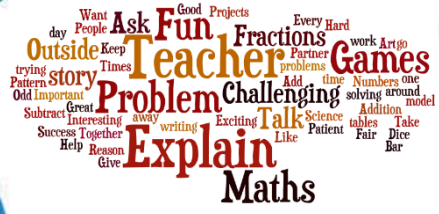


The Russell School

Maths Calculation Policy

The Russell School
Petersham

Updated: February 2016

About Our Calculation Policy

This documents is written for all adults working with our pupils; including teachers, teaching assistants, students, supply teachers and parents. It should be part of an induction package for all staff with inset as appropriate.

Our Calculation Policy has been devised to meet the requirements of the National Curriculum 2014, but most importantly the learning needs of our children at the Russell. The policy has been designed to give pupils a consistent and smooth progression of learning calculations across the school. Teachers should refer to this policy in all planning for calculations including cross curricular links.

The calculation policy is organised according to the requirements that need to be embedded in each year group of the primary curriculum as set out in the National Curriculum 2014; one set of mathematical concepts and big ideas for all. One of our fundamental mathematical Key principles; that this policy has been derived from, is the assumption that children use the language of maths correctly, so that children can develop mathematical concepts and also allows teachers to address misconceptions early and ensure that children have a firm understanding of key mathematical concepts before moving on.

It is vital that children are taught according to the 'stage' that they are working at, the transition between stages should not be hurried as not all children will be ready to move on to the next stage at the same time. Throughout this policy stages have been developed which introduces new concepts, outlines appropriate manipulatives and visual models, and what mathematical language is involved for a particular concept. Latter stages are for those children who are showing to have 'mastered' a concept, allowing them to apply their learning in a real life context further deepening their understanding. The new curriculum focuses on skills and mastery and is not about moving children on to the next method as soon as they can do the one before.

Written methods of calculations are based on mental strategies that have been taught using appropriate manipulatives and are only expected once a child has a clear understanding of the processes involved. This policy uses pictorial models that are consistent across year groups which means that skills can be taught, practised and reviewed constantly. These skills lead to more formal written methods of calculation.

Strategies for calculation need to be supported by familiar models and methods to reinforce understanding, such as the whole part model which children are exposed to throughout this policy. The written methods in this document are important but they by no means replace the superb mental methods we have developed. It is important for children to handle manipulatives to develop and reinforce understanding at all stages from Foundation to Year Six. A sound understanding of the number system and the value of a given number (place value) is essential for children to carry out calculations efficiently and accurately. Efficiency in calculation requires having a variety of mental strategies, which are carefully taught at a particular stage in a child's learning. Another key principle is the importance of 10, referred to as 'magic 10' (NCETM, 2015), which allows children to partition numbers to bridge 10, for example 9+6=9+1+5=15, which is helpful to make 10 as this makes this calculation easier.

Children need to be taught and encouraged to communicate their reasoning and thinking at all stages. Confidence in their ability in mathematics and calculations should be encouraged and supported with all children, fostering a 'can do' attitude. The long term aim is for our children to be able to select an efficient method of their own choice asking systematically:

Can I do this in my head?

Can I do this using drawings or jottings?

Do I need to use a pencil and paper procedure?

What resources could I use to help me?

A Malin

January 2016

Year Two

Children in Year Two will begin to record addition and subtraction in columns developing their understanding of place value which prepares for formal written methods with larger numbers.
Children will continue to partition numbers in different ways for example 23=20+3 and 23=10+13 using the whole part model, understand 0 as a place holder and be able to read and write numbers to at least 100 in numbers and in words. Using resources they will make connections between the 2s, 5s and 10s multiplication tables and will learn to use repeated addition to find the multiples of the 3 times table.
By the end of Year Two, children should be able to fluently recall the 2s, 5s and 10s multiplication tables and use this knowledge to count divisions on a clock face, recognise odd and even numbers, tell the time at intervals of 5 minutes, including quarter past/to and draw hands on a clock face to show these times as well as know the number of minutes in an hour and the hours in a day.

Key Vocabulary: addition, plus, subtraction, take away, difference, partition, tens, ones, whole, parts, value, greater than, smaller than, multiplication, lots of, array, groups of, equal parts, division, shared, array, number line, money, value, coin, notes, change

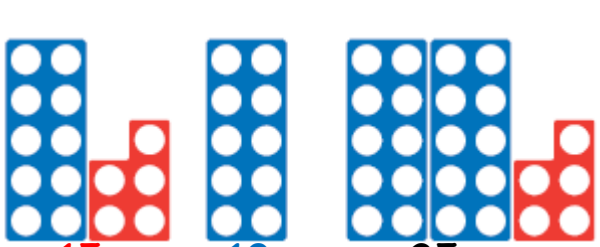
Key Instant Recall Facts

Autumn 1: I know number bonds for each number to 20.
Autumn 2: I know the multiplication and division facts for the 2 times table.
Spring 1: I know doubles and halves of numbers to 20.
Spring 2: I know the multiplication and division facts for the 10 times table.
Summer 1: I can tell the time.
Summer 2: I know the multiplication and division facts for the 5 times table.

Number- Number and place value

Count in steps of 2,3 and 5 from 0 , and in tens from any number, forward and backward.

Stage 1 (adding or subtracting ten to/from any given number)



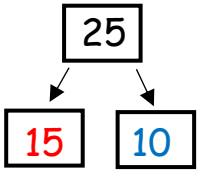
15 + 10 = 25

25 - 10 = 15

What do you notice with these two equations?

Use Numicon alongside base 10 to develop understanding of mathematical language.

Record using whole part model and number equation:



$15+10=25$ $10+15=25$

$25-10=15$ $25-15=10$

When you subtract or add ten to a number the ones **part** stays the same.

Stage 2 (adding or subtracting ten to any given two digit number)

What is the missing part, 15+□=25 ?

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

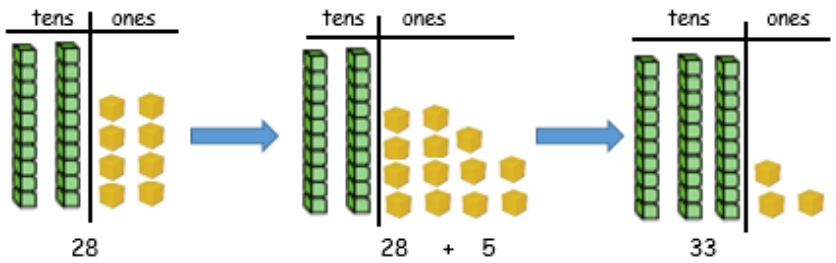
Use hundred square alongside a numberline to develop mental imagery of process.

Record using number equation:

$15+10=25$

I have 28 apples and I bought 5 more, how many will I have altogether?

Stage 1 (adding or subtracting in steps of 2,3 or 5 to/from any given number)



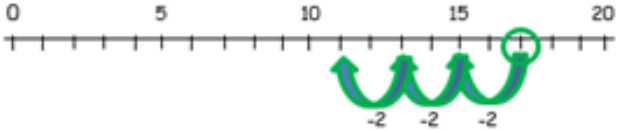
I had to **exchange** 13 **ones** to make a new lot of **ten** and 3 **ones**.

Use base 10 alongside Numicon to develop understanding of mathematical language.

Record using a number equation.

Stage 2

What is 17-6= □ ?



I have noticed that only the ones **digit** changed.

Use a number line to develop mathematical reasoning.

Record using a number equation.

17-6=11

Recognise the place value of each digit in a two-digit number (tens, ones).
Identify, represent and estimate numbers using different representations, including the number line.

