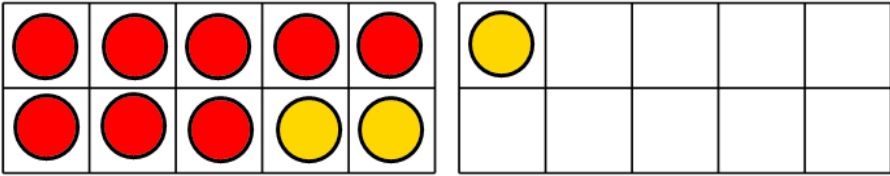
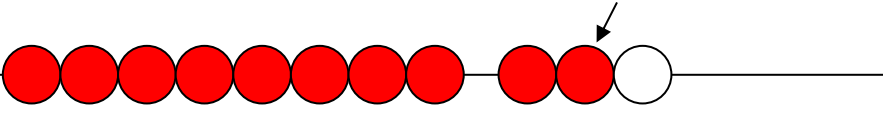
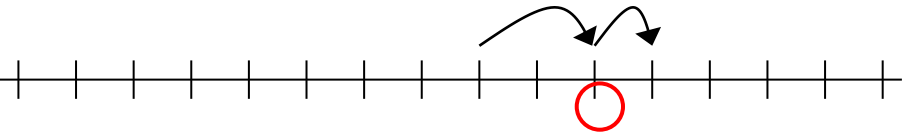
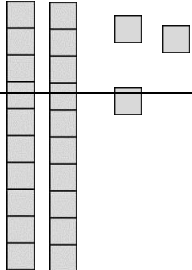
Numberline:



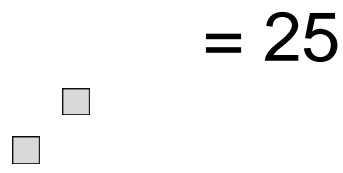
**Using and Applying:**

- If  $3 + 2 = 5$ , what else do

Under  
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 ident  
 large  
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 from

	<p>you know? (e.g. <math>13 + 2 = 15</math>, or <math>30 + 20 = 50</math> etc)</p>	
<p>Add a pair of single digit numbers/ single digit number and teen number (partitioning small numbers)</p>	<p>Ten Frame: <math>8 + 3 = 11</math></p>  <p>Beadstrings: <math>8 +</math></p>  <p>Numberline: <math>8 + 3 = 11</math></p>  <p><b>Using and Applying:</b>          Being able to visualise and understand that  <math>8 + 5 = (8+2) + 3 = 10 + 3 = 13</math></p>	<p>Know unde of nu bond Unde of pa</p>
<p>Add a single digit</p>	<p>Base 10: <math>20 + 5</math></p> 	<p>Know addit</p>

number to  
ten or to a  
multiple of  
10



Arrow Cards: 20 + 5



Place  
under  
what  
mean  
digit  
(tens

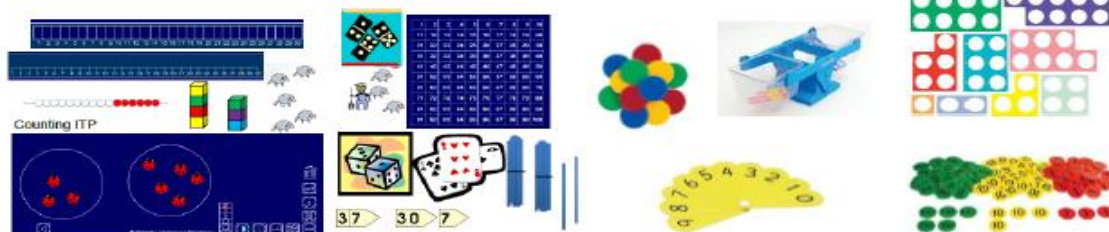
# Addition – Year 2


## End of Year Objective:

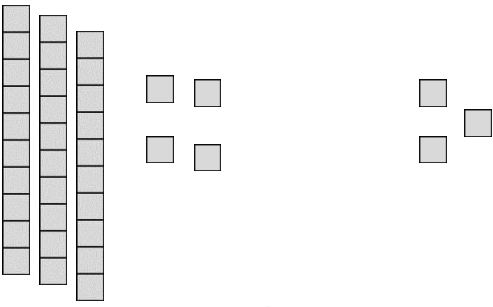

Add and subtract numbers mentally, including: a digit number and ones; a two-digit number and tens; two two-digit numbers; three one-digit numbers.

