handbook for leading mathematics teachers

Contents

Foreword

Demonstration lessons will be a key element of the support for teachers as they implement the National Numeracy Strategy. It is important that all teachers in primary schools have the opportunity to watch successful teaching based on the *Framework for Teaching Mathematics from Reception to Year 6*. Many teachers will be uncertain as to exactly what whole class teaching in mathematics will require of them and how their teaching may need to change.

We have asked for Leading Mathematics Teachers, alongside LEA Numeracy Consultants, to provide demonstration lessons in the early stages of the Strategy. I am delighted that many skilled teachers have taken up this challenge. This booklet provides you with some information and advice to help you to prepare and teach demonstration lessons.

The National Numeracy Strategy is an exciting opportunity to transform standards in our primary schools. I should like to take this opportunity to thank all of you who are working hard to make the National Numeracy Strategy a success.

Anita Straker
Director
National Numeracy Strategy

Introduction

The context

The National Numeracy Strategy will be launched in schools in September 1999. All primary schools will be asked to teach a daily mathematics lesson lasting from 45 to 60 minutes, depending on the age of pupils. Teachers should teach the whole class together whenever possible. Oral and mental work should feature strongly in each lesson.

A package of training and support will be available for teachers:

- 300 local Numeracy Consultants are being recruited and trained so that they can advise schools on good mathematics teaching.

- The *Framework for Teaching Mathematics from Reception to Year 6* will be sent to all schools in March 1999.

- Schools will be able to send their headteacher, mathematics coordinator and one other teacher (preferably the SENCO) to a three-day training course in the summer term 1999.

- Further training will take place, supported by national materials, during three INSET days. The first of these will be an extra INSET day for primary schools towards the end of the summer term 1999, announced by the Secretary of State in recognition of schools' commitment to the Literacy and Numeracy Strategies.

- Over the course of the Strategy around 60% of all schools will receive extra support, including five more days of training for two teachers. About 15% of all schools will benefit from this intensive support in the first year of the Strategy.

- All teachers should have the opportunity to watch a demonstration lesson and release time has been made available to schools for this purpose. Some of these lessons will be provided by Numeracy Consultants but they will not be able to meet early demand on their own. Skilled coordinators and other teachers will, therefore, act as Leading Mathematics Teachers by providing demonstration lessons.

Role of Leading Mathematics Teachers

As a Leading Mathematics Teacher, you will offer other teachers the opportunity to see you teaching a lesson based on the *Framework for Teaching Mathematics*. In this way you will supplement opportunities for demonstration lessons offered by local Numeracy Consultants.

You will normally teach demonstration lessons in your own school and to your own class. Teachers from nearby schools (usually from three to five at a time) will be able to watch these lessons, using release time provided for all schools in the first year of the Strategy.

You will need to decide with your headteacher the best time for inviting visiting teachers. Local arrangements should be in place to make sure that visits to your classroom are spaced at suitable intervals and at times to suit you and your school.

You will probably need a little extra time to prepare for the lessons, to brief visiting teachers and to talk to them afterwards. Your school will receive payment, equivalent to three days of supply cover, in recompense for this extra time.

The aim is to show teachers how to plan and teach lessons, using the principles set out in the *Framework for Teaching Mathematics*. When you are deciding what to include in a demonstration lesson your first priority, as ever, should be to enhance the learning of your own class. We are not looking for perfect lessons which have been well rehearsed. The lesson should be a real lesson, taught to children that you know. From the children's point of view, it should seem much like any other of their mathematics lessons.

Using the Framework

The *Framework for Teaching Mathematics* contains a double-page spread for each year group from Reception to Year 6, summarising the objectives for that year's teaching programme. Each spread includes a manageable number of key objectives, highlighted in bold, to which you should give priority when setting targets for pupils. These objectives are also used for assessment purposes.

With each year's summary of objectives there are planning grids which you can use, if you wish, to help you develop your medium-term plans. Each grid shows the topics, in units of work, for you to teach over the term. It also suggests the number of days you should spend on each unit. For Reception classes, you can determine time allocations once the children have settled in to school. The first and last units in each term are always shorter, to allow for the start and end of term. However, you can teach the units of work in any order. There is a separate grid for the spring term because it is usually shorter than the other two terms.

The programme for each year group allows you to revisit topics, in a number of cases several times during the year. Units and topics match up very closely in Years 1 and 2, in Years 3 and 4 and in Years 5 and 6. This is to help teachers with mixed-age classes.

There are also supplements showing examples of what pupils should know and be able to do in each year group for each topic.

The Framework covers the full range of National Curriculum requirements. Each yearly teaching programme is set out in the same four columns, with some slight modifications for Reception:

- Numbers and the Number System
- Calculations
- Making Sense of Problems, including Data Handling
- Measures, Shape and Space

Attainment Target 1, Using and Applying Mathematics, is integrated throughout.

Although the strands are set out separately, mathematics has many connections both within and across topics. You need to make these connections visible for pupils and help them to make some links of their own.

Key dates for schools

Spring Term 1999
- Two-day training session for Leading Mathematics Teachers (and any local Numeracy Consultants already in post) on teaching demonstration lessons

- *Framework for Teaching Mathematics from Reception to Year 6* will be sent to all schools

- Local arrangements for watching demonstration lessons by Leading Mathematics Teachers set up

Summer Term 1999
- Three-day training conferences for headteachers, mathematics coordinators and SENCOs

- One INSET day, after the training conference, to prepare for the daily mathematics lesson

- Demonstration lessons by Leading Mathematics Teachers begin

- Schools audit their current practice in mathematics

Autumn Term 1999
- All class teachers to teach a daily mathematics lesson for all pupils

- All teachers to watch a daily mathematics lesson, either a demonstration lesson by a Leading Mathematics Teacher, a consultant or a colleague in their own school or on video

- Five-day follow on intensive training for coordinators and SENCOs of schools receiving additional support

- Second INSET day devoted to the Strategy

Spring Term 2000
- Third INSET day devoted to the Strategy

Demonstration lessons

The three-part lesson

The key feature of the daily mathematics lesson is flexibility within a simple structure. It is designed to allow you to exercise judgement and to enable you to carry out more direct teaching, both with the class as a whole and with big groups. It has many features in common with the literacy hour: for example, the emphasis on interactive whole class and group teaching and a high proportion of oral work.

A typical National Numeracy Strategy lesson is based on three distinctive parts (see right). Timings are approximate; they will depend on the nature of the teaching input and activities for pupils that you have planned.

A typical lesson

whole class

Introduction
- oral and mental work to rehearse and sharpen skills

5–10 MINUTES

whole class groups pairs individuals

Main Activity
- clear objectives shared with pupils
- direct interactive teaching input
- practical and/or written work for pupils on the same theme for all the class
- if group work, usually differentiated at no more than three levels, with focused teaching of one or two groups for part of the time
- continued interaction and intervention
- misconceptions identified

30–40 MINUTES

whole class

Plenary
- feedback from children to identify progress and sort misconceptions
- summary of key ideas, what to remember
- links made to other work, discussion of next steps
- work set to do at home

10–15 MINUTES

National Numeracy Strategy
Notes for Course Tutors
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5.1

The introduction

The lesson usually starts with a short, whole-class session focused on mental and oral skills. The aim of this **introduction** is to rehearse and sharpen the mental skills that children already have, and to develop new ones. You may decide to concentrate on strategies for mental calculations. There are also games and activities which can be used to consolidate counting skills and promote rapid recall of number facts. Often you will select a particular aspect of number but other aspects of mathematics may well feature from time to time, for example, making estimates of measurements or suggesting suitable units for measuring specific things. Occasionally you could use this time for children to practise visualising and talking about shapes and patterns.

Mental calculations are not just confined to the opening section but, in some lessons, could also feature in the main activity.

The main activity

The **main activity** may well last for the bulk of the time, perhaps 30–40 minutes.
It will take learning forward in the mathematical topic or theme from the *Framework for Teaching Mathematics* that you are currently pursuing with the class.

There is likely to be teacher exposition — telling and showing children how to do something, giving them information — and, above all, there should be opportunities for pupils to become involved through questioning and giving explanations. You can tailor questions to suit children at different levels of attainment. Make pupils aware of the objectives of the lesson, and what is expected of them, as they embark upon activities, all with the same mathematical focus.

A flexible approach to suit the needs of the class at any one time is essential throughout the main part of the lesson. The amount of time the whole class works together with you will vary. Sometimes, and especially at the beginnings and ends of topics, you may work with the whole class for much of the time. Sometimes children will split up into groups quite quickly. You will then continue direct teaching with one or two of these groups while the others carry out practice and consolidation activities or practical work. At other times, children may not work in groups at all but will work individually or in pairs on the same open-ended task. Where group work is appropriate, aim for manageable sizes of no more than four groups covering three levels of attainment.

The plenary

It is essential that time is allowed at the end of the lesson for a **plenary** in which you identify what was really important during the lesson. You can also take feedback from pupils, make an informal assessment of their progress and clarify misconceptions. As a result of the plenary, children should know what they need to remember and how to remember it.

A good pace is important throughout the lesson to retain children's interest and attention. The lesson format allows you considerable scope for an imaginative and lively approach, as you can see from the models on p35.

Demonstration lessons

The purpose of a demonstration lesson is to show visiting teachers some of the key features of a National Numeracy Strategy lesson. Although there is scope for flexibility within the lesson format, and not all lessons will have the same features, teachers who visit your school to see you teaching are likely to be interested in one or more of the following:

- the three-part structure of the daily mathematics lesson and how each part is taught

- how you share objectives with the children at the beginning of the lesson and review them at the end

- how you maintain a suitable pace in each part of the lesson

- your questioning techniques and the way that you and your class use the correct mathematical vocabulary

- the strategies you have for interesting and involving pupils — for example, asking children to explain and demonstrate on the board, making time for discussing briefly in pairs, 'show me' activities involving number cards or fingers

- how you develop mathematical imagery by, for example, asking children to close their eyes and visualise numbers, number patterns or shapes

- how you make connections between different areas of mathematics

- how you enable children of different attainments to work profitably together as a class and in groups — for example, in class work, by directing questions to particular children, using support staff to provide discreet help, or offering particular children cue cards; or in group work using the same basic activity for all groups but adjusting it for children of different attainment

- how you organise groups — for example, by putting children who need extra help at the front or by moving tables to create the number of groups you need

- the direct teaching you do during group work, and how you avoid being interrupted by early finishers or children who are stuck, for example, by encouraging children to generate their own questions, ask their partner first or collect a help card

- your use of key resources (see p16)

Mathematical topics for demonstration lessons

Visiting teachers will usually come to see the key features of the three-part lesson used effectively, rather than the teaching of a given mathematical topic.