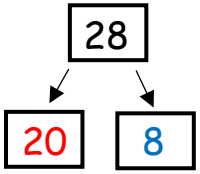
Stage 1

How can you **partition** the number 28?

There are 2 **lots of tens** and 8 **lots of one**.

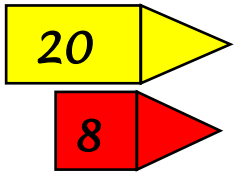
Use Numicon alongside base 10 to develop understanding of mathematical language.

Record using whole part model:



The **whole** is 28. The **parts** are 20 and 8.

Stage 2



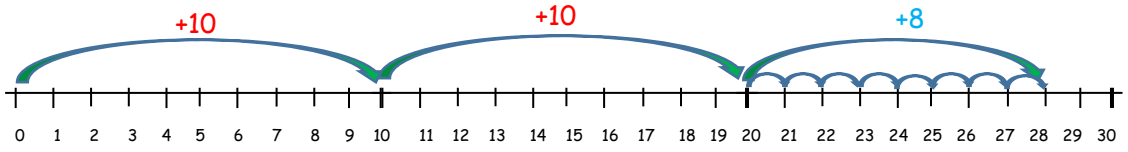
Use partition arrow cards alongside a balance scale to develop number sense.

Record number equation:

$$28=20+8$$

Stage 3

28 has two **lots of ten** and 8 **lots of one**.



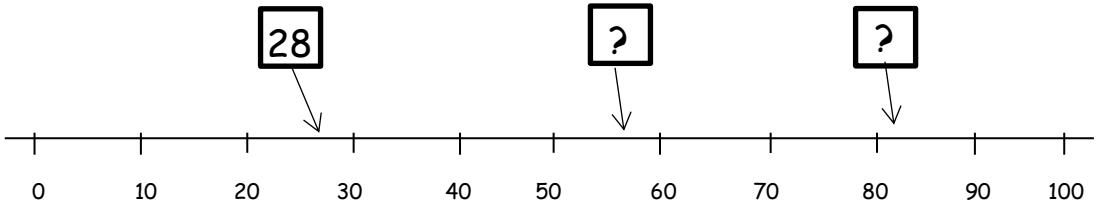
Use a number line alongside a beadstring to develop understanding of number value and also developing awareness of where a given number lays in the number system.

Record using number equation:

$$20+8=28$$

What numbers could it be?
What numbers couldn't it be?

Stage 4



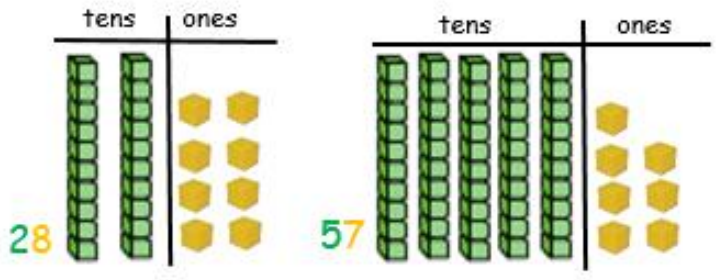
Use number line to develop awareness of where a given number is placed in the number system.

Compare and Order numbers from 0 up to 100; use < > and = signs.

Is 28 **smaller than** or **greater than** 57?

28 is **smaller than** 57 and 57 is **greater than** 28.

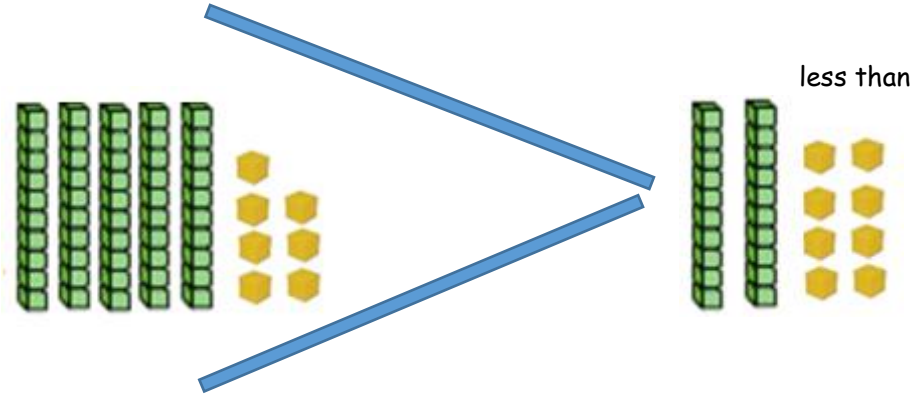
Stage 1



Use Base 10 alongside a balance scale to develop understanding of number value.

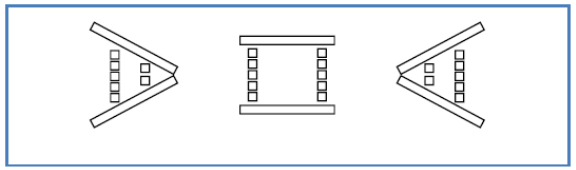
Stage 2

more than



less than

Use equality frames to develop understanding of inequality (< >) and equality (=) and to continue to develop mathematical reasoning.



Equality frame showing 5>2, 5=5 and 2<5.

What is the missing symbol? 5+7 □ 5+6

I know that 7 is **greater than** 6, so 5 plus 7 must be **greater than** 5 plus 6.

Record using a number equation:

28 < 57 OR 2 tens and 8 ones < 5 tens and 7 ones

57 > 27 OR 5 tens and 7 ones > 2 tens and 7 ones

Number- addition and subtraction

Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts to 100. E.g (3+7=10,10-7=3 and 7=10-3 to calculate 30+70=100,100-70=30 and 70= 100-30)

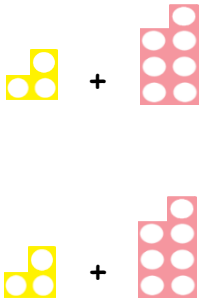
Use concrete objects and pictorial representations, including those involving number, quantities and measures.

Use place value and number facts to solve problems.

Recognise and use inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Stage 1

What is 13+7 equal to?

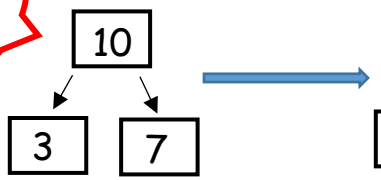


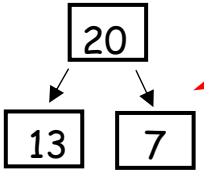
To help me find 13 + 7, I can recall my bond of 10 (3+7).

Use Numicon alongside a ten frame to recall bonds of 10 and to support calculation of a bond of 20 developing mental addition strategies.

Record using whole part model to develop mathematical language:

The **whole** is 10. The **parts** are 3 and 7.

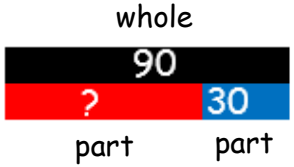


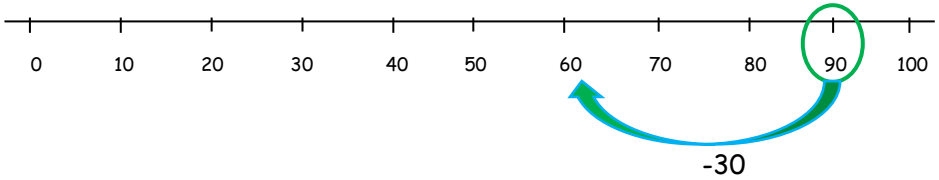


3 add 7 is equal to 10 **so** 13 add 7 is equal to 20.

