Progression through Calculations at Meadow Lane Infant School

Guidance for the teaching of Mathematics

Introduction

At Meadow Lane Infant School we know that mathematics is important in everyday life for shopping, cooking, measuring and DIY jobs etc. Through our mathematics lessons, we hope to give children the knowledge and skills to tackle everyday problems with confidence. We also aim to develop children's curiosity of how numbers work and fuel their enthusiasm for mathematics.

This policy exemplifies a recommended progression through the four numerical operations, beginning when methods are first introduced to children in the Foundation Stage and continuing on through KS1.

Children first begin to record on paper in the foundation stage, making marks to communicate their mathematical ideas. These recordings are valued by staff as an integral part of mathematical development. In order to begin to understand mathematics and in particular calculation children will first need to experience mathematics practically. This is therefore the emphasis in this policy in the earlier stages. During this time the children are introduced to using the mathematical symbols +, - and = and pictures to record calculations.

As children's practical maths skills grow they begin to develop their understanding of the concept of number and calculation in a more abstract form, using mental strategies, as well as apparatus such as hundred squares and number lines to solve problems. Children now begin to start recording on paper, in order to support new and existing practical and mental strategies. As they progress, the emphasis should move towards explaining mental strategies and ultimately towards developing written methods.

It is important to encourage children to first look at the problem and then to quickly identify an appropriate method to use to help solve the task, including pictures, mental calculation with or without jottings, structured recording or by using a calculator.

Understanding mathematical vocabulary is a crucial part of developing mathematical understanding. Children should be presented with calculations using a wide range of vocabulary.

In the following pages we have included some examples of calculations to aid the teaching of calculation in the classroom. The operations are detailed separately and are presented in 'stages'. In the earlier stages these are very much a progression of skills, for example a child should not be expected to add two numbers together until they have experienced practically combining two groups of objects. However, as the children move into the later stages it may be more appropriate for them to be able to use a variety of strategies and greater emphasis will be placed on enabling them to choose an appropriate method for a particular problem. It is important that children are confident with the strategies in each stage to enable this progression; so as a result, it is likely that there will be children at different stages of learning in a particular class or group.

This policy is intended to be used to aid the teaching of calculation skills and should be viewed in conjunction with the mathematics policy. It is important that calculation skills are taught within a varied and exciting maths curriculum which allows children to use them in a variety of contexts, such as problem solving, money, units of measurement, time, capacity and mass.

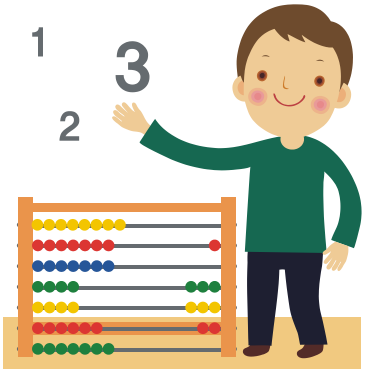
This policy is the first part of a joint calculations policy with College House and will continue with the children as they move on.

Aims

- To ensure a consistent approach to the teaching of calculation methods to enhance children's progression and understanding.

- To provide a step by step progression ladder for calculation methods that all members of staff are comfortable teaching and to ensure consistency through the schools.

- To provide children with an efficient, reliable, compact written method of calculation for each operation that they can apply with confidence when undertaking calculations that they cannot carry out mentally.



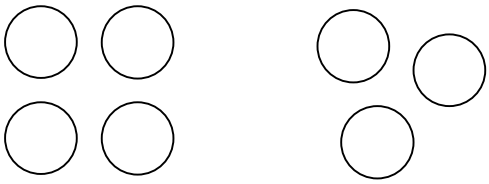
Methods for Addition

*** It is important for children to see the relationship between addition and subtraction from as early as possible. This should be integrated alongside the following strategies throughout the different stages. (See separate page on INVERSES)**

Stage 1

- Counting out loud in 1s, 10s, 2s, 5s
- Singing nursery rhymes
- Counting real objects
- Number recognition
- Recognising small quantities
- Combining 2 groups and being given the opportunity to relate this to written maths.