However, there are certain topics that it would be particularly helpful to demonstrate. For example:

- mental strategies, especially those new to many teachers

- topics such as division, fractions and decimals, and reading numbers from scales, which teachers find hard to teach and children find difficult to learn

- practical measurement work with the whole class, in which you demonstrate the use of equipment and call on individual children to demonstrate too

Handy tips

Remember, your demonstration lessons needn't be perfect; the emphasis is on helping others feel they can do it too. Don't rehearse the lesson: it will lack spontaneity. It is more useful to watch a challenging lesson, where real learning is taking place, than a 'safe' lesson, slickly delivered. Below are some tips to help your demonstration lessons go smoothly.

Before the lesson

- Check that the visitors know where to come and at what time they are expected.

- Prepare brief lesson notes so that others can easily follow them, and fill in the demonstration lesson overview (p20); set the lesson in the context of the week's programme or unit of work.

- Ensure that a copy of the National Numeracy Strategy's teaching checklist (pp18–19) is available to all visiting teachers.

- Plan the briefing for the visiting teachers.

- Make sure that your wall displays are stimulating and relevant to the lesson, for example, that number lines and the relevant mathematical vocabulary for the topic you are teaching are displayed.

- Brief any support staff scheduled to work with you during the observed lesson.

- Prepare the children by explaining that there will be visitors during their mathematics lesson on, say, Wednesday, who have come to see how good they are at maths; then tell the children how you expect them to behave.

Talking to visitors before the lesson

- You will want to make short but salient points about your school, your class, your lesson, the seating arrangements for the visitors and your expectations of their role, for example, that they may talk to pupils during the group work but not when you are working with the whole class.

- Outline the features you want them to look out for during the lesson. Give them your lesson plan. Explain that you don't necessarily write such detailed lesson plans for every lesson — this one gives more detail than you would need if it were just intended for your own personal use.

- Get the tone right during the briefing: striking up a good rapport with colleagues will make them more receptive and help the discussion after the lesson.

- Make sure that observers have the demonstration lesson overview, completed by you, and the teaching checklist, which they can use during the lesson.

- Prepare the seating arrangements for the visitors and make sure that all the children have a clear view of the board and/or resources to be used.

- Before the lesson starts, make a point of introducing the visitors to the class, then ask the children to face you and to concentrate on their work.

During the lesson

- Concentrate on the children and take little notice of the visitors.

- If any of the children start to 'play to the gallery', stop the lesson and deal with it.

- Don't keep rigidly to your lesson if children's responses require it to be adjusted; change your plans and discuss the change afterwards.

Talking to visitors after the lesson

- Keep control of the debriefing: you should chair it. Suggest that the visitors take notes.

- Keep it short and positive. Stick to the allocated time (about 30 minutes).

- Make a brief comment on the lesson yourself and then take a comment or question from each person.

- Keep the conversation flowing, ensuring that the key teaching points are drawn out for each part of the lesson.

- If somebody expresses a negative view, don't get side-tracked. Bring the other visitors in by asking them if that is how they saw it, or what they thought.

- If it is all too positive, encourage colleagues to focus on just one or two specific aspects which they could introduce into their own teaching.

- Try to reassure colleagues who are anxious or lack confidence that they don't have to introduce everything all at once: for example, they could begin by thinking about how they will start and end their lessons (that is, the introduction and the plenary) and then, when those parts are going well, work on the main part of the lesson.

- Five minutes before the end, tell your visitors it is time to sum up. Take one summary comment from each visitor in turn about one thing that they think they could go away and get started on.

Lesson notes for visiting teachers

Lesson notes are usually personal and don't have to be in a standard format. But notes for a demonstration lesson are for someone else as well and may need to be more comprehensive. However, if your lesson notes are too long they may not be read! Aim to give just enough detail in your lesson plan for the visitors to place the lesson in context. Set out your learning intentions and how you intend to bring them about.

If you have a weekly outline, give colleagues a copy of this as well. Your plan may already be in a combined weekly and daily format because some schools adopt this approach.

On pp39–48 you will find examples of lesson plans for demonstration lessons to compare with your own format.

Key resources for teaching number

Depending on the ages of children in your class, your classroom will probably be equipped with some of these resources:

- number lines and squares, including empty number lines to aid mental calculation

- counting sticks (different ranges in different year-groups: ones, twos, fives, tens, hundreds, halves, tenths, decimal fractions, negative numbers)

- number cards: digit cards, place value cards, 'follow-me' cards, symbol/operation cards, chain cards (for practising mental recall)

- objects: rods, assorted large dice, and so on

- ICT: OHP calculator, computer with software such as *Developing Number** as used in the video

- posters: tens number chart, 100 grid, multiplication chart, and so on

- games and puzzles

It could be helpful for visiting teachers to see you and your class using some of the resources.

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Teaching checklist and demonstration lesson overview

National Numeracy Strategy: teaching checklist

This checklist has been devised to help with lesson observations. No single lesson will contain all the features listed, but you can use the checklist to note aspects of teaching that you see in each part of the lesson.

In the introduction, the teacher:

- [ ] gives a clear start to the lesson
- [ ] maintains a brisk pace
- [ ] provides a variety of short oral and mental activities
- [ ] asks a range of open and closed questions
- [ ] makes sure that all children can see the teacher clearly and take part in the lesson
- [ ] targets individuals, pairs or small groups with particular questions
- [ ] uses children's responses to make an informal assessment
- [ ] makes sure any support staff give discreet help to certain children
- [ ] avoids disruption from too much movement of pupils around the room
- [ ] avoids running over time and moves smoothly to the next part of the lesson

In the main activity, the teacher:

- [ ] makes clear to the children what they will learn
- [ ] makes links to previous lessons or to work in other subjects
- [ ] tells children what work they will do and how long it should take
- [ ] tells children what, if anything, they need to prepare for the plenary session
- [ ] maintains pace and gives children a deadline for completing their work

When working directly with the whole class, the teacher:

- [ ] demonstrates and explains ideas and methods using a board, flipchart, computer, OHP
- [ ] highlights new vocabulary, notation or terms and gets pupils to use them in their oral and written work
- [ ] involves children interactively through carefully planned questioning
- [ ] asks children to offer their methods and solutions for discussion
- [ ] ensures that children with particular learning needs in mathematics are supported effectively with appropriate resources, wall displays or adult help
- [ ] identifies and corrects any misunderstandings or forgotten ideas
- [ ] uses mistakes as teaching points

When working directly with groups, the teacher:

- [ ] has a manageable number of groups (usually a maximum of four)
- [ ] gives a clear introduction to tasks
- [ ] sets clear time scales and expectations for the tasks
- [ ] ensures the degree of differentiation is manageable (for example, by providing linked tasks on the same theme, usually at no more than three levels of difficulty)
- [ ] ensures that children do not have to wait long for their turn
- [ ] maintains all children's interest and motivation and makes sure they are on task
- [ ] sits and works intensively with one or two of the groups (does not flit among them)
- [ ] makes appropriate use of any support staff or adult helpers
- [ ] avoids interruption by making sure that those working independently know:
  - [ ] where to find the resources
  - [ ] what to do before asking for help
  - [ ] what to do if they finish early

When working directly with individuals or pairs, the teacher:

- [ ] keeps the children working on related activities, exercises or problems
- [ ] targets individuals or pairs for particular questioning or support
- [ ] encourages children to discuss and cooperate during paired work

In the plenary, the teacher:

- [ ] makes sure that there is sufficient time for the plenary
- [ ] draws together what has been learned, highlighting key facts, ideas and vocabulary, and what needs to be remembered
- [ ] indicates link with previous work, or where the work is leading
- [ ] brings the lesson to a close, reflecting on what has been achieved

General management features:

- [ ] seating arrangements allow children to see demonstrations and resources clearly
- [ ] resources and vocabulary have been prepared for use in the lesson
- [ ] any classroom assistants have been fully briefed and are aware of their role

National Numeracy Strategy: demonstration lesson overview

Tick or mark the relevant boxes and hand a copy to each visiting teacher, with a copy of your lesson plan, before a demonstration lesson. The information will provide a guide for each of the three parts of the lesson.

◆ Class being taught

Year group(s) ☐   Number of pupils on roll ☐

Number on SEN register ☐   Number with statements ☐

Number learning English as an additional language ☐

◆ The introduction will feature:

☐ rehearsing and sharpening of skills

    ☐ counting in steps of different sizes, as a whole class or around the class

    ☐ practising rapid recall of number facts

    ☐ figuring out new facts from known facts

☐ practising mental calculations in various ways

    ☐ explaining strategies

    ☐ building on a previous strategy

☐ identifying facts that children should learn by heart and discussing ways of remembering them

☐ reviewing an activity done at home

◆ The main activity will feature:

☐ introduction of a new topic

☐ consolidation or extension of previous work

☐ using and applying concepts and skills

◆ The plenary will feature:

☐ giving pupils an opportunity to present or explain their work

☐ getting pupils to check their work

☐ rectifying misconceptions or errors, if necessary

☐ discussing and comparing different methods of calculation

☐ generalising a rule from a number of examples

☐ discussing problems that can be solved using the ideas and skills that have been learned

☐ making links to other work and discussing briefly what the class will do next

☐ reminding pupils about their personal targets and highlighting progress made

☐ providing mathematical tasks or ideas for pupils to do at home

Organisation

If you are lucky enough to be supported by an assistant during a demonstration lesson, you will need to brief the assistant about the arrangements for the visitors. You will also need to explain the assistant's role to the visitors.

Schools usually have an agreed policy on the deployment of support staff. All teachers should be clear about what they can reasonably expect any assistant to do and what help and guidance they need. In the daily mathematics lesson, the role of the general classroom assistant is to help the teacher ensure that each child plays a full part. There may also be assistants who are assigned to work with particular groups or individuals, for example, for language support or special educational needs.

