Teacher guidance materials to develop good practice within Levels 1 and 2 Number

Belfast Education and Library Board Numeracy Team
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“Guidance materials were user-friendly”

“This resource is quite specific and is useful in identifying strengths and weaknesses”

“Specific targets within each Assessment Check meant they were easy to follow and use to identify concerns”

“This would be fantastic for term 1 - it highlights the gaps in each pupil’s learning”

“Preparation activities to support Assessment Checks were appropriate for most pupils but I also used ideas of my own for the target group”

“I focused on two groups of 5 pupils initially”

“I used the materials with the whole class, the target group and individuals (special needs pupils) and found that many activities were suitable for all”

“In KS2 the materials were very valuable with pupils having difficulty. But if they were used with the whole class in KS1 it might prevent pupils from being pushed on too quickly without understanding”

“Starting below what I thought the pupil’s level was, ensured a baseline to build on - also any gaps in the pupil’s knowledge were then covered”

“Pupil Records were useful. I found that if I ticked or dotted unsure areas I could revisit them either as a whole class, a small group or with an individual”
INTRODUCTION

Numeracy is the development and application of mathematics across the curriculum and in real life situations....Activities should be balanced between tasks which develop knowledge, skills and understanding, and those which develop the ability to apply mathematical learning and solve problems (The Northern Ireland Curriculum Primary, CCEA, 2007).

The Numeracy Strategy identifies approaches that contribute towards improvements in teaching and learning of numeracy. During our work with schools teachers request additional guidance and support for those pupils, regardless of age, who are struggling mathematically. Many of these pupils require a little more time than their peers to grasp mathematical ideas, as well as a structured progression in small achievable steps.

To be able to work confidently with number, pupils need to have a secure understanding of some key mathematical milestones:

- Demonstrate 1:1 correspondence
- Recognise a set of objects
- Recognise differences and similarities within sets of objects
- Know number names and recognise numerals
- Have conservation of number
- Know the order of our number system
- Understand and use the commutative aspect of addition
- Have quick recall of number facts within 10, including doubles
- Understand and use addition and subtraction as inverse operations
- Group objects in tens to make counting easier
- Use known facts to derive corresponding facts within addition and subtraction

These maths milestones are fundamental elements of the preparation activities to support the appropriate Assessment Checks.
The purpose of these materials is to provide teachers with a series of assessment checks to enable them to identify pupil’s strengths, alongside the appropriate activities to further develop the pupil’s understanding of Number. These activities are designed to support the development of fundamental skills and concepts (i.e. Maths Milestones) rather than representing a series of tasks to be completed. The focus is on encouraging pupils to be confident in mental addition and subtraction within 100, which will provide a secure foundation for future mathematical development.

Pupils should be encouraged to consider mental methods as a first resort in any calculation (Northern Ireland Strategy for Numeracy, Teaching and Learning file1, 2000). Anghileri (2000) also notes that “All pupils are expected ultimately to use efficient written methods for calculating but the only way such methods can be meaningful is if they are developed progressively to support and extend mental strategies”.

Borthwick and Harcourt-Heath’s (2007) research looked at the range of calculation methods that pupils use when working within the four operations and revealed that pupils often find it difficult to choose the most efficient and effective strategy when faced with a written test situation. Their research showed that when pupils use a calculation strategy which is based on mental methods they usually reach the correct solution.

Use of language within these mathematical activities is fundamental to progression within pupils’ thinking. Modelling the use of specific mathematical terminology over a period of time is necessary before pupils can begin to use this language to explain their understanding. Opportunities for pupils to use language to express their thinking provide valuable assessment tools. Use of open and closed questioning techniques by both pupils and teachers encourages a rich language environment that challenges pupils’ thinking (Appendix 4.2)

Integrating thinking skills into mathematics means designing learning so that pupils will think more skilfully than they would otherwise do and as a result deepen their understanding across a range of contexts. Rich collaborative tasks allow learners to make decisions; involve learners in testing, proving, explaining, reflecting and interpreting; promote discussion and communication; encourage originality and invention; encourage ‘what if?’ and ‘what if not?’ questions; are enjoyable and contain the opportunity for surprise (Improving learning in mathematics: challenges and strategies, 2005, DFES).

1 Teaching and Learning file (T&L file) published by the Inter-Board Numeracy Group, 2001
The teaching approaches encouraged within these materials support the three core elements of Every School a Good School - a strategy for raising achievement in literacy and numeracy (2008)

- Wave One: Quality whole class teaching
- Wave Two: Quality teaching plus additional support for identified pupils
- Wave Three: Quality teaching plus personalised support to meet the specific needs of individual pupils

Maths Milestones 1 and 2 provides support for pupils working towards Levels 1 and 2 in Number. The materials are flexible and may be used to support whole class (Wave One), target groups (Wave Two) or individuals (Wave Three) within the numeracy lesson alongside appropriate classroom experiences. For example, within Wave Two support, an appropriate quality learning activity could be identified for the target group for that lesson and the role of the teacher is to actively teach / facilitate quality group interaction whilst the rest of the pupils work independently on appropriate activities to further develop their learning.

Teacher guidance material is provided on sorting progression (Appendix 4.1), mathematical language (Appendix 4.2), different aspects of pupil recording (Appendix 4.3) and potential useful resources (Appendix 4.6).