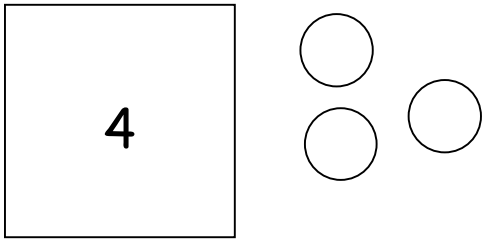
E.g.



4 + 3 = 7

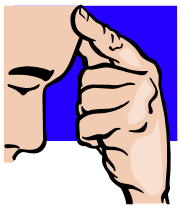
- Then cover one group of objects and replace with the number to show that you don't need to start from one every time.
-

E.g.



4 + 3 = 7

- Putting the biggest number in head and counting on using fingers (adding less than 10)



4 + 3 = 7

- Calculating 1 more or 1 less than given numbers using counters and on a number line.
- Addition facts to five, including number bonds to five.

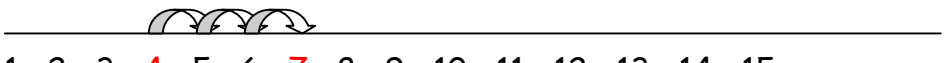
E.g. 1+1=2, 1+2=3, 1+3=4, 1+4=5

- Introduction to number lines and hundred squares – using them to count and find numbers.

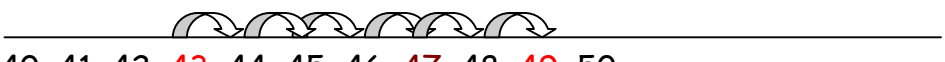
Stage 2

- Counting on by single digits using a number line (without bridging through ten)

E.g. 4 + 3 = 7 Start at 4 and count on 3



43 + 6 = 49 Start at 43 and count on 6



- Using a hundred square to add and take 1s and 10s

34 + 3 = 37

42 + 10 = 52

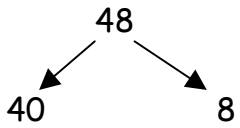
76 – 3 = 73

59 - 10 = 49

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

- Number facts to 10, including number bonds to 10.
- Doubling numbers from 1 to 10.
- Counting on in 10s from any number E.g. 23, 33, 43, 53
- Partitioning 2 digit numbers

E.g.



Stage 3

- Addition of 2 digit numbers using a hundred square

43 + 17 = 60

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

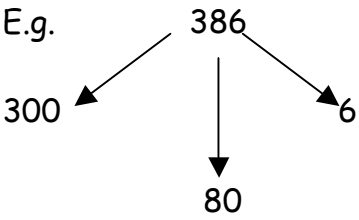
- Number facts to 20, including number bonds to 20.
- Multiples of 10 bonds to 100

E.g. 20 + 80 = 100 10 + 90 = 100 30 + 70 = 100

- Doubles of numbers to 20

- Partitioning to 100 and then 1000

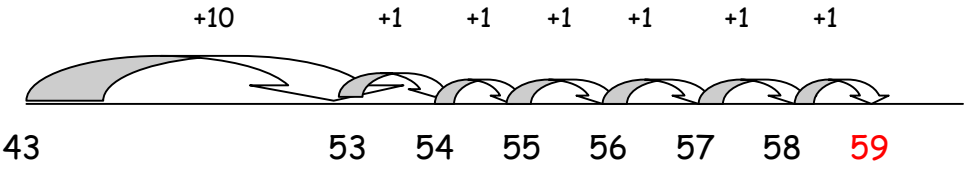
E.g.



Include examples where 0 is a place holder e.g. 207

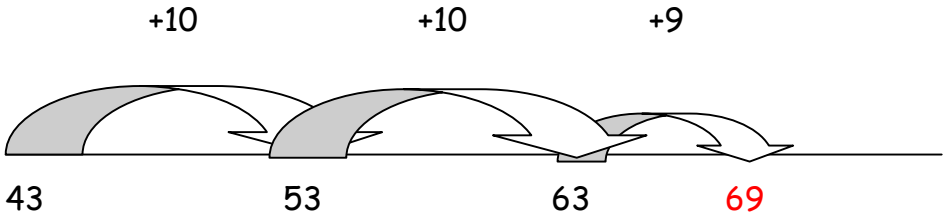
- Using a blank number line counting on in tens and ones:

43 + 16 = 59



……..then in tens and units

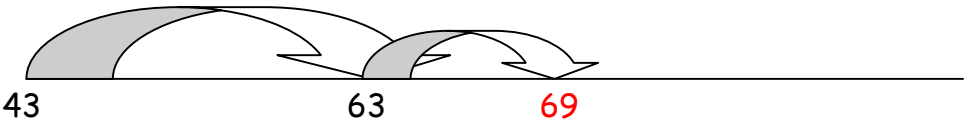
43 + 26 = 69



……..then tens in one jump and units in one jump (using multiples of 10)

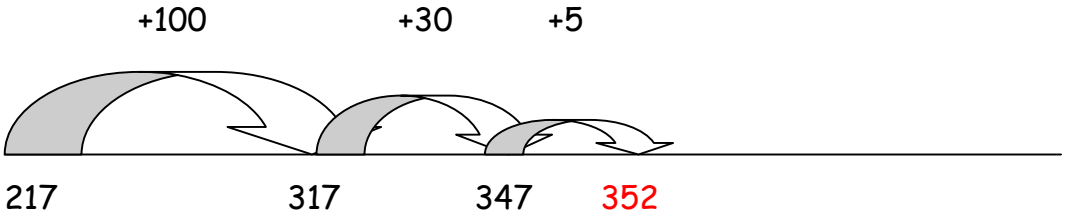
43 + 26 = 69

+20 +9



- Leading to bridging through ten and using increasingly larger numbers (reinforcing largest number first regardless of calculation order):

135 + 217 = 352



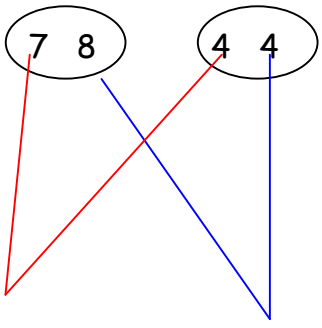
- Number bonds to 100

E.g. 34 + 66 = 100 54 + 46 = 100 28 + 72 = 100

Stage 4

- Partitioning to support addition

78 + 44 = 122



70 + 40 = 110 8 + 4 = 12

110 + 12 = 122

- Using known number facts to support addition

Methods for Subtraction

*** It is important for children to see the relationship between subtraction and addition from as early as possible. This should be integrated alongside the following strategies throughout the different stages. (See separate page on INVERSES)**

Stage 1

- Counting backwards out loud in 1s, 10s and 2s
- Singing nursery rhymes which develop counting on and back
- Taking away real objects from a group and counting those left
- Becoming familiar with the – and = symbols in a number sentence.

E.g. 8 – 3 = 5

- Talking about the differencing between two groups of objects including questions about how many more.
- Putting the biggest number in head and counting back using fingers (taking less than 10)

8 - 3 = 5

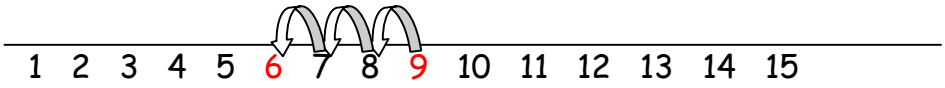
- Find one less than a given number using objects or a number line.
- Subtraction facts to 5

E.g. 5-1=4, 5-2=3, 5-3=2, 5-4=1, 5-1=0

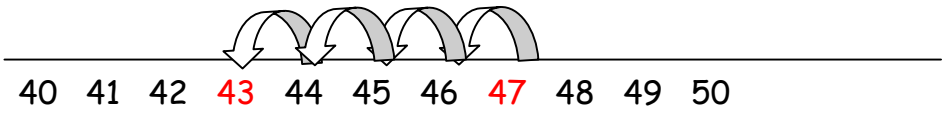
Stage 2

- Counting back in single digits using a number line (without bridging through 10)

E.g. 9 – 3 = 6 Start at 9 and count back 3



47 – 4 = 43



- Counting backwards out loud in 10s from any number
- Subtraction facts to 10
- Halves to 20
- Using a hundred square to count back in 1s or 10s

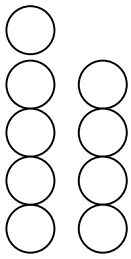
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

37 – 3 = 34
76 – 3 = 73

52 – 10 = 42
59 – 10 = 49

- Alongside these strategies, children will also be introduced to 'finding the difference' through arrays. This will allow them to begin to see the relationship between subtraction and addition.

