



Developing **number**

Optional Skills Assessment Materials

Teacher's guide

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Welsh Assembly Government

Optional Skills Assessment Materials

Developing number

Audience	Teachers at Key Stage 2, in particular those with Year 5 classes; local authorities; tutors in initial teacher training; and others with an interest in education.
Overview	These new materials support learning, teaching and assessment of learners' skills in Year 5. They are designed to assist schools in implementing the revised school curriculum and its frameworks.
Action required	Schools' senior managers and local authority advisers are requested to raise awareness of these new materials within their schools, and to encourage teachers to use the materials to support their focus on developing learners' skills.
Further information	Enquiries about this document should be directed to: Curriculum and Assessment Division Department for Children, Education, Lifelong Learning and Skills Welsh Assembly Government Cathays Park Cardiff CF10 3NQ Tel: 0800 083 6003 e-mail: C&A3-14.C&A3-14@wales.gsi.gov.uk
Additional copies	Can be obtained from: Tel: 0845 603 1108 (English medium) 0870 242 3206 (Welsh medium) Fax: 01767 375920 e-mail: dcells1@prolog.uk.com Or by visiting the Welsh Assembly Government's website www.wales.gov.uk/educationandskills
Related documents	<i>Optional Skills Assessment Materials for Year 5 – An overview;</i> <i>Optional Skills Assessment Materials: Developing communication;</i> <i>Optional Skills Assessment Materials: Developing thinking</i> (Welsh Assembly Government, 2009) These materials are also available in Welsh.



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Introduction

Optional Skills Assessment Materials for Year 5

The themed activities presented in this pack are part of the Optional Skills Assessment Materials (OSAMs) that have been developed for Year 5 learners. The purpose of the activities is to provide opportunities for teachers to make useful observations that can be used to supplement their ongoing assessments of learners' skills in 'Developing number across the curriculum'.

Although the activities have been designed with Year 5 learners in mind, teachers should feel free to adapt them to meet the needs of other learners as appropriate.

Developing number

The Developing number pack of materials comprises this Teacher's guide and six theme-based activity booklets. Each of the booklets contains a number of activities that can be used to generate evidence relating to learners' ability to use and develop their number skills in cross-curricular contexts.

These activities are also likely to provide evidence of learners' skills in other areas of the skills framework (thinking, communication and ICT), as well as providing assessment for learning opportunities within a variety of related subjects.

Using the activities

The activities are designed to encourage collaborative learning in which individuals are able to discuss, test and evaluate their ideas in a mutually supportive environment.

This pedagogy is predicated upon the notion of treating all learners as thinkers who are able to construct their own understanding from effective learning situations by a process of questioning, exploration and reflection.

Consequently, when working with learners, you should encourage them to put forward, develop and evaluate their own ideas.

The activities are not intended to be timed assessment tasks with pre-defined outcomes, nor is it intended that outcomes are 'levelled' against national curriculum Orders.

The principle aim is that each booklet provides a set of interesting and motivating learning experiences, which can be used in an inclusive manner to enable all learners to demonstrate and develop their number skills.

Flexibility of approach

In order to achieve maximum benefit, it is vital that you use the materials provided in a flexible manner. In particular, you should feel free to adapt, omit or extend any of the activities to suit your own purposes and to meet the varying needs of your learners. Evidence gathered by piloting the materials suggests that most activities provide starting points that are suitable for whole-class development, but that the most valuable learning experiences are provided by those teachers who are prepared to:

- plan differentiated routes through the activities
- customise the resources provided to meet the varying needs of their learners
- value differentiated outcomes.

Flexibility of approach also needs to extend to the approximate timing given to each of the activities. These timings are an indication of the average time teachers spent working with them during piloting. In some classrooms, learners found elements of an activity particularly motivating and spent considerably longer working with them, while in other classrooms the same elements were found less stimulating.

Similarly, teachers exploited the activities to varying degrees, with some commenting that certain activities had the potential to become extended projects that could be run over a full or half term.

As a general rule, it is suggested that you allow learners to pursue in some depth those elements that interest them, while moving on briskly from those that do not.