Briefing classroom assistants

Staff who are supporting you need to know not only what children are to do but also **what they are to learn**. The assistant should have access to a copy of the *Framework for Teaching Mathematics* and have some involvement in planning lessons. You could draw the attention of support staff to the booklet *Mathematical Vocabulary* and identify the words they should focus on in a particular unit of work.

Whole class work

In any whole class work, the classroom assistant should sit or stand close to children who need special help and provide this discreetly. For example, by:

- prompting shy or reticent pupils

- signing or translating core vocabulary or phrases

- sitting close to pupils who have a visual impairment and using a hand-held whiteboard to reproduce what is on the main board or flipchart

- helping children to use specific individual resources to find an answer, such as personal number cards or table top number lines

- operating individualised ICT resources as indicated in a child's Individual Education Plan

Before oral work, you could ask classroom assistants to observe carefully the responses of the pupils they will be working with later in the lesson. This will help them to be more aware of the kind of support they will need to give.

Group work during the main activity

When you are organising group work as part of the main activity, you should use your classroom assistant to work with particular groups. For example, if you have four groups, explain to the assistant that you will be working with two of the groups and that s/he should oversee the other two groups.

The assistant's role with the group is mainly to:

- ensure that children interpret instructions correctly, concentrate and behave responsibly

- provide reminders of previous teaching points

- emphasise the correct use of the key mathematical vocabulary used in the lesson

- question children and encourage their participation in discussion by using prompts to initiate responses

You will need to suggest the questions and prompts that would be appropriate and identify any particular children on whom they should focus. Assistants should always use visual or practical aids, such as a number line and/or 100 grid, if necessary with a tactile finish, when they are helping children who have difficulty or who don't understand.

Support in the plenary session

Think how best to involve the support staff at the end of the daily lesson. One valuable way is to get your assistant to focus on particular children and monitor their responses to the discussion in the plenary session. Agree in advance with the assistant what s/he should look out for. This might include:

- whether particular children concentrate and show interest during the plenary session

- whether they try to make any attempt to respond to general questions

- the nature of any responses they do make and whether these reflect their responses in the rest of the lesson

The classroom assistant can help the group with which s/he has been working to give feedback to the whole class, perhaps focusing on particular skills the children might have.

Supporting children with particular needs

Some classroom assistants work with certain children more than others and sometimes exclusively with individuals with particular educational needs. You will need to plan together the work for these pupils and ensure that you are both monitoring what they are learning.

The daily mathematics lesson is appropriate for virtually all pupils. Aim to include everybody as fully as possible. All benefit from oral work if given appropriate support. For some children, writing things gets in the way of the mathematics and they find oral sessions particularly beneficial. You need to plan oral questions carefully, especially for children at the early stages of learning English as an additional language and for those with special educational needs.

Mathematics has a strong visual element. Exploit this feature to help pupils with particular needs. Number cards, number lines and squares and other resources will provide useful support for many pupils. Children with visual impairments may need tactile materials which serve the same purpose.

Take quick action to support pupils in need of additional help. Make sure key learning points are secure in your half-termly 'assess and review' days.

Pupils with special educational needs and Individual Education Plans

You will have some pupils who need special consideration in your class. Help them to benefit from watching and listening. Encourage them to join in. You will need to take steps to enable some children to have full access, for example, through the use of signing, Braille, tactile materials, ICT applications or the support of a classroom assistant or another adult. In order to ensure such pupils' interest and concentration, slightly shorten the time they have for independent work, especially if there is no other adult present.

You may decide to take into consideration teaching objectives for earlier year groups when constructing 'Group Education Plans'. The mathematical topic will be the same as for all the other children.

In a few cases, pupils with complex or profound difficulties may need an individual programme in the main part of the lesson, with adult support. Individual Education Plans should identify priorities for mathematics as well as addressing other issues, such as behaviour.

Pupils learning English as an additional language

Remember that many pupils who are at the early stages of learning English will be good at mathematics. They will often understand much more than they can convey. Whole class sessions provide useful models of spoken English. Emphasise key words and articulate them clearly. Once other pupils have established the language patterns associated with answering a particular sort of question, invite children learning English to take a turn. Encourage children to join in counting rhymes and chanting activities. Written materials should be expressed in simple language and should contain picture clues.

Emphasise early on that all children need to understand, say, read and write numbers in English and to learn simple mathematical terms. However, encourage pupils to exploit their experience of numbers and number games in their own language.

Further advice on children with particular needs can be found in the *Framework for Teaching Mathematics*, including suggested adaptations for special schools.
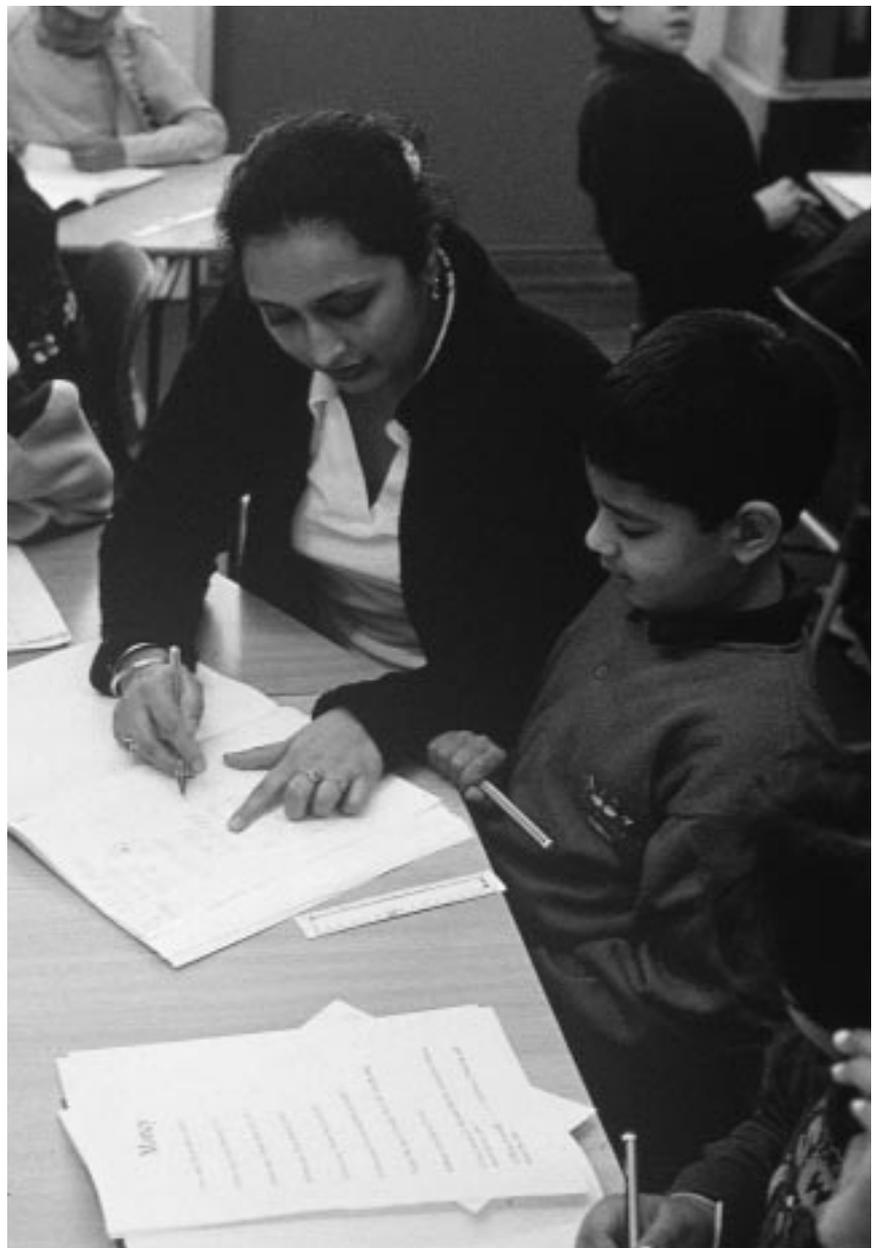
Appendices

OHTs

Reproduced on the next six pages are the overhead projector transparencies which are shown on the two-day course for Leading Mathematics Teachers.

Outline programme for the course

DAY 1	LENGTH OF SESSION
1 Effective strategies for teaching mathematics.	**75** MINUTES
2 National Numeracy Strategy and the role of LMTs.	**75** MINUTES
3 Introduction to the *Framework for Teaching Mathematics* and its approach to calculation.	**90** MINUTES
4 The effective use of key resources for teaching number.	**60** MINUTES
DAY 2	
5 Demonstration lessons — key features and strategies.	**90** MINUTES
6 Preparing notes for a demonstration lesson.	**60** MINUTES
7 Helping colleagues to benefit from their visit — before, during and after.	**75** MINUTES
8 Next steps — personal planning and local arrangements for visiting and support.	**60** MINUTES

1.1

- The National Numeracy Strategy builds on existing effective practice, in this country and elsewhere.

- The Strategy's key ideas have been developed in the National Numeracy Project. All groups of children in NNP schools have made significant gains in tests, including pupils with SEN.

- Some LEAs have had similar numeracy initiatives.

- The key ideas are reflected in effective primary mathematics practice in other countries.

- The Strategy reinforces teaching strategies used in the National Literacy Strategy.

2.1

The approach to teaching is based on these principles:

- dedicated mathematics lessons every day

- all pupils working on mathematics relating to a common theme

- direct teaching and interactive oral work with the whole class and groups

- controlled, manageable differentiation

- an emphasis on teaching mental calculation strategies and not introducing standard written methods too early

2.2

Support provided by the National Numeracy Strategy:

- the *Framework for Teaching Mathematics*, with yearly teaching programmes from Reception to Year 6 and guidance on planning, teaching and assessment

- up to 300 LEA Numeracy Consultants

- Leading Mathematics Teachers to supplement consultants in giving demonstration lessons

- training for the head, two teachers and a governor

- an extra INSET day for all staff in the summer of 1999

- prepared materials to support three whole-school INSET days

- five days of extra supply cover per school to release teachers

- extra support and five days of further training for some schools

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- As a rough guide, LMTs might be expected to offer about 15 lessons, usually teaching their own class.