E.g.



Questions may be asked such as, how many *more* circles are on the left than the right? **or** how many less circles are on the right than the left?

5 – 4 = 1
4 + 1 = 5

Stage 3

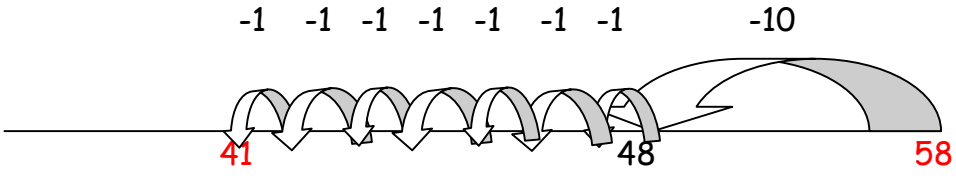
- Subtraction of 2 digit numbers on a hundred square using partitioning. E.g. 14 would go up 1 square (-10) and back 4 squares (-4)

59 – 14 = 45

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

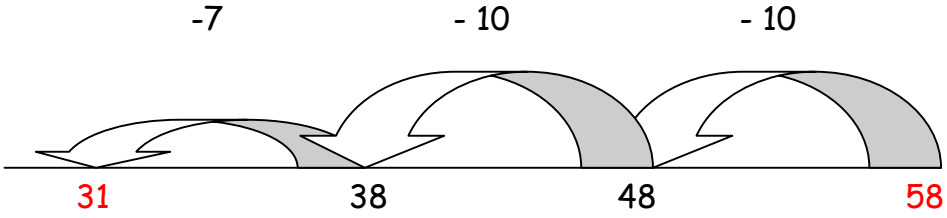
- Using a blank number line to count back in tens and ones.

53 – 17 = 41



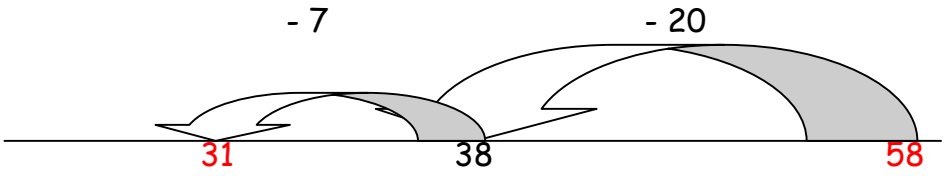
……..then in tens and units

58 – 27 = 31



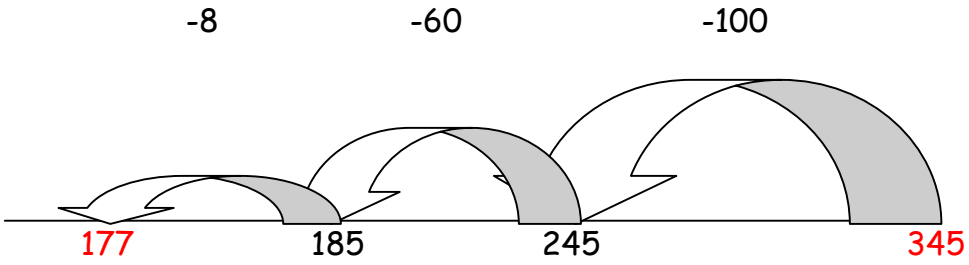
……..then tens in one jump and units in one jump (using multiples of 10)

58 – 27 = 31



- Leading to bridging through ten and using increasingly larger numbers:

345 – 168 = 177



- Using a hundred square to find differences, answer how many more/fewer/less questions.

E.g.

How many more is 25 than 19?

