Deanery C.E. Primary School

Maths Policy

October 2010

Introduction

This document outlines the teaching, organisation and management of the mathematics taught and learnt at Deanery Primary School.

The school's policy for mathematics is based on the document **'The New Primary Framework for Mathematics'** from Reception to Year 6.' The document has been drawn up as a result of staff discussion and has the full agreement of the Governing Body. The implementation of this document is the responsibility of all the teaching staff.

Rationale

The teaching of mathematics is underpinned by the principles of 'Every Child Matters' and the Christian ethos distinctive to our school. Mathematics equips pupils with a uniquely powerful set of tools to understand and change the world. These tools include logical reasoning, problem solving skills, and the ability to think in abstract ways. Mathematics is important in everyday life, many forms of employment, science and technology, medicine, the economy, the environment and development, and in public decision-making. The subject transcends cultural boundaries and its importance is universally recognised. Mathematics is a creative discipline. It can and does stimulate moments of pleasure and wonder when a pupil solves a problem for the first time, discovers a more elegant solution to that problem, or suddenly sees hidden connections or patterns. We at the Deanery strive for this passion in maths.

Purposes

To fulfil the requirements of National Curriculum Programmes of Study and Attainment Targets for Mathematics

- To incorporate the strategies suggested in the **New primary framework.**
- To ensure new and existing staff follow a collegiate approach to Mathematics**.**
- To provide simple, documented statements to inform new staff, parents, governors and the community in general.
- To ensure that statutory requirements are met.

Teaching Mathematics in K.S. 1 and 2
At the Deanery we aim to teach Numeracy by:~

- Ensuring a 3 part lesson
- Using appropriate, varied and interesting resources
- Sharing the objectives with the children
- Giving a context in which the maths will be useful
- Following the **New Primary Framework**
- Using adults to support children in the classroom appropriately
- Occasionally using games
- Encouraging the children to talk mathematically to each other
- Using correct and extensive vocabulary
- Having extension material ready for children who have finished
- Stretching and challenging children
- Adapting planning as the week progresses as necessary
- Sharing children's strategies to get the same answer
- Using I.C.T. appropriately
- Differentiating
- Giving homework which links to the work in class
- Marking constructively

Teaching time
To provide adequate time for developing numeracy skills each class teacher will provide a daily mathematics lesson. This may vary in length but will usually last for about 45 minutes in Key Stage 1 and 50 to 60 minutes in Key Stage 2. Cross-curricular links will also be made to mathematics within other subjects so pupils can develop and apply their mathematical skills.

School & Class Organisation
From Year 1, all pupils will have a dedicated daily mathematics lesson. Within these lessons there will be a good balance between whole-class work, group teaching and individual practice. Teachers within a year group may choose to set children from year 2 onwards.

A typical lesson

A typical 45 to 60 minute lesson in Year 1 to 6 will be structured like this:

- Oral work and mental calculation (about 5 to 10 minutes)
  This will involve whole-class work to rehearse, sharpen and develop mental and oral skills.
- The main teaching activity (about 30 to 40 minutes)
  This will include both teaching input and pupil activities and a balance between whole class, grouped, paired and individual work.
- A plenary (about 10 to 15 minutes)

This will involve work with the whole class to sort out misconceptions, identify progress, to summarise key facts and ideas and what to remember, to make links to other work and to discuss next steps.

At the start of each lesson the teacher must explain and share with the children, "What I am looking for," (W.I.L.F.) and why-,"This is because," (T.I.B.)

Out-of-class work and homework
The daily mathematics lessons will provide opportunities for children to practice and consolidate their skills and knowledge, to develop and extend their techniques and strategies, and to prepare for their future learning. These will be extended through out-of-class activities or homework. The main homework scheme will be 'Headstart', a scheme written and devised by the maths subject leader to inform parents and to practise what has been learnt in a fun way. These activities will be short, focused and differentiated through suggested extension work and will relate to work already covered in class. (*In years 2 and 6 teachers may also want to send home S.A.T.s type questions in preparation for their tests*).

How we cater for pupils who are more able
Where possible more able pupils will be taught within their group or class and stretched through differentiated group work and extra challenges. When working with the whole class, teachers will direct some questions towards the more able to maintain their involvement. Very occasionally special arrangements will be made for an exceptionally gifted pupil e.g. they may be taught with children from a higher age range or may follow an individualised programme with more challenging problems to tackle. This should include investigations at their level and not merely work from the next level up, although inevitably they will on occasion need work from a higher level.

When a child is working at above level 6 it may be appropriate to seek the advice of Secondary schools. We have links with feeder/local Secondary Schools. The School has joined the Primary Maths Challenge to motivate more able children.

Pupils with special educational needs and individual education plans
Teachers will aim to include all pupils fully in their daily mathematics lessons. All children benefit from the emphasis on oral and mental work and participating in watching and listening to other children demonstrating and explaining their methods. The teacher, to meet the needs of a range of learners, can vary questions. However a pupil whose difficulties are severe or complex may need to be supported with an individualised programme in the main part of the lesson. The use of Springboard 3,4 and 5 is being used as suggested by the strategy.

Teaching Maths in the Foundation Stage
Mathematical development at the Foundation stage depends on confidence and competency in learning and using key skills.

Mathematical development includes counting, solving, matching, seeking patterns, making connections, recognising relationships and working with numbers, shapes, space and measures.

Mathematical understanding is developed through stories, songs, games and imaginative play, so that children enjoy using and experimenting with numbers, including numbers larger than 10.

Key skills include

- Using numbers as labels
- Counting
- Calculation
- Shapes space and measure

We encourage children's mathematical development through daily experiences in a rich and interesting environment promoting social skills and the development of mathematical language and understanding.

Resources

In each classroom you will find~
An appropriate number line
A number square
Counters
Deans equipment
Digit cards
An appropriate number display
In K.S.1, a display of key vocabulary
Abacus materials, which is the main published scheme, used by staff
In each shared area, you will find~
Larger equipment, such as weighing scales, trundle wheels etc.
Money
1000, 100, 10 and units cards etc.

TEACHERS WANTING ADDITIONAL OR NEW RESOURCES ARE ACTIVELY ENCOURAGED TO LET THE MATHS LEADER KNOW THEIR REQUESTS ON A REGULAR BASIS. REASONABLE REQUESTS WILL BE CATERED FOR.

Information and Communication Technology

ICT will be used in various ways to support teaching and motivate children's learning. ICT will involve the computer, calculators, and audio-visual aids. They will however only be used in a daily mathematics lesson when it is the most efficient and effective way of meeting the lesson objectives. The Abacus software is being used at present from years 1 to 6 and the interactive software has been bought in preparation for classes with interactive boards. The software is differentiated, but where a teacher feels a child/group of children are extremely bright or have specific difficulties, the year above or below software may be used. We have recently purchased Education city which is now accessible through the internet.

Assessment

Assessment will take place at three connected levels: short-term, medium-term and long-term. These assessments will be used to inform teaching in a continuous cycle of planning, teaching and assessment.

Short-term assessments will be an informal part of every lesson to check their understanding and give a teacher information, which will help them to adjust day-to-day lesson plans.

Medium-term assessments will take place in the two 'assess and review' lessons timetabled each half term and will assess some of the ideas linked the key objectives that have been covered during the half term. The outcomes will be recorded on a class record sheet of key objectives.