## Example Equipment:


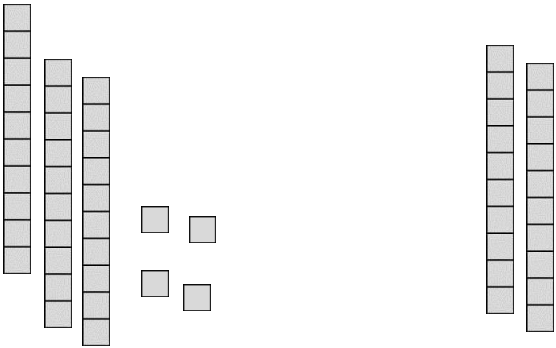
Practical equipment, models and images to support children with mental addition:

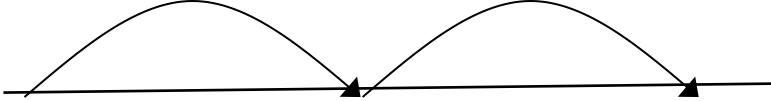
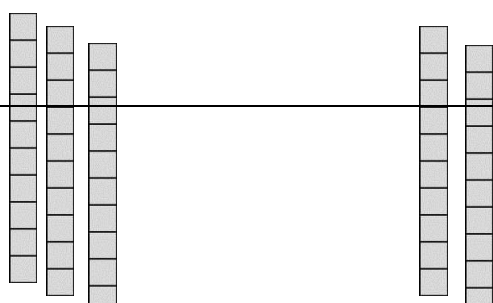


Mental Calculation Skills	Examples	Pre-requisite skills
Rapid Recall of number bonds to 100	Beadstrings: 	Known number facts to 20.
Partition and	$40 + 37$ 40 add 30 and 7 = $5 + 14$ 10 and 5 add	Count using one to one correspondence

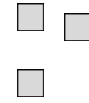
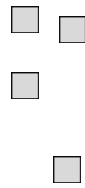
<p>combine multiples of tens and ones</p>	<p>10 and 4 = 10 add 10  add 5 add 4 or 15 add  10 add 4  <b>37 + 12</b> 37 add 10 and  2 = 37 add 10 add 2  <b>78 - 42</b> 78 take away 40  and 2 = 78 take  away 40 take  away 2  <b>80 - 35</b> 80 take away  30 and 5 = 80 take away  30 take away 5</p>	<p>Count forward  and backward  in ones and  tens.  Understand  place value  understand  which digit  represents  and ones  Partition  numbers in  tens and ones</p>
<p>Add a two digit number and ones</p>	<p>34 + 3 = 37 (shown using Base 10 equipment)</p>  <p>34 + 3 = 37 (shown using a beadstring)</p> 	<p>Count using  one to one  correspondence  Count forward  and backward  in ones and  tens.  Understand  place value</p>



	<p><math>34 + 3 = 37</math> (shown using a numberline)</p> 	<p>understand which digit represents and ones Partition numbers in tens and o</p>
<p>Add a 2 digit number and tens</p>	<p><math>34 + 20 = 54</math> (shown using Base 10 equipment)</p> <p>Children could use Base 10 equipment to calculate this as:</p> <p><math>30 + 20 = 50</math> <math>50 + 4 = 54</math></p>  <p><math>34 + 20 = 54</math> Children could use a</p>	<p>Count forward and backward in ones and tens. Understand place value understand which digit represents and ones Partition numbers in tens and o</p>

	<p>beadstring to calculate this as:</p> $34 + 10 = 44$ $44 + 10 = 54$ <p><math>34 + 20 = 54</math> (shown using a numberline)</p> 	
<p>Add two 2 digit numbers</p>	<p><math>34 + 23 = 57</math> (shown using Base 10 equipment to partition both numbers)</p> <p>Children could use Base 10 equipment to calculate this as:</p> $30 + 20 = 50$ $4 + 3 = 7$ $50 + 7 = 57$ 	<p>Count forward and backward in ones and tens. Understand place value and understand which digit represents tens and ones. Partition numbers in</p>

tens and o



$$34 + 23 = 57$$

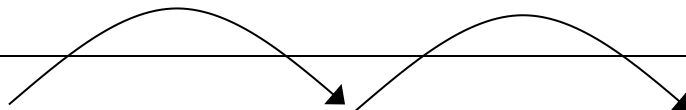
Children could use a  
beadstring to calculate this  
as:

$$34 + 10 = 44$$

$$44 + 10 = 54$$

$$54 + 3 = 57$$

$34 + 23 = 57$  (shown using a  
numberline to keep the first  
number the same and just  
partition the second)