Maths Milestones 1 and 2 is structured as a series of Preparation Activities that develop a range of skills which are subsequently monitored through the appropriate Assessment Check. Preparation activities become progressively more challenging within and between each Assessment Check. This is not intended to restrict flexibility in use, but does indicate the structured progression inherent in mathematical conceptual development.

Maths Milestones 1 and 2 can be used to support Assessment for Learning. Elements within the Assessment Checks and the Preparation Activities can be used as targets for individual pupils or for groups of pupils. Targets and Learning Intentions can be shared with pupils so they can monitor their progress. Effective feedback tells learners where they have been successful, where they should focus their next improvement and precisely how to go about making that improvement happen.
The oral introduction aspect of lessons could be linked to some of the preparation activities. Most of the tasks could form the basis of the main practical element of the lesson for a target group of pupils. It is anticipated that pupils would experience the whole range of preparation activities before moving on to the next Assessment Check. If pupils are still struggling with a particular preparation activity, teachers may need to review related activities in previous Assessment Checks. Some of the maths milestones may need to be more formally assessed as a pupil works through the Assessment Checks e.g. conservation of number and quick recall activities.

An initial assessment of each pupil within the target group could involve identifying which Assessment Check and its Preparation Activities best describes the pupil’s current level of understanding. For example, a pupil may be capable of achieving most of the statements within Assessment Check 2 and some of those within Assessment Check 3. This pupil would progress most by completing the full range of Preparation Activities supporting Assessment Check 2 before moving on to those related to Assessment Check 3. Assessment forces us to recognise that each learner is an individual with different learning needs and to adapt the pace and content of teaching accordingly (Improving learning in mathematics: a professional development guide, 2005, DFES). The class teacher should liaise with the numeracy coordinator, SENCO and external educational partners to ensure an integrated approach within all of the numeracy provision for pupils.

Two formats of Pupil Records have been provided to accommodate both whole class involvement and monitoring target group progression (Appendices 4.4 and 4.5)
Assessment Checks
**ASSESSMENT CHECKS**

### Assessment Check 1
- Recognise and say numerals up to 5
- Compare unequal/equal sets within 5
- Demonstrate 1:1 correspondence within 5
- Count collections of objects within 5
- Use language e.g. 1 more/1 less, number after/before

### Assessment Check 2
- Recognise and say numerals up to 10
- Order numbers within 5
- Demonstrate conservation of number within 5
- Add and subtract (take away) within 5
- Partition sets within 5 confidently
- Count collections of objects within 10

### Assessment Check 3
- Recognise and say numerals up to 20
- Order numbers within 10
- Demonstrate conservation of number within 10
- Appreciate commutative aspect of addition (e.g. $3 + 4 = 4 + 3$)
- Add numbers within 10

### Assessment Check 4
- Use counting back mental strategy to support subtraction within 10
- Appreciate inverse relationship between addition and subtraction processes
- Add and subtract within 10
- Have quick recall of ‘adding 1’ and ‘taking away 1’ within 10
- Have quick recall of doubles within 10
- Know odd and even numbers within 10

### Assessment Check 5
- Apply knowledge of addition and subtraction within 10 across a range of contexts (e.g. difference between 5 and 3 is 2, within function machines and use in structured play)
- Order numbers within 20
- Approximate and estimate a collection of objects up to 20
- Understand composition of 2-digit numbers to 20
Assessment Check 6
- Recognise number names and know numbers 1-50
- Add and subtract within 1-20 practically without bridging
- Add and subtract within 1-20 practically with bridging
- Have quick recall of addition and subtraction stories within 10
- Have quick recall of doubles within 20

Assessment Check 7
- Recognise number names and know numbers 1-100
- Order numbers to 50
- Group and exchange practically to 20 in 2s using a range of materials
- Group and exchange practically to 30 in 5s using a range of materials
- Group and exchange practically to 50 in 10s using a range of materials

Assessment Check 8
- Understand composition of 2-digit numbers to 50
- Partition numbers within 50 into tens and ones
- Add and subtract 10 from multiples of 10 (e.g. 20 + 10 = 30)
- Add and subtract multiples of 10 from multiples of 10 (e.g. 30 – 20 = 10)
- Add and subtract 10 from 2-digit numbers within 50

Assessment Check 9
- Understand composition of 2-digit numbers to 100
- Appreciate the position of tens digit indicates its value
- Order numbers to 100
- Understand our number system to 100 by describing the position of any number on 1-100 square
- Have quick recall of addition and subtraction within 20
- Use derived facts for addition and subtraction (e.g. 2 + 5 = 7, 22 + 5 = 27)
- Add and subtract a single digit from any 2-digit number without bridging within 1-50
- Add and subtract a single digit from any 2-digit number without bridging within 1-100

Assessment Check 10
- Add using 1-50 grid with bridging
- Subtract using 1-50 grid with bridging
- Add and subtract a single digit from any 2-digit number with bridging within 1-100
- Use 1-100 grid to develop a range of methods for adding or subtracting any two 2-digit numbers
- Mentally add and subtract two 2-digit numbers within 50
- Mentally add and subtract two 2-digit numbers within 100
Preparation