19 + 6 = 25
25 – 6 = 19

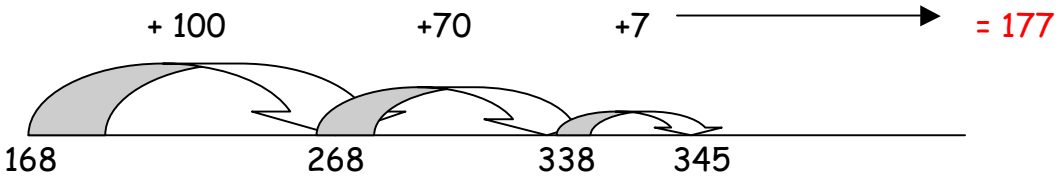
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Stage 4

As children progress to larger numbers and their understanding of the link between 'subtraction' and 'difference' is more secure, they should be developing the idea of difference and using an empty number line to count on from the smaller number.

- First in tens and ones as before, then by counting on the tens and units in larger jumps until they are confident with increasingly larger numbers (using multiples of tens).

345 – 168 = 177

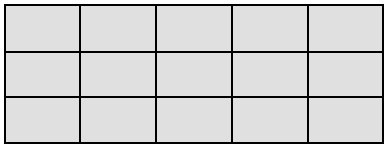


Methods for Multiplication

*** It is important for children to see the relationship between multiplication and division from as early as possible. This should be integrated alongside the following strategies throughout the different stages. (See separate page on INVERSES)**

Stage 1

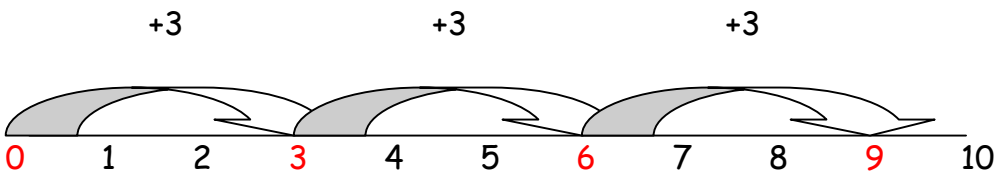
- Putting objects into equal groups or sets
- Counting in 2s, 5s and 10s out loud
- Doubling numbers to 10
- Making rectangular arrays in play. E.g. using peg boards or blocks



Stage 2

- Doubling numbers to 20
- Recognising and devising numbers that are multiples of 2, 5 and 10 (E.g. even numbers are multiples of 2, numbers ending in a 5 or 0 are multiples of 5 and numbers ending in 0 are multiples of 10)
- Using a number line to count on in equal steps, introducing the link with repeated addition to multiplication.

Jumps of 3 = 0, 3, 6, 9



Show the link to repeated addition:

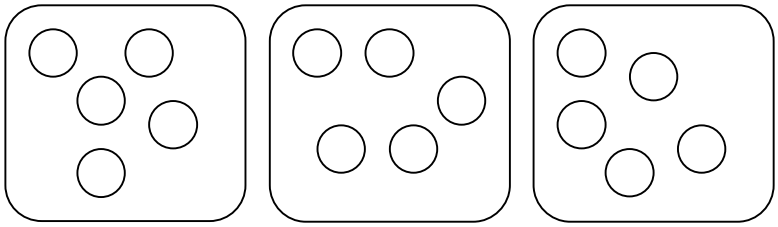
3 + 3 + 3 = 9 and 3 x 3 = 9 (3 lots of/groups of 3 = 9)

- Introduced to the x symbol in number sentences as meaning 'times' or lots of/groups of

Stage 3

- Link counting in 2s, 5s, 10s etc to repeatedly adding real objects.
- Using pictorial representations and real objects such as counters and cubes to solve problems

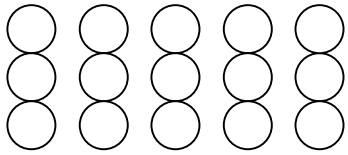
3 x 5 = 15



5 + 5 + 5 = 15

…..leading to arrays:

3 x 5 = 15



3 rows of 5 (3 x 5)

5 columns of 3 (5 x 3)

* Here children can begin to see the commutability of multiplication

- Include using square arrays ready for introduction to square numbers in Key Stage 2.
- Using a hundred square to find multiples and see patterns (Counting in 2s, 5s and 10s, extending to 3s and 4s then 6s and 7s.