The themes

The Developing number OSAMs are based around six themes, each of which contains a number of related activities. The titles of the six themes, along with the main area of the curriculum with which each is linked, are shown in the table below.

Theme	Main curriculum links
Mosaics	Art and design
Time	Science
Dinasfawr	Geography
Then and now	History
Secret codes	Mathematics
Clocks	Design and technology

Each theme has been produced using a similar format and contains:

- an overview
- a section describing the relationship between the materials and the 'Developing number across the curriculum' section of the skills framework
- cross-curricular links, referenced to the curriculum orders
- two or three activities for you to use with your Year 5 learners.

Each activity is self-contained and includes all the information you will need for its implementation.

In particular, each activity contains:

- a section showing links between the activity and the skills framework
- a section on 'Context' containing an overview of the activity
- details of the resources provided and information regarding any additional materials that may be needed or which are likely to enhance learners' experience
- detailed teachers' notes on 'Developing the activity', which offer suggestions for using the activities and include examples of classroom practice
- a 'What to look for' table, providing task-specific criteria, that links the activity to the skills framework
- copies of all necessary activity sheets, worksheets and resource materials.



Overview of links to the skills framework and the curriculum

Theme	Mosaics			Time		
Activities	1	2	3	1	2	3
Using numbers	●	●	●	●	●	●
Measuring	●	●	●	●	●	●
Gathering information	●	●	●	●	●	●
Using the number system	●	●	●	●	●	●
Using a variety of methods	●	●	●	●	●	●
Talking about and explaining work	●	●	●	●	●	●
Comparing data	●	●	●	●	●	●
Recording and interpreting data and presenting findings	●	●	●	●	●	●
Links to the curriculum	• Art and design • English • ICT • Mathematics			• English • Geography • ICT • Mathematics • PSE • Science		

Key

● Main focus
 ● Incidental focus
 ● No intentional focus

Dinasfawr			Then and now		Secret codes			Clocks	
1	2	3	1	2	1	2	3	1	2
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
●	●	●	●	●	●	●	●	●	●
- English - Geography - Mathematics - PSE			- English - History - Mathematics - PSE		- English - Mathematics - PSE - Science			- Art and design - Design and technology - English - Mathematics - PSE	

Opportunities for assessment

As learners engage with the activities provided, they will generate evidence that contributes to their individual skills profile.

The 'What to look for' section, found at the end of each activity, contains task-specific criteria that can be used to link this evidence with one or more of the principles in the 'Developing number across the curriculum' section of the *Skills framework for 3 to 19-year-olds in Wales*. The eight principles are shown below.

Use mathematical information

- Using numbers
- Measuring
- Gathering information

Calculate

- Using the number system
- Using a variety of methods

Interpret and present findings

- Talking about and explaining work
- Comparing data
- Recording and interpreting data and presenting findings

The process by which evidence can be linked with a principle is illustrated in the examples that follow. It is likely that the evidence learners generate will contribute to more than one principle, but initially it may be helpful to concentrate on just one of them. This is illustrated in the examples, where most of the principles are highlighted in turn with the commentary suggesting additional links.

As you review the examples, you will need to refer to the relevant activities in the theme-based booklets that accompany this guide. To help with this, appropriate cross-references are provided and, in some cases, relevant illustrations are reproduced.

It is important, when considering the examples, to appreciate that the primary purpose of the exercise is to link the evidence generated with cells in the skills framework and not to 'level' individual pieces of work. However, the evidence gathered will undoubtedly have benefits in providing useful information regarding assessment for learning and in contributing to teacher assessment.

At the end of the school year, all the evidence gathered should be reviewed and a best-fit judgement made regarding each learner's ability in using number skills across the curriculum.

When making these judgements, the following points should be kept in mind:

- The evidence generated by the activities will be a small part of the overall evidence that is available to you.
- Much evidence will have been generated during other day-to-day learning experiences and this will contribute significantly to your overall judgements.
- The evidence you have gathered can also be used to inform your summative teacher assessments in a range of subjects, which will be dependent on the particular activity and its cross-curricular links.