Target setting

Long-term assessments will take place towards the end of the school year to assess and review pupils' progress and attainment. These will be made through compulsory National Curriculum mathematics tests for pupils in Years 2 and 6 and supplemented by the optional QCA tests. Teachers will also draw upon their class record of attainment against tracking data and supplementary notes and knowledge about their class to produce a summative record. Accurate information will then be reported to parents and the child's next teacher. Teachers will also be given an analysis of SATs for year 2 and 6 and the QCA optional tests to target areas of need within each particular year group, to be taught during the following academic year.
From January 2005 the breakdown of maths levels will be stuck in the front of maths books. Teachers will highlight each strand as they feel children have shown a grasp of each concept. This information is shared with children and parents. A record of each child's tracking level will be sent to the assessment coordinator each half term and a copy kept by the class teacher in the year group assessment folder to inform future planning.

Children will have individual targets in the back of their maths books that they have identified with their class teacher. The progress of these targets will be kept on a display within the year group and in the back of the children's books. When the child achieves their target it is recorded and dated by the teacher.

Planning of Mathematics

Any format of planning is acceptable providing it details the following:~

- Mental/oral starter
- Main objective/introduction to the lesson
- Differentiated work outlined
- A plenary
- Resources to be used
- Vocabulary to be learnt or revised
- Identify teaching block e.g. Block A

At present it is a mixture of DFES/Hamilton and own planning.

Management of Mathematics

Role of the Maths Leader

- Ensure teachers are familiar with the Framework and school policy
- To support and enable staff to deliver school policy in mathematics
- To provide teachers with a written calculations policy for each teaching stage (Appendix 1 Page 9), for mental and written strategies for addition (Appendix 2 Pages 10-15), subtraction (Appendix 3 Pages 16-24), multiplication (appendix 4 Pages 25-35) and division (Appendix 5 Pages 36-44) Lead by example in the way they teach in their own classroom
- Prepare, organise and lead INSET, with the support of the Head teacher
- Work co-operatively with the SENCO

- Monitor Maths in school by carrying out regular book trawls, observing lessons and ensuring planning moves learning forward in line with the SDP.
- Attend INSET to keep knowledge and skills current and up-to-date.
- Inform parents
- Discuss regularly with the head teacher and the numeracy governor the progress of mathematics in the school.
- Manage a budget
- Audit test results
- Target and arrange support for children who may need specific help
- Analyse S.A.T.s papers to establish weaker areas, gender abilities etc.
- Track pupils to ensure children are reaching their target.
- Order resources
- Role of the Head teacher
- With the Numeracy governor, keep the governing body informed about the progress of mathematics
- Ensure that mathematics remains a high profile in the school's development plan
- Deploy support staff to maximise support for mathematics
- Support the maths leader in the management and leading of mathematics through the school
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Presentation of Mathematics
This is in line with our 'Presentation Policy'.

Marking of Mathematics
This is in line with our 'Marking policy'.

Extra time for Problem Solving
We have invested in the LCP problem solving scheme by M. Wilkinson, as an initial response to S.A.T.s analysis. Each teacher delivers an additional Maths lesson based on solving problems lasting approximately ½ hour. This is over and above the 5 Maths lessons each week.

Moving Forward
The '99' club has been developed to encourage children to sharpen their mental maths skills. This will be held half-termly and children gaining 100% will be awarded certificates/badges in School Awards Assembly at the end of the half term. Precision teaching of maths skills will be introduced to develop the mental skills of some children. A copy of the skills that each child needs to work on will be sent home for the parents so that they are aware of the areas in need of development. Then parents and children can work on them together to develop their mathematical understanding.

Conclusion

Essentially any Maths lesson should move the child's knowledge and understanding on, in a lively, interactive, differentiated and fun way.

Policy written by Sue Youngman — March 2005
Reviewed by David Sawyer — October 2010

Presented to the Governing Body — November 2010

……..(signature)

Appendix 1

Progression through Calculations Policy Guidance Document

Rationale: To guide all teaching staff at the Deanery CE Primary School through the 'Progression through Calculations' policy for mathematics.

Purpose: To enable all teaching staff to be aware of the teaching strategies, mental and written, at each stage of a pupil's mathematical development for addition, subtraction, multiplication and division.

This guidance document has been developed for the Deanery CE Primary School in collaboration with all the teaching staff. The policy exemplifies a structured progression through the four operations, starting at stage 1 and carrying through to stage 6, including a selection of mental and written strategies.

Although the focus of the policy is on pencil and paper procedures it is important to recognise that the ability to calculate mentally lies at the heart of the New Primary Frameworks for mathematics. The mental methods in the Primary Framework for teaching mathematics will be taught systematically from Reception onwards and pupils will be given regular opportunities to develop the necessary skills.

It is important to remember that, in every written method there is an element of mental processing. Sharing written methods with the teacher encourages children to think about the mental strategies that underpin them and to develop new ideas. Therefore written recording both helps children to clarify their thinking and supports and extends the development of more fluent and sophisticated mental strategies.

This policy does restrict teachers to a particular selection of strategies for each specific year group, but allows teachers the flexibility to take children on to the next stage of their written mathematical development. It also allows teachers, where needs arise through assessment, to move back a stage to secure a strategy so that the child is ready to move on with confidence towards the most efficient strategy for each operation.

Children will be allowed to work through the school's agreed progression in order that they know and understand the most suitable standard method for each numerical operation. For the majority at the end of year 6, children would know and understand a compact method for each of the four number operations.

It is important that procedures are in place to ensure that all staff are aware of the progression through calculations, and that children are being taught appropriate methods for their age and ability, which are in line with the agreed policy.

Appendix 2 (Pages 10 - 15)

PROGRESSION THROUGH CALCULATIONS FOR ADDITION

MENTAL CALCULATIONS

(ongoing)

These are a **selection** of mental calculation strategies:

See NNS Framework Section 5, pages 30-41 and Section 6, pages 40-47

Mental recall of number bonds

6 + 4 = 10 □ + 3 = 10

25 + 75 = 100 19 + □ = 20

Use near doubles

6 + 7 = double 6 + 1 = 13

Addition using partitioning and recombining

34 + 45 = (30 + 40) + (4 + 5) = 79

Counting on or back in repeated steps of 1, 10, 100, 1000

86 + 57 = 143 (by counting on in tens and then in ones)

460 - 300 = 160 (by counting back in hundreds)

Add the nearest multiple of 10, 100 and 1000 and adjust

24 + 19 = 24 + 20 – 1 = 43

458 + 71 = 458 + 70 + 1 = 529

Use the relationship between addition and subtraction

36 + 19 = 55 19 + 36 = 55

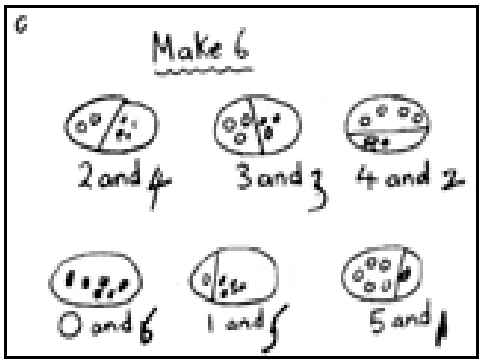
55 – 19 = 36 55 – 36 = 19

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

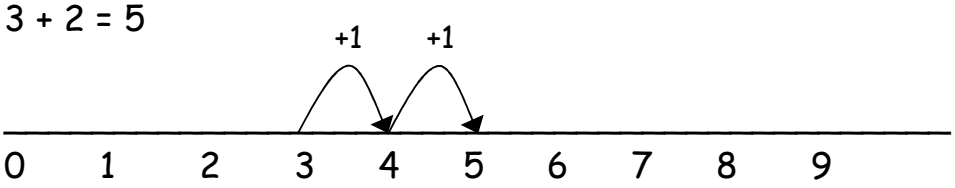
Stage 1

Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures, etc.