Multiples of 10

Multiples of 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

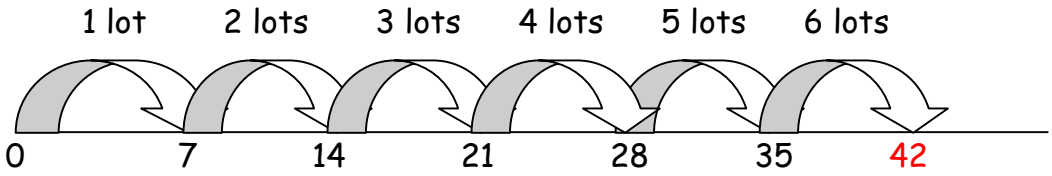
- Using a hundred square to solve calculations. (Counting on in regular steps)

4 x 5 = 20

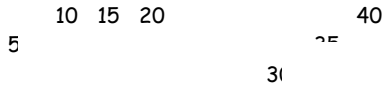
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

- Leading to relating the use of the number square to the number line

6 x 7 = 42



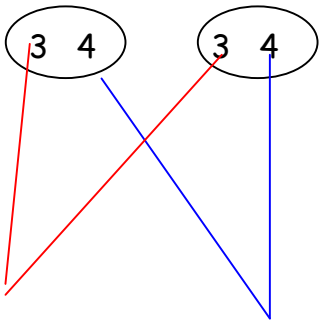
- Alongside these strategies, children will be asked questions such as, 'how many 5s are in 40?' using fingers to help count the 'lots'.



- Learn to count in 3s and 4s and use this to derive the answers to multiplication calculations such as 6 x 4 = 24.
- Emphasise multiplying by ten, linking it to place value. Avoid using the term 'add a zero'.

- Using place value to calculate doubles to 100

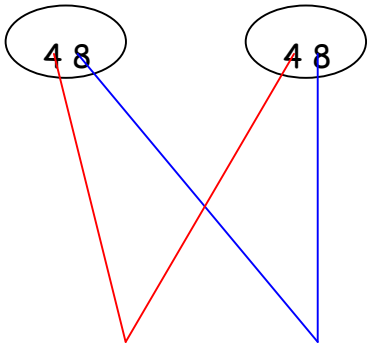
E.g. Double 34 = 68



30 + 30 = 60 4 + 4 = 8

60 + 8 = 68

Double 48 = 96



40 + 40 = 80 8 + 8 = 16

80 + 16 = 96

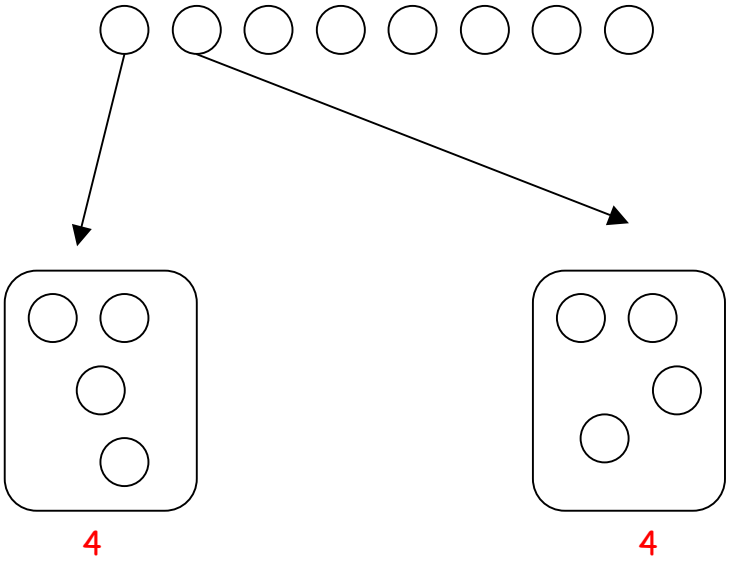
Methods for Division

- **It is important for children to see the relationship between division and multiplication from as early as possible. This should be integrated alongside the following strategies throughout the different stages. (See separate page on INVERSES)**

Stage 1

- Repeated subtraction stories, demonstrating with real objects.
- Sharing objects equally into groups

