

Introduction

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Policy or Subject Co-ordinator: Leonie Jackson

POLICY FOR MATHEMATICS

This policy is accessible to:

- all staff (permanent, temporary, supply or otherwise)
- advisers/inspectors
- parents (on request)
- Saracens Broadfields Governors.

All staff has access to a copy saved on the school website.

The policy can also be found in the master policy file in the Head's room.

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Foundation Stage (.....Nursery and Reception)

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<u>Understanding Number</u>	
<p>What is a number?</p> <p>Understanding Zero</p>	<p>Numbers are used for labels for identifying things (the nominal aspect) and as labels for putting things in order (the ordinal aspect) and as an indicator of how many there are in a set of things (the cardinal aspect).</p> <p>Issues: zero seen as nothing</p> <p>Zero (as a label on the number line as the same status as all the other numbers, in fact it becomes more significant as it separates the positive numbers from the negatives. In real life, 0 is the ground floor, it is the freezing point on a thermometer, (which doesn't mean that there is no temperature). Zero is the cardinal of a set with no elements.</p>

Reading and Writing Numbers

Read and write numbers(insist on correct formation)
<http://www.communication4all.co.uk/HomePage.htm>

0 – Around and round and round we go. When we get home we have zero.

1 – Start at the top and down we run that's the way we make one.

2- Around and back on the railway track.

3- Around the tree, around the tree. That's the way we make three.

4-Down and over and down some more. That's the way we make four.

5-Down and around and a flag on high. That's the way we make five.

6- Down we go and make a loop. Number six makes a hoop.

7-Across the sky and down from heaven. That's the way we make seven.

8-Make an s and do not wait. When it's joined up you have an eight.

9-Make a loop and then a line. That's the way we make 9.

- **Feely bag**- plastic/ wooden symbols, Numicon shapes, Cuisenaire rods

Guess the number

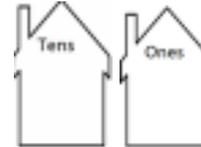
- Read numbers on **number tracks**
- **Real-life resources**(telephones, telephones directories, remote controls, clocks, calculators, cash registers etc.
- **Fishing game**(children to make/ decorate their own numbers(stick magnets on back)0- children to fish for numbers.
- **Role play**-E.g: Farmer: write a list with all the animals

How to introduce numbers up 20

Explain children that each number lives in a house. All these houses are one next to another. E.g:



The first house is called "Ones", next one is called "Tens", next is called



"Hundreds"...

Make sure that children retain the fact that only one symbol is allowed to "live" in each of these houses.

Use ones and tens only in order to explain the concept of place value. Straws could also be used, if you go through the process of making bundles of



ten.

Give children one one (Numicon, base ten, one straw) to place in the "One's" house and record the number in the same box.

How many straws? 1



Continue to demonstrate where numbers live up number 9.

When you get to ten, give children ten Numicon ones/ ten base ten /10 straws, count and place in the

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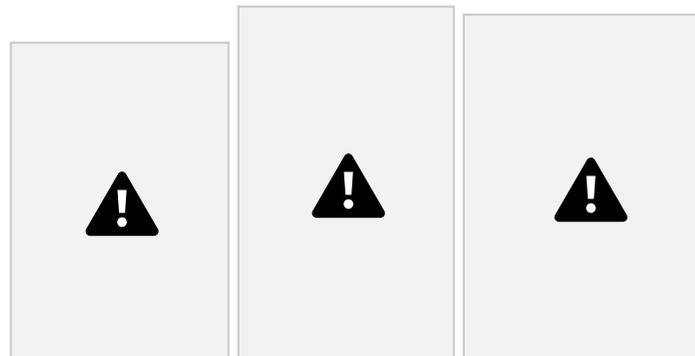
Bundle, bundle, bundle

We made a group of ten.

Move them to the tens' house

Now we start again.

same house.

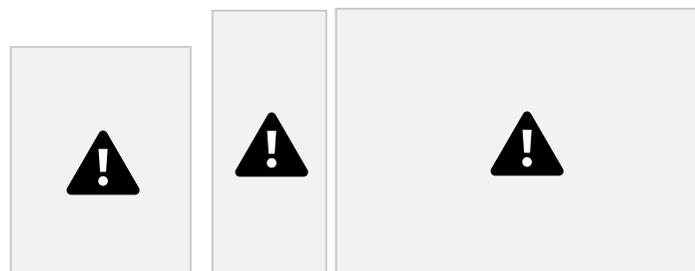


Explain that 10 ones (Numicon, straws, cubes-base ten) are **'old' enough** to move next door, as we have a house called "Tens' "House.



Give children samples of 10-base ten/ Numicon(one TEN) and ask them **to find** a shape that represents the same number as the group of 10 ones.

Use a rubber band to make a bundle of ten straws and place it in the Tens' house.



How many ones? How many tens? Remind children that 0 is the number that stands for a set that has

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Introduce number 10

Introduce numbers 11-19

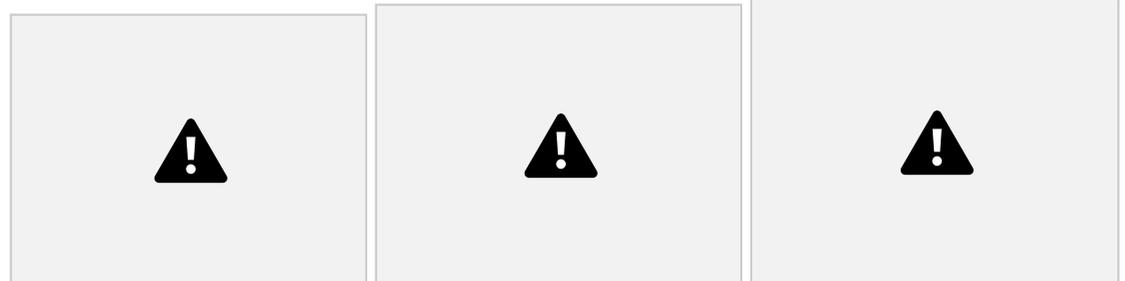
Making and partitioning numbers:

<http://www.ictgames.com/abacusInteger.html>

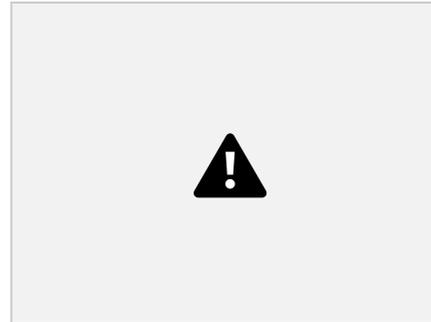
http://www.ictgames.com/arrowCards_revised_v4.html

<http://www.topmarks.co.uk/Flash.aspx?f=diennesandcoinsv3>

no elements.



Introduce all numbers 11-19, using the same strategy. Give children 11 Numicon ones/11 base ten ones/ 11 straws to count and place in the right house. Once they get a group of ten, **exchange for one ten**, move the ten in the tens' house and leave the rest of the ones in the ones' house.



E.g:

Place Value Arrows come to reinforce making and partitioning the numbers



Generate numbers 1-20

http://www.math-aids.com/Place_Value/Base_10_Blocks.html

You can create models and images for all the numbers and make displays with the work that children

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How many? Counting

<http://mzaue2.phoenix.mathletics.com/RainForest.aspx?authToken=6FPYNbS5yoLl64iKs21eGHtK4a+l5c6TKIwjgP+GzR4=>

Compare and order numbers:

Dot to dot

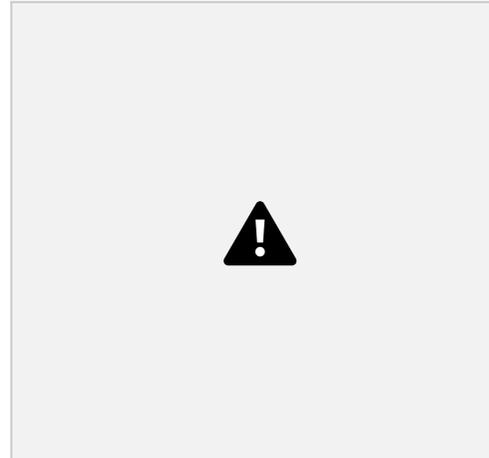
http://www.abcya.com/connect_the_dots_20.htm

<http://www.topmarks.co.uk/ordering-and-sequencing/caterpillar-orderi>

<ng http://www.topmarks.co.uk/Flash.aspx?f=order>

http://www.ictgames.com/caterpillar_slider.html

produce, as reminders.



E.g:

Most important aspect is to understand that 11 is more than 10, 12 is 2 more than 10 etc and start reasoning with these concepts.

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<u>Counting</u>		
Sequence Context	Learning the conventional sequence of counting words is not easy. Children learn the 1-10 range by rote, followed by 11, 12, 13, but 14 is the first number which has a strong parallel with number 4. Then they learn the decades (multiples of ten). This has implications for writing and children often struggle when arriving at a new decade.	
Counting Context	Number words are applied to objects. Children will often point, nod etc.	
Cardinal Context	The number word describes a set of objects.	
Measure context	Children learn what the appropriate units are. Accuracy is an important concept to develop. Research shows that young children have difficulty in making sense of the measure context.	
Ordinal Context	The number word describes the relative position of things.	
Non-numerical context	Number words to identify codes(phone numbers, registration numbers on cars)	
<u>Counting Principles</u>		
HOW TO COUNT	The 1 to 1 principle	Assigning a distinct counting word to each item(even if they say 1,6,2)
	The stable order principle	Knowing that the list of words must be a consistent one (sometimes children make their own lists).
	The cardinal principle	Counting leads to a 'product' at the end. If a child has to count again in response to 'how many...' they have not grasped the principle.
WHAT TO COUNT	The abstract principle	Counting collections of abstract, even if they refer to them as 'things'.

	The order-irrelevance principle	Knowing that the order of counting is irrelevant.
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<u>Early development of the word sequence:</u>
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1. **String level:** a continuous sound string
2. **Unbreakable list level:** separate words but the sequence can't be broken and always starts on 1
3. **Breakable chain:** children learn to be able to start at any point which is essential if they are going to be able to count on.
4. **Numerable chain level:** sequence, count and cardinality are merged so, if you are counting from 3, then 3 is the first number, 4 is the second.
5. **Bi-directional chain:** child can say the numbers in either direction and start at any point

Vocabulary	Learning Episodes	Resources
number zero, one....twenty(and beyond) none count count up/ count to count back/ count from..to count in ones pair	<p>Play games that involve counting/ chanting. Use different voices, speeds, volume to recite numbers(high pitched, animal's voice, whisper/ shout).</p> <p>Clapping, hopping, skipping, jumping(forwards and backwards)- with/ without number track.</p>	real objects tins boxes baskets counting noisy stick 
	<p>Talk about numbers that children know(How old are you? What number do you line on? How many brothers/ sisters? How many people in your house/ family? Do you travel by bus? What number? What is the largest number that you know? How many letters in your name?</p>	
	<p>Build up a repertoire of songs to encourage rhythmic pattern-making and counting (Ten Green bottles, There were 10 in Bed, Five current Buns etc).</p>	Nursery Rhymes
	<p>Range of activities to select a starting number and count forwards (on) from that number or count backwards. (Number tracks, turn card facing down and card with numbers hidden in the sand).</p>	Number Cards to build a track
	<p>Counting with a puppet that makes mistakes(puppet counts in funny voices and makes mistakes/ children have to correct it)</p>	