Activities
Preparation activities to support Assessment Check 1

- Sorting: free-play/ random/ structured (see Appendix: 4. 1)
- Pattern making: copy/ continue/ create
  (RSG 2 p50-52)
- Recognising numerals and knowing number names 1-5
  Oral response, e.g. pupil says number name when shown specific digit card
- Comparing unequal sets without counting
  (RSG p56)
- Comparing equal sets without counting
  (RSG p56)
- Developing 1:1 correspondence within 5
  (RSG game ‘Happy Faces’)
- Counting on and back in ones within 5, different starts
  (Counting on/back mental strategy – red level T & L file)
- Developing cardinal aspect of 1-5 (e.g. knowing that the number 3 refers to the whole set of 3 objects)
  (RSG games ‘Sweetie Jars, Snail Trail, Animal Hunt and Memory Match 1-6’)
- Comparing unequal sets within 5 with counting
  (RSG p58)
- Comparing equal sets within 5 with counting
  (RSG p58)
- Responding to language e.g. 1 more/ less, number after/ before
  E.g. What is 1 more than 4? What number comes before 3?

Pupil should now have developed the skills for

Assessment Check 1

2 Ready, Set, Go – Maths (Eunice Pitt) published by the Inter-Board Numeracy Group, 2001
Preparation activities to support Assessment Check 2

- Recognising number names and knowing numbers 1 - 10
  Oral response, e.g. pupil says number name when shown specific digit card

- Developing ordinal number 1-5
  (Place random digit cards in order)

- Testing for conservation of number within 5
  (RSG p135-136)

- Adding and take away within 5 and talking about it
  E.G. Pupil has 5 cubes and is asked to ‘take away 2’, pupil describes ‘I have 5 cubes and take 2 away. Now I have 3 left’

- Working towards mental addition within 5
  (RSG game ‘Make five’)

- Using addition experience to support subtraction (take away) within 5
  E.G. ‘4 and 1 more is 5, so 5 take away 1 is 4’

- Sorting two-property collections in two different ways and talking about their arrangements
  (RSG p24-26)

- Partitioning within 5 using practical materials
  (RSG p63)

- Exploring commutative aspect of addition within 5 (e.g. 2+3=5, 3+2=5)
  (Use of multilink or Cuisenaire rods see www.berkshiremathematics.com/rods.asp)
  (Informal recording using digit cards, Appendix 4.3 Example 1)
• **Understanding addition and subtraction stories within 5 and talking about them**

  Oral response e.g. 2 and 1 makes 3, 3 take away 1 leaves 2

• **Applying knowledge of number stories within 5 to real-life contexts**
  (Respond mentally)
  (Shop/money using 1p only, Structured play activities)

• **Recognising 1p and 2p coins**
  (Oral response and using plastic coins for simple games e.g. target boards, matching activities)

• **Understanding concept of zero as a set with no objects**
  (Towards mental response – RSG p67 ‘Box game’)

• **Counting on and back in ones within 10, different starts**
  (Counting on/back mental strategy – red level, T & L file)

• **Comparing unequal sets within 10 with counting**
  (RSG p60)

• **Comparing equal sets within 10 with counting**
  (RSG p60)

Pupil should now have developed the skills for

**Assessment Check 2**
Preparation activities to support Assessment Check 3

- **Recognising number names and knowing numbers 1 - 15, then 1 - 20**
  Oral response e.g. pupil says number name when shown specific digit card

- **Exploring cardinal numbers 6-10**
  (RSG games ‘Hidey Holes, Humpty Dumpty and Memory Match 5-10)

- **Developing ordinal number 1-10**
  (Place random digit cards in order)

- **Testing for conservation of number within 10**
  (RSG p143-144)

- **Sorting three-property collections in three different ways and talking about their arrangements**
  (RSG p27-29)

- **Partitioning sets within 10**
  (RSG p69-70)

- **Exploring commutative aspect of addition within 10 (e.g. 7+3=10, 3+7=10)**
  (Use of Cuisenaire)
  (Informal recording using digit cards)

  ![Cuisenaire Rods Example](image)

  \[\begin{align*}
  &\quad \text{3} + \quad 7 = \quad 10 \\
  &\quad 7 + \quad 3 = \quad 10
  \end{align*}\]

- **Beginning to use addition experience to support subtraction (take away) within 10**
  Oral response e.g. 8 and 1 more is 9, 9 take away 1 is 8
• **Beginning to explore addition of doubles up to 5+5**  
  (Informal recording using digit cards, simple recording format RSG p71)  
  (Use of Cuisenaire)

• **Applying knowledge of addition within 10 to real life contexts**  
  (Respond mentally)  
  (Shop/money using 1p only, Structured play activities)

• **Understanding addition and subtraction stories within 10 and talking about them**  
  (Using Cuisenaire)  
  (Towards mental response)

• **Re-arranging numbers when adding to make the calculation easier**  
  (Re-ordering mental strategy - red level, T & L file)

  E.g. Re-arranging 1 + 7 and calculating 7 + 1 which is easier

Pupil should now have developed the skills for

**Assessment Check 3**
Preparation activities to support Assessment Check 4

- **Linking counting back in ones to subtraction in ones**
  (Counting back mental strategy – red level)

- **Introducing subtraction process as inverse of addition**
  (Use of Cuisenaire - RSG p79)
  (Inverse Operations mental strategy – orange level, T & L file)