Mosaics – Designing tiles

Learners design four tiles using their own criteria (see **Mosaics** activity booklet, pages 13 to 19).

The following task-specific criteria are used to consider the evidence generated.

Using numbers

When designing and producing their own tiles and/or when using **Mosaic designer**, are learners able to:

- use number as one of the design criteria they employ or count the number of squares and triangles used in a particular pattern (Cell 1)
- use simple fractions to identify the proportion of a tile that has been shaded and use number and proportion as some of the design criteria they employ (Cell 2)
- describe and compare the patterns they produce, using fractions and percentages as appropriate (Cell 3)?

Talking about and explaining work

When discussing the given tiles, describing and recording their own design criteria, and/or when reporting back, are learners able to:

- talk about what they have done, referring to the number of shaded squares and/or triangles in a particular design (Cell 1)
- compare the various patterns, using the language of number and shape, e.g. compare the number of shaded squares and triangles used to make two different patterns (Cell 2)
- use the language of position, movement and measures, e.g. explain that parts of a pattern are reflections of others, identify the shaded area of a particular tile or give the perimeter of a particular grid (Cell 3)
- use correct mathematical language, symbols and notation, e.g. record design criteria using mathematical symbols and notation (Cell 4)?

Teacher's guide | Developing number | Mosaics – Designing tiles

The diagram indicates how learners' work can provide evidence for the assessment of **Using numbers**. The commentary provided alongside the learners' work also links the evidence with **Talking about and explaining work**.

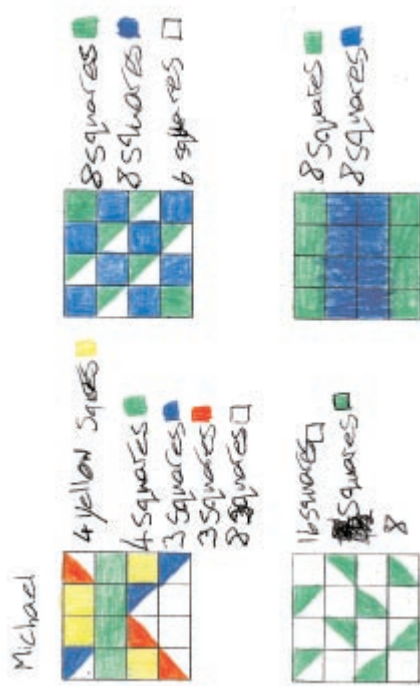
Using numbers appears in the skills framework as follows.

Using numbers	Use numbers in games and role play.	Use whole numbers in practical situations; use fractions in the context of simple shape. Recognise and use coins of different values.	Use decimals in the context of money and measures; use negative numbers in the context of temperature; use fractions and percentages to estimate, describe and compare proportions of a whole in practical contexts.	Use ratio and proportion in practical contexts, including currency exchange rates, value for money and scale drawings.	Use whole numbers, decimals, fractions, percentages, negative numbers, ratio and proportion in a variety of ways in practical contexts, including scale drawings, maps and plans.	Read and understand ways of writing very small and very large numbers.
						

What to look for (task-specific criteria):
When designing and producing their own tiles and/or when using **Mosaic designer**, were learners able to:

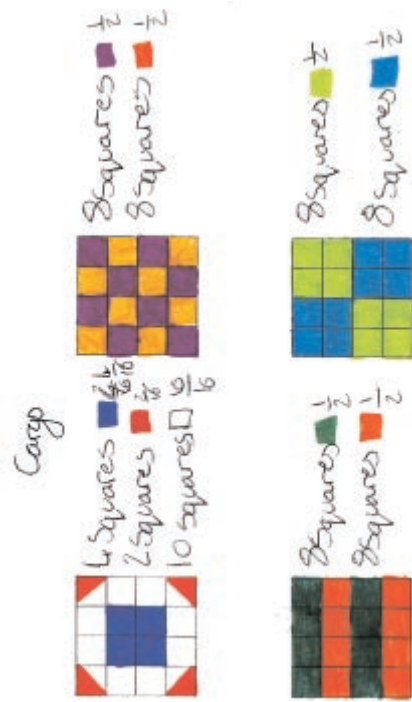
- use number as one of the design criteria they employ or count the number of squares and triangles used in a particular pattern?