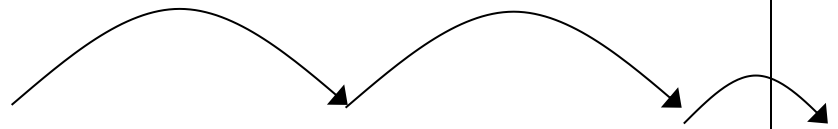




34                      44                      54  
55 56 57

Encourage children to become more efficient by adding the units in one jump (by using the known fact  $4 + 3 = 7$ ).

$$34 + 23 = 57$$



34                      44  
54    57

Followed by adding the tens in one jump and the units in one jump.

$$34 + 23 = 57$$



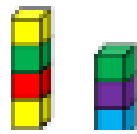
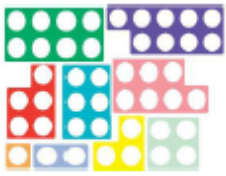
	$\begin{array}{r} 34 \\ 57 \end{array}$	$54$	
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## Subtraction – EYFS





### 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 Equipment:



Mental Calculation Skills	Examples	Pre-requisite skills
Taking Away	Take amount away. Count how many are left	Knowing values of amounts

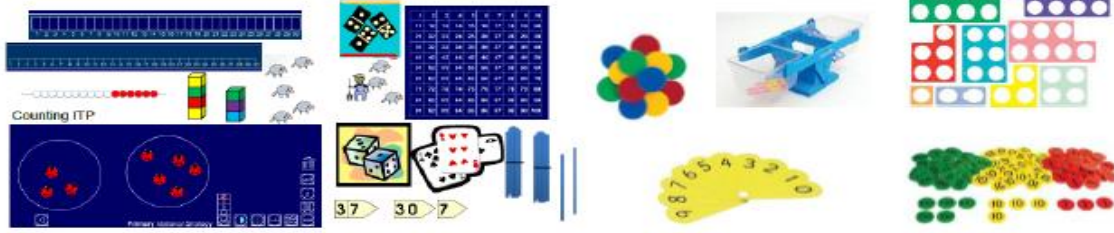
	$4 - 2 =$  1 2 	e.g. recognising that 4 counters/4 numicon is worth 4 without touch counting the holes.
<b>Counting Back</b>	Counting back is a very abstract concept for young children so this stage may not be met until Year 1. $6 - 2$  4  5	Ability to count forwards and backwards in ones

# Subtraction – Y1

**End of Year Objective:** Add and subtract one-digit and two-digit numbers to 20, including zero.

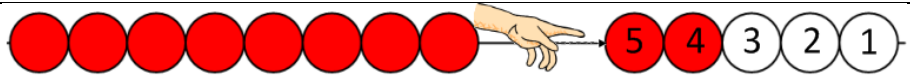
## Example Equipment:

Practical equipment, models and images to support children with mental addition:



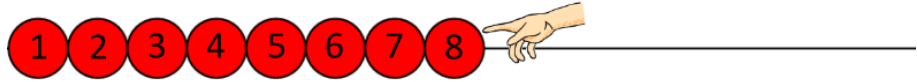
Mental Calculation Skills	Examples	Practical Equipment
Counting Back	<p>Counting back is a very abstract concept for young children so this stage may not be met until Year 1.</p> $6 - 2$ <p>● ● ● ●      ● ●</p> <p style="text-align: center;">5   4</p>	Practical equipment for counting back
Subtracting a one digit	$13 - 5 = 8$ <p>Touch count and remove the number to be taken away, in this case 5.</p>	Practical equipment for subtracting a one digit

number  
from a two  
digit  
number

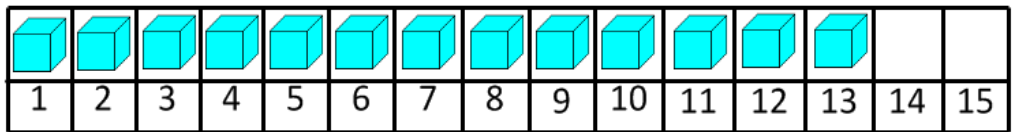


Beadstring stage 1

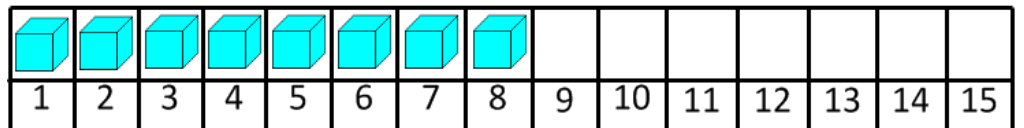
Touch count to find the number that remains.