  E.g.  $2 + 4 = 6, \quad 6 - 2 = 4, \quad 6 - 4 = 2$

- **Subtracting practically by taking away within 10**
  (Refine language of subtraction e.g. take away, subtract, RSG p80 - 82)
  (Informal recording using symbols + - and =)

- **Working towards subtraction within 10**
  (RSG game ‘Number chains’, 1-10 digit cards and 1 less and 2 less game cards)

- **Working towards mental confidence in adding or subtracting one within 10**
  (e.g. ‘7 take away 1 leaves 6’)
  (Oral mental response)

- **Working towards mental addition and subtraction within 10**
  (Using RSG games ‘ Buzz Ten’)

- **Working towards mental confidence in knowing doubles within 10**
  (Oral mental response)

  E.g. ‘double 3 is …..’ and ‘10 is double …..’
• Developing a feel for the size of a set of objects up to 10
  (Early Approximation and Estimation skills, red level, T & L file)

• Exploring odd and even numbers within 10
  Using a counting stick or swinging apple e.g. ‘counting forwards and backwards 2,4,6…………… 7,5,3,……………’

• Recognising 1p, 2p, 5p and 10p coins
  (Oral response and using plastic coins for simple games e.g. target boards, matching activities)

• Counting forwards and backwards within 1-15, 1-20, different starts
  (Use of counting stick, counting hoop, number line and number track)

• Developing confidence to mentally add and subtract within 10
  (Using RSG game - ‘Three in a Line’)

Pupil should now have developed the skills for

**Assessment Check 4**
Preparation activities to support Assessment Check 5

- **Introducing the language of difference**
  (Informal recording using digit cards and symbols - and =)

  E.g. 5 - 3 = 2, the difference between 5 and 3 is 2

- **Investigating function machines to carry out simple addition and subtraction activities within 10**
  (Informal recording, Appendix 4.3 Example 2)

```
3  + 1  \rightarrow  \square
5  + 1  \rightarrow  \square
```
```
4  - 2  \rightarrow  \square
8  - 2  \rightarrow  \square
```

- **Applying knowledge of subtraction number stories within 10 to real-life contexts**
  (Structured Play including money activities with 1p and 2p coins)

- **Exploring cardinal numbers 1-15, then 1 - 20**
  (Using practical materials and digit cards)

- **Ordering numbers within 15 (then 20) and comparing quantities within 15 (then 20)**
  (Informal recording using digit cards)
• Developing a feel for the size of a set of objects up to 20
  (Early Approximation and Estimation skills, red level, T & L file)

![Image of candies]

Have a quick look and estimate how many sweets?

• Appreciating the composition of numbers to 20 and relating to names of teen numbers
  (Using blank 1-20 grid, rods of 10 and digit cards, RSG p151)

Pupil should now have developed the skills for

Assessment Check 5
Preparation activities to support Assessment Check 6

- **Recognising number names and knowing numbers 1 - 50**
  (Oral response)
  
  E.g. pupil says number name when shown specific digit card

- **Counting on/ back in ones within 1-50 using different starts**
  (Counting on/back mental strategy – orange level, T & L file)

- **Counting in twos within 10 and then 20, forwards and backwards**
  (Towards Quick Recall mental strategy – orange level, T & L file)

- **Adding and subtracting initially within 11-15, and then 11-20 without bridging**
  (Using materials and a number-line)
  (Oral response)

- **Applying knowledge of addition and subtraction stories within 10 to numbers up to 20 without bridging**
  (Using practical materials and 1-20 grid)
  (Oral response)

  E.g.  
  2 + 4 = 6  
  12 + 4 = 16  
  7 - 3 = 4  
  17 - 3 = 14

- **Adding and subtracting initially within 11-15, and then 11-20 with bridging**
  (Using materials and a number-line)
  (Oral response)
• Exploring addition and subtraction stories up to 20 and talking about them
  (Using Cuisenaire)
  (Towards mental response)

  E.g.  $11 + 3 = 14$,  $14 - 3 = 11$

• Working towards mental confidence in knowing doubles up to 10 + 10
  (Using Cuisenaire)
  (Towards mental response)

• Using doubles to support addition of near-doubles
  (Rounding and Adjusting mental strategy - orange level, T & L file)
  (Towards mental response)

  E.g.  $6 + 7 = 6 + 6 + 1 = 12 + 1$

• Applying knowledge of addition and subtraction within 20 with bridging to
  real-life contexts
  (Structured Play including money activities with 1p and 2p coins)
  (Respond mentally)

• Exploring composition of 2 - digit numbers to 20 through partitioning
  activities
  (Towards mental response)

Pupil should now have developed the skills for

Assessment Check 6
Preparation activities to support Assessment Check 7

- Recognising number names and knowing numbers 1 - 100
  Oral response e.g. pupil says number name when shown specific digit card

- Counting forwards and backwards in ones and twos within 1- 50 using different starts
  (Using counting stick, counting hoop, number line, number track)
  (Count on/back mental strategy – orange level, T & L file)

- Counting forwards and backwards in fives and tens within 1- 50 using different starts
  (Count on/back mental strategy – orange level, T & L file)

- Ordering numbers to 50 with different starts, using 1- 50 number-line
  (Using digit cards and 1-50 number line or washing line)