- Observers will be teachers from other schools — perhaps between three and five per visit — depending on the size of the classroom.

- There should be briefings for visiting teachers both before and after the lesson.

- The main purpose will be to demonstrate lessons based on the three-part model in the *Framework for Teaching Mathematics*.

| March 1999 | • The Framework and vocabulary booklet distributed to schools, with QCA guidance on mental calculation, use of calculators and assessment |
| | • LEAs make local arrangements for demonstration lessons by LMTs |

Summer Term 1999	• Head and two teachers of every school attend three-day INSET
	• First of three whole-school INSET days using materials supplied
	• Visits start
	• Schools carry out audit of current teaching practice and prepare action plan
	• Schools plan their use of five release days to support the teaching of mathematics

Autumn Term 1999	• Teachers introduce the daily mathematics lesson
	• Programme of demonstration lessons by LMTs continues
	• Second whole school INSET day

Ideas behind the Strategy

- Emphasis on mental calculation

- Delay of formal, standard written methods

- Teaching of mental strategies

- Daily three-part lesson, with some manageable differentiation

- Direct teaching of the whole class

- Interactive teaching

- Variety of teacher presentation

- Year-by-year approach

- Support for long-term and medium-term planning

- Planned development of mathematical vocabulary

A typical lesson

whole class — **Introduction**
- oral and mental work to rehearse and sharpen skills

5–10 MINUTES

whole class / groups / pairs / individuals — **Main Activity**
- clear objectives shared with pupils
- direct interactive teaching input
- practical and/or written work for pupils on the same theme for all the class
- if group work, usually differentiated at no more than three levels, with focused teaching of one or two groups for part of the time
- continued interaction and intervention
- misconceptions identified

30–40 MINUTES

whole class — **Plenary**
- feedback from children to identify progress and sort misconceptions
- summary of key ideas, what to remember
- links made to other work, discussion of next steps
- work set to do at home

10–15 MINUTES

Seven of the key ideas

- Emphasis on mental calculation
- Delay of written methods
- Teaching of mental strategies
- Direct teaching of the whole class
- Interactive teaching
- Manageable differentiation
- Variety of teacher presentation

Mental calculation strategies (Year 2)

- **Identify near doubles, using doubles already known : 25 + 26**

  "51... because I know double 25 is 50... so it's one more... 51." Richard

- **Find a small difference by counting up from the smaller to the larger number : 63 – 59**

  "4... well... I know that 59 up to 60 is 1... then 63 is 3 more... and 1 and 3 is 4." Sami

- **Add/subtract 9: add/subtract 10 then adjust by 1: 37 + 9**

  "46... I did add 10... and that made 47... and then I just took away 1 because I know 9 is one under 10." Liam

- **Bridge through 10 or 20, then adjust : 17 + 8**

  "25... well, I thought 17 add 3 is 20... and because you need another 5 to make 8... then 20 and 5 make 25." Chrissie

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A typical lesson

whole class — **Introduction**
- oral and mental work to rehearse and sharpen skills

5–10 MINUTES

whole class / groups / pairs / individuals — **Main Activity**
- clear objectives shared with pupils
- direct interactive teaching input
- practical and/or written work for pupils on the same theme for all the class
- if group work, usually differentiated at no more than three levels, with focused teaching of one or two groups for part of the time
- continued interaction and intervention
- misconceptions identified

30–40 MINUTES

whole class — **Plenary**
- feedback from children to identify progress and sort misconceptions
- summary of key ideas, what to remember
- links made to other work, discussion of next steps
- work set to do at home

10–15 MINUTES

A visiting teacher could be helped by seeing:

- the three-part structure of the daily mathematics lesson, and how each of the three parts is taught

- how a particular part of the lesson is managed, including how the teacher uses resources and ensures that each child is involved

- how pace is maintained in each part of the lesson

- questioning strategies and the correct use of vocabulary by the teacher and the children

- how children demonstrate and explain on the board

- how manageable differentiation is achieved

- how the teacher caters for children with particular needs during whole class work

- direct teaching during group work

- variety in the plenary part of the lesson

Writing lesson notes

- spend a few minutes thinking of a lesson you have done, or are planning to do — perhaps one that you discussed in Session 1

- start with a blank sheet of paper and write down the headings you want to use, well spaced out — don't worry about the format

- add a few notes under each heading — these may not be very complete

- tick the relevant boxes on your demonstration lesson overview

- keep the notes brief — they should not be too detailed

- if there is time, make some brief notes on a second sheet of paper to explain what came before and what is planned to follow the lesson

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Information for visitors to provide before the lesson

- the prepared lesson plan

- an outline of the week's lessons, to put the lesson observed in context

- a brief description of the school and class, including any information which it would be useful for observers to know

- information about the number of pupils with SEN

- description of how any support staff are usually deployed in mathematics lessons

- the teaching points checklist

- a reassurance that children in the class are fully aware of the visit

- clarification that they are expected to observe the lesson, not join in with the teaching, but that they should feel free to talk to some of the children when the class is working informally in groups

---

Meeting with visiting teachers before a lesson

- mention the composition of the class and the classroom arrangements

- explain the role of any support staff

- explain what you are going to do and why, then talk through the lesson plan highlighting the key points of the lesson

- mention anything you are uncertain about in terms of children's responses, and alternative strategies which you might then use

- don't give the impression that you have all the answers: for example, say that there may be things that don't go as you hope and it will be interesting to talk about these after the lesson

- use the teaching checklist to point out particular features of the lesson the visitors might see and invite them to use it during the lesson

- explain where visitors are to sit and whether they should interact with the children or not

Preparing the class and the classroom

- Will there be a quiet area in the school where you can talk to the visitors before and after the lesson?

- Will your classroom have to be rearranged to accommodate extra chairs?

- How will you talk to the children about these lessons?

- How will you introduce the visitors to the children?

- Have you established your expectations of children's good behaviour?

- Do the children understand that they should not interrupt you when you are teaching a group?

- How will you need to prepare any support staff or extra adults who may be helping with your lesson?

7.3

Possible ways to start the discussion after the lesson

- Tell the visitors what time you will round off the discussion, and remind them that there is about half an hour talking time

- Encourage visitors to make notes to take away

- Invite each visitor in turn to make one brief comment about their general impressions

- Name the aspect of teaching you found easiest to incorporate into your lesson, and propose spending the first ten minutes on that

- Suggest that you spend just under ten minutes on teaching points from each part of the lesson (introduction, main activity, plenary), using the checklist to guide the discussion

- If visitors have come to see a particular part of the lesson, suggest that you spend about 15 minutes on that part, and then talk about the other two parts for five minutes each

7.4

Ways to maintain momentum and focus on teaching

- Aim to take comments from each visitor

- Maintain the flow by asking a question or inviting comments

- As a general rule, when one person comments, bring in some others — it keeps things flowing if at least one other person adds to the comment

- Steer visitors away from anecdotes about their own class or school

- Have a set of questions to ask them if conversation dries up or strays from teaching points

7.5

Prompts to keep the discussion focused

- Is this something you already do regularly? What about the rest of you?

- Is this something you could try? Anyone else?

- What kinds of lessons would lend themselves most readily to using that teaching point?

- If you introduced that, would it need a bit of extra planning, do you think?

- Would it be equally effective with larger/smaller groups?

- Would it be best to start that approach with groups or the whole class?

7.6

Handbook for Leading Mathematics Teachers

Ways to summarise and draw discussion to a close

- After 25 minutes or so, recap on things visitors have noted

- Remind them to begin with small changes, and try to identify what these changes should be

- Highlight one or two teaching points that they could all try

- Ask each visitor to say one thing that she or he will try

- Take one summary comment from each visitor in turn about what has been best about the visit for them

- Try to give particular encouragement to visitors who seem anxious, lack subject confidence, or think their pupils will not cope

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Self help for LMTs

- improving your knowledge of the *Framework for Teaching Mathematics*

- developing your use of the three-part lesson, including identifying:
  — key teaching strategies to demonstrate
  — mathematical topics for demonstration, including mental calculation

- inviting other staff in your own school to watch a lesson and play the part of a 'visiting teacher'

- arranging your own informal networks of LMTs for support

- exchanging lesson notes with other LMTs

- visiting other LMTs to observe lessons and exchange ideas

What can schools do to help?

- an agreed procedure for arranging visits

- visiting arrangements that allow schools to contact each other directly (for example, having a local directory saying what weeks or days are available, details of class taught, date when bookings can be made, and so on)

- a standard form which the host school could send to the visiting school to confirm arrangements, with a map for finding the school

- a friendly letter of welcome, with an agreed description of the school and the class to be observed, which could be sent with the map

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Information about the class:

- the number of boys and girls on roll

- the number on the special needs register

- the number learning English as an additional language

- the number eligible for free school meals

- the amount of support for the class, whether it is general support or specific support, for a group or for an individual pupil

- when pupils are working in groups, how they are organised

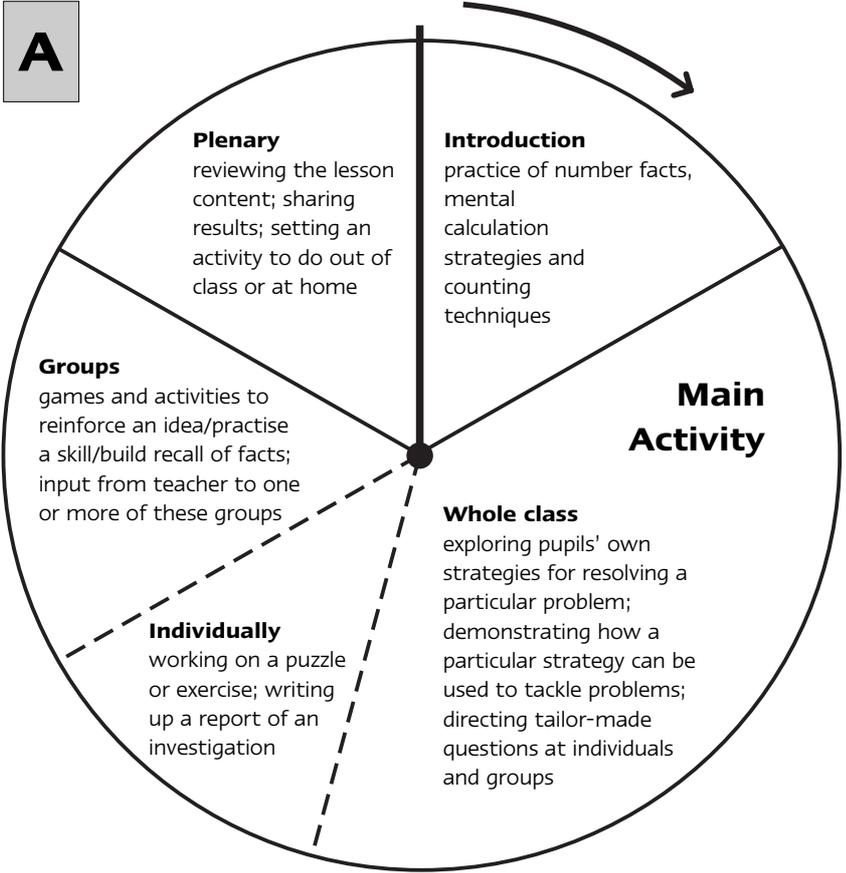- if the class is set by attainment, which set it is

Phases in a whole class mathematics lesson

The models of mathematics lessons shown on the following pages demonstrate the flexibility of the three-part lesson structure.