- use simple fractions to identify the proportion of a tile that has been shaded and use number and proportion as some of the design criteria they employ?



Michael enjoyed colouring the tiles, but his number work is restricted to counting those squares that have been coloured or partially coloured (Using numbers, Cell 1).

When discussing his work with the teacher, Michael was able to identify the shapes in the partially coloured squares as triangles and explain that more of a tile was covered when a whole square was coloured than when a half square was coloured. However, Michael was only able to complete the most obvious of comparisons between areas and was unable to identify the amount of area covered by three or more half squares without help (Talking about and explaining work, Cell 1).



Carys has been able to combine half squares correctly to find the equivalent number of whole squares coloured on her first tile. She has also been able to use simple fractions to identify the proportion of each tile that has been coloured (Using numbers, Cell 2).

When reporting back, Carys was able to make comparisons between the tiles in terms of the number of squares that had been coloured, pointing out that three of the tiles were similar because, 'They are half and half and only use squares', but that the other one is different because, 'It uses three colours and some are triangles' (Talking about and explaining work, Cell 2).

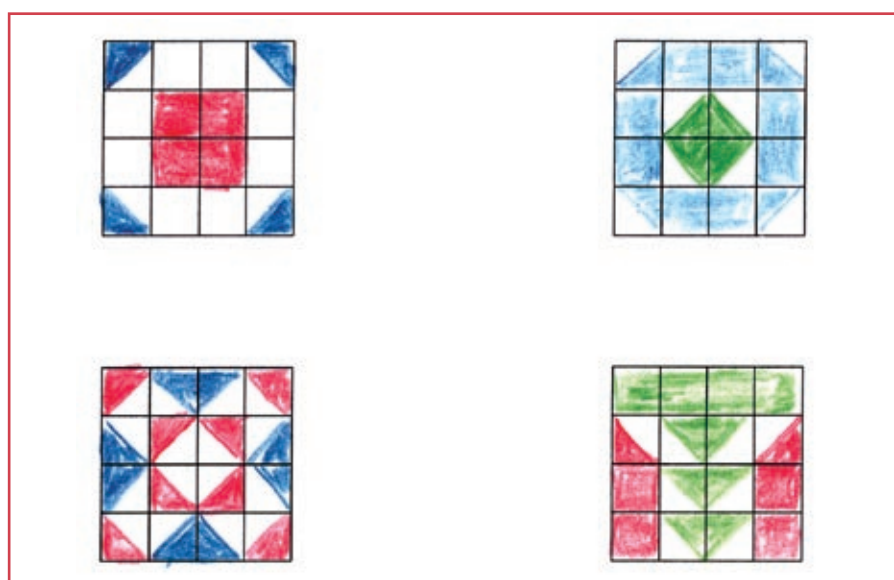
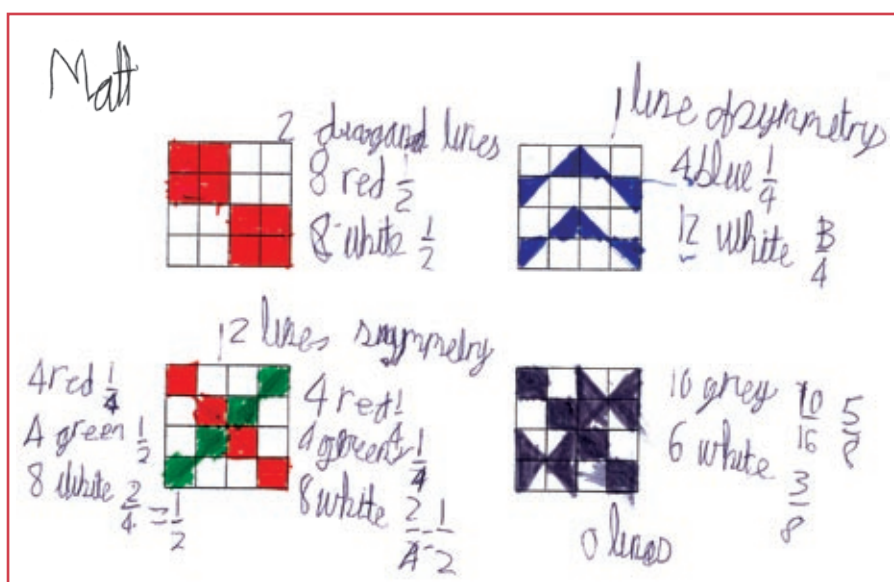
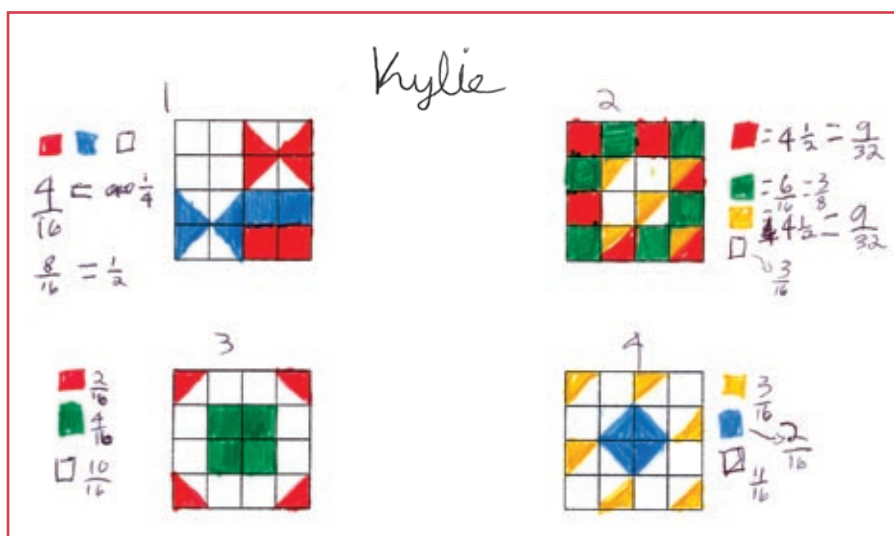
Some further examples