- Developing the concept of grouping, regrouping and exchanging using the following progression:

  o Counting in twos and ones to find the total of a collection grouped in twos and ones

    17 cubes
    \[ \rightarrow \]
    8 groups of 2 and 1 more

  o Using a range of materials to group in twos and exchange within 1-20

    17 cubes
    \[ \rightarrow \]
    8 sweets and 1 cube

    2 cubes = 1 sweet
- Counting in fives and ones to find the total of a collection grouped in fives and ones
  
  22 cubes → 4 groups of 5 and 2 more

- Using a range of materials to group in fives and exchange within 1-30
  
  22 cubes → 4 sweets and 2 cubes

- Counting in tens and ones to find the total of a collection grouped in tens and ones
  
  34 cubes → 3 groups of 10 and 4 more

- Using structured materials to group and exchange a 2-digit number within 50
  
  34 cubes → 3 tens and 4 units

Pupil should now have developed the skills for

**Assessment Check 7**
Preparation activities to support Assessment Check 8

- **Using one colour of cube to complete rows of 10 on blank 1-50 grid (three rows of 10 is 30 cubes)**  
  (Using blank 1-50 grid initially and one colour of cubes)  
  (Oral response)

- **Showing any 2-digit number to 50 practically (e.g. 33 is the same as 3 rows of 10 and 3 ones)**  
  (Using blank 1-50 grid initially and one colour of cubes)  
  (Oral response)

- **Using a single marker to indicate position of a 2-digit number within 50**  
  (e.g. placing counter in correct position for 24 on 1-50 grid)  
  (Using blank 1-50 grid and counters)

- **Partitioning 2-digit numbers within 50**  
  (Using Cuisenaire or Dienes)  
  (Oral response)

  - [Image of Cuisenaire rods]

  43 is the same as 4 tens and 3 units

- **Exploring addition and subtraction of 10 from multiples of 10**

  - [Chart showing numbers 1 to 50 with 20 and 30 highlighted]

  E.g. placing counter on 20 and moving to 30 to support mental addition of 10 i.e. 20 +10 = 30 as well as 30 - 10 = 20
• Adding and subtracting multiples of 10 from multiples of 10

```
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
```

E.g. placing counter on 50 and moving to 80 to support mental addition of 30 i.e. 50 + 30 = 80 as well as 80 - 30 = 50

• Adding or subtracting 10 from any 2-digit number within 50

```
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
```

E.g. placing counter on 27 and moving to 37 to support mental addition of 10 i.e. 27 + 10 = 37 as well as 37 - 10 = 27

• When adding or subtracting within 50 using number stories to 10 to support partition of a single digit to allow for landing on the nearest multiple of 10 (Partitioning Mental Strategy – orange level, T & L file)

E.g. 27 + 5 = 27 + 3 + 2 = 32

Pupil should now have developed the skills for

Assessment Check 8
Preparation activities to support Assessment Check 9

- **Counting forwards and backwards in ones, twos, fives and tens within 1-100 with different starts**
  (Using counting stick, counting hoop, number line, number track)
  (Count on/back Mental Strategy – yellow level, T & L file)

- **Showing any 2 - digit number to 99 practically using rods of 10 and cubes**
  (Using Multilink, Cuisenaire or Dienes)
  (Oral response)

  ![82 is the same as 8 rods and 2 cubes](image)

- **Explaining the value of each digit within any 2 - digit number (e.g. 82 is 8 tens and 2 units or 80 and 2 units)**
  (Using Multilink, Cuisenaire or Dienes)
  (Oral response)

- **Using two 6 - sided dice to derive random digits and re-arranging digits to make largest and smallest numbers (e.g. throwing 1 and 6 on two die can make 61 or 16)**
  (Using two 6 - sided dice)
  (Recording informally e.g. table)

- **Using a single marker to indicate position of a 2 - digit number within 99**
  (Using blank 1 - 100 grid)
  (Oral response)

- **Using a single marker, exploring position of any 2 - digit number using knowledge of key locations (e.g. knowing position of 20, find 19 and 21)**
  (Using blank 1 - 100 grid)
  (Oral response)

- **Ordering numbers within 100 (e.g. order 51, 17, 63, 29, 80, 4)**
  (Using digit cards)
  (Oral response)
- Exploring relationships and patterns within 1 - 100, including odds and evens (e.g. 7, 17 and 27 in one column, 31 - 39 in 4th row, counting on in fives)
  (Using 1 - 100 grid)

- Mentally recalling position of numbers (e.g. what are all the numbers on the bottom row?)
  (Using 1 - 100 grid)
  (Oral response)

- Developing patterns of addition and subtraction using known facts (e.g. 2 + 5 = 7 then 22 + 5 = 27, 7 - 5 = 2 then 27 - 5 = 22)
  (Record horizontally, using digit cards initially)

- Using a single marker on the 1-50 grid to add a single digit to or subtract a single digit from a 2-digit number without bridging (e.g. 24 + 3 = 27 or 27 - 3 = 24)
  (Record horizontally, using digit cards initially)

- Using a single marker on 1-100 grid to add a single digit to or subtract a single digit from a 2-digit number without bridging (e.g. 64 + 5 = 69 or 69 - 5 = 64)
  (Using the 1-100 grid)
  (Record horizontally)