E.g. One for me, one for you, one for me, one for you etc



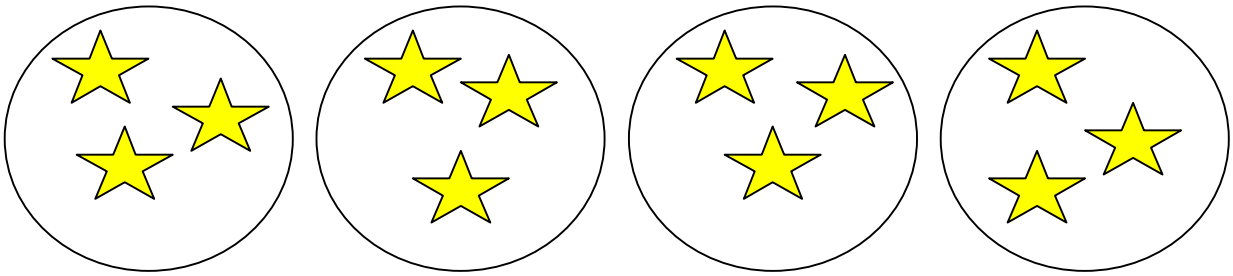
Stage 2

- Finding halves of even numbers to 20
- Using clock faces to help understanding of halves E.g. half past
- Using halves in other contexts such as making half turns.
- Repeated taking away.

E.g. 20 – 5 = 15
15 – 5 = 10
10 – 5 = 5
5 – 5 = 0

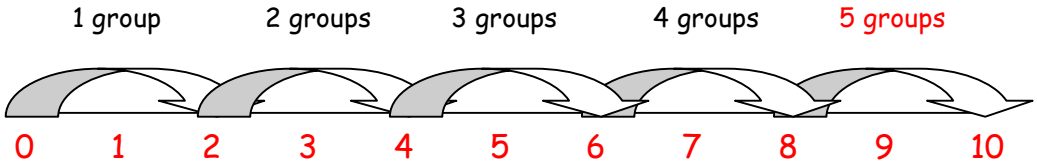
- Using pictorial representations to solve problems

E.g. Share 12 star stickers equally between 4 children



- Using a number line to count on:

How many 2s are there in 10? Answer: 5



- Using times table to help solve problems:

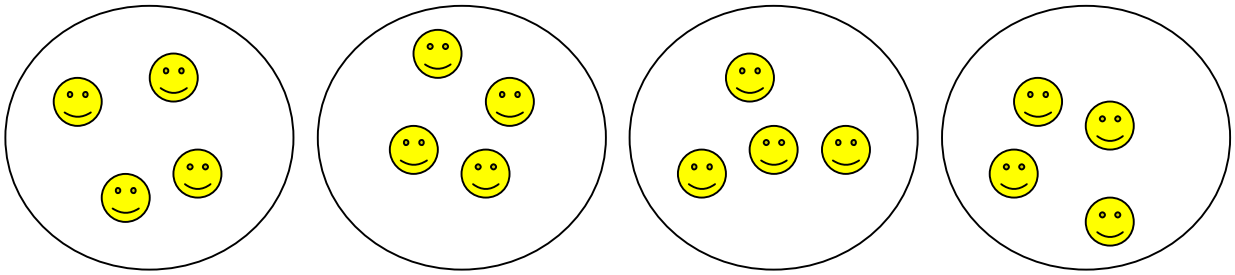
Children will be asked questions like how many 10s in 40? Where they could use their fingers to assist with the calculation

E.g.

This will be extended to counting in 5s and 2s, then 3s and 4s as the children become more confident.

- Finding quarters of numbers by putting objects into equal groups…..

What is one quarter of 16? Answer: 4



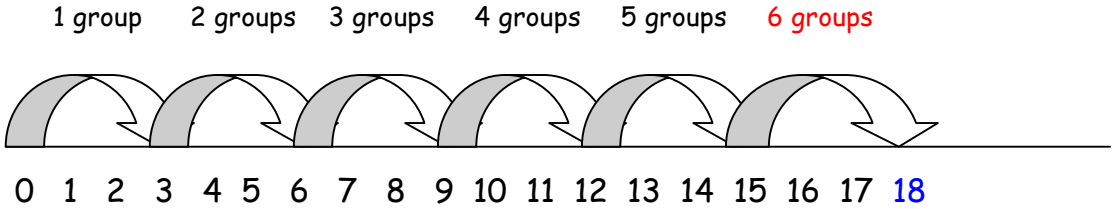
……or by halving, then halving again

E.g. One quarter of 16 = 4

$\frac{1}{2}$ of 16 = 8
$\frac{1}{2}$ of 8 = 4

- Children are introduced to the ÷ symbol as meaning divide or 'shared equally between' or 'shared by'