Kylie and Matt have been quite ambitious with their tiles. Both learners have combined squares and half squares (not always correctly) to find the proportions of the tiles coloured. They have also used simple and equivalent fractions to record their answers (Using numbers, Cell 2).

However, neither has provided evidence of their ability to use percentages (Using numbers, Cell 3) and this is an area that the teacher may wish to investigate in subsequent sessions.

Matt has also indicated the number of lines of symmetry on his tiles. This provided an interesting topic for discussion in the reporting back session, with Matt revealing a sound command of the language of position and movement (Talking about and explaining work, Cell 3).

Matt's references to symmetry also provided a further assessment opportunity for the teacher to exploit. Many of the other learners were enthusiastic about the idea of designing symmetrical tiles, an activity that they engaged in during a subsequent session. Some examples of the work produced are shown opposite.



Time – The year on Earth

Learners consider how the passage of time on Earth is measured (see **Time** activity booklet, pages 5 to 15).

The following task-specific criteria are used to consider the evidence generated.

Measuring

When compiling their facts, responding to questions and/or reporting back, are learners able to:

- compare two or more of the units of time in everyday use, e.g. 'A day is longer than an hour', 'A week is shorter than a month', etc. (Cell 1)
- order and use common relationships between units, e.g. '60 minutes in an hour', '24 hours in a day', 'seven days in a week', etc. (Cell 2)
- deduce further relationships between these units by using one or more conversions, e.g. 'Find the number of hours in a week... the number of minutes in a day... the number of seconds in a week' (Cell 3)?

Talking about and explaining work

When discussing their work, recording their findings and/or reporting back, are learners able to:

- talk about what they have done, referring to some of the numbers they have encountered (Cell 1)
- make comparisons, talking about and recording number relationships using appropriate language and symbols (Cell 2)
- use language associated with the passage of time and its measurement (Cell 3)
- use correct mathematical language, symbols and notation, e.g. when carrying out, recording or checking calculations (Cell 4)?