Object Counting		
Vocabulary	Learning Episodes	Resources
number zero, one....twenty(and beyond) none count count up/ count to count back/ count from..to count in ones how many? altogether pair teens guess how many estimate enough/ not enough/ too much nearly, about close to about the same exact balance	<p>Use simple percussion instruments to model a number of beats. Children have to listen and identify the number of beats.</p> <p>Close the eyes and count what they hear(sounds). Count the beats silently, clap when you hear the 10th beat(for example).</p>	Percussion Instruments coins /tins
	<p>Close the eyes and count what they hear(£1 coins dropped in a metal tin, counting noisy stick etc).</p> <p>Count the sounds silently, clap when you hear the ...th beat.</p>	coins/ tins counting noisy stick
	<p>Count a variety of objects/ pictures both movable and fixed</p> <p>Strategies to count accurately</p> <p>-separate the objects that have been counted from the ones that have not been counted (move them on the table/ touch the objects)</p> <p>-cross out the pictures that have been counted form the ones that have not been counted to avoid counting the same item twice (or miscount)</p>	real objects, pictures bubbles five wise ten frames
	<p>Finger patterns/ Dice patterns/ Structured images(Numicon-Cuisenaire Rods-Dice)</p> 	Dice Numicon Cuisenaire Rods Five Wise Ten Frames

	 <p>Subitise the dice patterns, small organised groups, recognise/ make finger patterns to five/ ten, recognise pairs-wise patterns and five-wise patterns on a ten frame.</p>	
	<p>Conservation of Numbers</p> <p>Child has to count and identify the cardinal of a set.</p> <p>T spreads the objects out or bunch them up(do not add/take away anything). Does the child think there is still the same numbers ? More? Fewer?</p>	
	<p>Estimations</p> <ol style="list-style-type: none"> 1. Child makes a set of two and matching with any other set of two things (from some ready-made sets)- up 7 2. Give children a set (random objects on the table, objects in a jar/bag/ pot etc). Child to estimate how many, then count and find the cardinal. 3. T to set a regular. irregular pattern, child to estimate, then count to check. 4. How many.....)(straws, cubes etc) do you need to measure the table? <p>How many cups of water do you need to fill the jar? Role play area-Are there enough plates for the teddies?</p>	<p>Counters in a transparent bag buttons in a box marbles in a jar scissors in a pot</p> <p>Dotted Frames</p>

Addition		
Vocabulary	Learning Episodes	Resources
-sign -more -add -plus -makes -equals -sum -total -altogether -more -more than -count all -count in from -count on from..to..	Begin to make comparisons between quantities.	-sets of objects(preferably same objects/ same colour)
	<p>Understand that a group of things changes in quantity when something is added (or taken away).</p> -make sets and keep on adding one, identify the new cardinal/ the actual number on the number track -keep practicing until children realise that the quantity changes and that a new element is leading to the number that comes next	-real objects -number tracks -floor tiles
	<p>Before and After</p> -give children Numicon pegs on a board, identify the cardinal, go and stand on that number(number floor tiles), give the child another peg, identify the new cardinal and move on the tile that stands for the new total(the number that comes next/ one step forward)	
	<p>Begin to use the vocabulary involved in adding in practical activities and discussions.</p>	-real life scenes
	Relate addition to combining 2 groups of objects. Demonstrate awareness that numbers can be combined to make a larger one(when using real objects/ natural numbers) -ask children to identify the cardinals of two given sets, then combine them and count all to find the total -make two sets (given cardinals), put the sets together and identify the total -make a set (e.g: 4 elements) and partition it in a variety of ways E.g : make a set of 4 fish and put them into 2 fishbowls	-real objects -mats -derive pairs that total numbers up 5 -derive pairs that total numbers up 10 

Find the total number of items in 2 groups by counting them all.

-develop their ability to add by using practical equipment to count out the correct amount for each number in the calculation and then combine them to find the total. E.g: when calculating $4 + 2$, first encourage them to

count out four counters/objects and count out two counters.



To find how many altogether, touch and drag them into a line one at a time whilst counting (this is the first step before moving to horizontal/vertical number lines). By touch counting and dragging in this way, it allows children to keep track of what they have already counted to ensure they don't count the same item twice.



-Use structured images(Numicon) to calculate the totals



- real objects
- real life scenes
- addition mats



- finger patterns
- pegs on hangers



- double sided counters



<http://www.iboard.co.uk/iwb/Simple-Addition-Stories-721>

<http://www.iboard.co.uk/iwb/Adding-Two-Dice-716>

[16](http://www.iboard.co.uk/iwb/Adding-Two-Dice-716)

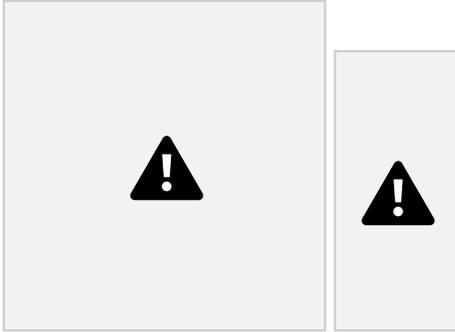
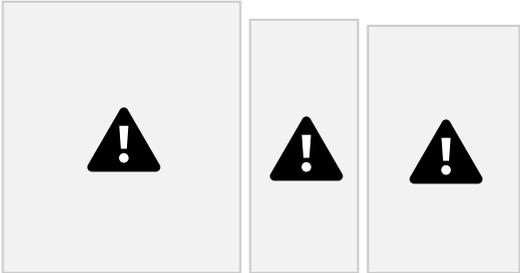
<http://www.iboard.co.uk/iwb/Addition-Stories-641>

[41](http://www.iboard.co.uk/iwb/Addition-Stories-641)

<http://www.iboard.co.uk/iwb/Bee-Swarms-401>

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	<p><i>Extend to calculating the total by counting on (high achievers/Reception)</i></p> <ol style="list-style-type: none"> 1. Find totals by counting on from the first number. 2. Find totals by counting on when the first number is hidden. 3. Find totals by counting on when the second number is hidden. 4. Solve addition problems by counting on in 1s from the larger number. <p><i>-to support children in moving from a counting all strategy to one involving counting on, children should still have two groups of objects but one should be covered so that it cannot be counted.</i></p> <p><i>-for example, when calculating $4 + 2$, count out the two groups of counters as before, then cover up one group with a cloth.</i></p> <div style="text-align: center;">  </div> <p><i>-count on from a given number</i></p> <div style="text-align: center;">  </div> <p><i>-count on from a given number to another given number</i></p> <div style="text-align: center;">  </div>	<ul style="list-style-type: none"> -real objects -structured images(Numicon/Rods) -mats -real life scenes <p>-dotted frames</p> <div style="text-align: center;">  </div> <ul style="list-style-type: none"> -number tracks
	<p>Understand the effect of adding 0.</p>	<ul style="list-style-type: none"> -manipulatives

<u>Subtraction</u>		
Vocabulary	Learning Episodes	Resources
-sign - -more/ less -less than -take away -minus -makes -count back -count back from -count back From..to.. Fewer than	<p>Begin to <u>make comparisons</u> between quantities.</p> 	-sets of objects(preferably same objects/ same colour)
	<p>Understand that a <u>group of things changes in quantity when something is taken away.</u> -make sets and keep on taking one, identify the new cardinal/ the actual number on the number track -keep practicing until children realise that the quantity changes and that taking away one element is leading to the number that comes before</p> <p>Before -give children Numicon pegs on a board, identify the cardinal, go and stand on that number(number floor tiles), take away one peg, identify the new cardinal and move back the tile that stands for the new number of elements(the number that comes before/ one less)</p> 	-real objects -number tracks -floor tiles

Begin to use the **vocabulary** involved in subtraction in practical activities and discussions.



- real life scenes
- taking away
- reduce the initial quantity when eating, paying, cutting, playing something that involves removing one at a time

Relate subtraction to **splitting a given set into 2 groups of objects.**

Demonstrate awareness that **objects can be separated** to make more groups (use real objects/natural numbers)

Place a number of objects in a box, draw a line in the middle (conservation of numbers- no objects will be added/taken away)
Shake the box. How many on each side?

- real objects
- mats
- derive pairs that total numbers up to 5
- derive pairs that total numbers up to 10



Subtract using real objects-3 steps

E.g: 9 take away 4



objects. Take away 4 How many are left?

- real objects
- real life scenes
- subtraction mats

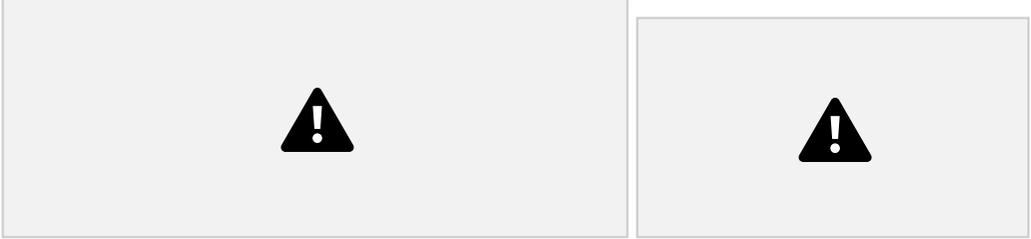
- finger patterns
- pegs on hangers



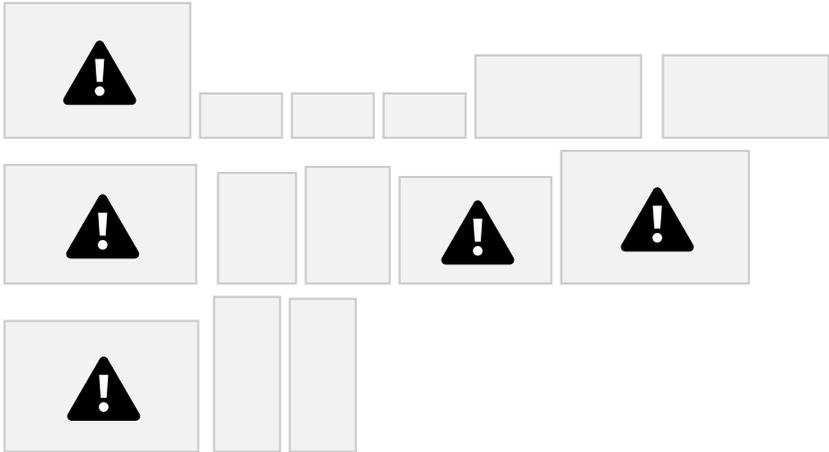
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	<p>Place a number of double sided counters on a five wise frame/ ten frame (place all counters on the same side). Turn the counters one by one. E.g: place 6 counters 6 red counters= 6 5 red counters and 1 white counters make 6 counters. 4 red counters and 2 white counters make 6 counters.</p>	<p>-double sided counters</p>  <p>http://www.iboard.co.uk/activity/Simple-Subtraction-Stories-7 20 http://www.iboard.co.uk/iwb/Subtraction-Stories-633</p>
	<p>-count back from a given number</p>  <p>-count back from a given number to another given number</p> 	<p>-number tracks</p>  <p>-Blast off the rocket in... seconds!</p> 

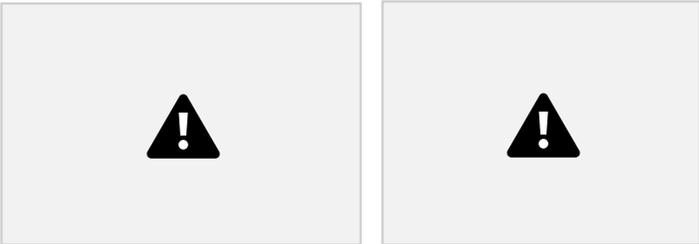
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<p>Subtract using structured images</p> 	<p>Numicon Cuisenaire Rods</p>
<p>Difference Who's got more? Who's got less? How many more? How many less?</p> 	<ul style="list-style-type: none"> -counters -1p coins -Numicon -Cuisenaire Rods
<p>Understand the effect of subtracting 0.</p>	<p>-manipulatives</p>