Pupil should now have developed the skills for

Assessment Check 9
Preparation activities to support Assessment Check 10

- Using a single marker on the 1-50 grid to add a single digit to a 2-digit number with bridging, supported by partitioning
  (Record horizontally)

  
  ![Grid Image]

  
  \[
  24 + 8 = 24 + 6 + 2 = 30 + 2 = 32
  \]

- Using a single marker on the 1-50 grid to subtract a single digit from a 2-digit number with bridging, supported by partitioning (e.g. 24 - 6 = 24 - 4 - 2 = 20 - 2 = 18)
  (Using 1-50 grid)
  (Record horizontally)

- Using a single marker on 1-100 grid to add a single digit to or subtract a single digit from a 2-digit number with bridging, supported by partitioning
  (Record horizontally, Appendix 4.3 Example 3)

  
  ![Grid Image]

  
  \[
  62 - 9 = 62 - 2 - 7 = 60 - 7 = 53
  \]
• **Adding or subtracting any two 2 - digit numbers using 1-100 grid, based upon experience of adding or subtracting multiples of 10** (e.g. $13 + 11 = 13 + 10 + 1 = 23 + 1 = 24$ or $74 - 25 = 74 - 20 - 5 = 54 - 4 - 1 = 50 - 1 = 49$)
  (Using Partitioning mental strategy – orange level, T & L file)
  (Mental response)

• **Consolidating mental addition and subtraction within 50 using a range of resources**
  (Using Follow me cards, dice, dominoes, games, Bingo game)
  (Mental response)

• **Sharing and talking about the Mental Strategies used to add or subtract any two 2 - digit numbers within 100 to develop an awareness of the range of methods available**
  (Using 1-100 grid)
  (Using Counting on/back, Re-ordering, Rounding and Adjusting and Partitioning Mental Strategies, orange level, T & L file)

• **Exploring the range of Mental Strategies to support mental addition of any 2 - digit numbers within 100**
  (Using the 1-100 grid)
  (Using Counting on/back, Re-ordering, Rounding and Adjusting and Partitioning Mental Strategies, orange level, T & L file)

• **Consolidating mental addition and subtraction within 100**
  (Using a range of resources e.g. Follow me cards, dice, dominoes, games, Bingo game)
  (Mental response)

Pupil should now have developed the skills for

**Assessment Check 10**
Appendices
The importance of a carefully planned programme of sorting activities cannot be over-emphasised. In general, it provides an excellent context for the early promotion of the pupil’s skills in observation, reasoning and language. More particularly, it is a vital prerequisite to meaningful work with number. The table below summarises the natural links between sorting activities and number.

**Sorting Experiences**

- Developing the notion of a set
- Comparing unequal sets ‘more’ ‘fewer’
- Comparing equal sets ‘both the same’
- Partitioning sets into subsets

**Links with Number**

- Making sets develops the concept of cardinal number e.g. the ‘fourness of 4’
- Comparing unequal amounts - more than/ less than
- Comparing equal quantities ‘the same number’ develops ideas of invariance/ conservation
- Finding components of number

Progression within sorting activities enables pupils to develop gradually a sound appreciation of the concept of a set. The following progression in sorting is carefully graded so that the first experiences are clear and straightforward, progressing later to more demanding collections. Pupils will benefit greatly if they are allowed the time they need to acquire confidence at each stage in this development.
**SORTING PROGRESSION**

**Towards the notion of a set**

- Pupils will sort random collections and talk about their arrangements
- Pupils will sort one-property collections in one way and talk about their arrangements
- Pupils will sort two-property collections in two different ways and talk about their arrangements
- Pupils will sort three-property collections in three different ways and talk about their arrangements

**Using pictorial representation**

- Pupils will use Tree / Venn / Carroll diagrams to sort for one property and talk about their arrangements
- Pupils will demonstrate their ability to reason in practical situations

**The notion of sub-sets**

- Pupils will understand subsets in the context of practical situations
- Pupils will use Venn diagrams to sort a set of logic people in three different ways. They will talk about their arrangements and explain their decisions
- Pupils will use Tree diagrams to sort for one property
- Pupils will use Carroll diagrams to sort for one property
- Pupils will demonstrate their ability to make reasoned choices

**Combining sets**

- Pupils will combine 2 or more sets and talk about their arrangements
- Pupils will use Tree / Carroll / Venn diagrams to sort collections of logic blocks. They will talk about their arrangements and explain their decisions
- Pupils will demonstrate their reasoning ability in games with logic blocks
APPENDIX 4.2: MATHEMATICAL LANGUAGE

(adapted from National Numeracy Strategy Mathematical Vocabulary booklet, DFES, 2000)

Teaching mathematical language

- Plan and use a structured approach to teach language
- Encourage pupils to use mathematical language in context
- Use a language board / display

Effective questioning

- Create a challenging learning environment
- Encourage pupils to explain and discuss strategies for finding answers
- Use open-ended questions ‘What if…?’
- Use questions rather than instructions e.g.
  - How can we be sure that…?
  - What is the same and what is different about… and…?
  - Is it ever true that ..?
  - Why is it that…, … and … all give the same answer?
  - How do you know that…?
  - What evidence do you have for…?
  - How would you explain…?
  - What does that tell us about…?
  - What is wrong with…?