In Diagram A (p35), the main activity is split into differentiated phases, in which children work together as a whole class, and separately in groups and as individuals. In Diagram B (p35), the main activity is more integral, involving the whole class throughout.

The sample lessons that follow present a range of ways to interpret the three-part lesson structure. The main activity might have easier or harder versions for children of different abilities, or introductions and plenaries might vary in length or emphasis. However, the three-part lesson structure remains intact.
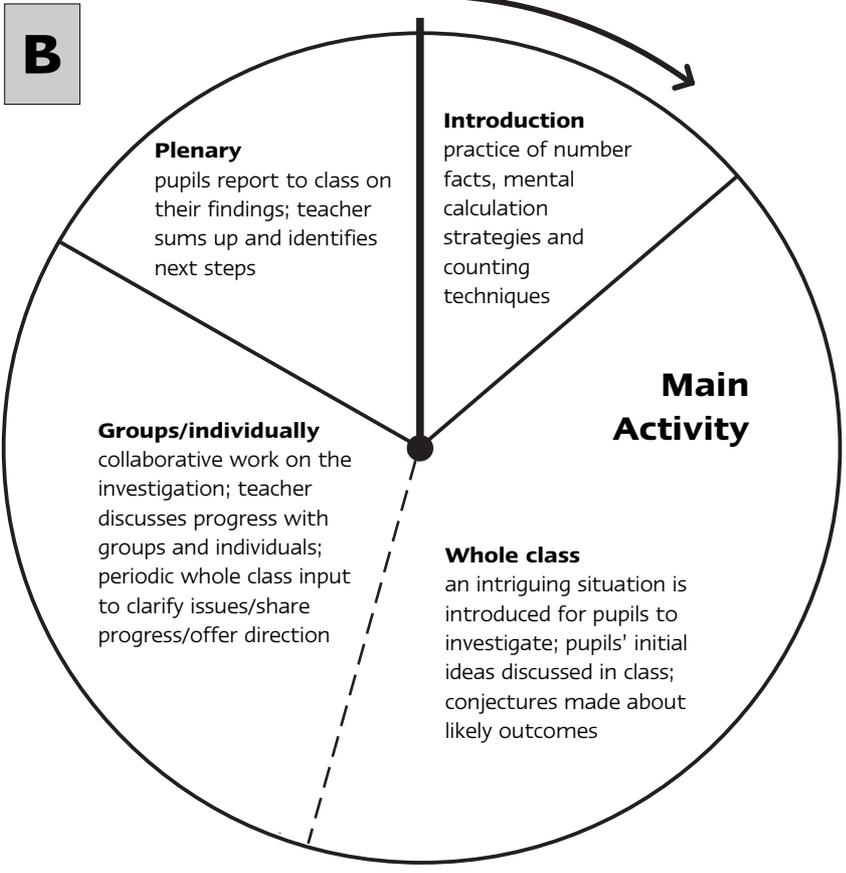
A

Plenary
reviewing the lesson content; sharing results; setting an activity to do out of class or at home

Introduction
practice of number facts, mental calculation strategies and counting techniques

Groups
games and activities to reinforce an idea/practise a skill/build recall of facts; input from teacher to one or more of these groups

Main Activity

Individually
working on a puzzle or exercise; writing up a report of an investigation

Whole class
exploring pupils' own strategies for resolving a particular problem; demonstrating how a particular strategy can be used to tackle problems; directing tailor-made questions at individuals and groups

Here are two models of a mathematics lesson. They show where the teaching input can be focused at different times during the lesson.

Diagram A shows a lesson in which the pupil activities are differentiated, whereas **Diagram B** illustrates a lesson where the whole class focuses upon a single open-ended activity and the teacher varies his or her expectations of the children's responses according to their attainment levels.

B

Plenary
pupils report to class on their findings; teacher sums up and identifies next steps

Introduction
practice of number facts, mental calculation strategies and counting techniques

Groups/individually
collaborative work on the investigation; teacher discusses progress with groups and individuals; periodic whole class input to clarify issues/share progress/offer direction

Main Activity

Whole class
an intriguing situation is introduced for pupils to investigate; pupils' initial ideas discussed in class; conjectures made about likely outcomes

The lessons in this section are adapted from originals by Ian Sugarman: MMU, Crewe School of Education

Y1 A lesson about reading, writing and ordering numbers to 20
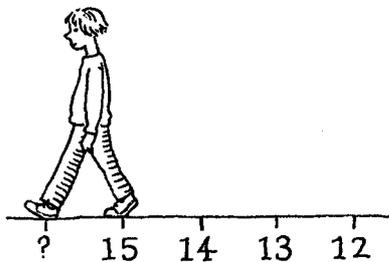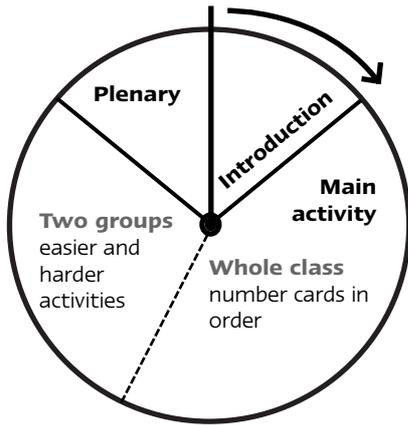
Introduction

Add 1 to different numbers that end in 6:

6, 16, 26, 126, 836...

Repeat with other sets of numbers — for example, numbers that end in 0.

Main activity

Give out cards 1–9 to nine children, one at a time — children stand in line in order, holding cards.

Using different children, make a sequence going backwards; make a sequence starting from a different number; extend the sequence to include numbers 10–19.

Ask questions such as: "What is the number before 8? After 4? Before 19?"
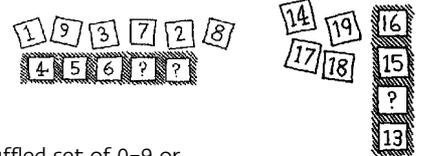
easier

● Find the missing number from a shuffled set of 0–9 or
0–19 cards. Paste number cards onto strips of card in order.
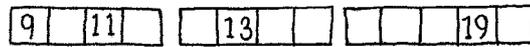
harder

● Play Rummy with two sets of 5–19 cards. The first person to get a sequence of four consecutive numbers wins.

Plenary: Walk steps forwards and backwards on a 0–20 number line chalked on the floor.

Y2 A lesson about finding the total value of several coins
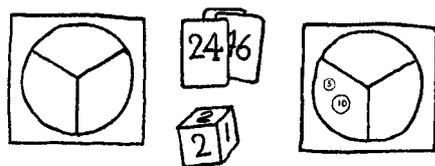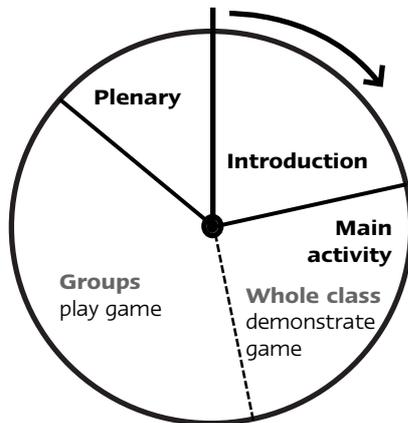
Introduction

In unison, count from 0 in ones, twos and fives as high as the class can go, and back to 0.

Children take turns to come to the front and secretly select any two coins, then announce the total value of their coins. The class try to work out which coins have been selected. Extend to three coins.

Main activity

Demonstrate the game by playing against the class. Pick a target card to decide the total amount of money to aim for. In turn, roll a dice showing just numbers 1 and 2, read out the dice number, and select that many coins to place on your board. After three turns, add up the value of your coins. Who is closest to the target?

Now children play the game in groups; differentiate for different attainments by choosing target cards and coins to suit the group. To challenge higher attaining children, include a 3 on the dice, or allow four tosses of the dice.

Plenary: Talk about how to add together the values of several coins. Show strategies such as: counting in twos or fives; making piles of 10p coins; looking for pairs of 5p coins.
Homework: Record the amounts you can make, up to 20p, using just two coins (or three coins for higher attainers).