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<u>Multiplication</u>		
Vocabulary	Learning Episodes	Resources
<p>-how many in each set -count in steps</p>	<p>Count in steps</p> 	<p>-pairs of socks, shoes, earrings... -Numicon -Cuisenaire Rods</p> <p>-hand prints -Numicon -Cuisenaire Rods</p> <p>-toes -bundles of ten straws -Numicon -Cuisenaire Rods</p>
<p>-double</p>	<p><u>Doubling(real life)</u></p>  <p>double 4 double 5 double 3 double 2 double 1</p> <p><u>Doubling- structured images</u></p> 	<p>-visuals -Numicon shapes -rods -dominos</p> <p>http://www.iboard.co.uk/iwb/Adding-Two-Dice-716</p> <p>http://www.iboard.co.uk/iwb/Market-Shopping-Buying-Two-619</p>

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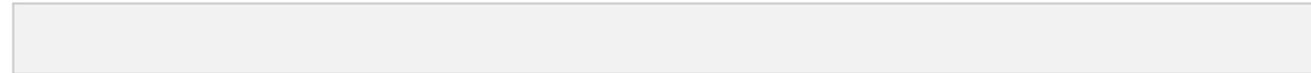
Division		
Vocabulary	Learning Episodes	Resources
-share -share equally	Give children an set of objects and ask them to share equally between a given number of children. 	-real objects; -toys to share between; -plates; -mats; 
-halving -share equally between two -equal amounts -fair	-halving by sharing equally between two:  -halving real objects and shapes: 	-counters, real objects, halving  mats; -shapes; -halving circles;

Addition

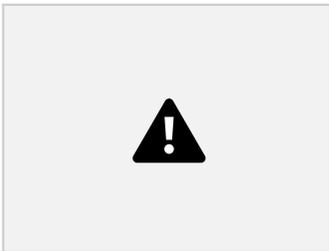
Stage 1

Secure Grounds

Recognising all finger patterns from 1 to 10 and being able to understand that 6 is 5 and one more, 7 is 5 and 2 more, 8 is 5 and 3 more, 9 is 5 and 4 more, 10 is 5 and 5 more.

**Being able to make numbers up to 20 with different structured images**

E.g: Number 13

**Understanding 1 more**

E.g: One more than 4 is the same as 5/ one more than 4 is the number that comes next.

**Understanding 0 as a place holder**(Number 10)

10

1 stands for **one group of ten ones**/ 0 stands for **zero ones/ units**

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Counting all method

Children have to develop their ability to add by using practical equipment to count out the correct amount for each number in the calculation and then **combine** them to find the **total**.

For example, when calculating $4 + 2$, encourage them to count out four counters and count out two counters.

To find how many **altogether**, touch and drag them into a line one at a time whilst counting (this is the first step before moving to horizontal/vertical number lines). By touch counting and dragging in this way, it allows children to keep track of what they have already counted to ensure they don't count the same item twice.

1 2 3 4 5 6

Children can also put the counters together in a known structured way, or use Numicon shapes to figure out the

total : 

Counting on method

To support children in moving from a counting all strategy to one involving counting on, children should still have two groups of objects but one should be covered so that it cannot be counted. For example, when calculating $4 + 2$, count out the two groups of counters as before, then cover up the larger group with a cloth.

4

- Represent and use number bonds and facts within 20.
- Add one digit numbers and two-digit numbers to 20, including 0.
- Read, write and interpret mathematical statements involving addition (+) and equals sign(=).
- What is 3 **add** 1? What is 6 **plus** 2? What is **the sum** of 5 and 7? What is the **total** of 6 and 5? What is **2 more than** 7?

• Continue the pattern:



$$0 + 6 = 6$$

$$1 + 5 = 6$$

$$2 + 4 = 6 \dots\dots$$

• Continue the pattern:

$$10 + 8 = 18$$

$$11 + 7 = 18 \dots\dots$$

Can you make a similar pattern for number 17?

• What two numbers can be added to make 9?

• Missing numbers:

$$9 + \square = 10 \quad \square + 5 = 7 \quad \square = 8 + 3$$

• Missing symbols:

Write the missing symbols (+, -, =) in these number sentences:

$$6 \square 4 \square 10$$

$$15 \square 5 \square 10$$

$$7 \square 4 \square 3$$

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For most children, it is beneficial to place the digit card/Numicon shape on top of the cloth to remind the children of the number of counters underneath. They can then start their counting at 4, and touch count 5 and 6 in the same way as before, rather than having to count all of the counters separately .

Another way to encourage children to count on is to place counters in a box, identify the cardinal, close/cover the box, recall the cardinal and count as many more as the addend says. If children struggle counting on from a given number, give them the Numicon shape that stands for the cardinal of the first set, place them in a hat, put the hat on children's heads and count on.

Record their own calculations using appropriate symbols.



Using Numicon, songs and games children learn the number bonds to number 10.



E.g:

Children have to use practical resources and structured images and derive/ recall numbers that bond to any number up 20.

- **Working backwards:**

Use a real number line/ puppets, throw a dice(0-9), land on a number.

What number would you need to throw to land on...?

How many more to make...?

- **Fact Families**

Which four number sentences link to these numbers?

1, 5 and 6



- **Convince me!**

In my head I have two odd numbers with a difference of two. What could they be? Convince me!

- **Making an estimate**

Pick (from a selection of addition number sentences)the ones where the answer is 8 or 9.

- **Is it true that...?**

Is it true that $3 + 4 = 4 + 3$?

- This domino has 3 spots on one side and 2 on the other side, making 5 altogether. If I turn it around, will there still be 5?
- Start at 2 then count on 3. Start at 3, then count on 2. Will you land on the same number?
- There are 10 people on the top deck of a bus and 9 on the bottom. **How many people altogether?**

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Move from **counting on** using real objects/ structured

images to **adding using a number line**:

$$3 + 2 = 5$$

$$\underline{+1 + 1}$$

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Bead strings or bead bars can be used to illustrate addition including bridging through ten by counting on 2 then counting on 3.

E.g: $8 + 5 =$

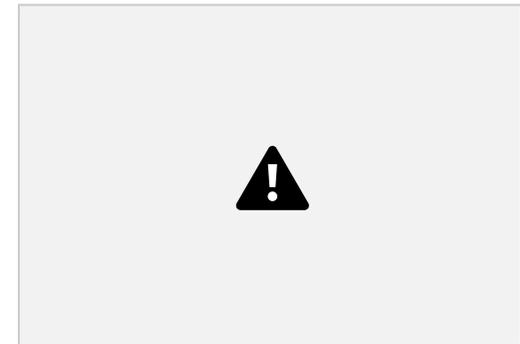
In order to understand **bridging to number ten**, children have to be able to identify a pair of numbers that total 10. Challenge them to add three numbers (making sure that two of them total 10) by bonding the pair that totals 10 and adding the third number.

- **I am thinking of a number.** I add 3 and the answer is 7. What is my number?

[http://www.topmarks.co.uk/Flash.aspx?f=GuessMyNum](http://www.topmarks.co.uk/Flash.aspx?f=GuessMyNumber)

[ber](#) • **How many more?**

- **Make a story:**



<http://www.iboard.co.uk/iwb/Simple-Addition-Stories-721>



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8 + 7 = 15 Counting on

+1 +1 +1 +1 +1 +1 +1

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



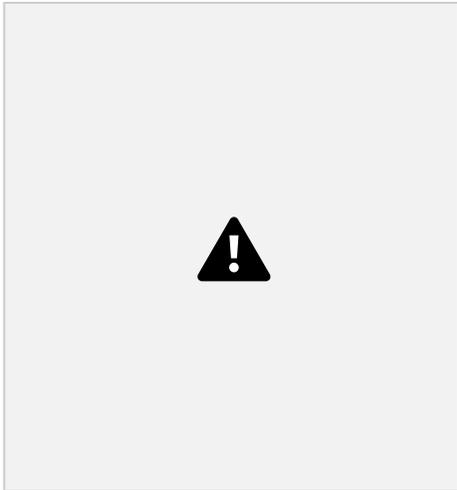
8 + 7 = 8 + 2 + 5 =

10 + 5 = 15

8 + 7 = 15 Bridging to ten

+2 +5

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



Stage 2

Secure Grounds

Count by grouping in tens and ones Make two digits numbers with transposed digits Understand -ty and -teen to understand the value of each digit (when the digits numbers are reversed e.g. 32 and 23)

Being able to partition in a variety of ways using various resources:



Being able to find one more than any number/ Being able to calculate 10 more than any number(range 0-100)



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Add three one digit numbers/ Bridging to number ten

$$8 + 7 = 8 + 2 + 5 =$$

$$10 + 5 = 15$$

$8 + 7 = 15$ Bridging to ten

$$\begin{array}{r} +2 \\ +5 \\ \hline \end{array}$$

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Add multiples of ten

Partition both numbers and recombine.

$$\text{eg } 37 + 23 = 20 + 30 + 7 + 2$$

$$= 50 + 9$$

$$= 59$$

- Recall and use addition facts to 20 fluently.
- Derive and use addition facts up to 100.
- Add numbers using concrete objects and structured images
 - add three one-digit numbers;
 - add tens/ multiples of ten;
 - add a two digit number and ones, without crossing boundaries;
 - add a two digit number and ones/ cross boundaries;
 - add a two digit number and tens;
 - add two two-digit numbers;
- Show that addition can be done in any order(commutative).
- Recognise and use the inverse relationship between addition and subtraction and use this to check and estimate calculations.
- **Continue the pattern:**
 - 90=100-10
 - 80=100-20
 -



Begin able to use 'empty number lines' starting with the larger number and **counting on** in order to develop mental strategies. First counting on in tens and ones:

$$34 + 23 = 57$$

+10 +10

+1 +1 +1

34 44 54 55 56 57

Become more efficient by **adding the units in one jump** (by using the known fact $4 + 3 = 7$).

$$34 + 23 = 57$$

+10 +10 +3

34 44 54 57

Next step: **add the tens in one jump and the units in one jump**.

$$34 + 23 = 57$$

+20 +3

34 54 57

Bridging through a multiple of ten can help children become more efficient.

• **Missing numbers**

$$91 + \square = 100$$

• **True or False?**

$$73 + 40 = 113$$

$$46 + 77 = 123$$

Give your reasons!

• **Hard or easy?** Which questions are hard and which ones are easy? Explain!

$$23 + 10 =$$

$$93 + 10 =$$

$$54 + 9 =$$

$$54 + 1 =$$

• **Other possibilities**

$$\square + \square + \square = 14$$

What single digits could go in the boxes? How many different ways can you do this?

• **Fact Families**

Which four number sentences link these numbers? 100, 67 and 33

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$$37 + 15 = 52$$

$$+10 +3 +2$$

$$37 - 47 = 50 - 52$$

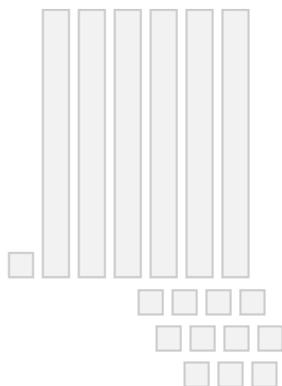
In order to understand the **vertical addition** and be able to **verbalise it correctly**, children should use the Base 10 equipment/ Numicon shapes to support their **practical calculations**.

For example, to calculate $32 + 21$, they can make the individual amounts, figure out the total of **ones**, then the total of **tens**.