Types of questions

- Recalling facts (e.g. What is 3 add 7?)
- Applying reasoning (e.g. 7 coins in a bag total 23p. What could the coins be?)
- Compare strategies (e.g. How might we count the cubes? How could you take 17 from 22?)
- Interpreting results (e.g. What does that tell us about the numbers in this sequence? What could the next number in this pattern be … and why?)
- Applying facts (Tell me 2 numbers with a difference of 12. What units could we use to measure the table?)
- Hypothesizing or predicting (Estimate the number of marbles in the jar.)

When pupils are starting work

- How are you going to start / tackle this?
- What information do you have? What do you need to find out or do?
- What operations are you going to use?
- Will you do it mentally? Why?
- What method are you going to use? Why?
- What equipment will you need?
- What questions do you need to ask?
- How are you going to record?
- What do you think the answer will be? Can you estimate or predict?
Check progress while pupils are working:

- Can you explain what you have done so far? What else is there to do?
- Why did you decide to use this method or do it this way?
- Can you think of another method that might have worked?
- Could there be a quicker way of doing this?
- What do you mean by…?
- What did you notice when…?
- Why did you decide to organise your results like that?
- Are you beginning to see a pattern or rule?
- Do you think that this would work with other numbers?
- Have you thought of all the possibilities? How can you be sure?

When pupils are stuck:

- Can you describe the problem in your own words?
- Can you talk me through what you have done so far?
- What did you do last time? What is different this time?
- Is there something that you already know that might help?
- Could you try it with simpler numbers, fewer numbers, using a number-line?
- What about putting things in order?
- Why not make a guess and check if it works?
- Have you discussed your work with anyone else?

At the end of the lesson:

- How did you get your answer?
- Can you explain your method/pattern/rule to us? Can you explain why it works?
- What could you try next?
- Would it work with different numbers?
- What if you started with… rather than…?
- What if you could only use…?
- Is it a reasonable answer? What makes you say so?
- How did you check it?
- What have you found out today?
- If you were doing it again, what would you do differently?
- Where could you use the method/idea again?
- Did you use any new maths language today?
- What are the key points/ideas you need to remember about…?
APPENDIX 4.3: PUPIL RECORDING

Rationale

Recording pupils’ work can be necessary to support their mathematical thinking as they progress through the Assessment checks. It can provide teachers with evidence of pupil achievement as well as a greater insight into the pupil’s understanding. However, pupil progress can also be monitored through teacher observation, oral interaction and peer discussion.

Range of recording methods

Recording pupil’s work can be achieved through a variety of methods using practical materials, oral or written response or a combination of all three.

Example 1: A preparation activity to support Assessment check 2. Pupils can record using digit cards alongside their practical work with Cuisenaire rods.

Example 2: A preparation activity to support Assessment Check 5. Pupils record their work using simple function machines.
**Example 3:** A preparation activity to support Assessment Check 10. Pupils can use either a 100 square or a number-line to 100, initially with digit cards, before horizontal written recording.
Informal jottings

Pupils’ informal jottings can be very personal or unique methods of written recording which can be talked through by the pupil. The need for recording is not dependent on pupil-age but is dependent on the pupil’s mathematical thinking and the level of the task involved. Pupils could choose when they are ready for some level of recording to support their mathematical thinking.

Informal jottings can become necessary when there are too many numbers to remember, numbers become too big or there are a number of stages involved in the task. Teachers may need to model the use of informal jottings to ensure that pupils are able to use a range of written recording methods.

Example 1: adding $4 + 2 + 3 + 1$ mentally could be supported by allowing the pupil to simply jot down the numbers on an individual pupil’s whiteboard (below are three alternative ways of recording)
Example 2: adding two larger numbers together could be mentally calculated by using an individual whiteboard to record the numbers as well as an indication of the method of calculation.

\[
\begin{array}{c}
80 \\
59 + 34 \\
13 \\
80 + 13 = 93
\end{array}
\]

\[
\begin{align*}
59 + 34 &= 50 + 30 \\
&+ 9 + 4 \\
&= 80 + 13 \\
&= 93
\end{align*}
\]

Example 3: the following multi-stage problem, read orally by the teacher, could be recorded on a whiteboard as the pupil’s work progresses.

\[
\begin{align*}
6 + 6 + 6 &= 18p \\
9 + 9 + 9 + 9 &= 36p \\
18p + 36p &= 40p + 14p \\
14 &= 54p \\
100p - 54p &= 46p \text{ change}
\end{align*}
\]

Sean buys 3 apples costing 6p each and 4 oranges at 9p each.