Using a variety of methods

When compiling their facts, responding to questions and/or investigating leap years, are learners able to:

- count-on in steps of four, perhaps with the help of a number line (Cell 1)
- count-on or back mentally in steps of four (Cell 2)
- carry out appropriate calculations using a variety of mental, written and calculator methods (Cell 3)
- check the accuracy of results using mental estimation, approximation and inverse operations to decide whether or not the results make sense (Cell 4)?

Teacher's guide | Developing number | Time – The year on Earth

The diagram indicates how learners' work can provide evidence for the assessment of **Measuring**. The commentary provided alongside the learners' work also links the evidence with **Using a variety of methods** and **Talking about and explaining work**.

Measuring appears in the skills framework as follows.

Measuring	Compare two or more objects by direct comparison of physical properties.	Measure and compare length and mass; order events in time.	Choose and use everyday units of measure and familiar measuring equipment; read scales to an appropriate degree of accuracy.	Use more precise measuring equipment with finer calibrations. Make reasonable estimates of a range of measures in everyday situations. Use correct units for compound measures such as volume, density or speed.	Read scales on a range of measuring equipment to given levels of accuracy.	Make accurate and reliable observations choosing suitable equipment; measure in a variety of appropriate units.
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What to look for (task-specific criteria):

When compiling their facts, responding to questions and/or reporting back, were learners able to:

- order and use common relationships between units, e.g. '60 minutes in an hour', '24 hours in a day', 'seven days in a week', etc.?

- deduce further relationships between these units by using one or more conversions, e.g. 'Find the number of hours in a week... the number of minutes in a day... the number of seconds in a week'?

There are 24 hours in a day.
 There are 60 minutes in an hour.
 There are 60 seconds in a minute.
 It takes about $365\frac{1}{4}$ days for Earth to orbit the Sun.
 There is a leap year every 4 years.
 There are 52 weeks in a year.

4 weeks in a month.
 1,000 years in a millennium.
 The earth spins on its axis once a day.
 There are 14 days in 2 weeks.
 A decade is 10 years.
 2 weeks is called a fortnight.
 100 years is a century.

The written evidence provided by Debbie and Rhys indicates a sound understanding of the common units of time and the relationships between these (Measuring, Cell 2).

Appropriate questioning, while the learners worked and during the reporting back session, confirmed that both Debbie and Rhys were able to order these relationships and talk confidently about them, using appropriate language associated with the passage of time (Talking about and explaining work, Cell 3).

There is little written evidence upon which to base an assessment of the learners' ability to calculate. However, the teacher was able to exploit the context and obtain information relating to each learner's ability to carry out appropriate mental and written calculations (Using a variety of methods, Cell 3) by asking relevant questions, for example, 'You've written that there are four weeks in a month. How many weeks are there in three months? ...five months? ...10 months? What about 15 months? ...20 months?'.

TIME

- There are 60 minutes in an hour.
- There are 24 hours in a day.
- There are 1440 minutes in a day. $(60 \times 10 = 600, 60 \times 60 = 3600)$
- There are 3600 seconds in an hour. $(60 \times 10 = 600, 60 \times 60 = 3600)$
- There are 60 seconds in a minute.
- There are 60 minutes in an hour.
- There are 86,400 seconds in a day. $(3600 \times 24 = 86400)$

During the reporting back session, Debbie and Rhys presented their results to the class. Other learners also presented similar lists of results, so the teacher suggested they might consider how such lists could be better organised. She also suggested that learners explore relationships between various units, for example, finding the number of days in three years, or the number of minutes in a day.

Debbie and Rhys then worked together to follow up these suggestions. The written results produced provide evidence of their ability to deduce further relationships between the common units of time using one or more conversions (Measuring, Cell 3). The calculations also provide limited evidence of the learners' ability to carry out calculations (Using a variety of methods, Cell 3) and use correct mathematical symbols and notation (Talking about and explaining work, Cell 4). Asking how the results might be checked should provide evidence of their ability to use estimation, approximation and inverse operations (Using a variety of methods, Cell 4).