53

When the units total more than 10, children should be encouraged to exchange 10 ones for 1 ten. This is the start of children understanding 'carrying' in vertical addition. For example, when calculating $35 + 27$, they can represent the amounts using Base 10 as shown:



- **Missing symbols:**

Write the missing symbols in these number sentences:

$$80 \square 20 \square 100$$

- **Convince me!**

What digits could go in the boxes? How do you know you have got them all? Convince me!

$$7\square + 2\square = 99$$

- **Making an estimate:**

Which of these sentences have an answer between 50 and 60?

$$74 + 13 =$$

$$46 + 26 =$$

$$55 + 17 =$$

$$34 + 25 =$$

- **Always, sometimes, never**

Is it always, sometimes or never true that if you add three numbers less than 10 the answer will be an odd number?

- Find three numbers with **the total of...**

- There are...people on the top deck and below.

How many people are there **altogether**?

identifying the fact that there are enough units/ones to exchange for a ten, they can carry out this exchange:

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To leave:



• **I think of a number**, I add....and the answer is.
What is my number?

Children will also use Cuisenaire Rods to reinforce the relation between numbers when adding and understand the inverse.
This will also help when solving problems / numbers sentences with unknown values and part/whole problems:



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$254 + 324 =$

$+300 +20 +4$

$254 + 554 + 574 + 578$

Use compensation where appropriate:

$126 + 49 = 175$

$+50$

-1

$126 + 175 + 176$

Add amounts of money by partitioning and recombining:

E.g:

$£6.34 + £5 = £6 + £5 + 34p = £11 + 34p = £11.34$

$£8.50 + £3.70 = £8 + £3 + 50p + 70p = £11 + 120p = £11 + £1.20 = £12.20$

• **Missing symbols:**

Write the missing symbols in these number sentences:

$180 \square 120 \square 300$

$458 \square 258 \square 200$

• **Convince me!**

$\square \square + \square \square + \square \square$

The total is 201. Each missing digit is either 9 or 1. Write the missing digits. Is there only one way of doing this? Convince me!

• **Making an estimate:**

Which of these sentences have an answer between 250 and 300?

$119 + 168 =$

$154 + 89 =$

$895 + 125 =$

$189 + 120 =$

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Mentally, add a two digit number and ones crossing boundaries/ with regrouping.

$$\begin{array}{r} 47 \\ +5 \\ \hline 12 \text{ (} 7 + 5 \text{)} \\ \underline{40} \text{ (} 40 + 0 \text{)} \\ 52 \end{array}$$

Written Methods:

Note: Use practical equipment alongside this written method.

Always start by adding the least significant digits!



Group the 12 ones/ units into tens and ones.

• **Always, sometimes, never**

Is it always, sometimes or never true that if you subtract a multiple of ten from any number, the units digit of that number stays the same?

Is it always, sometimes or never true that when you add to numbers together you will get an even number?

• **Read a number sentence in a variety of ways**

E.g: 123 add 321
123 and 321 altogether
the total of 123 and 321
the sum of 123 and 321
add 123 to 321
increase 321 by 123

• **I think of a number.** I add... to it and the answer is...
What number did I think of?

 <p data-bbox="741 778 1128 799">Exchange 10 ones/units for one ten.</p>	
--	--



Make each number using structured images. Add the

least significant digits.



Exchange 10 units for one ten. Add the tens.



Exchange 10 tens for one hundred.

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Continue to use structured images to support understanding.

Adding a three digit number with a one/ two digit number crossing boundaries:

Adding two three digit numbers crossing boundaries:

$$\begin{array}{r} 73737 \\ + 125 + 187 \\ \hline 862924 \\ 111 \end{array}$$

Stage 4

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Continue to use place value and partitioning in order to develop mental strategies

E.g: $1\ 746 + 203 = 1\ 000 + (700+200) + 40 + (6+3) =$

1949

Or

$1\ 859 + 478 = 1\ 859 + 400 + 70 + 9 =$

$= 2\ 259 + 70 + 9 =$

$= 2\ 329 + 9 =$

= 2 338

+400 +70 +9

1 859 2 259 2 329 2 338

Written methods:

Use structured images (base ten/ place value counters) and expanded mental addition to support understanding before going into the vertical layout:

Th HTO Th HTO

8 249 8 249

+ 1 348 + 1 348

17 **9 597**

80 1

500

9 000

9 597

Th HTO Th HTO

5 568 5 568

+ 3 177 + 3 177

15 **8 745**

130 1 1

600

8 000

8 745

Th HTO Th HTO

• Add numbers with up to 4 digits using a formal written columnar method.

• Estimate and use inverse to check answers to a calculation.

• Solve addition problems in context, deciding which operations and methods to use and explain why.

• **True or False?**

Are these number sentences true or false?

$6.7 + 0.4 = 6.11$

$8.1 + 0.9 = 10$

• **Hard and easy questions?**

Which questions are hard/easy? Explain why.

$3\ 323 + 300 =$

$9\ 954 + 100 =$

• **Convince me!**

$+ 1\ 475 = 4\ 9 \square 9$

What is the largest possible number that will go in the rectangular box? Which one is the smallest? Convince me!

• **Making an estimate**

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$$\begin{array}{r}
 5\ 568\ 5\ 568 \\
 +\ 3\ 577\ +\ 3\ 577 \\
 \hline
 15\ 9\ 145 \\
 130\ 111 \\
 1\ 000 \\
 \hline
 8\ 000 \\
 9\ 145
 \end{array}$$

Extend to decimals in the context of money:

- **Note:** decimals with up to two decimal places (with each number having the same number of decimal places), knowing that the decimal points line up under one another.

$$\begin{array}{r}
 3.56 \\
 +\ 2.47 \\
 \hline
 6.03 \\
 1
 \end{array}$$

Practice number bonds to £ 1.

<http://www.topmarks.co.uk/Flash.aspx?f=DartboardFDP>

Which of the number sentences have the answer between 1 550 and 1 600?

$$789 + 567 =$$

$$987 + 521 =$$

$$1\ 009 + 472 =$$

$$683 + 975 =$$

- **Always, sometimes, never**

Is it always, sometimes or never true that the total of two odd numbers is odd?

Stage 5

Children should extend the carrying method to numbers with any number of digits.

$$7\ 648\ 16\ 584\ 24\ 642 + 1\ 486 + 5\ 848\ 6\ 432\ 9\ 134\ 22\ 432\ 786 \overset{1111111}{+} 3\ 31\ 863 \overset{1111}{}$$

Continue to develop mental strategies by using place value and partitioning:

Count on from large numbers

E.g:

$$6\ 834 + 3\ 005 = 6\ 834 + 3\ 000 + 5$$

$$= 9\ 834 + 5$$

$$= 9\ 839$$

$$12\ 658 + 2\ 327 = 12\ 658 + 2\ 000 + 300 + 20 + 7$$

$$= 14\ 658 + 300 + 20 + 7$$

$$= 14\ 958 + 20 + 7$$

$$= 14\ 978 + 7$$

$$= 14\ 985$$

Count in 0.1

E.g: What is 0.1 more than 0.51?

Partition and recombine when adding decimal numbers

E.g:

$$2.4 + 5.8 = 2 + 5 + 0.4 + 0.8 = 7 + 1.2 = 8.2$$

Add to decimal numbers by adding the ones then the tenths/ hundredths

$$E.g: 5.72 + 3.05 = 8.72 + 0.05 = 8.77$$

Add near multiples of 1

$$E.g: 6.34 + 0.99 = 6.34 + 1 - 0.01 = 7.34 - 0.01 = 7.33$$

Number bonds to 1 and 10 using decimal numbers with one and to digits after the decimal point

• **Add numbers mentally with increasingly large numbers.**

• **Add numbers with more than 4 digits using a formal written columnar method.**

• **Estimate and use inverse to check answers to a calculation.**

• **Solve addition multi step problems in context, deciding which operations and methods to use and explain why.**

• **True or False?**

Are these number sentences true or false?

$$6.17 + 0.4 = 6.57$$

$$8.12 + 0.9 = 10$$

• **Hard and easy questions?**

Which questions are hard/easy? Explain why.

$$213\ 323 + 70 =$$

$$512\ 893 + 300 =$$

$$819\ 854 + 100 =$$

$$319\ 954 + 500 =$$

• **Convince me!**

$$+ 1\ 475 = 6 \square 24$$

What is the largest possible number that will go in the rectangular box? Which one is the smallest?

Convince me!

<http://www.topmarks.co.uk/Flash.aspx?f=DartboardFDP>

Add to the next multiple of ten from a decimal number

E.g: $7.8 + \square = 10$

+0.2 +2

7.8 8.00 10.00

Add decimal numbers using a compact method:

72.8 +

54.6

127.4

11

• **Making an estimate**

Which of the number sentences have the answer between 1.5 and 1.6?

$$0.47 + 0.89 =$$

$$1.45 + 0.24 =$$

$$0.95 + 0.87 =$$

• **Always, sometimes, never**

Is it always, sometimes or never true that the sum of four even numbers is divisible by 4?

Use vertical addition using regrouping/ exchanging when adding several large natural (N) and decimal numbers. E.g:

$$\begin{array}{r} 42\ 569 \\ + 12\ 524 \\ 5\ 365 \\ \hline 1\ 008 \\ \hline 61\ 466 \\ 1\ 112 \end{array}$$

Continue to develop mental strategies

Counting 0.1s, 0.01s, 0.001s

E.g:
What is 0.001 more than 6.725?

Partition and recombine to add mentally

E.g:
 $9.54 + 3.25 = 9 + 3 + 0.5 + 0.2 + 0.04 + 0.05 = 12 + 0.7 + 0.09 = 12.79$

Add two decimal numbers by adding the ones, then the tenths, the hundredths followed by the hundredths E.g:

$$6.314 + 3.006 = 9.314 + 0.006 = 9.32$$

Add near multiples of 1

E.g:
 $6.345 + 0.999 = 6.345 + 1 - 0.001 = 7.345 - 0.001 = 7.344$
 $5.673 + 0.9 = 5.673 + 1 - 0.1 = 6.673 - 0.1 = 6.672$

- **Perform mental calculations, including mixed operations and large numbers.**
- **Use knowledge of order of operations to carry out calculations involving four operations.**
- **Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.**
- **Solve addition multi-step problems in context deciding which operations and methods to use and explain why.**

• **True or false?**

Are these sentences true or false?
 $6.32 + \square = 8$
when $\square = 1.68$

• **Hard and easy questions**

Which questions are easy/hard? Explain!
 $512\ 893 + 37 =$
 $8193.54 + 5.9 =$
 $512893 + 100 =$
 $8193.5 + 0.5 =$

• **Missing symbols:**

Write the missing symbols in this sentence:

$$6 \square 12.3 = 61.9 \square 11.9$$

Add to the nearest whole number/ Use empty number lines in the context of money(change)



+0.03 +0.40 +17 +2

27.57 27.60 28 48 50

Outcomes/Samples

- Tick the two numbers which have a total of 10:

0.01 0.11 0.01 9.09 9.9 9.99

- Write the next numbers in the sequence:

0.1 2.1 2.2 4.3 6.5

- The answer is 12.6. What is the question?
- Make up an addition question that has the answer 0.014.
- Find two numbers between 3 and 4 that total 7.36.
- Three parcels weight 785g, 55g and 0.25 kg. How much do they weight altogether?
- Nasreen poured 2.4l of water, 1.35l of pineapple juice and 78 ml of mango juice in a large bowl How much fruit punch did she make?

Pizzas

Small Medium

Ham £4.20 £5.50

Salami £4.40 £5.75

Mushroom £4.50 £6.00

Cheese £3.80 £5.40

Tuna £4.25 £5.40

Extra tomato 50p

Extra cheese 60p

Ben buys a small pizza and a medium one. They cost £10 altogether. Which two could they be?

• What else do you know?

If you know that $86.7+13.3=100$ what other facts do you know?

• Convince me!