Sean has £1 to spend, how much change would he have left?
APPENDIX 4.4: PUPIL RECORD (CLASS VERSION)
<table>
<thead>
<tr>
<th>Assessment Check 1</th>
<th>Assessment Check 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerals up to 5</td>
<td>Numerals up to 10</td>
</tr>
<tr>
<td>Unequal/equal sets within 5</td>
<td>Count objects within 10</td>
</tr>
<tr>
<td>1:1 correspondence</td>
<td>Order numbers within 5</td>
</tr>
<tr>
<td>Count objects within 5</td>
<td>Conservation within 5</td>
</tr>
<tr>
<td>1 more/1 less/number before/number after</td>
<td>Addition and subtraction within 5</td>
</tr>
<tr>
<td></td>
<td>Partition sets within 5</td>
</tr>
</tbody>
</table>
### Assessment Check 3

- Numerals up to 20
- Order numbers within 10
- Conservation within 10
- Odd and even numbers within 10
- Commutative aspect of addition
- Addition and subtraction within 10

### Assessment Check 4

- Counting back to support subtraction within 10
- Inverse relationship - addition & subtraction
- Quick recall of addition and subtraction facts
<table>
<thead>
<tr>
<th>Assessment Check 5</th>
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</thead>
<tbody>
<tr>
<td>Addition &amp; subtraction to 10 - different contexts</td>
<td></td>
</tr>
<tr>
<td>Order numbers within 20</td>
<td></td>
</tr>
<tr>
<td>Approximate and estimate within 20</td>
<td></td>
</tr>
<tr>
<td>Begin to understand composition of 2-digit numbers</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Check 6</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number names and numerals up to 50</td>
<td></td>
</tr>
<tr>
<td>Addition and subtraction within 20 mentally</td>
<td></td>
</tr>
<tr>
<td>Quick recall of addition and subtraction within 20</td>
<td></td>
</tr>
<tr>
<td>Understand composition of 2-digit numbers to 20</td>
<td></td>
</tr>
<tr>
<td>Pupil Names</td>
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</table>

**Assessment Check 7**

- Order numbers to 50
- Group and exchange numbers to 50
- Number names and numerals up to 100
- Practically exchange within 50

**Assessment Check 8**

- Understand composition of 2-digit numbers to 50
- Add or subtract 10 to multiples of 10
- Add or subtract multiples of 10 to multiples of 10
- Add or subtract 10 from any 2-digit number to 50
- Partition numbers within 50 into tens and ones
<table>
<thead>
<tr>
<th>Assessment Check 9</th>
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</thead>
<tbody>
<tr>
<td>Appreciate position of tens digit - value</td>
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<tr>
<td>Order numbers to 100</td>
</tr>
<tr>
<td>Use derived facts for addition and subtraction</td>
</tr>
<tr>
<td>Addition and subtraction within 50 without bridging</td>
</tr>
<tr>
<td>Addition within 50 with bridging</td>
</tr>
<tr>
<td>Mental addition of 2-digit numbers within 50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment Check 10</th>
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</thead>
<tbody>
<tr>
<td>Subtract within 50 with bridging</td>
</tr>
<tr>
<td>Add and subtract a single digit from a 2-digit number without bridging within 100</td>
</tr>
<tr>
<td>Add and subtract a single digit from a 2-digit number with bridging within 100</td>
</tr>
<tr>
<td>Add and subtract two 2-digit numbers within 100</td>
</tr>
<tr>
<td>Use range of methods for adding and subtracting two 2-digit numbers within 100</td>
</tr>
<tr>
<td>Mental addition and subtraction of two 2-digit numbers within 100</td>
</tr>
</tbody>
</table>
APPENDIX 4.5: PUPIL RECORD (TARGET GROUP VERSION)
<table>
<thead>
<tr>
<th></th>
<th>Pupil Names</th>
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</thead>
<tbody>
<tr>
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<tr>
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<td>Assessment Check 5</td>
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<td>Addition and subtraction within 10 across a range of contexts</td>
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<tr>
<td>Assessment Check 9</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
</tr>
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<td>Appreciate position of tens digit indicates its value</td>
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</tbody>
</table>
APPENDIX 4.6: RESOURCES

- Random sorting materials (e.g. buttons, coloured blocks)
- Structured sorting materials (e.g. bears, threading beads, frogs)
- Play money
- Counting materials (e.g. counters, cubes, beads)
- Multilink
- Cuisenaire
- Base ten material, Dienes
- Digit cards
- Counting stick, counting hoop
- Number line, number track
- Blank 1-20 grid, numbered 1-20 grid
- Blank 1-50 grid, numbered 1-50 grid
- Blank 1-100 grid, numbered 1-100 grid
- Dice
- Dominoes
- Bingo game
- Follow Me cards (e.g. I have 25, who has 30 + 42)

- Ready, Set, Go - Maths (RSG) games
- Ready, Set, Go - Maths (RSG) handbook
- Northern Ireland Strategy for Numeracy, Teaching and Learning file (T & L file), 2001
- Ready For Calculating handbook, BELB, 2005
APPENDIX 4.7: BIBLIOGRAPHY

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- Improving learning in mathematics: challenges and strategies, DFES, 2005
- Improving learning in mathematics: a professional development guide, DFES, 2005

The authors acknowledge the support of the Belfast Education and Library Board numeracy team in the development of these guidance materials. We would also like to thank the Principals of the schools involved for their willingness to participate in a pilot of these teacher guidance materials as well as all the teachers and pupils who worked through the activities within Maths Milestones 1 and 2 and contributed valuable suggestions. The schools involved in the pilot of these materials were:

- Black Mountain Primary School
- Downey House Preparatory Department
- Holy Cross Girls Primary School
- Holy Family Primary School
- Park Special School
- Rosetta Primary School
- St Matthew’s Primary School
- Star of the Sea Primary School
- Wheatfield Primary School

Deirdre Martin (BELB)
Jonathan Cockroft (BELB)