Stage 2

Mary has 90 apples and she sells 30 apples how many has she got left?





Use a bar model alongside a number line to explore addition and subtraction facts developing mathematical reasoning.

Record as a fact family:

60+30=90

30+60=90

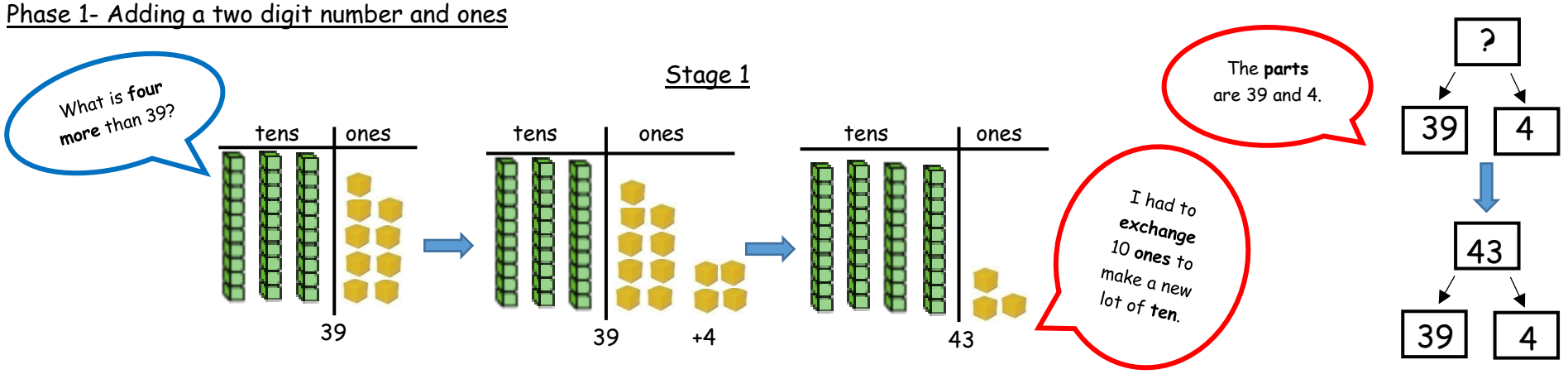
90-60=30

90-30=60

Add and subtract numbers using concrete objects, pictorial representations, and mentally, including adding 3 one-digit numbers.
Recognise and use inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
Show that addition of two numbers can be done in any order (commutative-> 5+2+1=1+5+2=1+2+5) and subtraction of one number from another cannot.

Addition (The process of finding the total of two or more sets)

Phase 1- Adding a two digit number and ones

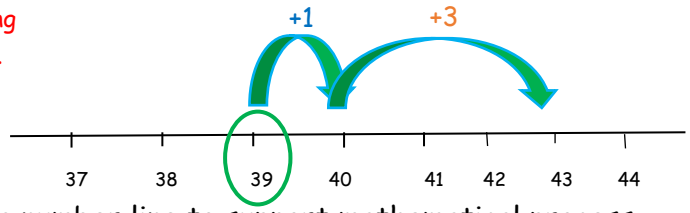


Use base 10 to develop understanding of mathematical language.

Record using whole part model.

Note: It is important that children count on to the nearest ten further developing their knowledge of making 10 and then count on the remainder.

Stage 2



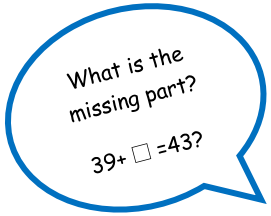
Use a number line to support mathematical process.

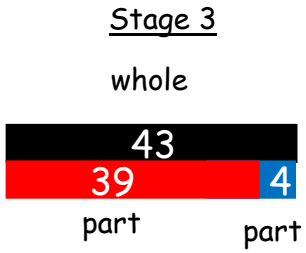
Record using a number equation:

$39+4=39+1+3$

$40+3=43$

Stage 3





Use a bar model to support mathematical reasoning.

Record as a fact family:

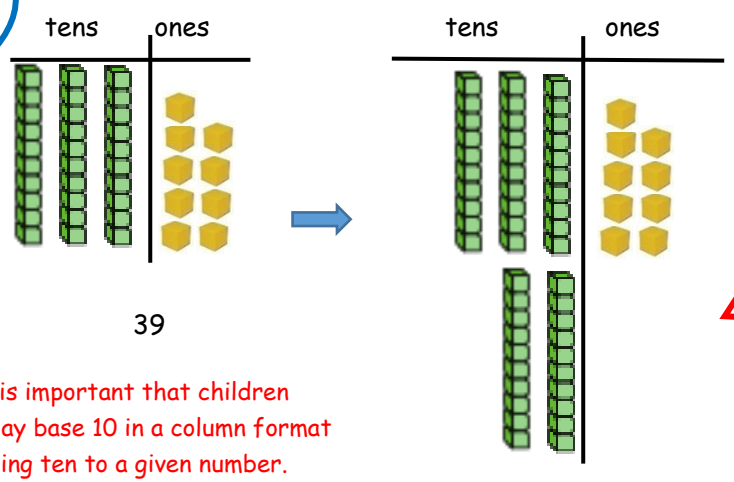
$4+39=43$ $39+4=43$

$43-4=39$ $43-39=4$

Phase 2- Adding a two digit number and tens (Ensuring that the tens do not cross the tens boundary)

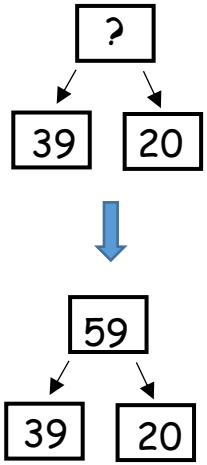
What is **twenty more** than 39?

Stage 1



I have noticed that I have **two more** tens and the **ones are the same.**

The **parts** are 39 and 20. I know that 39 add 20 will give me the **whole.**



The **whole** is 59 and the **parts** are 39 and 20.

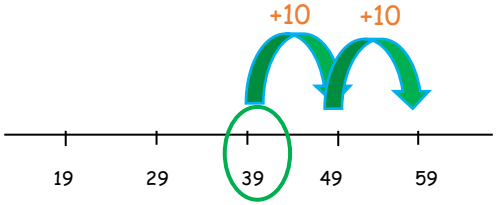
Record using whole part model.

Note: It is important that children begin to lay base 10 in a column format when adding ten to a given number.

Use base 10 to develop understanding of mathematical language.

Stage 2

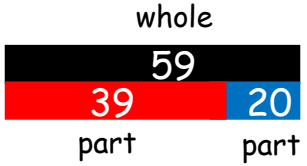
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



What is the missing part?

39+ □ =59?

Stage 3



Use a bar model to support mathematical reasoning.

Use a blank number line alongside a number square to support mathematical process.

Record using a number equation:

$39+20=59$

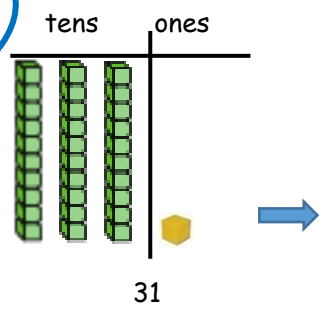
Record as a fact family:

$39+20=59$ $20+39=59$

$59-39=20$ $59-20=39$

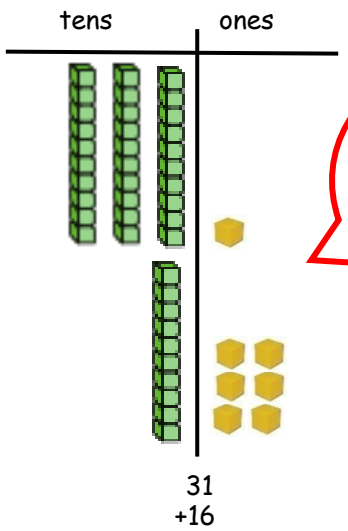
Phase 3 (When ones do not bridge 10) -Adding 2 two-digit numbers (Ensuring that the tens do not cross the tens boundary)

What is the **total** of 31+16?