Three four digit numbers total 12 435. What could they be? Convince me!

• Making an estimate

Circle the number that is the best estimate to $12.5+ 24.9$

37.5 34.1 39.4

Explain your thinking!

• Always, sometimes, never

Is it always, sometimes or never true that the sum of two consecutive triangular numbers is a square number?

Subtraction

Stage 1

Secure Grounds

Recognising all finger patterns from 1 to 10 and being able to understand that 6 is 5 and one more, 7 is 5 and 2 more, 8 is 5 and 3 more, 9 is 5 and 4 more, 10 is 5 and 5 more(in order to be able to keep a track of how many have been taken away)

Being able to use structured images to make all numbers up 20

E.g: Number 13



Understand 1 less

E.g: One less than 4 is the same as the number before:



Understand 0 as a place holder(Number 10)



1 0

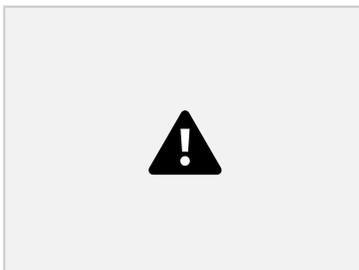
1 stands for **one group of ten ones**/ 0 stands for **zero ones/ units**

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Children are encouraged to develop a mental picture/representation of the number system to use for calculation. They should experience practical calculation opportunities using a wide variety of practical equipment, including small world play, role play, counters, cubes etc.

There should be a big focus on developing ways of recording calculations using pictures etc.



Taking away

Children will begin to develop their ability to subtract by using practical equipment to count out the first number and then remove or take away the second number to find the solution by counting how many are left e.g. $9 - 4$. Children would be encouraged to physically remove these using touch counting.

4 3 2 1

By touch counting and dragging in this way, it allows children to keep track of how many they are removing so they don't have to keep recounting. They will then touch count the amount that is left to find the answer.

Move to counting backwards as many as the subtrahend says. Children to use real objects/ use fingers to keep a track of how many steps backwards have been made-in an abstract context.

E.g: $9 - 4 \rightarrow 8, 7, 6, 5$ (the last number becomes the answer)

$$9 - 4 = 5$$

• **Represent and use number bonds and facts within 20.**

• **Subtract one digit numbers and two-digit numbers to 20, including 0.**

• **Read, write and interpret mathematical statements involving subtraction (-) and equals sign(=).**

• What is 3 **take away** 1? What is 6 **subtract** 2? What is **the difference between** of 7 and 5? What is **2 less than** 7?

• **Missing numbers:**

$$\square = 9 - 3 \quad 10 - \square = 6 \quad \square - 5 = 3$$

• **Missing symbols:**

Write the missing symbols (+, -, =) in these number sentences:

$$6 \square 4 \square 10$$

$$15 \square 5 \square 10$$

$$7 \square 4 \square 3$$

• **Working backwards:**

Use a real number line/ puppets, throw a dice(0-9), land on a number.

What number would you need to throw to land on...?

Challenge children to record their own calculations using appropriate symbols:



Use subtraction covers when using Numicon shapes and Cuisenaire Rods to help them to understand the inverse and derive facts to demonstrate the relation between addition and subtraction.



Use number lines and practical resources to support calculation:

$$6 - 3 = \quad \quad \quad -1 \ -1 \ -1$$

0 1 2 3 4 5 6 7 8 9 10

The number line should also be used to show that 6 - 3 means the 'difference' between 6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.

• **Fact Families**

Which four number sentences link to these numbers? 1, 5 and 6



$$1 + 5 = 6 \quad 6 - 1 = 5$$

$$5 + 1 = 6 \quad 6 - 5 = 1$$

• **Convince me!**

In my head I have two odd numbers with a difference of two. What could they be? Convince me!

• **Making an estimate**

Pick (from a selection of subtraction number sentences) the ones where the answer is 8 or 9.

• **Is it true that...?**

Is it true that $9 - 5 = 1 + 3$?

• There are 10 people on the top deck of a bus and 9 on the bottom. **How many people altogether?**

• **I am thinking of a number.** I take away 3 and the answer is 7. What is my number?

<http://www.topmarks.co.uk/Flash.aspx?f=GuessMyNumber>

r





Children then begin to use numbered lines to support their own calculations to count back in ones. $15 - 7 = 8$

-1 -1 -1 -1 -1 -1 -1

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Bead strings or bead bars can be used to illustrate subtraction including bridging through ten by counting back 3 then counting back 2.

$$15 - 7 = 8$$



$$\begin{aligned} 15 - 7 &= 15 - 5 - 2 \\ &= 10 - 2 \\ &= 8 \end{aligned}$$

• Make a story:

<http://www.iboard.co.uk/iwb/Simple-Subtraction-Stories-720>



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Stage 2 Secure Grounds

Count by grouping in tens and ones Make two digits numbers with transposed digits Understand -ty and -teen to understand the value of each digit numbers



Being able to partition in a variety of ways using various resources:



Being able to find one less than any number/ Being able to calculate 10 less than any number(range 0-100)



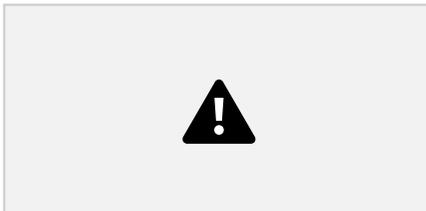
Reinforce bridging to the nearest multiple of ten

Use bead strings

$$15 - 7 = 8$$



Numicon



$$\begin{aligned} 15 - 7 &= 15 - 5 - 2 \\ &= 10 - 2 \\ &= 8 \end{aligned}$$

Take away a one-digit number from a two digit- number

-Use structured images and count backwards in ones, alongside number lines:

$$47 - 3 = 44$$



• Recall and use subtraction facts to 20 fluently.

• Derive and use subtraction facts up to 100.

• Subtract numbers using concrete objects and structured images

-subtract a one digit number from a two-digit number;

-subtract tens/ multiples of ten;

-subtract a multiple of ten from a two -digit number;

-subtract a two- digit number (tens and ones) from a two-digit number/ cross boundaries;

• Recognise and use the inverse relationship between addition and subtraction and use this to check and estimate calculations.

• **Continue the pattern:**

$$90 = 100 - 10$$

$$80 = 100 - 20$$

.....

• **Missing numbers**

$$101 - \square = 89$$

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Develop children's' representations of numbers and analyse if numbers are *far apart* or *close together*.

This will be very helpful when children are challenged to find the difference between two given numbers. Take away a multiple of ten from a two-digit number:

$$35 - 10 = 25$$



Begin to use number lines to make jumps of ten backwards:

-10

25 35

Take away a two digit number from a two digit number using structured images:

First counting back in tens and ones.

$$47 - 23 = 24$$

-10 -10 -1 -1 -1

24 25 26 27 37 47

Help children to become more efficient by subtracting the units in one jump (by using the known fact $7 - 3 = 4$). $47 - 23 = 24$

-3 -10 -10

24 27 37 47

• **True or False?**

$$98 - 18 = 70$$

$$92 - 67 = 65$$

Give your reasons!

• **Hard or easy?** Which questions are hard and which ones are easy? Explain!

$$23 - 10 =$$

$$103 - 10 =$$

$$54 - 9 =$$

$$54 - 11 =$$

• **Fact Families**

Which four number sentences link these numbers? 100, 67 and 33

• **Missing symbols:**

Write the missing symbols in these number sentences:

$$100 \square 20 \square 80$$

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Move to subtracting the tens in one jump and the units in one jump.

$$47 - 23 = 24$$

$$\begin{array}{r} 7 \\ -23 \\ \hline 24 \end{array}$$

Bridging through ten can help children become more efficient.

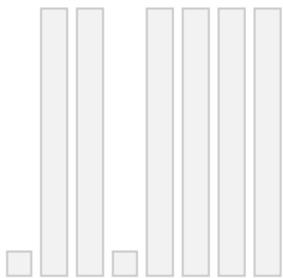
$$42 - 25 = 17$$

$$\begin{array}{r} 2 \\ -25 \\ \hline 17 \end{array}$$

In order to understand the **vertical subtraction** and be able to **verbalise it correctly**, children should use the Base 10/Numicon to support their **practical calculations**.

When the number of units to be subtracted is greater than the units in the minuend number, exchanging is required. This relies on children's understanding of ten ones being an equivalent amount to one ten. To calculate $53 - 26$, by using practical equipment, they would count out 53 using the tens and units, as in Step 1. They need to consider whether there are enough ones to remove 6. In this case there are not so they need to **exchange a ten into ten ones** to make sure that there are enough, as in step 2.

Step 1 Step 2



• **Convince me!**

What digits could go in the boxes? How do you know you have got them all? Convince me!

$$7\boxed{} - 2\boxed{} = 46$$

• **Making an estimate:**

Which of these sentences have an answer between 50 and 60?

$$74 + 13 =$$

$$46 - 26 =$$

$$55 + 17 =$$

$$87 - 34 =$$

- Find three numbers with a **difference of...**
- There are... people on the bus.... get off.
How many people are **left**?
- **I think of a number**, I takeand the answer is.
What is my number?



becomes

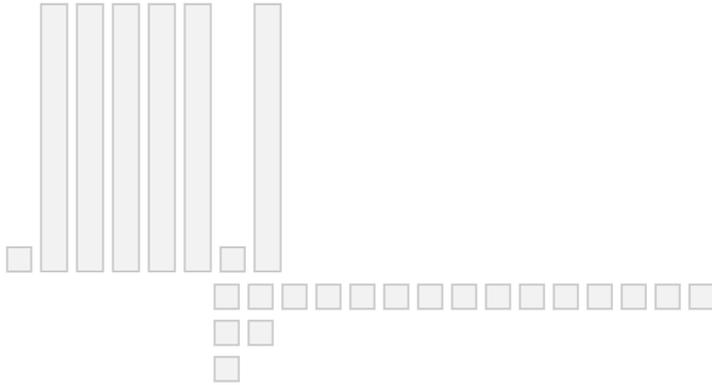


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The children can now see the 53 represented as 40 and 13, is **still the same total**, but **partitioned in a different way**, as in step 3 and take away the 26 from the calculation to leave 27 remaining, as in Step 4

Step 3 Step 4



Children will use structured images(Cuisenaire rods/Numicon) in order to reinforce the relation between addition and subtraction. They will also use the rods to solve problems with unknown values/ comparison problems:



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Stage 3

Continue to use empty number lines with increasingly large numbers, including compensation where appropriate in order to **develop mental strategies**.

Count backwards

$$144 - 6 = 138$$

-6

$$138 \quad 144$$

Bridge to the nearest multiple of ten:

-2

-4

$$138 \quad 140 \quad 144$$

$$188 - 10 = 178$$

-10

$$178 \quad 188$$

$$238 - 100 = 138$$

-100

$$138 \quad 238$$

• **Subtract numbers mentally** including:

- ones from a three-digit number;
- tens from a three-digit number;
- hundreds from a three-digit number;

• **Subtract numbers up to three digits using formal written methods of columnar subtraction.**

• **Estimate the answer** to a calculation and use **inverse operations to check answers.**

• **Solve problems** including missing numbers, **using number facts and place value.**

• **True or False?**

$$597 - 7 = 614$$

$$760 - 140 = 62$$

$$804 - 70 = 744$$

Give your reasons!

• **Hard or easy?** Which questions are hard and which ones are easy? Explain!

$$323 - 10 =$$

$$303 - 10 =$$

$$454 - 100 =$$

$$954 - 120 =$$

$574 - 324 =$

$-4 -20 -300$

$254 - 258 - 278 - 578$

Use compensation where appropriate:

$175 - 49 =$

-50

$+1$

$125 - 126 - 175$

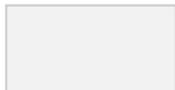
Develop counting up to find the difference. The change in money context and in time

E.g.