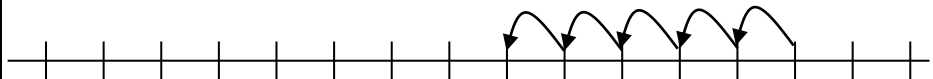
Beadstring stage 2



Number track stage 1



Numbertrack stage 2



## Examples of Calculations

$8 + 3$  - doesn't need reordering as the greater number is first already

$2 + 7$  - reorder as  $7 + 2$

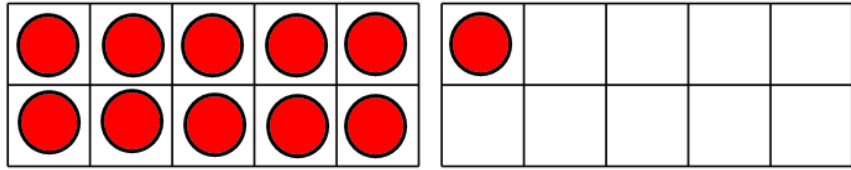
$5 + 13$  - reorder as  $13 + 5$

$11 + 6$  - doesn't need reordering as the greater number is first already

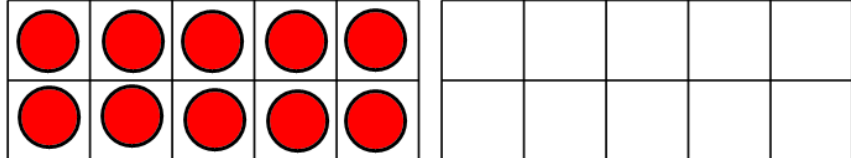


Subtracting using knowledge of partitioning numbers.

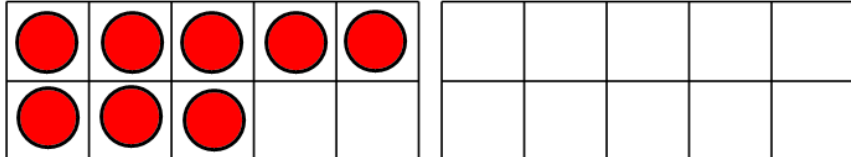
$$11 - 3 = 8$$



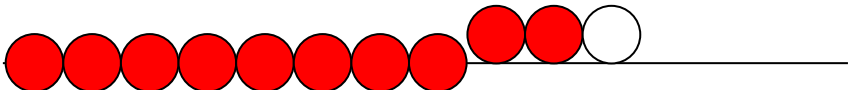
Ten frame stage 1



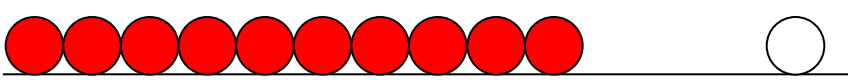
Ten frame stage 2 (take away 1)



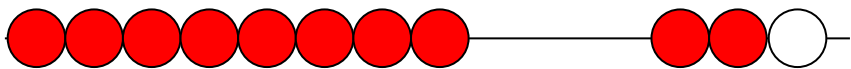
Ten frame stage 3 (take away 2)



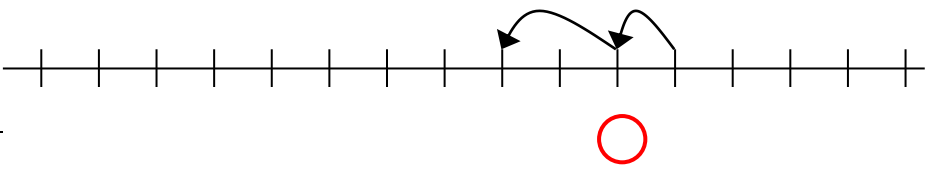
Beadstring stage 1



Beadstring stage 2 (take away 1)