Note: It is important that children begin to lay base 10 in a column format when adding 2 two digit numbers.

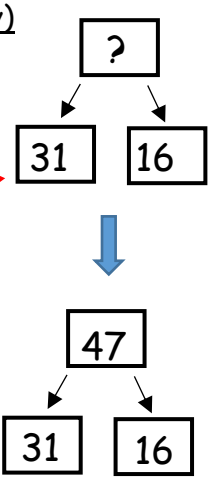
Stage 1



Altogether there are **4 lots of ten** and 7 **lots of ones**.

The **parts** are 31 and 16. I know that 31 add 16 will be the **whole**.

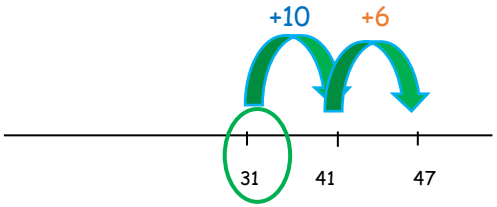
The **whole** is 47 and the **parts** are 31 and 16.



Record using whole part model.

Use base 10 to develop understanding of mathematical language.

Stage 2



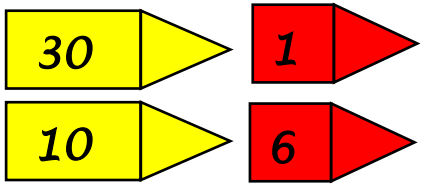
Use a blank number line to support mathematical process.

Record using a number equation:

$31+16=31+10+6$

$41+6=47$

Stage 3



Use partition arrow cards to support mathematical process.

Record using partitioned column method:

$31+16=47$

$6+1=7$

$30+10=40$

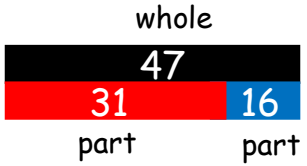
$40+7$

$=47$

What is the missing part?

16+ □ =47?

Stage 4



Use a bar model to support mathematical reasoning.

Record as a fact family:

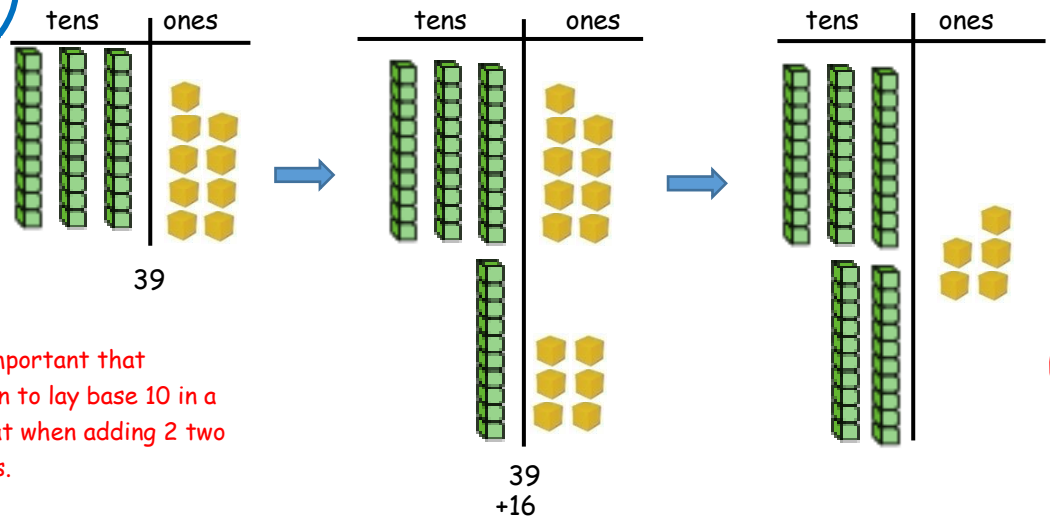
$31+16=47$ $16+31=47$

$47-16=31$ $47-31=16$

Phase 4 (When ones bridge 10) -Adding 2 two-digit numbers (Ensuring that the tens do not cross the tens boundary)

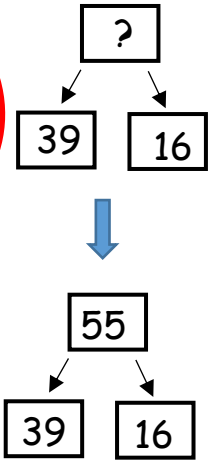
Stage 1

What is the **total** of 39+16?



There were 15 **ones** in the **ones column**. I **exchanged** ten ones to make a **lot of ten** and there are 5 ones left in the **ones column**.

The **whole** is 55 and the **parts** are 39 and 16.

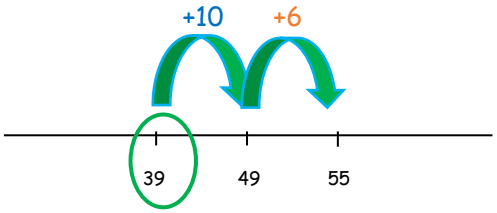


Record using whole part model.

Note: It is important that children begin to lay base 10 in a column format when adding 2 two digit numbers.

Use base 10 to develop understanding of mathematical language.

Stage 2



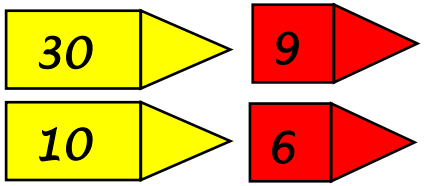
Use a blank number line to support mathematical process.

Record using a number equation:

39+16=39+10+6

49+6=55

Stage 3



Use partition arrow cards to support mathematical process.

What is the missing part?

39+ □ =55?

Record using partitioned column method:

39+16= 55

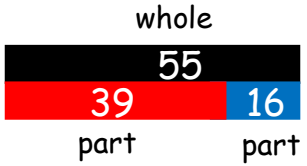
9 + 6 = ~~15~~= 10+5

30 + 10 = 40

40+10+5 =55

Note: Children should further partition the ones to make it easier for mental addition.

Stage 4



Use a bar model to support mathematical reasoning.