Y3 A lesson about reasoning about the properties of 2D shapes in order to solve problems

Plenary

Introduction

**Main activity**

Whole class making shapes
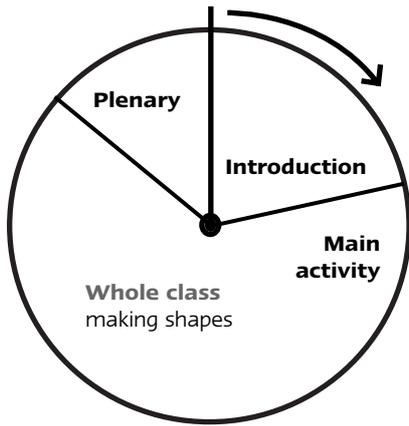
Introduction

Ask children to imagine they are a beetle following these instructions: "Walk in a straight line for five paces; turn right; take another three paces straight ahead; turn right and take another three paces; stop; now walk back to where you started." Ask children to help you draw the shape on the board.
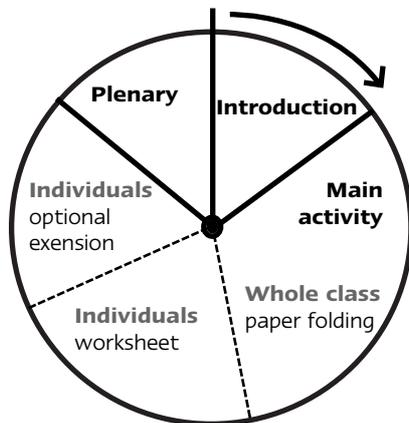
Main activity

Repeat the beetle's instructions as children draw the shape on squared paper stuck on thin card. They cut out two such shapes to use as a template. They then create new shapes by putting the two shapes together and drawing around them, using the rule 'put a pair of equal sides together'. (These shapes can be used in the following day's lesson for sorting onto Venn diagrams.)
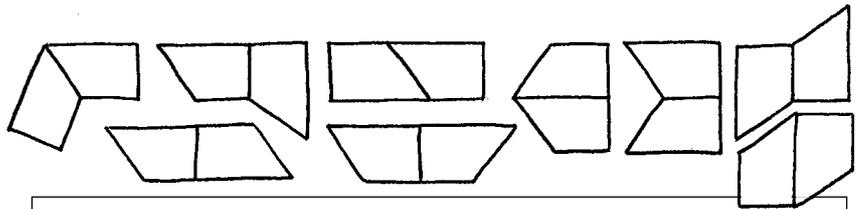
Plenary: The children tell you how to create new composite shapes, using large versions of the trapezium. Start with one shape on top of the other and encourage the children to use the words 'reflect', 'rotate' and 'translate' to get the top shape into position.

Homework: Take home a sheet with five-piece tangram to cut out and reassemble into a hexagon.

Y4 A lesson about equivalent fractions and doubling and halving

Plenary

Introduction

Individuals optional exension

Main activity

Individuals worksheet

Whole class paper folding

Introduction

Chant the four times-table, forwards and backwards. Play 'Number Journeys'. Say: "Start with 6; double it; add 10; subtract 3; add 1; halve the result. What are you left with?" Repeat with other starting numbers and other 'journeys'.

Main activity

Each child folds a square in half — discuss alternative ways of doing this. Fold it in half again. Get children to show you a quarter, half and three-quarters of the square. Establish that one half is equal to two quarters, and that a quarter is a half of a half.

Provide a worksheet with shapes that have been part shaded.
Children write down what fraction of each one is shaded.
On the same sheet have pictures of shapes with grid lines.
Children shade in a quarter, half and three-quarters.
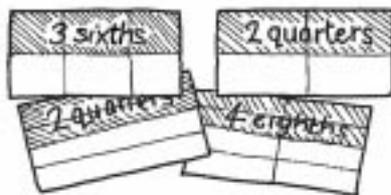
Get higher attaining children to draw their own shapes and shade in a quarter, half and three-quarters.

Plenary: Using cards, create a number line from 0 to 10 consisting of whole numbers and fractions.
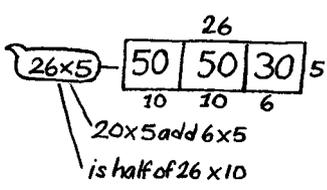
Homework: Find halves and quarters of small numbers.

Y5 A lesson about solving multiplication problems by splitting them up into manageable chunks
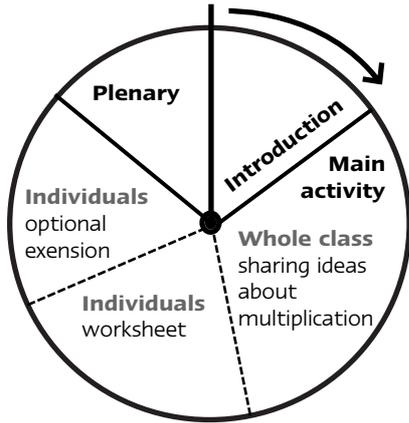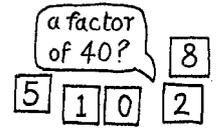
Introduction

Chant the six times-table forwards and backwards. Pupils use their own sets of 0–9 cards to respond to questions involving knowledge of tables, factors, and so on.

a factor of 40? 8 5 1 0 2

Main activity

Share ideas for finding the total number of dots in a rectangular array (single-digit number × two-digit number — for example 13 × 6). Discuss commutativity (the fact that 13 × 6 is the same as 6 × 13). Emphasise the idea of partitioning the array into smaller, more manageable displays such as 3 × 6 and 10 × 6.

Provide worksheets showing rectangular arrays of dots, ranging in difficulty from 4 × 5 to 35 × 6. Pupils partition the arrays by drawing lines and translating the smaller arrays into multiplication facts which are then added together.
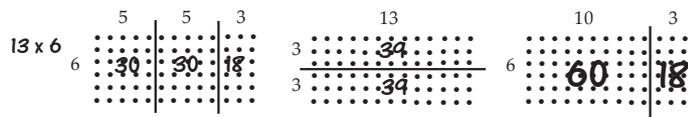
As an extension activity for higher attaining pupils, ask them to invent 'harder' multiplication problems for their partners to tackle.

6 x 4 is double 2 sixes

26 x 5 — 50 50 30 / 20 x 5 add 6 x 5 / is half of 26 x 10

Plenary:
Choose one easier and one harder example from the worksheet. Pupils share their strategies for calculating the solutions.

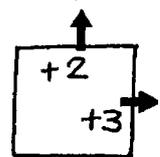**Homework:** Fill in the missing numbers in problems such as: 1☐ × 5 = 80

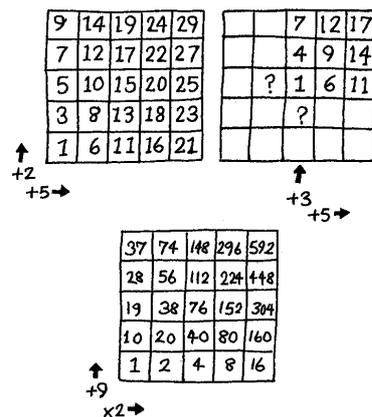# Y6 A lesson involving reasoning about the properties of numbers
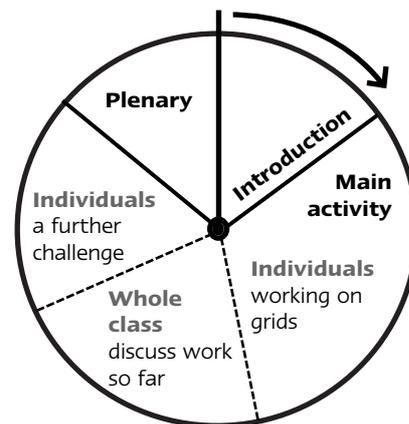
Introduction

Start off some number sequences for the class to continue, for example:

7, 10, 13, 16...
235, 245, 255, 265...
91, 88, 85, 82...

+2 +3

Main activity

Pupils draw a 5 × 5 grid on squared paper and in the bottom left-hand square they write 1. They are to make up a rule for going up and another one for going to the right. The aim is to fill in the whole grid using these two rules.

Stop the class and ask for two volunteers to describe the patterns and relationships in all eight directions on their grids. Now challenge the pupils to produce individually a new grid with more complex rules such as using larger numbers, multiplying, starting in the middle square...

9	14	19	24	29
7	12	17	22	27
5	10	15	20	25
3	8	13	18	23
1	6	11	16	21

↑ +2 +5 →

		7	12	17
		4	9	14
?	1	6	11	
?				

↑ +3 +5 →

37	74	148	296	592
28	56	112	224	448
19	38	76	152	304
10	20	40	80	160
1	2	4	8	16

↑ +9 ×2 →

Plenary:
Discuss the work of the lesson. Reproduce one or two grids on the board, asking their creators to state the rules then inviting the other pupils to fill in each square in turn.

Homework: Ask each of the pupils to prepare a grid and rules to give their partner to complete in the next lesson.

Demonstration lesson plans

On the following pages are examples of the notes that could be given to teachers who have come to observe a demonstration lesson. You will need to find your own way of writing such notes — they don't have to follow the formats shown here. The main aim is to clarify for the visitor how the lesson is structured and, where appropriate, to provide a context — for this reason you may want to show how the demonstration lesson fits into the whole week's plan (see pp40–41 for an example of a weekly plan).

Although the format does not matter, lesson notes for visitors should include:

- clear objectives for the introduction and the main activity
- the teaching input — what you will do and how you will do it
- key questions to ask and the mathematical vocabulary to emphasise
- an outline of any tasks or activities to be done by the whole class and/or differentiated groups, and the resources they will use
- the plenary and its purpose, including any out-of-class or homework task
- how any support staff will be deployed

When writing notes to give visitors it is important to bear in mind that:

- these notes are for the visitor, so will be different from the notes you normally write for personal use
- they should give enough detail for the visitor to place the lesson in context, but not be overlong — if you provide too much detail the notes may not be read
- they set out teaching intentions — what actually happens may differ in detail because a good teacher will take into account pupils' responses and adjust the lesson accordingly

The lesson plans that follow are adapted from originals by Wayne Roberts: Tower Hamlets Numeracy Centre

Example of weekly plan

Introductions

		Key questions
Lesson 1	Children rehearse counting on and back in tens, first through multiples of ten (10, 20...100, 90, 80...), then, following demonstration by the teacher on the 100 grid, through other two-digit numbers (3, 13, 23, and so on).	What happens to the tens digit? To the ones digit?
Lesson 2	As Lesson 1, then without the 100 grid. Teacher asks questions such as: "What is 40 + 10? 53 – 10?" Teacher demonstrates adding or subtracting 10 by counting in ones and tens to compare efficiency of methods.	Is it quicker to count back in ones or tens?
Lesson 3	Children rehearse counting on and back in tens (3, 13, 23...). Teacher uses counting stick to demonstrate addition and subtraction of 10.	How do you calculate 53 – 10?
Lesson 4	Teacher demonstrates how 24 is made using the place value cards 20 and 4. Children hold up place value cards to answer questions such as 20 + 3; 23 + 10; 23 – 10; 23 + 1.	Which card do you need to change?
Lesson 5	Teacher demonstrates how to make 24p from 10p coins and 1p coins. Children use 10p and 1p coins to answer questions as in Lesson 4.	Which sort of coin do you need to change?