Beadstring stage 3 (take away 2)



## Examples of calculations:

$7 + 5$       partitioned as  $7 + 3 + 2$

$9 + 7$       partitioned as  $9 + 1 + 6$

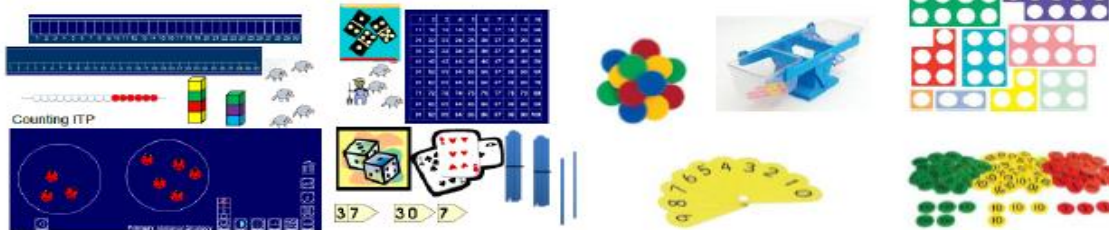
$6 + 8$       partitioned as  $6 + 4 + 4$

## Subtraction – Y2

**End of Year 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.

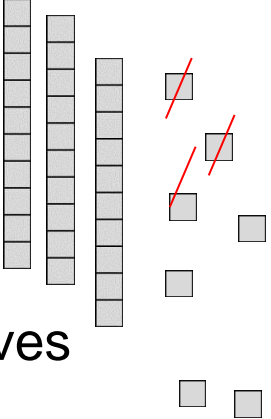

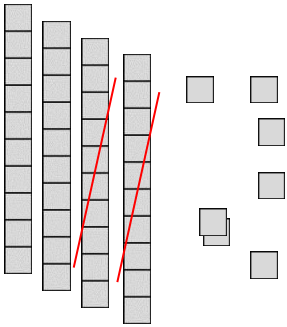
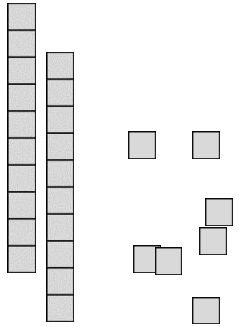
### Example Equipment:

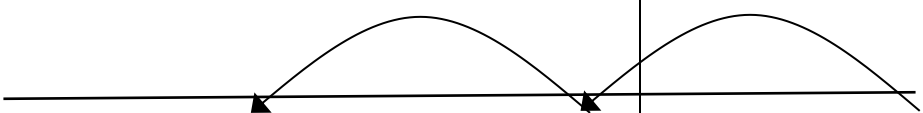
Practical equipment, models and images to support children with mental addition:

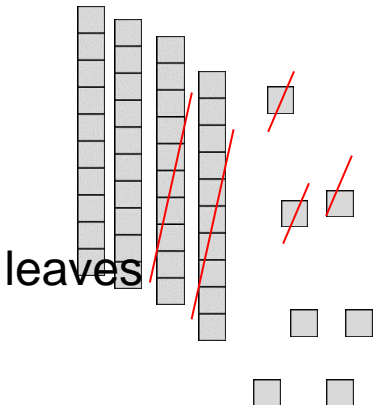


Mental Calculation Skills	Examples	Pre-requisite skills
Subtracting a one digit	$47 - 3 = 44$ (shown using Base 10 equipment)	Counting backwards



<p>number from a two digit number</p>	 <p>leaves</p> <p>so <math>47 - 3 = 44</math>  <math>47 - 3 = 44</math> (shown using a  numberline)</p> <hr/> <p>44 45 46 47</p>	<p>in ones. Know place value – tens and ones.</p> 
<p>Subtracting a two digit number that is a multiple of ten from a two digit number</p>	<p><math>47 - 20 = 27</math> (shown using Base 10 equipment)</p>  <p>leaves</p> <p>so <math>47 - 20 = 27</math></p> <p><math>47 - 20 = 27</math> (using a beadstring)</p>	<p>which</p> 