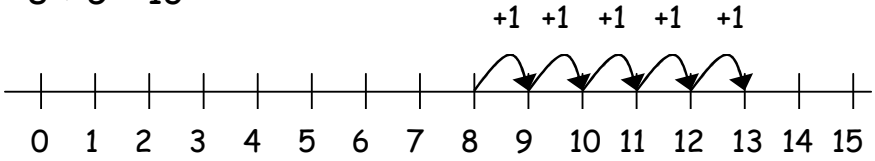
They use numberlines and practical resources to support calculation and teachers *demonstrate* the use of the numberline.

3 + 2 = 5

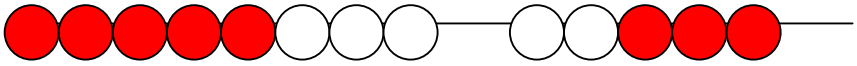


Children then begin to use numbered lines to support their own calculations using a numbered line to count on in ones.

8 + 5 = 13



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

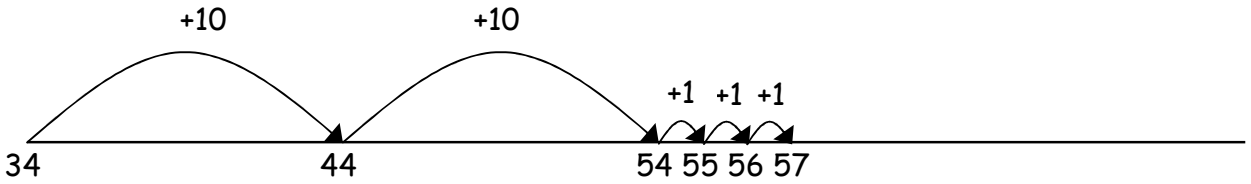


Stage 2

Children will begin to use 'empty number lines' themselves starting with the larger number and counting on.

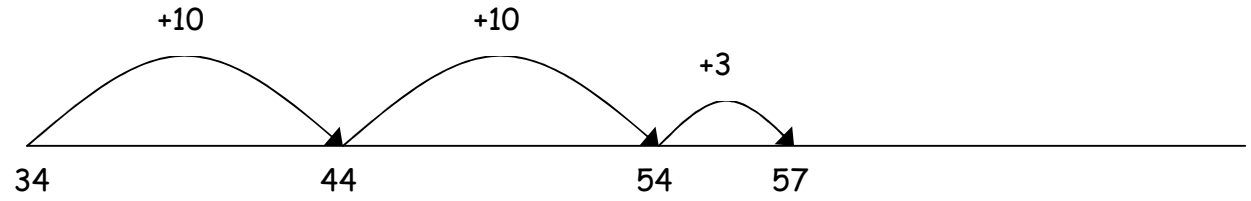
✓ First counting on in tens and ones.

34 + 23 = 57



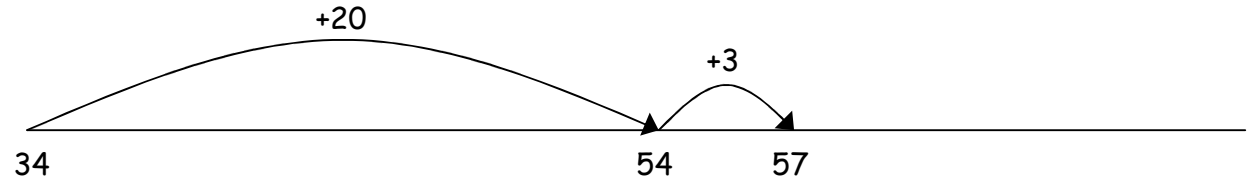
✓ Then helping children to become more efficient by adding the units in one jump (by using the known fact 4 + 3 = 7).

34 + 23 = 57



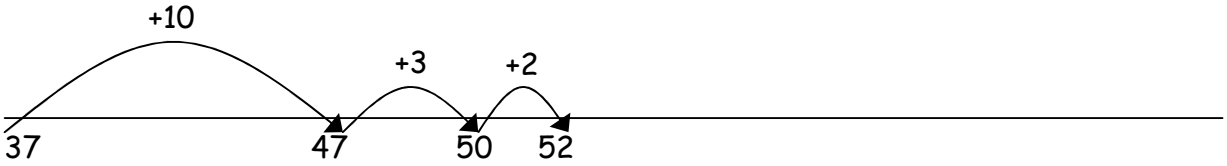
✓ Followed by adding the tens in one jump and the units in one jump.

34 + 23 = 57



✓ Bridging through ten can help children become more efficient.

37 + 15 = 52

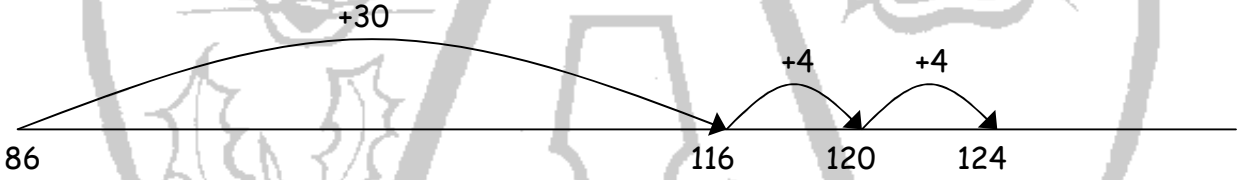


Stage 3

Children will continue to use empty number lines with increasingly large numbers, including compensation where appropriate.

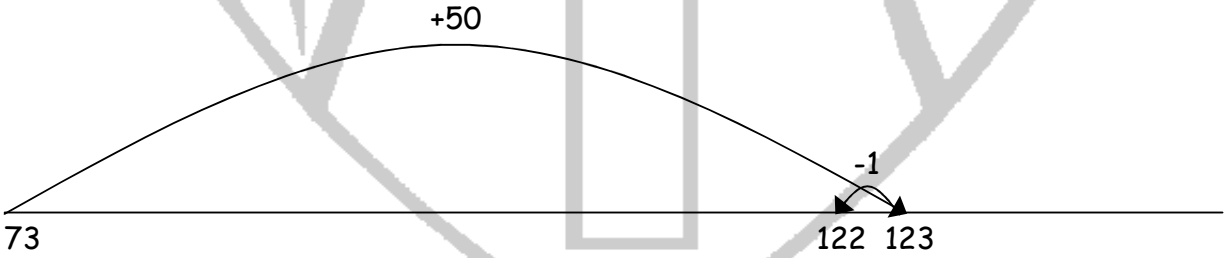
- ✓ Count on from the largest number irrespective of the order of the calculation.