The difference between 67 and 100/ how many more to make 100

$+3 +30$

$67 - 70 - 100$



£ 2.80

$+20p +£2$

$£ 2.80 - £ 3 - £ 5$

Change £2.20

• **Fact Families**

Which four number sentences link these numbers? 125, 200 and 325

• **Missing symbols:**

Write the missing symbols in these number sentences

$300 \square 120 \square 180$

$458 \square 258 \square 200$

• **Making an estimate:**

Which of these sentences have an answer between 50 and 60?

$174 - 119 =$

$333 - 276 =$

$932 - 871 =$

• **Always, sometimes, never**

Is it always, sometimes or never true that if you subtract a multiple of ten from any number, the ones digit of the number stays the same?

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Written Methods:

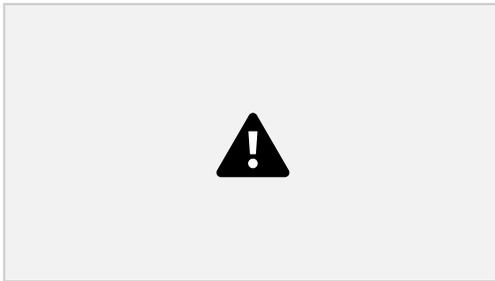
Note: Use practical equipment alongside explanations.

Always start by subtracting the least significant digits!

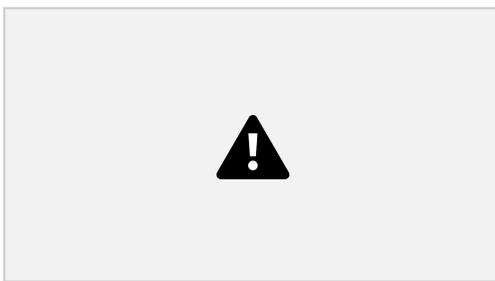
Subtract a one digit number form a two-digit number a two digit number with regrouping.

http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html

https://www-k6.thinkcentral.com/content/hsp/math/hspmath/na/gr3-5/itools_intermediate_9780547274058_/basetenblocks.html



Exchange one ten into 10 ones There are still **52** *grouped in a different way*(40+ 12)



Remove 5 from the 12 ones There are 4 tens and 7 ones left

• Partition two-digit and three digit numbers in a variety of ways

E.g:

$$37 = 30 + 7$$

$$37 = 20 + 10 + 7$$

$$37 = 20 + 17$$

$$148 = 100 + 40 + 8$$

$$148 = 110 + 30 + 8$$

$$148 = 118 + 30$$

.....

• **Read a number sentence in a variety of ways**

E.g: 321 take away 123

321 minus 123

123 less than 321

decrease 321 by 123

the difference between 321 and 123

• **I think of a number**, I take away...and the answer is.
What number did I think of?

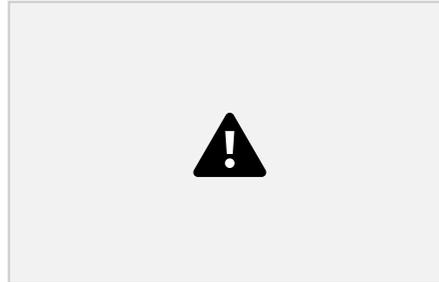
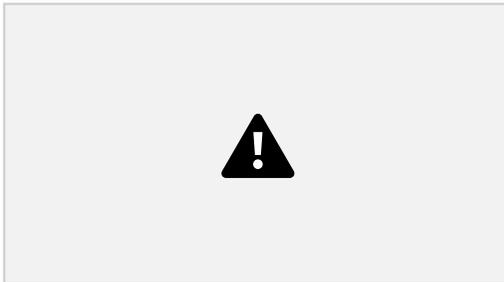
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http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html

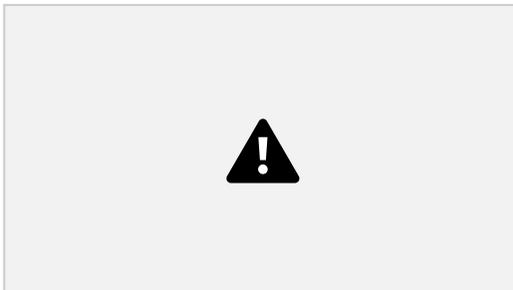
https://www-k6.thinkcentral.com/content/hsp/math/hspmath/na/gr3-5/itools_intermediate_9780547274058_/basetenblocks.html

Subtract a two-digit number crossing boundaries/ regrouping the ones and the tens

$$\begin{array}{r} 0 \ 1 \\ \blacksquare \ 12 \\ - 4 \ 5 \\ \hline 7 \ 7 \end{array}$$



Exchange one ten for 10 ones We still have **122 partitioned in a different way(100+10+12ones)** Show the new partitioning in writing. Take away 5 ones this leaves you with 7 ones, record.



Exchange one hundred for 10 tens. You will have 11 tens, take away 4 tens= this leaves 7 tens/record.

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Continue to use structured images to support understanding, leading to expected level of

understanding. Taking away three digit numbers with /without crossing boundaries:

$$36 \overset{13}{\cancel{6}} 12$$

$$84 \overset{12}{\cancel{7}} 4 \overset{12}{\cancel{7}} 3 \overset{17}{\cancel{1}} 7$$

$$\underline{-5 - 57 + 559}$$

$$\underline{837685178}$$

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Stage 4

Continue to use place value and partitioning in order to develop mental strategies.

E.g:

$$\begin{aligned} 1\ 949 - 203 &= 1\ 949 - 200 - 3 \\ &= 1\ 749 - 3 \\ &= 1\ 746 \end{aligned}$$

$$\begin{aligned} 2\ 318 - 328 &= 2\ 318 - 300 - 20 - 8 \\ &\quad -8 - 20 - 300 \end{aligned}$$

1990 1998 2 018 2 318

Written methods:

Use structured images to support understanding!

$$\begin{array}{r} 8 \\ 9\ 5\ 9\ 17 \\ +1\ 3\ 4\ 8 \\ \hline 8\ 2\ 4\ 9 \end{array}$$

$$\begin{array}{r} 6\ 13 \\ 8\ 7\ 4\ 15 \\ +3\ 1\ 7\ 7 \\ \hline 5\ 5\ 6\ 8 \end{array}$$

Extend to decimals in the context of money:

• **Note:** *decimals with up to two decimal places (with each number having the same number of decimal places), knowing that the decimal points line up under one another.*

O . t h

$$\begin{array}{r} 4 \\ 3.5\ 16 \\ -2.4\ 7 \\ \hline 1.0\ 9 \end{array}$$

- Subtract numbers with up to 4 digits using a formal written columnar method.
- Estimate and use inverse to check answers to a calculation.
- Solve subtraction problems in context, deciding which operations and methods to use and explain why.

• **True or False?**

Are these number sentences true or false?

$$6.7 - 0.9 = 6.2$$

$$8.1 - 0.9 = 7.2$$

• **Hard and easy questions?**

Which questions are hard/easy? Explain why.

$$13\ 323 - 70 =$$

$$19\ 354 - 500 =$$

$$12\ 500 - 200 =$$

• **Convince me!**

$$- 666 = 8 \times 5$$

What is the largest possible number that will go in the rectangular box? Which one is the smallest? Convince me!

• **Making an estimate**

Which of the number sentences have the answer between 550 and 600?

$$1\ 174 - 611 =$$

$$3\ 330 - 2\ 779 =$$

$$9\ 326 - 8\ 777 =$$

Practice number bonds to £ 1

<http://www.topmarks.co.uk/Flash.aspx?f=DartboardFDP>

Use counting up subtraction to find the change from £10, £20, £50 and £100.

E.g:

+25p +£5 +£60

£ 34.75 £ 3 5 £40 £ 100

• **Always, sometimes, never**

Is it always, sometimes or never true that the difference between two odd numbers is odd?

Children should extend the regrouping method to numbers with any number of digits.

$$\begin{array}{r} 59 \\ 1061017 \\ -2479 \\ \hline 8128 \end{array}$$

$$\begin{array}{r} 4999 \\ 510101010 \\ -24876 \\ \hline 25124 \end{array}$$

Continue to develop mental strategies by using place value, partitioning and a representation of a number line. Take away from large numbers

E.g:

$$\begin{aligned} 6834 - 3005 &= 6834 - 3000 - 5 \\ &= 3834 - 5 \\ &= 3829 \end{aligned}$$

$$\begin{aligned} 12658 - 2327 &= 12658 - 2000 - 300 - 20 - 7 \\ &= 10658 - 300 - 20 - 7 \\ &= 10358 - 20 - 7 \\ &= 10338 - 7 \\ &= 10331 \end{aligned}$$

Subtract decimal numbers using a compact method:

$$\begin{array}{r} 611 \\ 72.15 \\ -54.6 \\ \hline 17.9 \end{array}$$

- Subtract numbers mentally with increasingly large numbers.
- Subtract numbers **with more than 4 digits** using a formal written columnar method.
- Estimate and use inverse to check answers to a calculation.
- Solve subtraction multi steps problems in context, deciding which operations and methods to use and explain why.
- **True or False?**
Are these number sentences true or false?
 $6.17 - 0.4 = 5.77$
 $8.12 - 0.9 = 8.3$
- **Hard and easy questions?**
Which questions are hard/easy? Explain why.
 $13323 - 70 =$
 $12893 - 300 =$
 $19854 - 500 =$
 $19054 - 100 =$
- **Convince me!**
 $-1475 = 6 \square 24$
What is the largest possible number that will go in the rectangular box? Which one is the smallest?
Convince me!

Count in 0.1

E.g: What is 0.1 less than 1 .01?

Number bonds to 1 and 10 using decimal numbers with one and to digits after the decimal

point <http://www.topmarks.co.uk/Flash.aspx?f=DartboardFDP>

Find the difference by counting up to the next ten from a decimal number/ money context (calculate the change) Use counting up subtraction to find the change from £10, £20, £50 and 100 pounds.

E.g:

E.g: $7.8 + \square = 10$

+0.2 +2

7.8 8.00 10.00

$1.2 - 0.87 = 0.33$

$+0.03 +0.1 +0.2$

0.87 0.90 1 1.2

Use known facts from number bonds to 10 and 100.

E.g:

$65 +35 =100$

$5 - 0.65 =4.35$

$+0.35 + 4$

0.65 1 5

• Making an estimate

Which of the number sentences have the answer between 0.5 and 0.6?

$11.74 - 11.18 =$

$33.3 - 32.71 =$

• Always, sometimes, never

Is it always, sometimes or never true that the sum of four even numbers is divisible by 4?

Stage 6

Use vertical subtraction using regrouping/ exchanging when adding several large natural and decimal numbers. E.g:

$$\begin{array}{r} 1\ 10\ 5\ 9 \\ 2\ 1\ 10\ 6\ 1\ 0\ 1\ 7 \\ \hline 1\ 2\ 4\ 7\ 9 \\ \hline \mathbf{1\ 9\ 8\ 1\ 2\ 8} \end{array}$$

Use the same strategy when subtracting decimal numbers. Model the correct vocabulary.

$$\begin{array}{r} ^3\ 6\ 11 \\ 4^1\ 1\ 7\ .\ 2^1\ 0 \\ -3\ 4\ .\ 7\ 1 \\ \hline 3\ 8\ 2\ .\ 4\ 9 \end{array}$$

Continue to develop mental strategies

Counting 0.1s, 0.01s, 0.001s

E.g:

What is 0.001 less than 6.725?