	<p>Children could use a beadstring to calculate this as:</p> $47 - 10 = 37$ $37 - 10 = 27$ $47 - 20 = 27 \text{ (shown using a numberline)}$ 	
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<p><b>Subtracting a two digit number and ones from a two digit number</b></p>	<p><math>47 - 23 = 24</math> (shown using Base 10 equipment)</p>  <p>leaves</p> <p>Which</p> <p>So <math>47 - 23 = 24</math></p> <p><math>47 - 23 = 24</math> (shown using a beadstring)</p> <p>Children could use a beadstring to calculate this</p>	<p>Understand partitioning into tens and ones. Use known number facts. Count backwards in tens and ones.</p>
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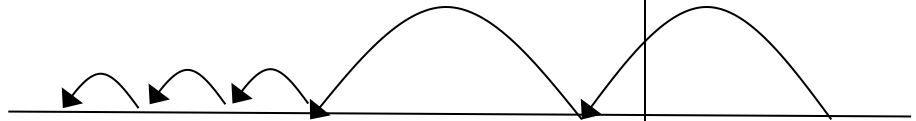
as:

$$47 - 10 = 37$$

$$37 - 10 = 27$$

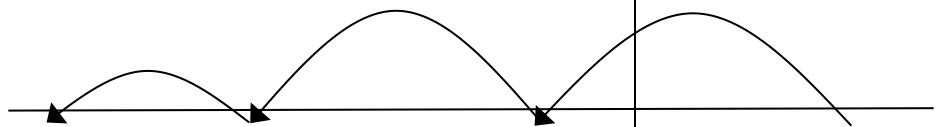
$$27 - 3 = 24$$

$47 - 23 = 24$  (shown using  
a numberline)



Encourage children to become more efficient by subtracting the units in one jump (by using the known fact  $7 - 3 = 4$ ).

$$47 - 23 = 24$$

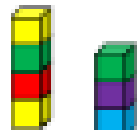
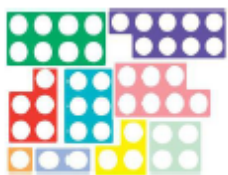


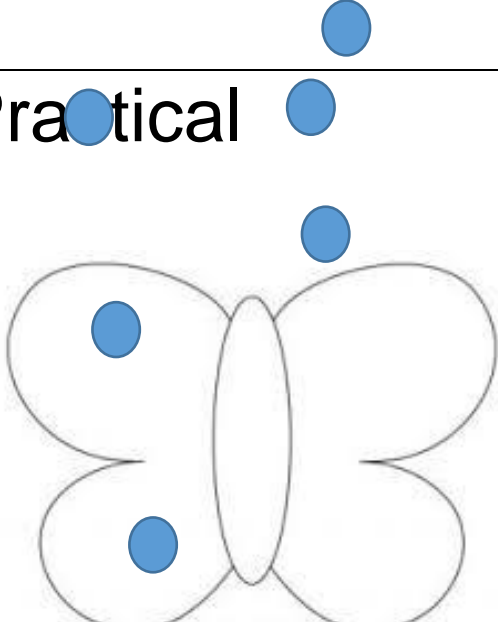
## Multiplication – EYFS

### Early Learning Goal:

Solve problems including doubling, halving and sharing.

### Example Equipment:



Mental Calculation Skills	Examples	Pre-requisite skills
Doubling	<p>Practical</p> 	<p>Language of the same. Basic understanding of equivalence.</p>

	examples of doubling – replicating same on both sides etc.	
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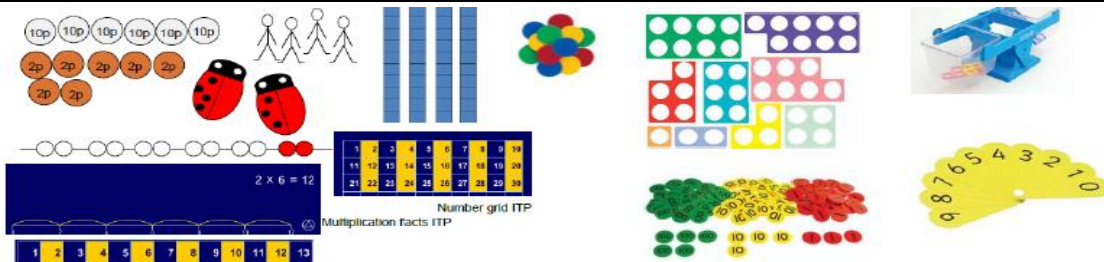
## Multiplication – Year 1