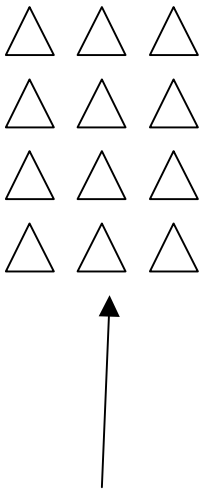
What is 18 shared by 3? ⟶ 18 ÷ 3 = 6



- Learning simple division facts e.g. how many 2s 5s or 10s in a given number

Stage 3

- Using arrays to show the reversibility of division



12 ÷ 4 = 3

(12 shared between 4 rows)

12 ÷ 3 = 4

(12 shared between 3 columns)

- Halving multiples of 10 and 100 using knowledge of place value

E.g. half of 80 = 40 half of 400 = 200

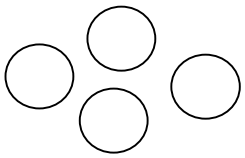
Inverse Operations

Understanding inverse operations allows children to have an alternative method of checking their answers to calculations, without the need of a calculator.

Stage 1

- Using counters and pictures etc to show inverse.

E.g.



4 counters

I hide 3.
1 is left.

Stage 2

- Knowing the opposite operations

E.g. + and -
x and ÷

- Completing missing number sentences

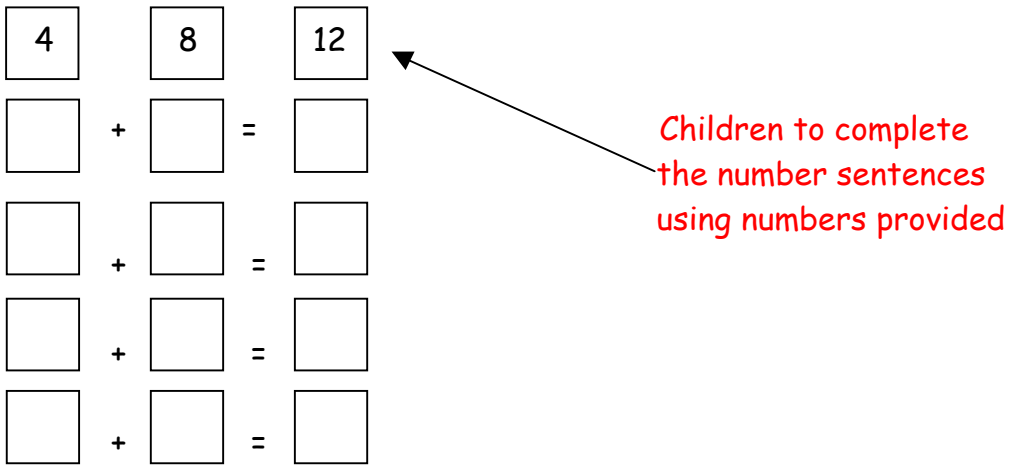
2 + Δ = 10
Δ + 5 = 10

Stage 3

- Recognising the relationship between addition/subtraction and multiplication/division within number sentences

6 + 4 = 10	2 x 5 = 10
4 + 6 = 10	5 x 2 = 10
10 – 6 = 4	10 ÷ 5 = 2
10 – 4 = 6	10 ÷ 2 = 5

- Applying this knowledge to blank number sentences



Stage 4

- Completing more complex missing number sentences

7 x 10 = Δ + 20
70 = Δ + 20
(Inverse) 70 – 20 = Δ
50 = Δ

So… 7 x 10 = 50 + 20

2 + 10 = 12 = 5 + Δ

$$12 = 12 = 5 + \Delta$$
$$\text{(Inverse)} \quad 12 - 5 = \Delta$$
$$7 = \Delta$$

So… $2 + 10 = 12 = 5 +$

Stage 4 and beyond

- Children to use their understanding of inverses in daily lessons and different contexts to check answers

E.g. £5.25 x 4 = £10.00 INVERSE ⟶ £10.00 ÷ 4 = £5.25