Subtract near multiples of 1

E.g:

$$6.345 - 0.999 =$$

$$5.673 - 0.9 =$$

- **Perform mental calculations, including mixed operations and large numbers.**
- **Use knowledge of order of operations to carry out calculations involving four operations.**
- **Use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy.**
- **Solve subtraction multi-step problems in context deciding which operations and methods to use and explain why.**
- **True or false?**
Are these sentences true or false?
 $6.32 - \square = 2$
when $\square = 4.32$
- **Hard and easy questions**
Which questions are easy/hard? Explain!
 $213\ 323 - 70 =$
 $8\ 193.54 - 5.9 =$
- **Missing symbols:**
Write the missing symbols in this sentence:
 $2 \square 25 = 61.9 \square 11.9$

<p>Add to the nearest whole number/ Use empty number lines in the context of money(change) Find the difference by counting up:</p> <p>£45.23 - £27 57=£17.66</p> <p>+0.03 +0.40 +17 +0.23</p> <p>27.57 27.60 28 48 48.23</p>	<p>• What else do you know?</p> <p>If you know that $86.7+13.3=100$ what other facts do you know?</p> <p>• Making an estimate</p> <p>Circle the number that is the best estimate to $932.6 - 931.05$</p> <p>1.3 1.5 1.7 1.9</p> <p>Explain your thinking!</p>
--	--

Multiplication

Stage 1

Count on in 2s, 5s and 10s to their tenth multiple using a variety of practical resources, songs, images, number lines and number squares.

Children use **repeated addition** using diagrams or practical resources such as **Numicon** and **Cuisenaire**

rods e.g. $2 + 2 + 2 + 2 = 8$



- **Count in 10s** from 0 to 100.
 - Count in 10s to 50, holding one finger for each 10 we count. How many tens did we count?
 - How many 10p coins are there? How much money is that?
 - What is **double 2**?
 - I roll double 3. What is my score?
 - How many socks are in two pairs?
- **Count in 2s** up 30.
 - Count in 2s to 10, holding up a finger for each 2 we count. How many twos have we counted?
- **Count in 5s** to 15. How many fives have we counted?
 - How many toes are there on two feet?
 - How many gloves in 3 pairs?
 - This domino is double 4. How many spots does it have?
- **Spot the mistake/** Use a puppet to count but make some deliberate mistakes.
e.g. 2 4 5 8 10

Use practical resources to **double numbers up to 5**

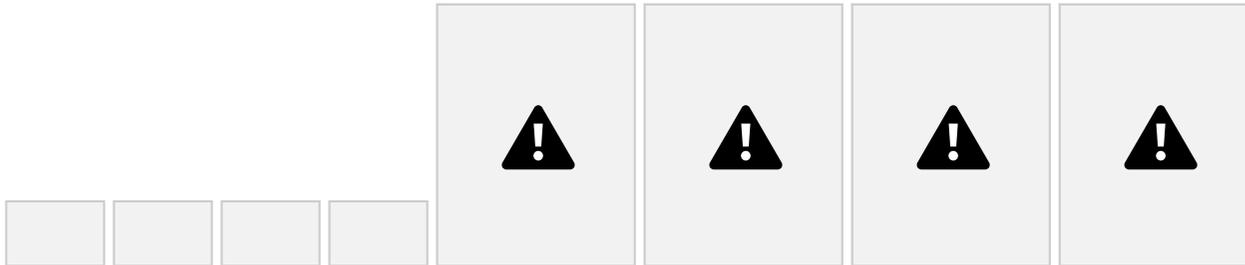


$$2 \text{ groups of } 4 = 2 \times 4 = 8$$

$$2 \text{ groups of } 4 = 4 + 4 = 8$$

Solve worded problems using images or practical resources.

E.g: There are 5 sweets in one bag. How many sweets are there in 4 bags?



Multiplication in relation to doubling. Children should be able to recall doubles to at least 10 and solve problems involving doubling practically.

E.g: There are 2 eggs in each Easter basket. How many eggs will there be in 2 baskets?



Stage 2

Introduce multiplication in a formal way (the \times symbol and action should be introduced as



'times'). e.g. 4×5 means $5+5+5+5$

Reinforce the fact that multiplication is repeated addition:

4 times 5 is

$$5 + 5 + 5 + 5 = 20$$

4 lots of 5

$$4 \times 5$$

4 times 5

5 multiplied by 4

$$\begin{array}{r} +5 \\ +5 \\ +5 \\ +5 \end{array}$$

0 5 10 15 20 Children should use Cuisenaire rods and Numicon to support their understanding.



- **Count in steps** of 2, 3 and 5 from 0, forwards and backwards.
- Count in 10s from any number, forwards and backwards
- **Recall and use multiplication facts** for the 2,5 and 10 multiplication tables.
- Recognise odd and even numbers.
- Show that multiplication can be done in any order(**commutative**).
- **Missing numbers.** What number could be written in the box?
 $10 = 5 \times \square$, $\square \times 10 = 40$, $\times \times \times = 100$,
 $\square \times \times = 12$
- What are two 5s? What is double 6?

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Arrays

Children should be able to model a multiplication calculation using an **array**. This knowledge will support with the development of the grid method, leading to long/short multiplication.

$$5 \times 3 = 15$$

$$3 \times 5 = 15$$

Commutativity

• Write the **multiplication sentence** that describes this array:

-
-
-

• Which **four number sentences** link to these numbers?

3, 5 and 15

• I have 30p in my pocket in 5p coins. How many coins do I have?

• **True or false?**

When you count up in tens starting at 5 there will always be 5 units.

If Sara counts in 2s and Nigel counts in 5s, when will they reach the same number?

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Commutativity

Complete **equations** using inverse operations using symbols to stand for unknown numbers :

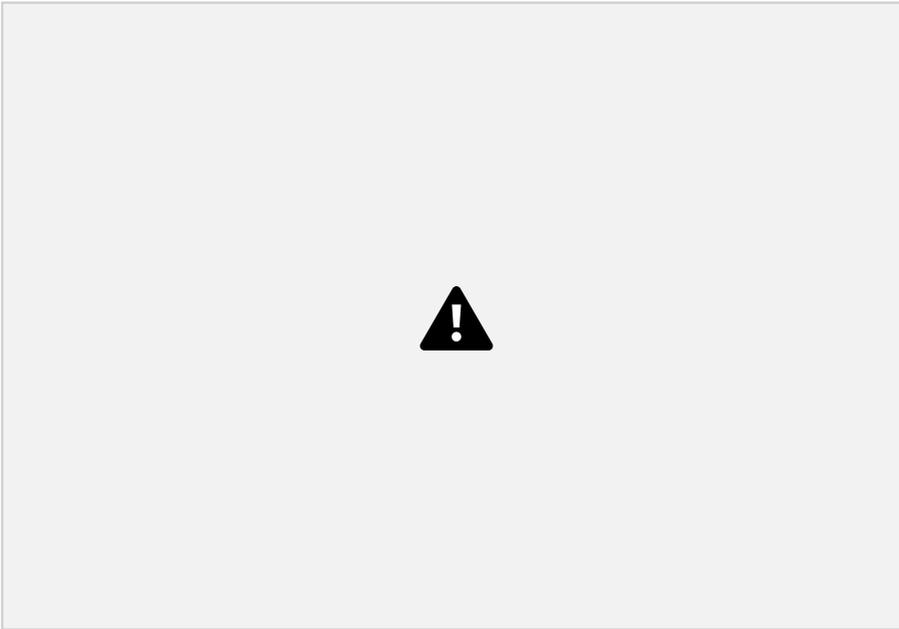
e.g. $\square \times 5 = 20$ $3 \times \times = 18$ $\square \times \frac{1}{2} = 32$ $\square \times \square = 100$

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Scaling

e.g. Find a ribbon that is 4 times as long as the blue ribbon

5 cm 20 cm

**Scaling/ Bar Model**

- A giant is **twice as tall as** a 10m high house. How tall is the giant?
- You have 4 blueberries. I have **three times as many** as you have. How many have I got?

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Use **partitioning and known doubles** to double higher numbers.

e.g. 15×2

$$10 \times 2 = 20$$

$$5 \times 2 = 10$$

10 5

$$10 + 20 = 30$$

Double 15 is the same as double 5 add double 10.

The **grid method combined with arrays** can also be used to work out higher doubles alongside structured

images. E.g: $14 \times 2 =$

$\times 10 4$

20 8

2

$\times 10 4$

2 20 8

$$2 \times 14 = (2 \times 10) + (2 \times 4) = 28$$

$$20 + 8 = 28$$

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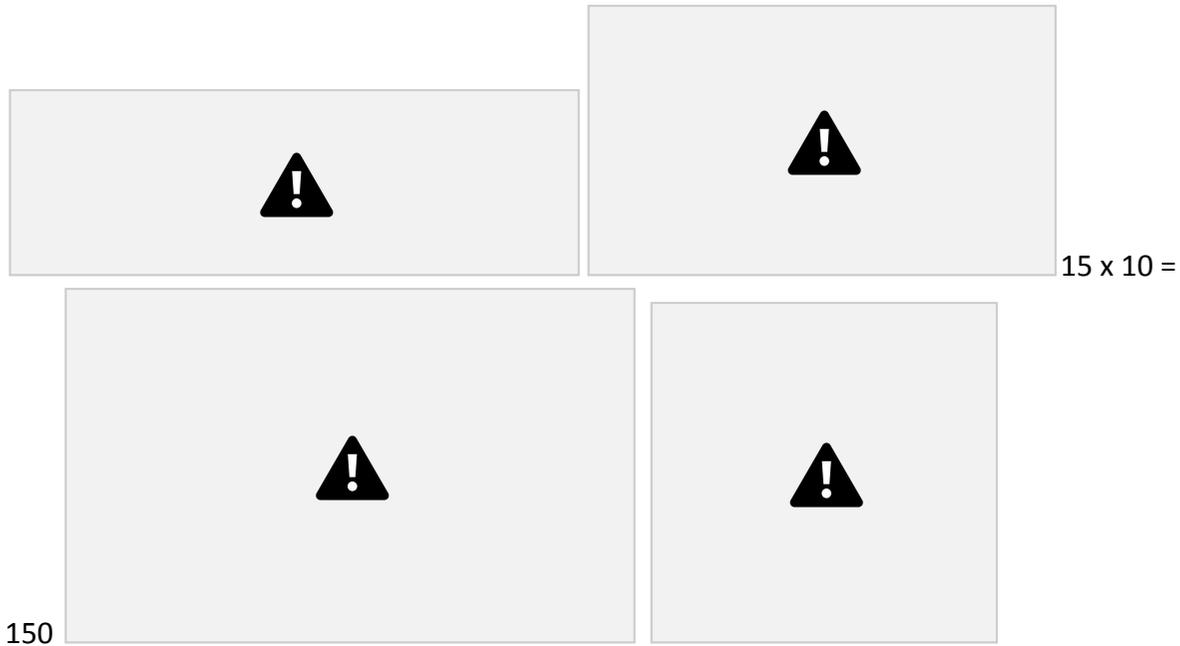
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Stage 3 *Continue to use Numcon and Cuisenaire Rods in order to understand the 3, 4 and 8 timetables/see stage 2*

Understand how to multiply a one digit number by 10.



Understand how to multiply a two-digit number by 10.



• **Count from 0 in multiples** of 4, 8, 50 and 100.

• **Recall multiplication facts** for the 3, 4 and 8 timetables.

• **Describe the array:**

o o o o o
o o o o o
o o o o o

• I have 4 stickers. If you have 3 times as many stickers, how many would you have?

• **What is the product** of 6 and 2?

• What is 5 **multiplied by** 8?

• Is 35 a **multiple of** 5?

• What numbers go in the boxes?

$4 \times 4 = \square$

$10 \times \square = 80$

$\square \times 4 = 28$

$\square \times \square = 60$

• **Use a fact:** $20 \times 3 = 60$

What is 21×3 ?