### **End of Year Objective:**

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

### **Example Equipment:**





<b>Mental Calculation Skills</b>	<b>Examples</b>	<b>Pre-requisite skills</b>
<p>Counting on in ones, twos, fives and tens.</p>	<ul style="list-style-type: none"> <li>● Count on in ones from any number to 100. -If you count in twos from 0, what will be the first six numbers?</li> <li>● I'm putting 10p coins into this piggy bank. Count in tens to check how much money is going in.</li> <li>● Count the number of eyes in this class.</li> </ul>	<p>Understanding of 2's 5's and 10's (pattern, what numbers end in etc)</p>



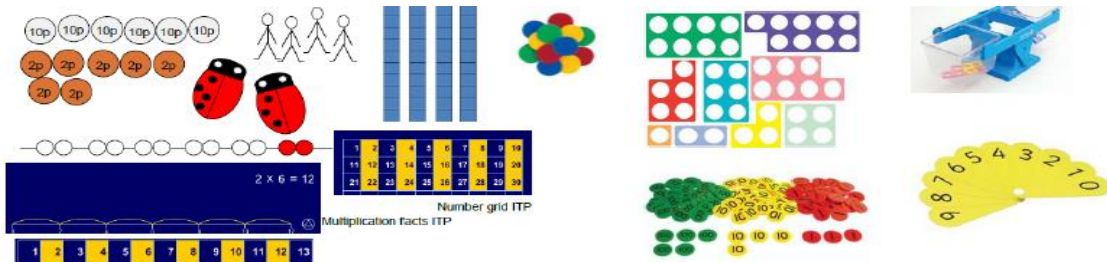
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## Multiplication – Year 2

### End of Year Objective:

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

### Example Equipment:



Mental Calculation Skills	Examples	Pre-requisite skills
Double any multiple of	Double 15 <ul style="list-style-type: none"> <li>• <math>30 + 30 =</math></li> <li>• Explain how you</li> </ul>	Double single digit numbers. Double multiples of

<p>10 up to 100.</p>	<p>could work out double 45.</p> <ul style="list-style-type: none"> <li>• Twice 25 is...</li> <li>• 40 multiplied by 2 equals...</li> </ul>	<p>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</p>	<ul style="list-style-type: none"> <li>• What is the total of six groups of 5?</li> <li>• How many fingers do these 4 children have? How did you work it out?</li> </ul>	<p>Count on from zero in twos, fives and tens. Relate 'groups of' to repeated addition. Understand that the last</p>

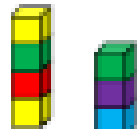
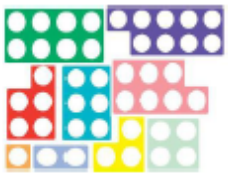
<p>in groups of 2,5 or 10.</p>	<ul style="list-style-type: none"><li>• What is the total of this tally? IIII IIII IIII IIII</li><li>• How else could you write <math>10 + 10 + 10 + 10</math>?</li></ul>	<p>number said in the count is the total of the group. Learn and apply 2x table, 10x table and 5x table. Understand and use commutativity (multiplication can be done in any order). Use estimation to predict and check answers.</p>
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## Division – EYFS

### Early Learning Goal:

Solve problems including doubling, halving and sharing.