38 + 86 = 124



- ✓ Compensation

49 + 73 = 122



Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies.

Adding the unit digits first, then moving to adding the ten digits.

```
  67
+ 24
  11  ( 7 + 4 )
  80  (60 + 20)
  91
```

```
  267
+  85
   12   ( 7 + 5 )
  140   (60 + 80)
  200
  352
```

By adding the unit digits first then the ten digits this should help the preparation for 'carrying' when they are secure.

Stage 4

From this, children will begin to carry below the line.

```
  625        783        367
+  48      +  42      +  85
  673        825        452
   1          1         1 1
```

Using similar methods, children will:

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more three-digit sums of money, with or without adjustment from the pence to the pounds;*
- ✓ *know that the decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. £3.59 + 78p.*

Stage 5

Children should extend the carrying method to numbers with at least four digits.

```
  587          3587
+ 475        +  675
 1062         4262
 1 1          1 1 1
```

Using similar methods, children will:

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 3.2 m – 280 cm.*

Stage 6

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

7648	6584	42
+ 1486	+ 5848	6432
9134	12432	786
1 1 1	1 1 1	3
		+ 4681
		1 2 1

11944

Using similar methods, children will

- ✓ *add several numbers with different numbers of digits;*
- ✓ *begin to add two or more decimal fractions with up to four digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, e.g. 401.2 + 26.85 + 0.71.*

+ - + - + - + - + - + - +

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

1) **they are not ready.**
2) **they are not confident.**

Children should be encouraged to approximate their answers before calculating.
Children should be encouraged to check their answers after calculation using an appropriate strategy – often the inverse operation.
Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

Appendix3 (Pages 16 – 24)

PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

MENTAL CALCULATIONS

(ongoing)
These are a **selection** of mental calculation strategies:
See NNS Framework Section 5, pages 30-41 and Section 6, pages 40-47

Mental recall of addition and subtraction facts

10 – 6 = 4	17 - □ = 11
20 - 17 = 3	10 - □ = 2

Find a small difference by counting up

82 – 79 = 3

Counting on or back in repeated steps of 1, 10, 100, 1000

86 - 52 = 34 (by counting back in tens and then in ones)
460 - 300 = 160 (by counting back in hundreds)

Subtract the nearest multiple of 10, 100 and 1000 and adjust

24 - 19 = 24 - 20 + 1 = 5
458 - 71 = 458 - 70 - 1 = 387

Use the relationship between addition and subtraction

36 + 19 = 55	19 + 36 = 55
55 – 19 = 36	55 – 36 = 19

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

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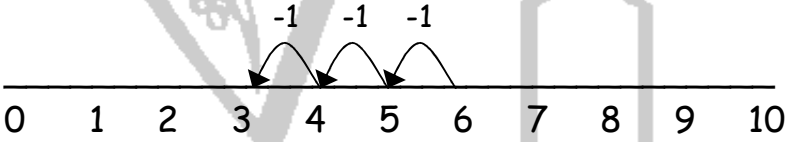
Stage 1

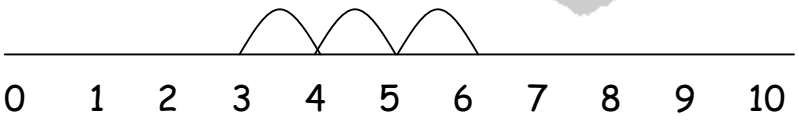
Children are encouraged to develop a mental picture of the number system in their heads to use for calculation. They develop ways of recording calculations using pictures etc.

They use numberlines and practical resources to support calculation. Teachers *demonstrate* the use of the numberline.

6 – 3 = 3

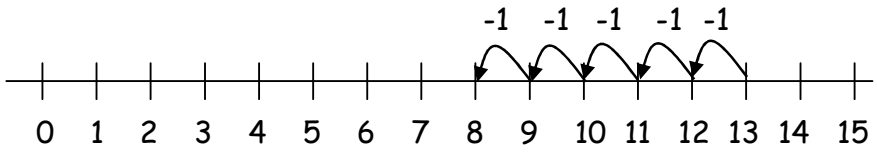


The numberline should also be used to show that 6 - 3 means the 'difference between
6 and 3' or 'the difference between 3 and 6' and how many jumps they are apart.



Children then begin to use numbered lines to support their own calculations - using a numbered line to count back in ones.

13 – 5 = 8



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

13 – 5 = 8

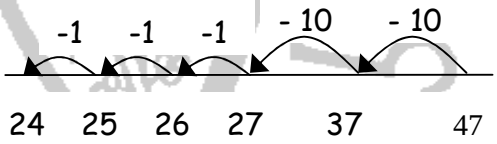
Stage 2

Children will begin to use empty number lines to support calculations.

Counting back

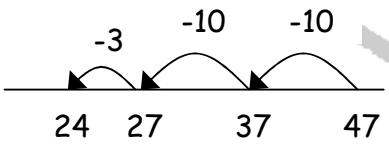
✓ First counting back in tens and ones.

47 – 23 = 24



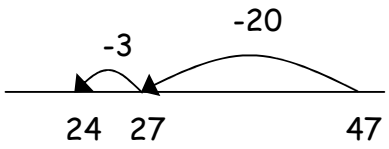
✓ Then helping children to become more efficient by subtracting the units in one jump (by using the known fact 7 – 3 = 4).

47 – 23 = 24



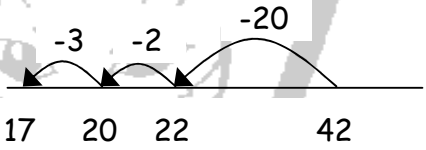
✓ Subtracting the tens in one jump and the units in one jump.

47 – 23 = 24



✓ Bridging through ten can help children become more efficient.

42 – 25 = 17



Counting on

If the numbers involved in the calculation are close together or near to multiples of 10, 100 etc, it can be more efficient to count on, e.g. 204 – 198 = 6.

Stage 3

Children will continue to use empty number lines with increasingly large numbers. Some children may need to go back to year 2 strategies for the first term, this is good practice.

Children will begin to use informal pencil and paper methods (jottings) to support, record and explain partial mental methods building on existing mental strategies.

Partitioning and decomposition

This process should be demonstrated using arrow cards to show the partitioning and base 10 materials to show the decomposition of the number.

NOTE When solving the calculation 89 – 57, children should know that 57 **does NOT EXIST AS AN AMOUNT** it is what you are subtracting from the other number. Therefore, when using base 10 materials, children would need to count out only the 89.

```
  89   =   80  +  9
- 57       50  +  7
           30  +  2  = 32
```

The expanded method would be modelled along side the compact method. **This is to *allow children to see what is happening.***

Initially, the children will be taught using examples that do not need the children to exchange.

From this the children will begin to exchange.

```
  71   =        =
- 46
```

Step 1

```
  70  +  1
- 40  +  6
```

The calculation should be read as e.g. 1 take away 6.