What is 22×3 ?

Continue to use arrays, where appropriate, leading into the grid method of multiplication. This will also help the children understand the **distributive and associative laws**.

x 10 4

$$6 \times 14 = (6 \times 10) + (6 \times 4)$$

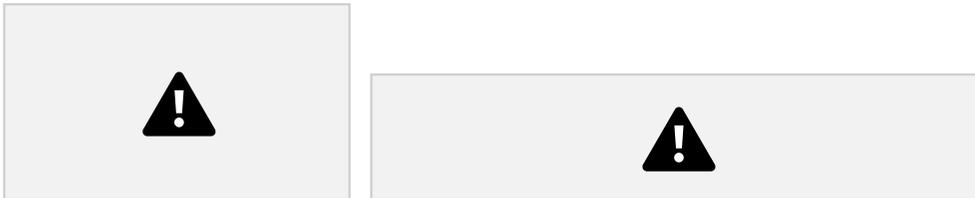
$$60 + 24$$

60 24

6

84

Bar Model and metal grid method(by partitioning) leading to short multiplication



Use the grid method(partition, mentally multiply and add the partial products in order to make sure that children understand the expected written method:

Expanded Short Multiplication

x 10 4

6 60 24

T O

1 4

x 6

2 4 (6x4)

6 0 (6x10)

• **Making links:**

$$4 \times 6 = 24$$

What is 40×6 ?

What is 20×6 ?

What is 24×6 ?

• **Double numbers up 50**, by partitioning.

E.g. Double 45 is the same as double 40 +double 5= $80+10=90$

• What numbers go in the **missing boxes**?

X ? ?

4 80 12

• **How close can you get?**

x

Using the digits 2, 3 and 4 in the calculation above, how close can you get to 100? What is the largest product? What is the smallest product?

• **True or false?**

All numbers in the two times table are even.

There are no numbers in the three times table that are also in the two times table.

**can written, if children need it*

Multiply a one digit number by any two-digit number /Using known facts



$$6 \times 163 = 6 \times 100 + 6 \times 60 + 6 \times 3 = 600 + 360 + 18 = 960 + 18$$

$$= 978$$

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Stage 4 *Continue to use Numcon and Cuisenaire Rods to understand the timetables/see stage 2*

Understand how to multiply a one-digit number by 10 and 100(*see stage 3)and a two- digit number by 10 and



100

Multiply a one-digit number by a two-digit number:

7 x 38 = ? **Expected Written Method. Expanded Short Multiplication Estimate first: 7 x 38 is approximately 7 x 40 = 280**

Partition and mentally multiply by using known facts:

$$\begin{array}{r} \times 308 \\ 721056 \end{array}$$

Note: Encourage children to

add the partial products

$$\begin{array}{r} \times 308 \\ 721056 = 266 \end{array}$$

mentally.

Short Multiplication

$$\begin{array}{r} \text{HTO} \\ 387 \times 8 = 56 \text{ record the } 6 \text{ ones and} \\ \text{transfer the } 5 \text{ tens in the tens' column} \\ \times 7 \\ 266 \end{array}$$

7 x 3 tens = 21tens + 5 tens that

$$\begin{array}{r} \text{HTO} \\ 38 \\ \times 7 \\ 56 \text{ (7x8)} \\ + 210 \text{ (7x30)} \\ 266 \end{array}$$

- **Count in multiples** of 6, 7, 9, 25 and 1 000.
- **Recall multiplication facts** for multiplication tables up to 12x 12.
- **Making links:**
 - If 7 x 3 = 21
 - What is 70 x 3?
 - (7 tens multiplied by 3 ~ 21 tens)
- If 5 x 9 is 45
 - What is 5 tens multiplied by 9?(45 tens)
 - What is 5 hundreds multiplied by 9?
 - (45 hundreds)
- **What numbers go in the boxes?**
 - 11 x 10 =
 - 9 x = 72
 - x 12 = 144
 - x = 99
- **Use Factor Pairs**
 - 13 x 12 = 13x 3 x4
 - = 13 x 3 x2 x2

5

have been transferred=26 tens

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$$3 \times 182 = 3 \times 100 + 3 \times 80 + 3 \times 2100802 = 300 + 240 + 6 = 540 + 6$$

$$= 546$$

Solve scaling problems

http://www.mathplayground.com/tb_multiplication/thinking_blocks_multiplication_division.html

Note: Use the Cuisenaire Rods to represent the relation between variables

(children/teacher to use real resources)

Alternative teaching tool to model

<http://mathtoybox.com/numblox/NumBlox.html#.VazRN6RVhHx> or the Numicon soft in the

school's system.



- **Always, sometimes, never?**

Is it always, sometimes or never true that an even number that is divisible by 3 is also divisible by 6?

Is it always, sometimes or never true that the sum of four numbers is divisible by 4?

- **Size of an answer**

Will the answer of the following calculations be greater or less than 300? Why?

$$152 \times 2 = 87 \times 3 =$$

$$78 \times 3 = 4 \times 74 =$$

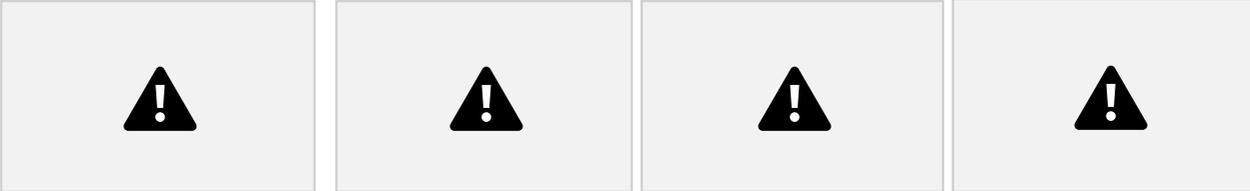
Stage 5	
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Multiply natural numbers by 10, 100 and 1 000.

TTh Th H T O

15
150 X 10
1500 X 100
15000 X 1000

Multiply decimal numbers by 10, 100 and 1 000.



When we multiply a decimal number by ten each digit becomes ten times larger. 4 tens become 4 hundreds, 3 ones become 3 tens, 1 tenth becomes 1 unit.

H T U t

431
4310

When we multiply a number by 100, each digit becomes 100 times larger:

Th H T U t 2 tens become 2 thousands

2575 ones become 5 hundreds

25707 tenths become 7 tens

The product has got 2 thousands, 5 hundreds, 7 tens and no ones (units), therefore we need to record 0 as the cardinal of the set with no units.

<http://www.topmarks.co.uk/Flash.aspx?f=MovingDigitCards>

- **Count forwards and backwards in steps of power of 10** (10, 100, 1 000 etc) for any given number up to 1 000 000.

- **Multiply whole numbers by 10, 100 and 1 000.**

Make links!

If you know that 8 x 4 is 32, 8 times 4 thousands is 32 thousands(32 000)

If you know that 8 times 5 is 40, 8 times 5 hundreds is 40 hundreds(4 000)

If you know that 8 times 9 is 72, then 8 times 9 tens is 72 tens(720).

- **Multiply numbers up to four digits by a one digit number.**

- **Multiply decimal numbers by 10, 100 and 1 000.**

- **Change £10.39 into pence(1039p)**

- **Identify multiples of a given number.**

E.g:

Write all multiples of 7 greater than ..and less than...

Multiply a two digit number by a one digit number/ a three-digit number by a one digit number (see stages 3 and

4) Multiply a four -digit number by a one digit number:

8 x 4 598=

Expanded Short Multiplication

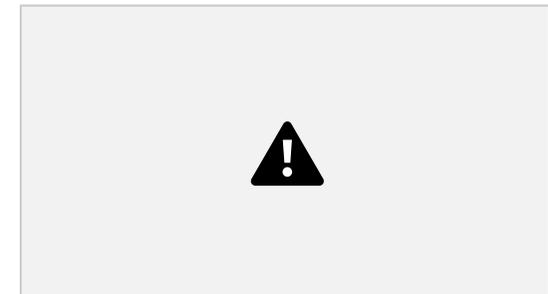
	Th	H	T	O	
	4	5	9	8	
x 8					
		6	4		(8x 8)
	7	2	0		(8x 90)
	4	0	0	0	(8x 500)
	3	2	0	0	0 (8x 4 000)
	3	6	7	8	4

Short Multiplication

	Th	H	T	O	
	4	5	9	8	
x 8					
	3	6	7	8	4
	4	7	6		

Th H T O 8 x 8 =64, record 4 ones and transfer 6 tens in the tens' column
8 x 9 tens =72 tens, add 6 tens that have been transferred=78 tens, record 8 tens and transfer 70 tens as 7 hundreds in the hundreds' column
8 x 5 hundreds=40 hundreds, add the 7 hundreds that have been transferred=47 hundreds, record 7 hundreds and transfer 40 hundreds as 4 thousands in the thousands' column.
8 x 4 thousands=32 thousands, add 4 thousands=36 thousands

- Sort numbers in a Venn Diagram(multiples of 2, multiples of 4)
- Sort numbers in a Carol Diagram(multiples of 6, not a multiple of 6, less than.../not less than...)
- Identify factors of a given number.
E.g. Write all factors of number 12.
(1,2,3,4,6 and 12)
- Identify common factors of two given numbers.
E.g. What common factors have 12 and 15 got?
1, 2, 3, 4, 6, 12
1, 3, 5, 15
1 and 3
E.g. What is the greatest common factor of 12 and 16?



- Identify prime numbers and understand the difference between prime numbers and composite numbers.
- Recall prime numbers up to 19.

- Recognise and use **square and cube numbers**

- **Making Connections:**

If you know that 7×8 is 56 what is 7×0.8 ?

If you know that 7×8 is 56 what is 0.7×0.8 ?

Missing Numbers:

$$6 \times 0.9 = \square \times 0.03$$

$$6 \times 0.04 = 0.008 \times \square$$

- **Use a fact:**

To multiply by 25 you multiply by 100 and then divide by

4. Solve $48 \times 25 = ?$ $4.6 \times 25 = ?$

- **Prove it!**

What goes in the missing box?

$$1 \square 3 \times 6 = 978$$

- **Always, sometimes, never?**

Is it always, sometimes or never true that multiplying a number makes it bigger?

Is it always, sometimes or never true that when you multiply a number by 9, the sum of its digits is also a multiple of 9?

Is it always, sometimes or never true that a square number has an even number of factors?

- **Size of an answer**

The product of a two digit number is approximately 6 500. What could the numbers be?

Multiply a two-digit number by a two-digit number

38 x 72 =

Long Multiplication

	Th	H	T	O
			1	
			7	2
X	5	3	8	
		7	6	
	2	1	6	0

3 tens x 7 tens = 21 hundreds ~ (2 thousands and 1 hundred) +

2	7	3	6
	1		

8 x 2 = 16, 6 ones and 1 ten that will be added to the tens' column
 8 x 70 = 56 tens, add 1 ten = 57 tens

3 tens x 2 = 60

Multiply a three digit number by a two-digit number

Long Multiplication

	Th	H	T	O
		3	7	2
X	1	4	2	4
			8	8
+	7	4	4	0
	8	9	2	8
		1		

--	--	--	--	--

4 x 2 = 8, record 8 ones
 4 x 7 tens = 28 tens, record 8 tens and transfer 20 tens as 2 hundreds in the hundreds' column
 4 x 3 hundreds = 12 hundreds, add the 2 hundreds that have been transferred = 14 hundreds

2 tens x 2 = 40

2 tens x 7 tens = 14 hundreds, record 4 hundreds and transfer

1 thousand into the thousands' column been transferred=7 thousands
2 tens x 3 hundreds=6 thousands, add 1 thousand that has

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