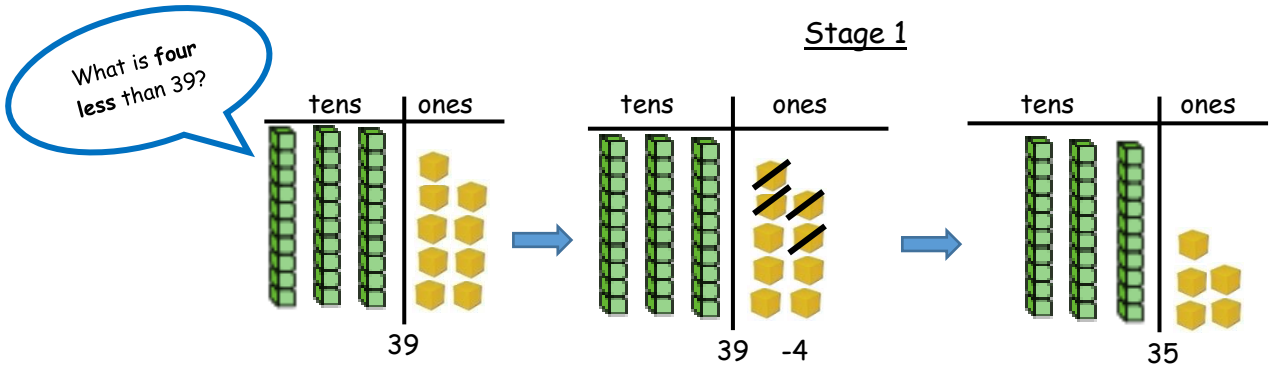
Record as a fact family:

39+16=55 16+39=55

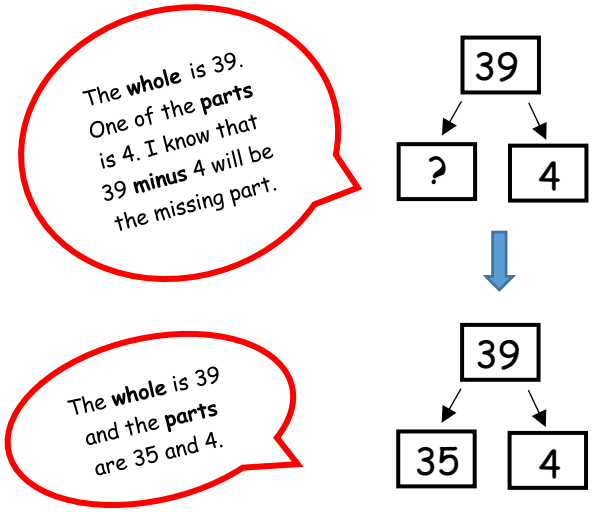
55-16=39 55-39=16

Subtraction- calculating the difference (The process of taking away and counting how many are left)

Phase 1- Subtracting ones from a two digit number

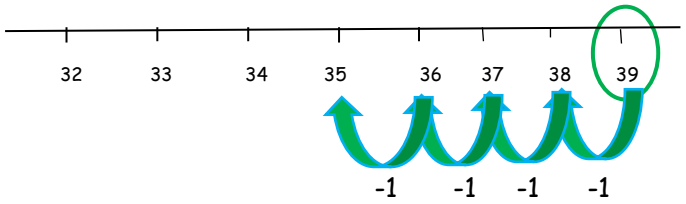


Use base 10 to develop understanding of mathematical language.



Record using whole part model.

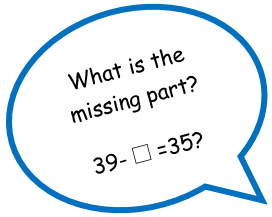
Stage 2



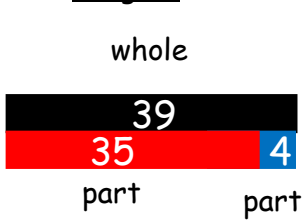
Use a blank number line to support mathematical process.

Record using a number equation:

$39-4=35$



Stage 3



Use a bar model to support mathematical reasoning.

Record as a fact family:

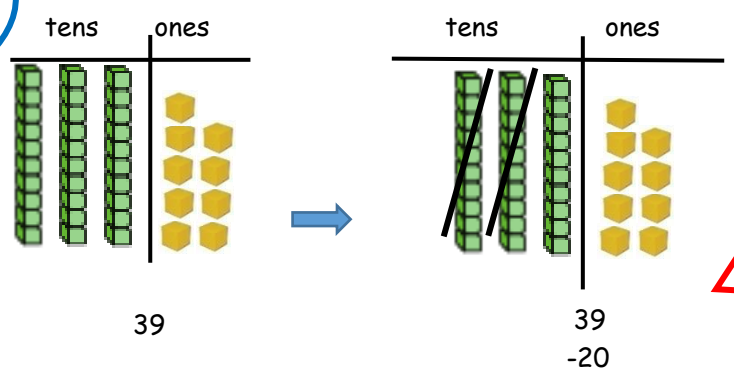
$39-4=35$ $39-35=4$

$4+35=39$ $35+4=39$

Phase 2- Subtracting a two digit number and tens

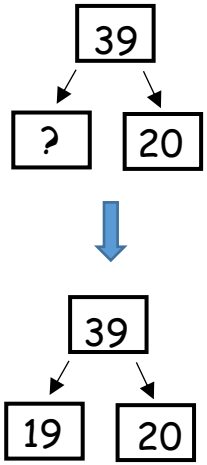
What is **twenty less** than 39?

Stage 1



I have noticed that I have **two less tens** and the **ones are the same.**

The **whole** is 39. I know that 39 take away 20 will give me the **missing part.**



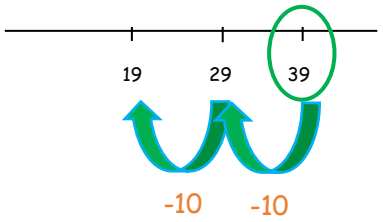
The **whole** is 39 and the **parts** are 19 and 20.

Use base 10 to develop understanding of mathematical language.

Record using whole part model.

Stage 2

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



Use a blank number line alongside a number square to support mathematical process.

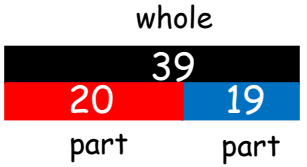
Record using a number equation:

$39 - 20 = 19$

Stage 3

What is the missing part?

39- □ =19?



Use a bar model to support mathematical reasoning.

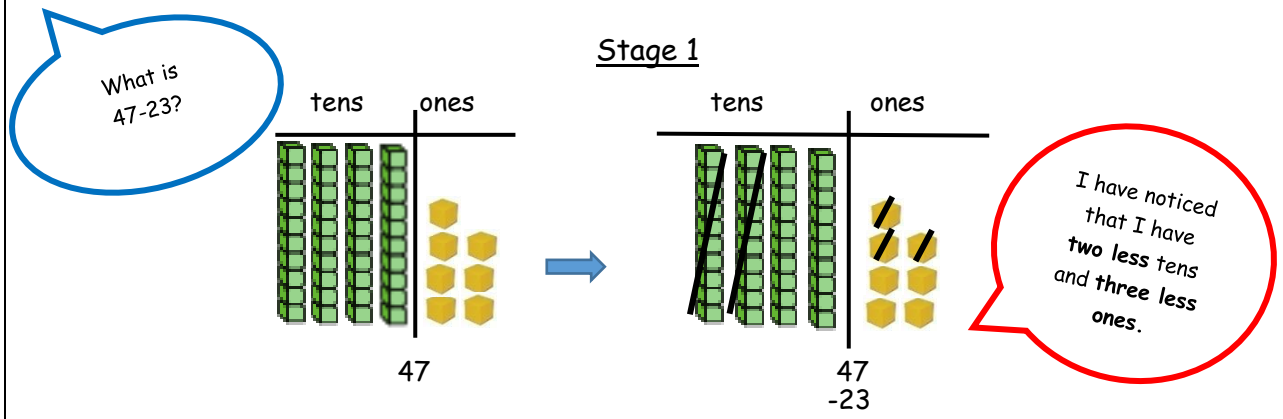
Record as a subtraction fact family:

$39 - 19 = 20$ $39 - 20 = 19$

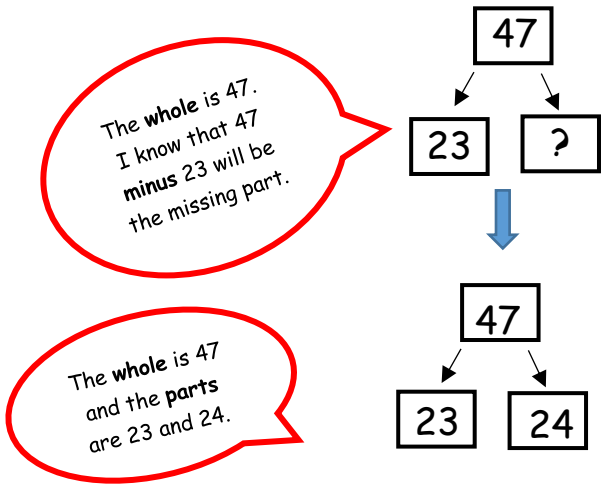
$20 + 19 = 39$ $19 + 20 = 39$

Phase 3 (When ones do not bridge 10) -Subtracting 2 two digit numbers

Stage 1

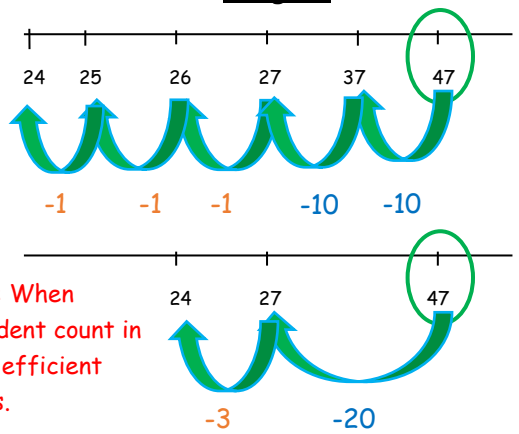


Use base 10 to develop understanding of mathematical language.



Record using whole part model.

Stage 2



Note: When confident count in more efficient jumps.

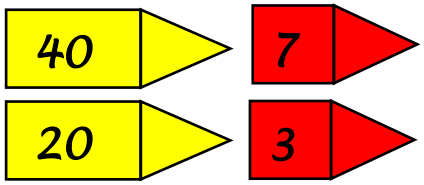
Use a blank number line to support mathematical process.

Record using a number equation:

47-23=47-20-3

27-3=24

Stage 3



Use partition arrow cards to support mathematical process.

Record using partitioned column method:

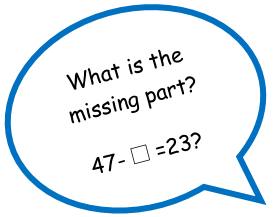
47-23 = ___

7 - 3 = 4

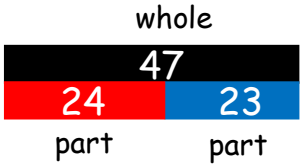
40 - 20 = 20

20+4 =24

Note: Children to subtract ones first and then tens.



Stage 4



Use a bar model to support mathematical reasoning.

Record as a fact family:

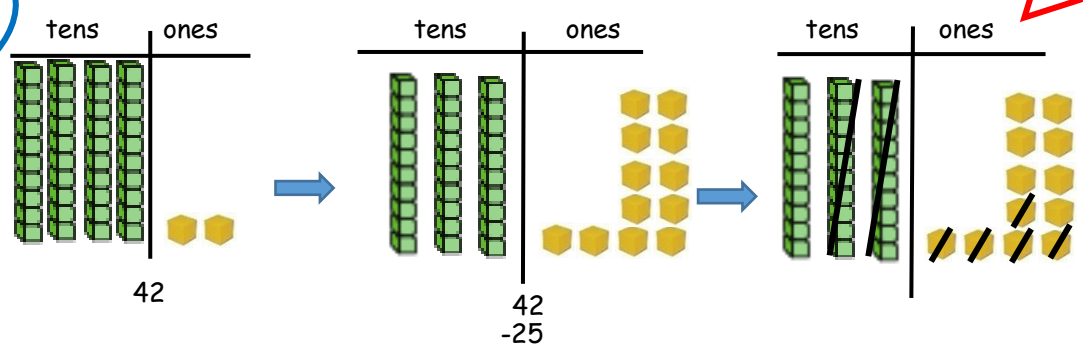
47-23=24 47-24=23

24+23=47 23+24=47

Phase 4 (When ones bridge 10) -Subtracting 2 two-digit numbers

What is 42-25?

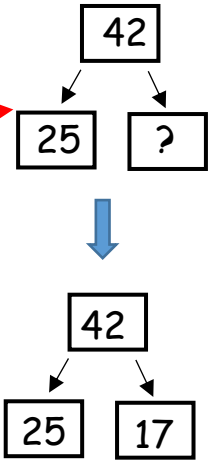
Stage 1



To **subtract** 25 I need to **take away** 2 **tens** and 5 **ones**.

There was only 2 ones so I couldn't subtract 5 ones. I had to **regroup** one ten to make 10 ones.

The **whole** is 42. I know that 42 **minus** 25 will be the missing part.

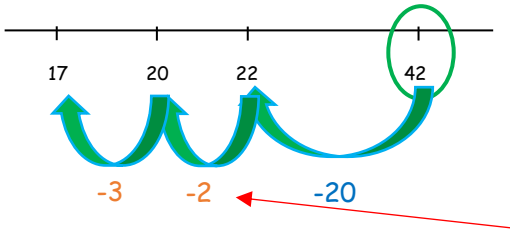


The **whole** is 42 and the **parts** are 25 and 17.

Record using whole part model.

Use base 10 to develop understanding of mathematical language.

Stage 2



Use a blank number line to support mathematical process.

Record using a number equation:

$42-25=42-20-5$

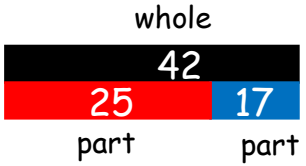
$22-5=17$

Note: When teaching children to bridge through 10. Children to subtract tens and then count back to the nearest 10, supporting mental maths strategy.

What is the missing part?

42- □ =17

Stage 3



Use a bar model to support mathematical reasoning.

Record as a fact family:

$25+17=42$ $17+25=42$

$42-17=25$ $42-25=17$

Number- multiplication and division

Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in a context.

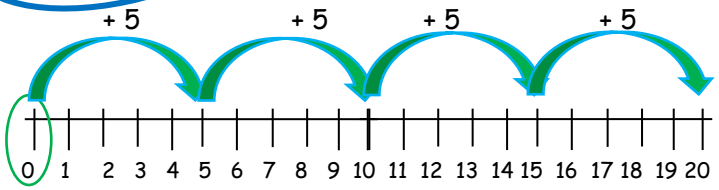
Show that multiplication of two numbers can be done in any order (commutative) and division of one number cannot.

Calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (x), division (÷) and equals (=) signs.

Multiplication

What are 4 lots of 5?

Stage 1

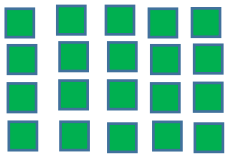


Use a number line to jump on in equal amounts (repeated addition) to develop mathematical process.

Record using equation:

$4 \times 5 = 20$

Stage 2



5 x 4= 20

4x 5= 20

Use an array alongside a beadstring to support mathematical process.

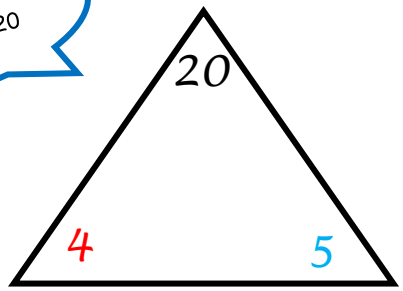
Record using an equation:

$5 \times 4 = 4+4+4+4+4 = \underline{20}$

$4 \times 5 = 5+5+5+5 = \underline{20}$

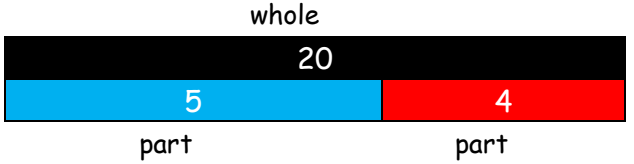
Stage 3

Complete this equation: 4 x _ = 20



I know that 5 lots of 4 equals 20 so 4 lots of 5 is equal to 20.