Step 2

```
  60  +  11
- 40  +  6
  20  +  5  =  25
```

This would be recorded by the children as

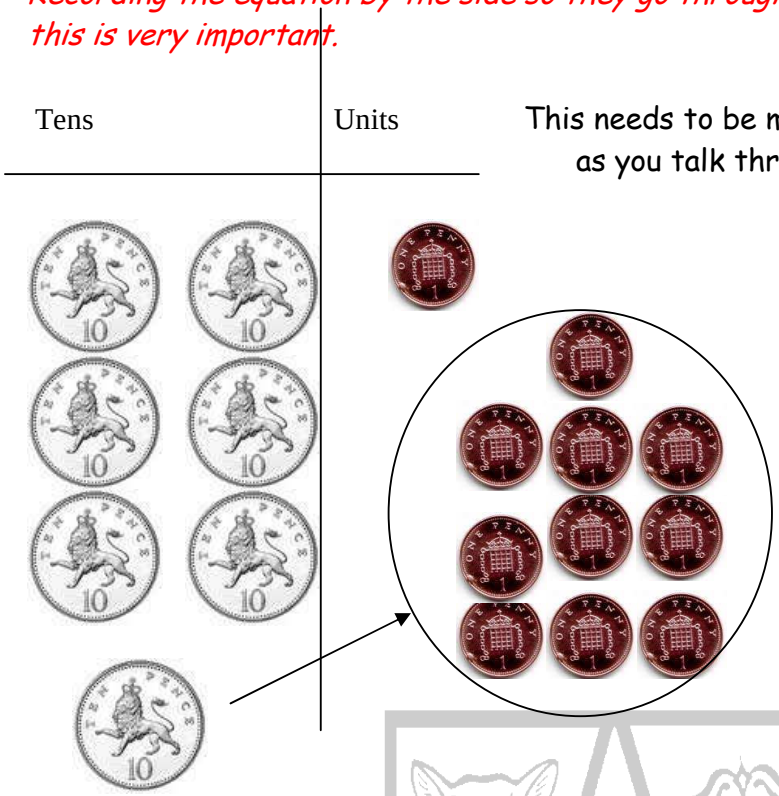
```
   60
  ~~70~~  +  11
- 40   +  6
  20   +  5  = 25
```

Children should know that units line up under units, tens under tens, and so on.

If you feel that the use of addition signs within a subtraction calculation will cause confusion, then they can be replaced with arrows, as in the example below.

```
  89   =   80  →  9
- 57       50  →  7
           30  →  2  = 32
```

As an alternatively to the above method, using money to make this concept more visual might help the lower groups. By showing the tens as 10ps and the units as 1ps; then you can visually show the transfer of 1 ten into the units column. Recording the equation by the side so they go through the process themselves; this is very important.



This needs to be modelled by the side as you talk through the strategy.

T	U
7	¹1
- 4	6
3	5p

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on should be used, e.g.

102 – 99 = 3

Stage 4

Partitioning and decomposition

754 =
- 86

Step 1 700 + 50 + 4
- 80 + 6

Step 2 700 + 40 + 14 *(adjust from T to U)*
- 80 + 6

Step 3 600 + 140 + 14 *(adjust from H to T)*

\- 80 + 6

600 + 60 + 8 = 668

This would be recorded by the children as

600 140

~~7~~00 + ~~5~~0 + ^{1}4

\- 80 + 6

600 + 60 + 8 = 668

Decomposition

614 1

~~7~~~~5~~4

\- 86

668

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *using this method, children should also begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds;*
- ✓ *know that decimal points should line up under each other.*

For example:

£8.95 = 8 + 0.9 + 0.05

leading to

-£4.38 - 4 + 0.3 + 0.08

= 8 + 0.8 + 0.15 *(adjust from T to U)*

\- 4 + 0.3 + 0.08

4 + 0.5 + 0.07

= £4.57

^{1}

8.85

\- 4.38

Alternatively, children can set the amounts to whole numbers, i.e. 895 – 438 and convert to pounds after the calculation.

NB If your children have reached the concise stage they will then continue this method through into years 5 and 6. They will not go back to using the expanded methods.

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on should be used, e.g.

507 – 497 = 10

Stage 5

Partitioning and decomposition

Step 1
$$\begin{array}{rcl} 754 & = & 700 + 50 + 4 \\ -\ 286 & & -\ 200 + 80 + 6 \end{array}$$

Step 2
$$\begin{array}{rl} & 700 + 40 + 14 \quad \textit{(adjust from T to U)} \\ - & 200 + 80 + 6 \end{array}$$

Step 3
$$\begin{array}{rl} & 600 + 140 + 14 \quad \textit{(adjust from H to T)} \\ - & 200 + 80 + 6 \\ \hline & 400 + 60 + 8 = 468 \end{array}$$

This would be recorded by the children as

$$\begin{array}{rl} & \overset{600}{\cancel{7}00} + \overset{140}{\cancel{5}0} + {}^{1}4 \\ - & 200 + 80 + 6 \\ \hline & 400 + 60 + 8 = 468 \end{array}$$

Decomposition

$$\begin{array}{r} {}^{6}\cancel{7}\,{}^{14}\cancel{5}\,{}^{1}4 \\ -\ 286 \\ \hline 468 \end{array}$$

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *begin to find the difference between two decimal fractions with up to three digits and the same number of decimal places;*
- ✓ *know that decimal points should line up under each other.*

NB If your children have reached the concise stage they will then continue this method through into year 6. They will not go back to using the expanded methods.

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on should be used, e.g.

1208 – 1199 = 9

Stage 6

Decomposition

//

Children should:

- ✓ *be able to subtract numbers with different numbers of digits;*
- ✓ *be able to subtract two or more decimal fractions with up to three digits and either one or two decimal places;*
- ✓ *know that decimal points should line up under each other.*

Where the numbers are involved in the calculation are close together or near to multiples of 10, 100 etc counting on should be used, e.g.

3002 – 2997 = 5

+ - + - + - + - + - + - +

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

3) **they are not ready.**
4) **they are not confident.**

Children should be encouraged to approximate their answers before calculating.
Children should be encouraged to check their answers after calculation using an appropriate strategy – often the inverse operation.
Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

Appendix 4 (Page 25 – 35)

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS

(ongoing)
These are a **selection** of mental calculation strategies:
See NNS Framework Section 5, pages 52-57 and Section 6, pages 58-65

Doubling and halving
Applying the knowledge of doubles and halves to known facts.
e.g. 8 x 4 is double 4 x 4

Expectations for using multiplication facts

Year 1 should start to count on in 2s,5s and 10s each day as a mental oral or at another appropriate time in the day. Tables should be taught everyday from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the day.

Year 1	Orally say: 2 times tables 5 times tables 10 times tables
Year 2	2 times table 5 times table 10 times table
Year 3	2 times table 3 times table 4 times table 5 times table 9 times table 10 times table
Year 4	Derive and recall all multiplication facts up to 10 x 10.
Years 5 & 6	Derive and recall quickly all multiplication facts up to 12 x 12.

N.B. If some children in the class are behind with their times table knowledge do not worry, Always, teach the times tables for your year group and the facts that they do not know should back fill.

Using and applying division facts
Children should be able to utilise their tables knowledge to derive other facts.
e.g. If I know 3 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc

Use closely related facts already known
13 x 11 = (13 x 10) + (13 x 1)
= 130 + 13
= 143

Multiplying by 10 or 100
Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.
Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

Partitioning
23 x 4 = (20 x 4) + (3 x 4)
= 80 + 12
= 102

Use of factors
8 x 12 = 8 x 4 x 3

The use of fact families
5 x 3 = 15
3 x 5 = 15
15 ÷ 5 = 3
15 ÷ 3 = 5

The children's understanding of these families (relationships) are very important and children need to become confident and finding them as soon as possible.