Main activities

		Key questions
Lesson 1	Teacher uses a number line marked in tens to demonstrate addition and subtraction of 10 to and from any multiple of 10. Children generate their own questions to practise. Teacher then progresses to demonstrating addition and subtraction of other multiples of 10, for example, 40 + 30, 70 – 20. Children again generate their own questions.	Is it quicker to count back in ones or tens?
Lesson 2	Teacher demonstrates 'Towards 100': roll dice marked '10, 10, 10, 1, 1, 1'; start at 1 on a 100 grid and add on the number rolled on the dice to create a path towards the bottom line (for example: '0, 10, 11, 21, 22, 32...96'). Children play in pairs. Discussion of methods of adding 10 and then possible quick ways of adding 11. Following demonstration by the teacher, children create questions for adding 11 to two-digit numbers, progressing to subtracting 11.	Is it quicker to count back in ones or tens? What's a quick way to add 11?

Main activities continued…

Lesson 3 Use the 100 grid to demonstrate adding 9 to two-digit numbers, progressing to subtracting 9. Children generate their own questions following exposition.

What's a quick way to add 9?

Lesson 4 Use the 100 grid to demonstrate addition and subtraction of multiples of 10 to and from any two-digit number, for example, 23 + 20, 72 − 30, and so on. Children generate questions.

Is it quicker to count back in ones or tens?

Lesson 5 As Lesson 4 but in the context of money, for example, 35p + 30p = ?, using coins or the 100 grid for support. Investigation: ask children to find all the amounts they can make using any two silver coins. Extend to any two coins (bronze and/or silver) for children who need extra challenge.

Do you have to add pennies each time? How can you record the combinations?

Plenaries

Lesson 1 Use sliding box cards to set questions such as 70 + ? = 90; 50 − ? = 20.

Lesson 2 Discuss how we could use the same method to add or subtract numbers such as 21 or 31.

Lesson 3 Discuss how we could use the same method to add or subtract numbers such as 19 or 29.

Lesson 4 Use sliding box cards to set questions such as 23 + ? = 43; 72 − ? = 42.

Lesson 5 Ask some pairs of children to give feedback on how they went about the investigation and how they recorded their results. Discuss how systematic recording could ensure we have all the combinations.

Reception

Learning objectives:

- Compare two numbers and say which is bigger or smaller
- Understand and use the vocabulary of addition and subtraction
- Add or subtract 1 to or from a number
- Begin to relate addition to counting on, and subtraction to counting back

Key vocabulary

- one more than
- one less than
- add
- take away

Resources

- washing line with numbers from 0 to at least 10
- 0–10 cards (several sets)
- dice showing 'one more', 'one less'
- counting cubes

Introduction

Sit children in a horseshoe so that they can all see the washing line. Read the numbers on the line in order.

Give each child a numbered card: "Whose card has a number that is more than 5? Hold them up." Check against the washing line that all the numbers are more than 5. Repeat with 'more than/less than/comes before' other numbers, referring to the number line each time.

Sing 'Five Speckled Frogs'. Each time a number is mentioned, all point to it on the washing line. Whole class says aloud: "5 take away 1 equals 4."

Key questions

What is the biggest number on the line? The smallest?
Which numbers are more than 5? Less than 5?
What is 1 more than 4? 1 less than 4? How do you know?

Main activity

Organise children into two mixed-ability groups.

Teacher directed activity

Explain to the children that they are frogs sitting in a circle around a pond. Ask two frogs to sit in the pond. Ask one of the other children to roll a dice showing 'one more' and 'one less', read the result out loud, then put frogs in or out of the pond accordingly. Each time the whole group says together what has happened — for example, "5 frogs and one more makes 6 frogs; 5 add 1 equals 6". Encourage the children to count on and back rather than counting all the frogs from the beginning each time.

Activity to be supported by the classroom assistant

Put out towers of 1, 2 and 3 cubes. Children work in pairs to make a similar set of towers and continue the pattern. Children repeat after assistant statements such as: "4 is 1 more than 3", "2 and 1 more makes 3".

Key questions

The dice says 'one more'. What does that mean we have to do?
How many frogs are in the pond now? How do you know?
What's the next tower you need to make? How many cubes will it have?
Close your eyes while I swap two towers around… Which ones did I swap?

Plenary

Sit children who need extra help at the front. Talk about the activities the children did. As a whole class, repeat sentences about the frogs and the towers, such as "There were 8 frogs in the pond and one got out so there were 7" and "Here is a tower with 5 cubes. Add one more to make 6."

Ask the children to close their eyes and imagine two frogs in a pond (children who need extra help can look at the teacher's fingers). "Another jumps in, so now there is one more. How many are in the pond?" Repeat using vocabulary such as 'one less'. Ask the children to show how many there are by holding up the correct number of fingers.

Home activity: Draw the numbers on your telephone key pad. What do you notice about them?
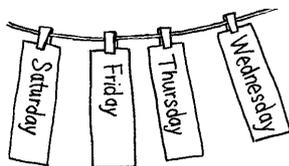
Year 1

Learning objectives:

- Understand and use the vocabulary of days of the week and times of day
- Sequence familiar events

Key vocabulary

- day
- week
- Monday
- Tuesday
- Wednesday
- Thursday
- Friday
- Saturday
- Sunday
- yesterday
- tomorrow
- weekend
- evening
- afternoon
- morning
- o'clock

Resources

- cards showing days of weeks
- cards showing 'morning', 'afternoon' and 'evening'
- A3 sheets divided into three parts with the headings 'morning', 'afternoon' and 'evening'
- blank cards
- washing line
- large clock with hands

Introduction

Tell children they are going to be learning about time: the days of the week and times of day.

Talk with the class about the days of the week and their significance: what happens on a Monday, which day the children like best, and so on. Show cards with the names of the days of the week and read them out all together. Then give the cards out to individual children to hang on the washing line in order.

Key questions

What happens on Fridays?
What is the day before Wednesday?
Which days are at the weekend?
What day is it today? So, what day was it yesterday?

Main activity

Hang on the line cards showing the words 'morning', 'afternoon' and 'evening' and read them with the children. Talk about the words and invite children to suggest things that happen at each of the three times of day. Also name various different events yourself and ask children to point to the appropriate time-of-day card on the line. Talk about the fact that some things can happen at any time of day.

Give out A3 sheets divided into three parts with the headings 'morning', 'afternoon' and 'evening'. The children write some events that happen under each heading. (Some children may need support with writing and may need to draw the events or choose from cut-out pictures and stick them in place.)

Key questions

What happens every school-day afternoon?
What time of day do we eat dinner?
When does the afternoon start?
After the afternoon, what comes next?
Do you always have tea in the afternoon? Might you have it in the morning?
What can you do at any time of day?

Plenary

Discuss the work of categorising events under 'morning', 'afternoon' or 'evening'. Ask children to name some of the events they chose, write these on blank cards, and invite children to come and place them on the line in order. Discuss which events have an inevitable order (such as going to sleep before waking up) and which don't (such as eating supper then brushing teeth).
Spend some time looking at the clock, moving the hands to show different hours, and reading these with the children. Talk about whether the times are in the morning, afternoon or evening.
Ask "What have you learned today?"
Homework: Draw something you do in the morning/afternoon/evening to contribute to a class display.

Year 2

Learning objectives:
- Count on and back in ones and tens
- Say the number that is one or ten more or less than any given two-digit number

Key vocabulary
- tens
- digit
- units
- multiple
- two-digit number
- count on/back
- add
- subtract

Resources
- class size 0–99 grid
- small 0–99 grids
- dice marked just 10 and 1

Introduction

Use a class 0–99 grid to rehearse counting forwards and backwards in tens from 0, first with eyes open, then with eyes closed:
0, 10, 20, 30... 90, 80, 70...

Then use the 0–99 grid to count in tens forwards and backwards from other numbers, again first with eyes open, then closed:
2, 12, 22, 32...   92, 82, 72...

Remind the children that when they count forwards in tens, they are adding on ten each time. Demonstrate adding on 10 by counting in ones, and discuss with the children which method is most efficient.

Record examples of number sentences on the board (for example, 42 + 10 = 52) and read them aloud as a class: "42 add 10 equals 52".

> **Key questions**
> What's happening to the tens digits? To the ones digits?
> How can you work this out?
> Is it quicker to add ten by counting on in ones or tens?

Main activity

Invite one of the children to come to the front of the class and play 'Towards the 90s' with you, using a class 0–99 grid. You both write your initials at 0 using different colours, then take turns to toss a dice showing just 10 and 1. Add this number to the number you are on, find the square with that number, then draw your path to that number. A path might go, for instance 0, 1, 11, 21, 22, 32...

Now set the class to play on their own grids, in pairs. Higher attainers could use blank grids and write the numbers in after each go. After five minutes or less, stop the children and discuss where they move when adding 10 or 1. Then set them to continue their game, bearing this in mind.

When children finish their game they can play in reverse on a fresh grid, moving from 99 towards 0.

> **Key questions**
> What happens when you add 10? And when you add 1?
> What happens when you subtract 10? And when you subtract 1?
> Can you predict where your answer will be on the grid?
> What would happen if you added 11?

Plenary

Talk about what the children think they have learned today about adding and subtracting. Ask how they would add or subtract other numbers quickly such as 11, 20, 21 or 31.
Play a final game of 'Towards the 90s' with the whole class. The children shut their eyes (children of lower attainment can look at the class grid) while you roll the dice and call out the numbers; the children visualise the path travelled. At the end check that everyone has reached the same end-point.
Homework: Play 'Towards the 90s' on your own or with a friend or family member.