Record array using a trio alongside a bar model to support mathematical reasoning.



Record as a multiplication fact family:

$4 \times 5 = 20 \quad 5 \times 4 = 20$

I have noticed that you can multiply either **part** and you always total the **whole**.

Recall and use multiplication facts for the 2,5 and 10 multiplication tables.

Use a hundred square to investigate place value and number patterns developing children's mathematical reasoning.

Counting on in 2s

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Counting on in 5s

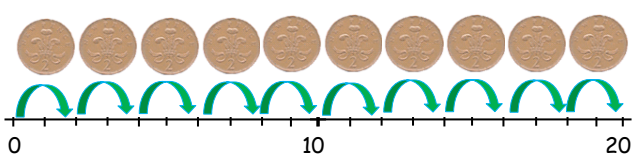
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

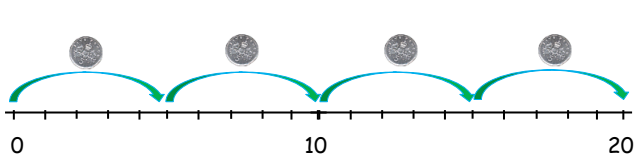
Counting on in 10s

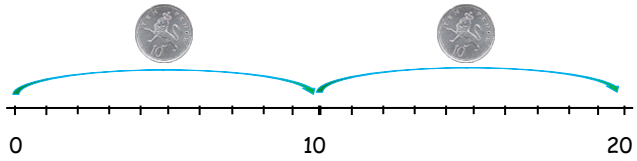
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

I have noticed that when I counted on in 2s the **ones digit** stays the same and the **tens digit** increase **ten more** each time.

Use a number line to support mathematical process and support problem solving.







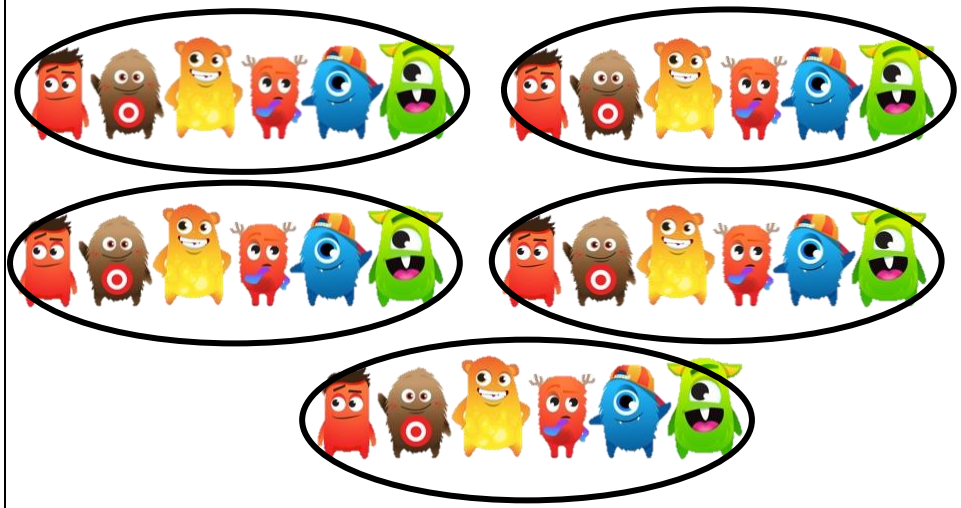
If I had 10 2ps how much money would I have **altogether?**

Division

There are 30 toys packed into 5 boxes. How many toys are in each box?

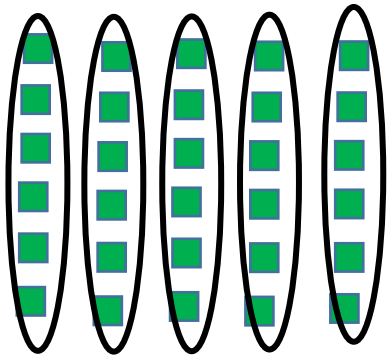
I have **shared** 30 toys into 5 boxes and there are 6 toys in each box.

Stage 1



Use objects to share evenly into groups to develop understanding of mathematical language.

Record as an array:



I have noticed that you always have to **divide** the **parts** by the **whole**.

Denominator

The number of groups that the objects are to be shared by.

Numerator

The total number of objects in the set.

$30 \div 6 = 5$

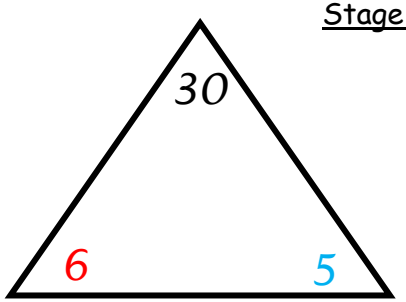
Stage 2

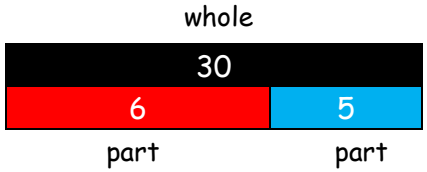
Use a beadstring to group in equal amounts to develop mathematical process.

Record as an equation:

$30 \div 6 = 5$

Stage 3





Use a trio alongside a bar model to develop mathematical reasoning.

$30 \div 5 = 6$ $\quad 30 \div 6 = 5$

$6 \times 5 = 30$ $\quad 5 \times 6 = 30$

Fractions

Recognise, find, name and write fractions 1/2, 1/4, 2/4 and 3/4 of a length, shape, set of objects or quantity.
Write simple fractions for example, 1/2 of 6=3 and recognise the equivalence of 2/4 and 1/2.

Stage 1

Each **part** is a **half** of the **whole**.

whole

part part

Each **part** is a **quarter** of the **whole**.

whole

part part part part

Two **quarters** is the **same as a half**.

Use a bar model to develop mathematical process and reasoning.

Record as a fraction.

Stage 2

What is greater 1/3 or 1/4?

whole

part part part part

David bought some apples. David ate 9 apples and had 3 left over. What fraction of the bag of apples did David eat?