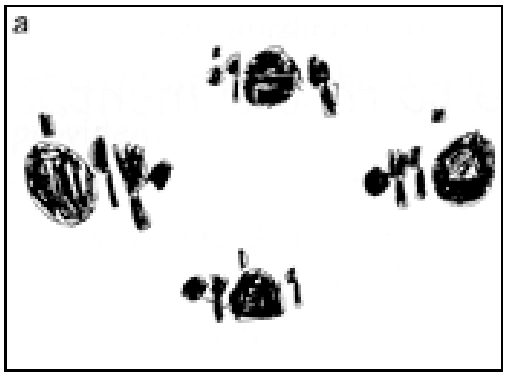
MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

IT IS ALSO GOOD PRACTICE TO GIVE THE CHILDREN A 100 SQUARE OR THE TIMES TABLES WHEN DEVELOPING THEIR UNDERSTANDING OF WRITTEN STRATEGIES. THIS TAKES AWAY THE WORRY FOR CHILDREN WHO ARE NOT SO CINFIDENT AT RECALLING THEIR TIMES TABLE FACTS.

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

Stage 1

Children will experience equal groups of objects and will count in 2s and 10s and begin to count in 5s. They will work on practical problem solving activities involving equal sets or groups.



Stage 2

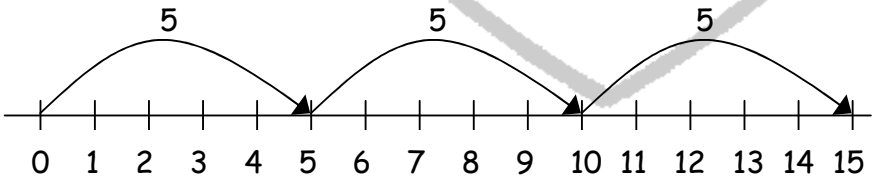
Children will develop their understanding of multiplication and use jottings to support calculation:

- ✓ **Repeated addition**

3 times 5 is 5 + 5 + 5 = 15 or 3 lots of 5 or 5 x 3

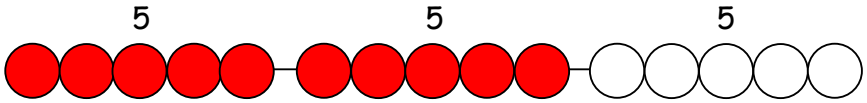
Repeated addition can be shown easily on a number line:

5 x 3 = 5 + 5 + 5



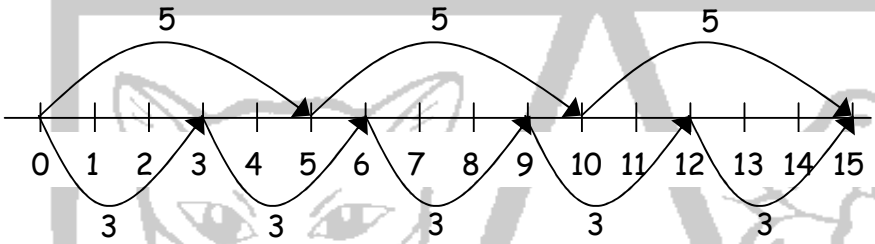
and on a bead bar:

5 x 3 = 5 + 5 + 5



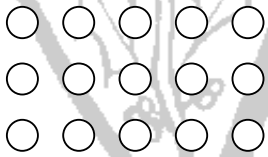
✓ **Commutativity**

Children should know that 3 x 5 has the same answer as 5 x 3. This can also be shown on the number line. This important and they can be referred to as 'fact families' this may help with remembering what is being asked for.



✓ **Arrays**

Children should be able to model a multiplication calculation using an array. This knowledge will support with the development of the grid method.



5 x 3 = 15

3 x 5 = 15

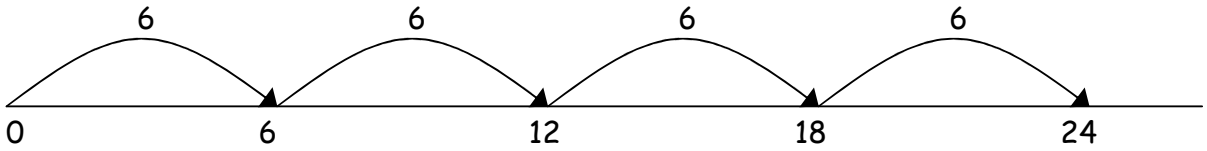
Stage 3

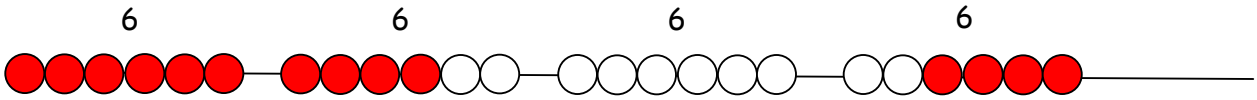
Children will continue to use:

✓ **Repeated addition**

4 times 6 is 6 + 6 + 6 + 6 = 24 or 4 lots of 6 or 6 x 4

Children should use number lines or bead bars to support their understanding.





✓ **Arrays**

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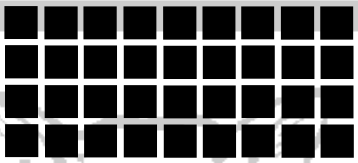


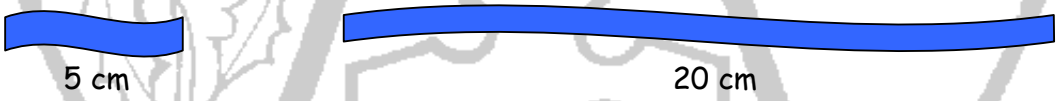
9 x 4 = 36

9 x 4 = 36

Children will also develop an understanding of

✓ **Scaling**

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



5 cm

20 cm

✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations**

□ x 5 = 20	3 x △ = 18	□ x O = 32
5 x □ = 20	△ x 3 = 18	O x □ = 32
20 ÷ □ = 5	18 ÷ 3 = △	32 ÷ □ = O
20 ÷ 5 =□	18 ÷ △ = 3	32 ÷ O = □

Nb. Children need lots of opportunity to practise and develop their understanding of these relationships where ever possible.

Partitioning

✓ **The grid method**

It may be necessary to break down further for some children in some maths groups.

X	30	8
5	5 x 30	5 x 8

Step 1

X	30	8
5	150	40

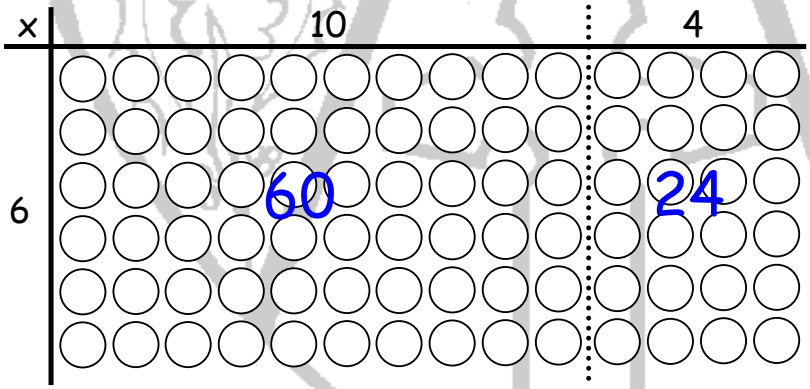
1 5 0
+ 40
1 9 0

38 x 5 = (30 x 5) + (8 x 5)
= 150 + 40
= 190

NNS Section 5 page 47

Stage 4

Children will continue to use arrays where appropriate leading into the grid method of multiplication.