Year 3

Learning objectives:

- Counting in twos, fives and tens
- Beginning to learn the four times-table
- Thinking of multiplication as repeated addition
- Understanding that multiplication can be done in any order

Key vocabulary

- array
- groups
- sets
- lots
- times
- multiply
- multiplied by

Resources

- dot array for four times-table

Introduction

Agree with the children the order in which they should take their turn counting round the class then see if the class can beat its previous best time for:

— counting in twos from 0 to 50 and back
— counting in fives from 0 to 100 and back
— counting in tens from 0 to 100 and back

Main activity

Show the class an array of dots from the four times-table, such as four rows of three. Talk about the fact that the total number of dots can be found by:

— repeated addition or
— multiplication: four rows of three or three columns of four

Show the different calculations on the board:

4 + 4 + 4 = 12   3 + 3 + 3 + 3 = 12
  4 × 3 = 12   3 × 4 = 12

Encourage children to come to the board and work through similar calculations for another array of dots, such as four rows of five. Emphasise that each array demonstrates number facts from the four times-table, and one other table.

Use the array method to build up (but not in order) all the facts from the four times-table. Then write these ten multiplication facts on the board in order. Chant the whole table aloud as a class, forwards then backwards.

Point to a single fact at random and ask everyone to say it aloud in the manner of a goat, cat, elephant, tiger or other animal. Repeat this for other facts.

Children now copy down the four times-table and decorate it as beautifully as they can. This is their copy from which to learn the table.

Key questions

If four lots of 3 makes 12, what do three lots of 4 make?
How many is five fours? What is 4 times 6? What is 4 multiplied by 9?
How many fours are there in 40?

Plenary

Recite the four times-table as a class then discuss with the children the best and quickest strategies for working out the answer to any fact that they have forgotten. Methods might include doubling a fact from the two times-table, visualising an array of dots, counting in fours.
Stress the importance of learning the twelve facts off by heart. Talk with the children about how this can best be done. Discuss tips for remembering awkward facts such as "Seven fours are twenty-eight, mate".
Homework: Practise saying the four times-table out loud to someone else.

Year 4

Learning objectives:
- Round any integer less than 1000 to the nearest 100
- Use vocabulary of length
- Use appropriate units and equipment to measure length
- Use a ruler to measure lengths, using millimetres to a suitable degree of accuracy

Key vocabulary
- round up/down
- approximate
- estimate
- length
- kilometre
- metre
- centimetre
- millimetre
- half

Resources
- metre rule with $\frac{1}{2}$ cm markings
- 30-cm rulers with $\frac{1}{2}$ cm and mm markings

Introduction
Count in 50s from 37 to 537 and back.

Ask individuals specific questions such as: "What do I need to add to 26 to make 100?"

Write on the board a three-digit number, and on either side write the hundreds numbers immediately below and above it. Ask the children to round the middle number to the nearest 100 in their heads and point to the answer. Repeat this for other numbers.

300	327	400
500	579	600
700	708	800
800	899	900

Main activity
Talk with the class about distances we measure in life, how we do it and what units we use. Build up on the board the list of units used for measuring length, and their abbreviations: kilometres/km, metres/m, centimetres/cm...

Discuss when it is important to make measurements as accurate and precise as possible and when rough measurements or estimates will do. Say that in today's lesson you want the children to work as accurately as they can.

Use a metre rule to measure a line drawn on the board. Ensure pupils all understand:
— the need to measure from the point representing 0, not the end of the ruler
— that the rule shows centimetres and half-centimetres
— that it can only measure to the nearest half-centimetre

Ask pupils to look at their rulers and discuss what they see. Ensure pupils all understand:
— how many centimetres are marked
— that each centimetre is divided into 10 millimetres
— there are 10 millimetres to a centimetre
— millimetres are used when our measuring needs to be more accurate

Now set the class to work with rulers, pencils and paper. Pupils draw lines of any length with their rulers then measure them to the nearest half centimetre and to the nearest millimetre.

Extension activities: drawing lines of specific lengths; drawing lines for a partner to measure; measuring the perimeters of shapes to nearest millimetre.

Key questions
What would you measure in millimetres? What would you use metres for?
What unit would you use for measuring the length of a necklace to see if it would fit round your Nan's neck? How would you do it?
What measuring equipment would you use to measure each of these items?

Plenary
Ask children to tell you the metric units for length and help you write them on the board in order of size. Talk about the sizes of these units and their relationships: "What can you think of that is about a metre long?" "How many millimetres are there in a centimetre?"
Establish the ground rules for accurate measurement with a ruler.
Homework: Make a list of ten things at home and estimate how long or tall they are; bring the list back to discuss with the rest of the class.

Year 5

Learning objectives:

- Know by heart multiplication facts up to 10 × 10
- Use knowledge of number facts and place value to multiply using a mental method
- Develop pencil and paper procedures for multiplying

Key vocabulary

- multiply
- diagram
- grid method
- table
- hundreds
- tens
- units
- two-digit number

Resources

- 2 cm squared paper
- 1 cm squared paper

Introduction

Divide the class into four teams and ask each child in turn a multiplication fact suited to their ability. Each correct answer wins a point for the team.

Discuss strategies for multiplying two-digit multiples of 10 by single-digit numbers (such as 30 × 5) and by another two-digit multiple of 10 (such as 20 × 80).

> ### Key questions
> Roughly how big will the answer be?
> What do you know that will help you multiply those numbers?
> Do you think that sounds about right?

Main activity

Ask the children to work in twos and discuss how they would work out in their heads the following: 17 × 5, 44 × 3, 38 × 4. After a few minutes open this out to a class discussion. Emphasise the strategy of splitting the problem into two parts, tens and ones.

Explain that they are going to learn the grid method of multiplication. Pin up a sheet of 2 cm squared paper and show how to do the calculation 37 × 6 as 6 lots of 30 and 6 lots of 7. Write this as (30 × 6) + (7 × 6). Repeat the process for the calculation 45 × 8 but this time just do a sketch on the board.

Ask children to make up their own two-digit by single-digit multiplication problems to tackle, using this or any other method. Support children who need help by working with them on multiplying a 'teens' number by a single digit (for example, 17 × 6). Challenge higher attainers to invent and tackle three-digit by single-digit calculations.

> ### Key questions
> How did you get your answer?
> Do your answers look about right?
> Do the last digits look right?
> Do you need to draw a diagram any more?
> How else could we record this?

Plenary

> Ask individual children to demonstrate their workings on the board. Emphasise that any method that works is acceptable; children do not have to use the grid method.
> Write on the board the problem: ☐☐☐ ÷ 10 = 3☐. Discuss with the children how to solve this. Is there only one possible correct answer?
> **Homework:** Combine the digits 3, 7 and 9 in any way to make two numbers (for example, 37 and 9) then multiply these together. What is the biggest product you can make?
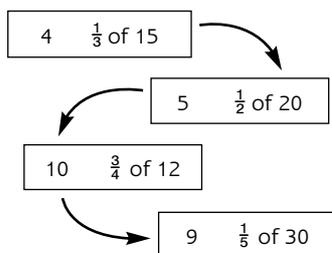
Year 6

Learning objectives:
- Use fraction notation
- Reduce a fraction to its simplest form by cancelling
- Change an improper fraction to a mixed number, and vice versa

Key vocabulary
- fraction
- numerator
- denominator
- improper fraction
- mixed number

Resources
- fraction loop cards

4	$\frac{1}{3}$ of 15
5	$\frac{1}{2}$ of 20
10	$\frac{3}{4}$ of 12
9	$\frac{1}{5}$ of 30

Introduction

Use loop cards round the class to find simple fractions of whole numbers.

Talk about fractions with the children and name the parts: "The top number is called the numerator and it shows how many bits you've got; the bottom number is called the denominator and it shows how many bits there are in the whole." Write up the words numerator and denominator on the board and go over their spelling with the children.

Draw an empty number line from 0 to 1 and ask children where to place fractions such as $\frac{1}{2}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{5}{6}$.

> **Key questions**
> If something is divided up into five equal bits and you have three of them, what is the fraction?
> If the denominator is 4, what kind of fraction is it?
> If the numerator is 2, how many bits are there?

Main activity

Tell the children they are going to learn about mixed numbers and improper fractions. Establish what these are, and write some examples of each on the board. Ask the children to provide examples of their own for each category.

| $1\frac{1}{4}$ | $2\frac{1}{2}$ | $5\frac{2}{3}$ |
| $\frac{13}{3}$ | $\frac{24}{6}$ | $\frac{9}{2}$ |

Emphasise that if the numerator and denominator are the same the fraction is equal to 1. Ask the children for examples of fractions that equal 1 and write these on the board.

| $\frac{1}{1}$ | $\frac{10}{10}$ | $\frac{12}{12}$ |

Ask the children how many halves there are in: $1\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$ and how many quarters there are in: $1\frac{1}{4}$, $2\frac{3}{4}$, $4\frac{1}{4}$. Discuss how these can be worked out from first principles. For example, "2 is worth 8 quarters so $2\frac{3}{4}$ is 8 plus 3 quarters which is $\frac{11}{4}$". Explain that a shorter way of doing this is to multiply the whole number by the denominator and add the numerator. For example, "I've got $2\frac{3}{4}$, 2 times 4 is 8; add 3: $\frac{11}{4}$".

Write some improper fractions on the board and show the children how to convert them to mixed numbers by dividing the numerator by the denominator. For example, "I've got $\frac{13}{3}$. 13 divided by 3 is 4 remainder 1. So it is 4 and one bit: $4\frac{1}{3}$".

Ask the children some questions about simplifying improper fractions and turning mixed numbers into improper fractions. Ask how they solved them.

> **Key questions**
> How many thirds are there are in: $1\frac{2}{3}$, $3\frac{1}{3}$, $5\frac{1}{3}$?
> How can you simplify: $\frac{12}{10}$, $\frac{25}{2}$, $\frac{7}{3}$?

Plenary

Choose a fraction such as thirds. Get the children to help you draw on the board a number line showing thirds both as improper fractions and mixed numbers.
Homework: Choose a fraction such as thirds, halves or fifths and make a number line from 0 to 10 in multiples of that fraction, showing improper fractions and mixed numbers.