### Example Equipment:

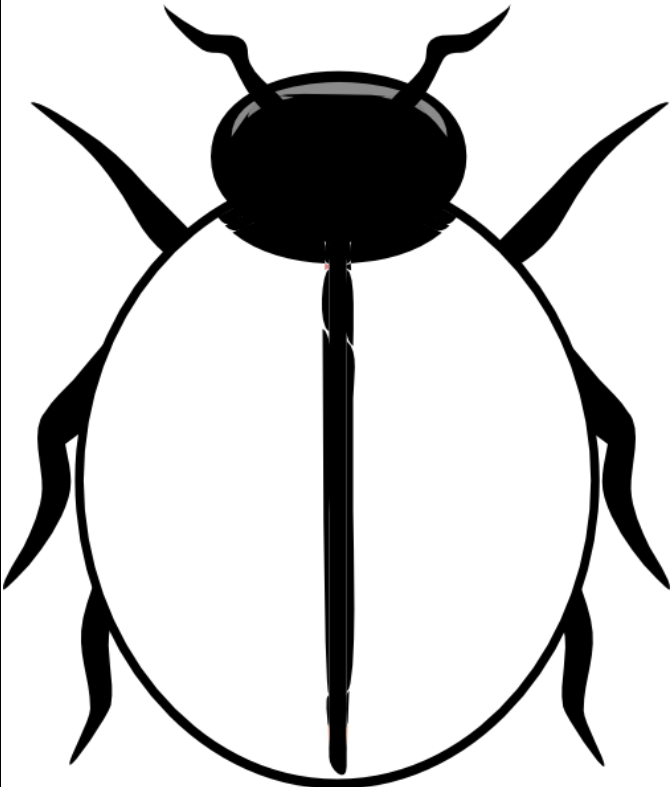



**Mental  
Calculation  
Skills**

**Examples**

**Pre-requisite  
skills**



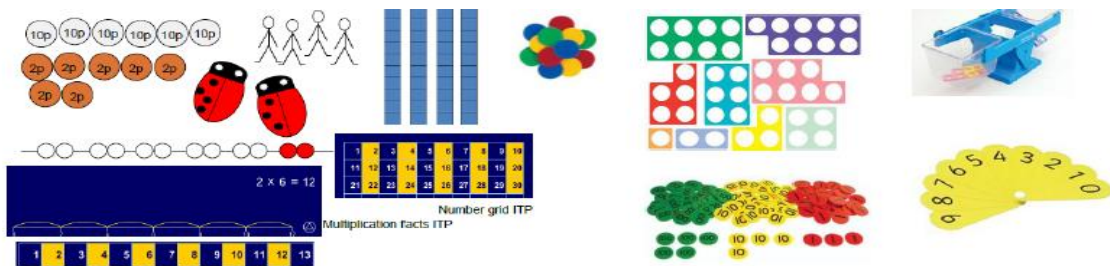
<p>Halving</p>	<p>Practical examples</p>  <p>of halving –</p> 	<p>Understanding of equivalence and Equal groups Halving means splitting down the middle.</p>
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## Division – Year 1

## End of Year Objective:

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

## Example Equipment:



<b>Mental Calculation Skills</b>	<b>Examples</b>	<b>Pre-requisite skills</b>
Counting back in ones, twos, fives and tens.	Count back in ones from 14 to 0. <ul style="list-style-type: none"><li>• Now try counting back in twos from 14 to 0. How many numbers did you say?</li><li>• Count back in tens from 90 to</li></ul>	Begin to understand the link between division and repeated subtraction Cross tens boundaries when

	0.	counting in ones and twos by understanding the base 10 number system. Understand the amounts the symbols and words represent.
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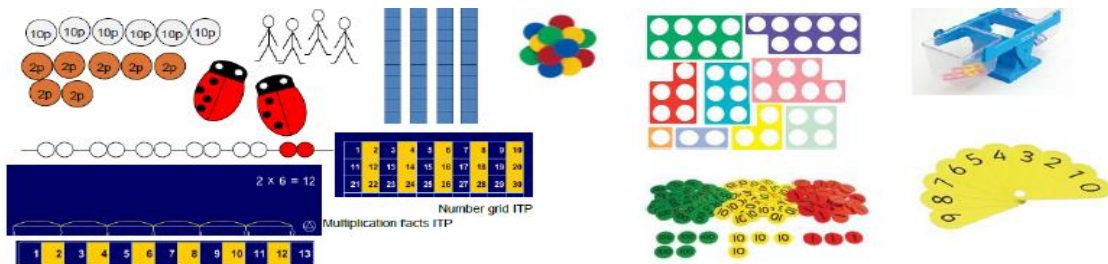
## Division – Year 2

### **End of Year Objective:**

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

arrays.

## Example Equipment:



### Mental Calculation Skills

Halve any multiple of 10 up to 100, where the answer is even

### Examples

$40 \div 2$   
Use these bundles of straws to help you halve 90.

### Pre-requisite skills

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 $80 \div 2$ .
Find half of even numbers up to 40.	Halve 24 $32 \div 2$ $?? \times 2 = 20$ $28 = ?? \times 2$	As above plus: Know even numbers. Partition numbers in different ways e.g. when finding half of 36 partitioning 36 into 20 + 16.
Use times table facts to divide even numbers by 2, 5 or 10.	$18 \div 2$ $45 \div 5$ $60 \div 10$	Know and use division facts related to the 2x table, 5x table and 10x table.