(6 x 10) + (6 x 4)

60 + 24

84

Grid method

TU x U
(Short multiplication – multiplication by a single digit)

23 x 8

Children will approximate first
23 x 8 is approximately 25 x 8 = 200

x	20	3
8	160	24

160
+ 24
184

If the children are secure and can apply the grid method then move them to short multiplication.

Stage 5

Grid method

HTU x U
(Short multiplication – multiplication by a single digit)

346 x 9

Children will approximate first
346 x 9 is approximately 350 x 10 = 3500

x	300	40	6
9	2700	360	54

2700
+ 360
+ 54
3114
1 1

If the children are secure with the grid method then move to short multiplication see below.

Expanded method leading into the compact method.

```
  H T U                          H T U
  3 4 6                          3 4 6
x     9                        x     9
2 7 0 0 (9 x 300)              3 1 1 4
  3 6 0 (9 x 40)               1 1
    5 4 (9 x 6)
3 1 1 4
1 1
```

TU x TU

(Long multiplication – multiplication by more than a single digit)

72 x 38

Children will approximate first

72 x 38 is approximately 70 x 40 = 2800

x	70	2
30	2100	60
8	560	16

```
  2100
+  560
+   60
+   16
 2736
    1
```

When the children are secure in this strategy then they need to move to long multiplication. Expanded method leading to the compact method.

```
  T U                            T U
  7 2                            7 2
x 3 8                          x 3 8
5 6 0 (8 x 70)                 2 7 3 6
  1 6 (8 x  2)
  6 0 (30 x 2)
2 1 0 0 (30 x 70)
2 7 3 6
  1
```

Using similar methods, they will be able to multiply decimals with one decimal place by a single digit number, approximating first. They should know that the decimal points line up under each other.

e.g. 4.9 x 3

Children will approximate first
4.9 x 3 is approximately 5 x 3 = 15

x	4	0.9
3	12	2.7

12
\+ 2.7
14.7

As above, when the children are secure with the grid and decimals move to short multiplication and then into the compact method.

U . t
4 . 9
x 3
1 4 . 7
2

Stage 6

ThHTU x U
(Short multiplication – multiplication by a single digit)

4346 x 8
Children will approximate first
4346 x 8 is approximately 4346 x 10 = 43460

X	4000	300	40	6
8	32000	2400	320	48

32000
\+ 2400
\+ 320
\+ 48
34768

<u>As above, when the children are secure with the grid and decimals move to short multiplication and then into the compact method.</u>

HTU x TU
(Long multiplication – multiplication by more than a single digit)

372 x 24

Children will approximate first
372 x 24 is approximately 400 x 25 = 10000

x	300	70	2
20	6000	1400	40
4	1200	280	8

6000
+ 1400
+ 1200
+ 280
+ 40
+ 8
8928
1

Using similar methods, they will be able to multiply decimals with up to two decimal places by a single digit number and then two digit numbers, approximating first. They should know that the decimal points line up under each other.

For example:

4.92 x 3
Children will approximate first
4.92 x 3 is approximately 5 x 3 = 15

x	4	0.9	0.02
3	12	2.7	0.06

12
+ 0.7
+ 0.06
12.76

As above, when the children are secure with the grid and decimals move to short multiplication and then into the compact method.

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

5) **they are not ready.**
6) **they are not confident.**

Children should be encouraged to approximate their answers before calculating.
Children should be encouraged to check their answers after calculation using an appropriate strategy – often the inverse operation.
Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.

Appendix 5 (Pages 36 - 44)

PROGRESSION THROUGH CALCULATIONS FOR DIVISION

MENTAL CALCULATIONS

(ongoing)
These are a **selection** of mental calculation strategies:
See NNS Framework Section 5, pages 52-57 and Section 6, pages 58-65

Doubling and halving

Knowing that halving is dividing by 2

Deriving and recalling division facts

Tables should be taught everyday from Y1 onwards, either as part of the mental oral starter or other times as appropriate within the day.

Year 1	Count in 10s, 5s and 2s
Year 2	2 times table 5 times table 10 times table
Year 3	2 times table 3 times table 4 times table 5 times table 9 times table 10 times table
Year 4	Derive and recall facts for all tables up to 10 x 10
Year 5 & 6	Derive and recall quickly division facts for all tables up to 12 x 12

Using and applying division facts

Children should be able to utilise their tables knowledge to derive other facts.
e.g. If I know 3 x 7 = 21, what else do I know?
30 x 7 = 210, 300 x 7 = 2100, 3000 x 7 = 21 000, 0.3 x 7 = 2.1 etc (This is very important and children need to be secure in their understanding of place values.)

Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

Use of factors

378 ÷ 21 378 ÷ 3 = 126 378 ÷ 21 = 18

126 ÷ 7 = 18

Use related facts

Given that 1.4 x 1.1 = 1.54

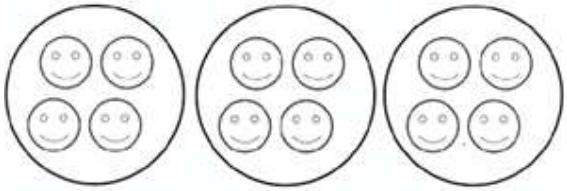
What is 1.54 ÷ 1.4, or 1.54 ÷ 1.1?

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

THE FOLLOWING ARE STANDARDS THAT WE EXPECT THE MAJORITY OF CHILDREN TO ACHIEVE.

Stage 1

Children will understand equal groups and share items out in play and problem solving. They will count in 2s and 10s and later in 5s.

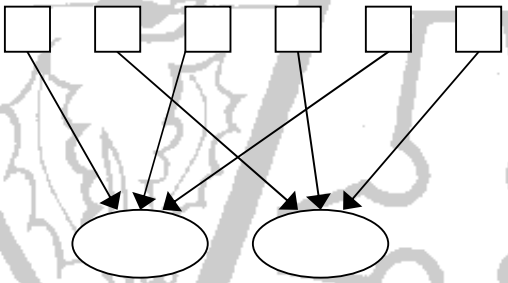


Stage 2

Children will develop their understanding of division and use jottings to support calculation

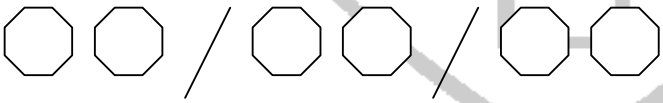
- ✓ **Sharing equally**

6 sweets shared between 2 people, how many do they each get?



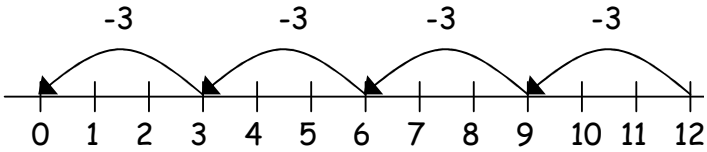
- ✓ **Equal groups of or repeated subtraction**

There are 6 sweets, how many people can have 2 sweets each?