whole

part part part

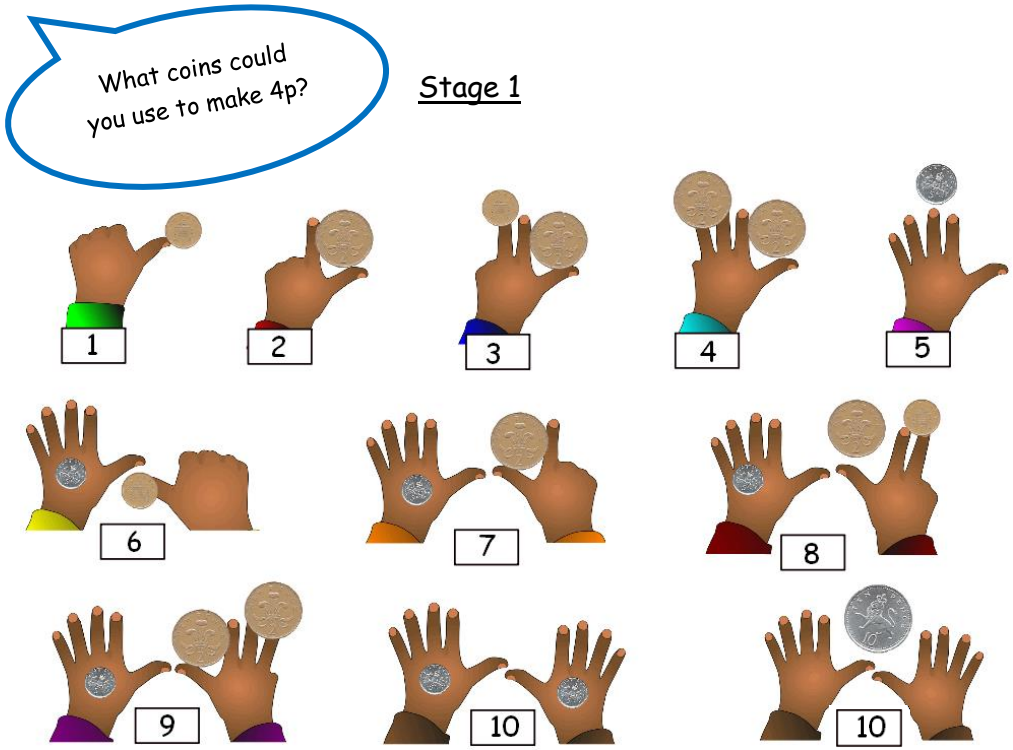
Use a bar model to develop mathematical reasoning.

Record as a fraction equation.

1/3 is greater than 1/4.

Measurements

Recognise and use symbols for pounds (£) and pence (p); combine amounts to make particular amounts.
Find different combinations of coins that equal the same amount of money.



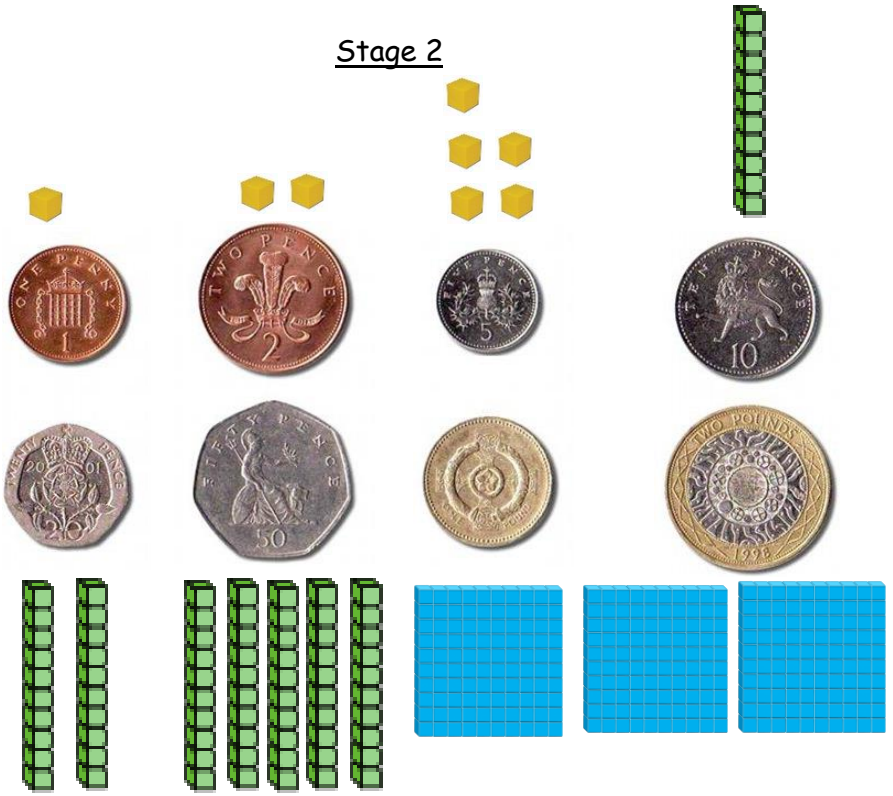
Use money hands visual for coins up to 10p alongside adapted Numicon tiles to develop understanding of coin value and support finding equivalent values.

Record using an equation:

$4p = 2p+2p$

$4p = 2p+1p+1p$

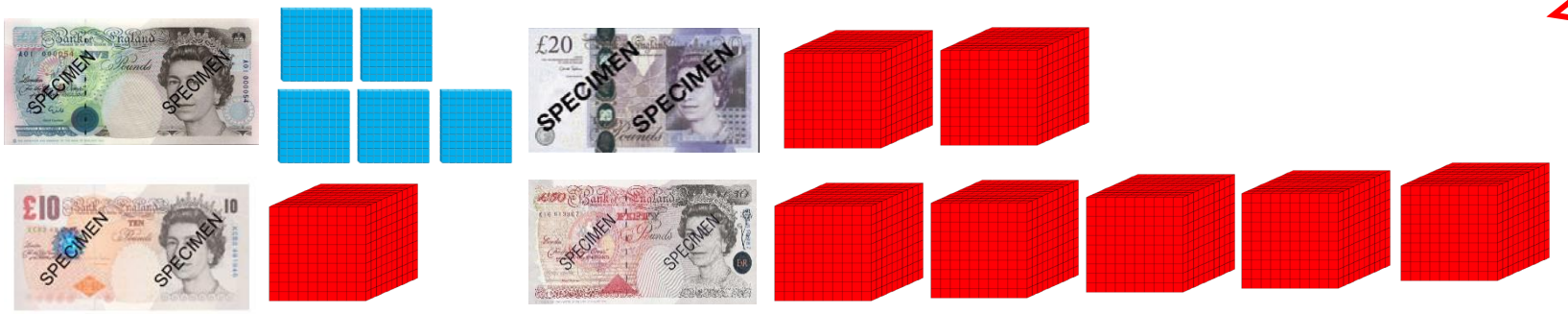
$4p = 1p+1p+1p+1p$



Use base 10 to develop mathematical reasoning, language and to support finding equivalent values.

Record as an equation.

Stage 3



£5 has a **value** of **5 lots of 100** that is 500.

A £5 note has the same **value** of 5 £1 coins because a £1 coin has a value of 100.

Using base 10 to develop understanding of monetary value and equivalance to further develop mathematical reasoning and language.

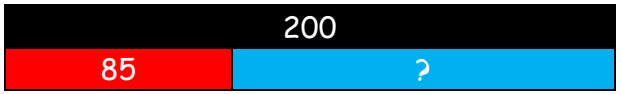
Stage 4

Adam uses a £2 coin to buy a drink which costs 85p. He is given four coins in change. What coins could he have been given back?

The whole is 200p and the parts are 85p and ?p

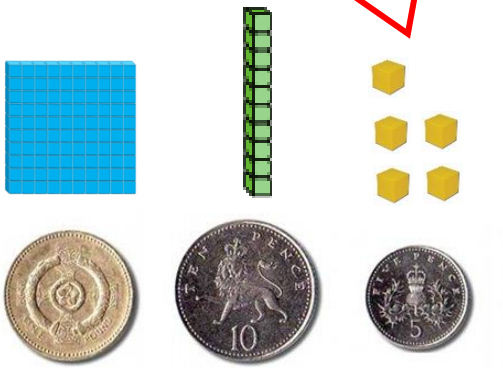
£2 has a **value** of **2 lots of 100** that is 200.

Adam could get a £1, 10p and a 5p coin as his change.



$$200 - 85 = 115$$

The missing **part** is 115. So Adam gets 115p change.



Use a bar model alongside base 10 to develop mathematical reasoning.