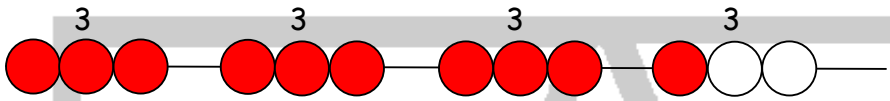


✓ **Repeated subtraction using a number line or bead bar**

12 ÷ 3 = 4



Then count the groups with the children 1, 2 ,3 and 4 equal groups of 3 in 12 to reinforce the understanding.



The bead bar will help children with interpreting division calculations such as 10 ÷ 5 as 'how many 5s make 10?'

✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations – this is a good opportunity to reinforce fact families mention in multiplication and must be highlighted to the children due to being the inverse operation.**

□ ÷ 2 = 4 20 ÷ △ = 4 □ ÷ △ = 4
□ ÷ 4 = 2 20 ÷ △ = 5 □ ÷ △= 5

Stage 3

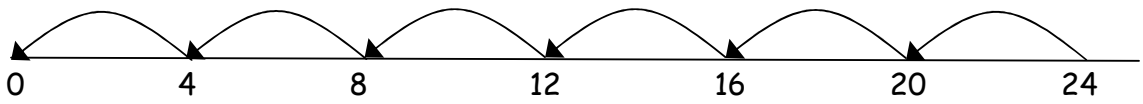
Ensure that the emphasis in Y3 is on grouping rather than sharing.

Children will continue to use:

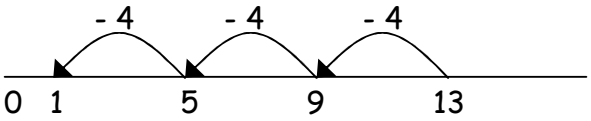
✓ **Repeated subtraction using a number line**

Children will use an empty number line to support their calculation.

24 ÷ 4 = 6



Children should also move onto calculations involving remainders.
13 ÷ 4 = 3 r 1



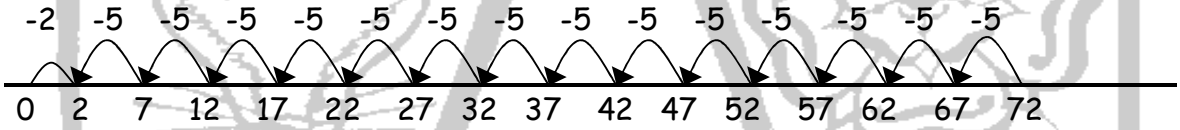
✓ **Using symbols to stand for unknown numbers to complete equations using inverse operations – See the end of year two for fact family links.**

26 ÷ 2 = □ 24 ÷ △ = 12 □ ÷ 10 = 8

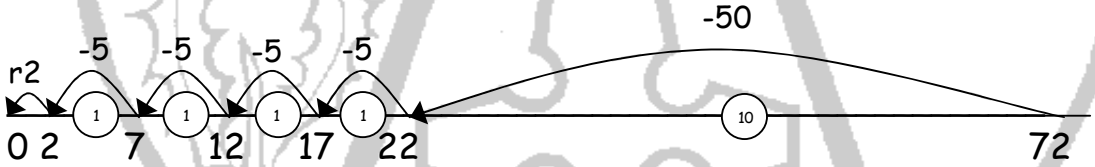
Stage 4

Children will develop their use of repeated subtraction to be able to subtract multiples of the divisor. Initially, these should be multiples of 10s, 5s, 2s and 1s – numbers with which the children are more familiar.

72 ÷ 5



Moving onto:



Then onto the vertical method:
Short division TU ÷ U (If ability allows it would be good to start approximating the answer first.)
72 ÷ 3

```
3 ) 72
  - 30      10x
    42
  - 30      10x
    12
  -  6       2x
     6
```

- 6	2x
0	↓
Answer :	24

Leading to subtraction of other multiples.
(If ability allows it would be good to start approximating the answer first.)

96 ÷ 6 =

1 6	
6) 96	
- 60	10x
36	
- 36	6x
0	↓
Answer :	16

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

Children need to be encouraged to discuss and practise checking their answers using the inverse operation.

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example 62 ÷ 8 is 7 remainder 6, but whether the answer should be rounded up to 8 or rounded down to 7 depends on the context.

e.g. I have 62p. Sweets are 8p each. How many can I buy?
Answer: 7 (the remaining 6p is not enough to buy another sweet)

Apples are packed into boxes of 8. There are 62 apples. How many boxes are needed?
Answer: 8 (the remaining 6 apples still need to be placed into a box)

Stage 5

Children will continue to use written methods to solve short division TU ÷ U.

Children can start to subtract larger multiples of the divisor, e.g. 30x

Children need to estimate their answers before they calculate. Practise using a multiple of the divisor. Teachers will need to model this to the children and explain the importance of estimating the answer.

Short division HTU ÷ U

196 ÷ 6

```
      32 r 4
   6 ) 196
     - 180      30x
       16
     -  12       2x
        4
```

Answer : 32 remainder 4 or 32 r 4

Any remainders should be shown as integers, i.e. 14 remainder 2 or 14 r 2.

Children need to be able to decide what to do after division and round up or down accordingly. They should make sensible decisions about rounding up or down after division. For example 240 ÷ 52 is 4 remainder 32, but whether the answer should be rounded up to 5 or rounded down to 4 depends on the context.

When the children are secure with chunking then they can move to the compact method on division using the below method. See example below.

```
    1 6
  6 ) 9 36
```

When they are secure with this method introduce remainders to them.

Stage 6

Children will continue to use written methods to solve short division TU ÷ U and HTU ÷ U.
Children should estimate their answers before calculating using a multiple of the divisor.

Long division HTU ÷ TU

972 ÷ 36

```
        27
    ------
36 ) 972
   - 720      20x
     252
   - 252       7x
       0
       ↓
Answer :       27
```

Any remainders should be shown as fractions, i.e. if the children were dividing 32 by 10, the answer should be shown as $3\ ^{2}/_{10}$ which could then be written as $3\ ^{1}/_{5}$ in its lowest terms.
Extend to decimals with up to two decimal places. Children should know that decimal points line up under each other.

87.5 ÷ 7

```
        12.5
    ------
7 ) 87.5
  - 70.0      10x
    17.5
  - 14.0       2x
     3.5
  -  3.5       0.5x
       0
       ↓
Answer :       12.5
```

Children should be able to explain how they would check their answers.

When the children are secure with this method then they can use the compact method for division. See below.

```
   1 2 . 5
  ---------
7 ) 8 1 7 . 3 5
```

Answer : 12.5

+ - + - + - + - + - + - +

By the end of year 6, children will have a range of calculation methods, mental and written. Selection will depend upon the numbers involved.

Children should not be made to go onto the next stage if:

7) **they are not ready.**
8) **they are not confident.**

Children should be encouraged to approximate their answers before calculating.
Children should be encouraged to check their answers after calculation using an appropriate strategy – often the inverse operation.
Children should be encouraged to consider if a mental calculation would be appropriate before using written methods.