Dinasfawr – Plan a route

Learners use a map of Dinasfawr to plan and record bus routes (see **Dinasfawr** activity booklet, pages 5 to 12).

The following task-specific criteria are used to consider the evidence generated.

Gathering information

When considering the map of Dinasfawr and attempting to plan their bus routes, are learners able to:

- demonstrate some understanding of the information given, e.g. by identifying various landmarks and bus stops (Cell 1)
- read, extract and interpret the information given (Cell 2)
- relate the information given on the map to the task presented on the activity sheet in order to produce an appropriate route (Cell 3)
- choose from the information available in order to produce another bus route (Cell 4)?

Recording and interpreting data and presenting findings

When presenting their bus routes, are learners able to:

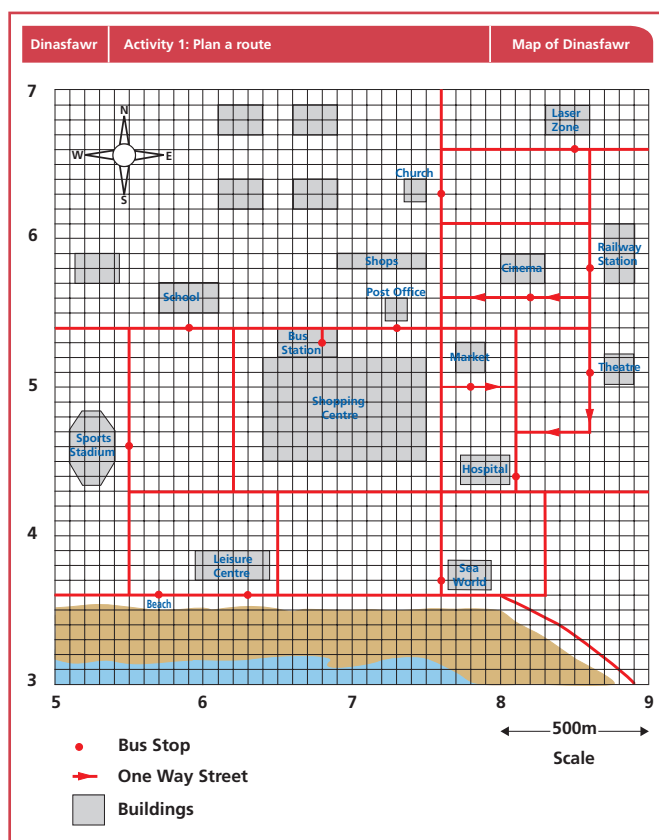
- use simple lists, tables or diagrams (Cell 2)
- use more sophisticated methods, e.g. by using four-figure references, compass directions and/or distances (Cell 3)?

Talking about and explaining work

When considering the map of Dinasfawr, discussing their bus routes and/or reporting back, are learners able to:

- talk about what they have done, showing some awareness of the task and the information that is needed for its solution (Cell 1)
- use the language of number, shape and comparatives, e.g. when putting the bus stops in order, discussing directions (left, right, up, down) and/or comparing distances (Cell 2)
- use the language of position (including co-ordinates and compass points), movement and measures when talking about their work (Cell 3)?

Teacher's guide | Developing number



Dinasfawr	Activity 1: Plan a route	Activity sheet
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You are in charge of the Dinasfawr Bus Company.

This diagram shows the places the Number 42 Bus visits.

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graph TD
    Bus((Number 42 Bus)) --- Cinema
    Bus --- LaserZone[Laser Zone]
    Bus --- Church
    Bus --- PostOffice[Post Office]
    Bus --- RailwayStation[Railway Station]
    Bus --- BusStation[Bus Station]
  
```

- Look at the map of Dinasfawr.
- Plan a route for the bus to follow.
The route should start and end at the bus station.
- Record your route.

Dinasfawr Activity 1: Plan a route

go East to the post office 250m then stop
 go East 150m then go North 450m to the church and stop
 go North 150m then go East to the Laser Zone 450m then stop
 then go East 50m After that go south to the Railway station then stop
 then go 100m south
 then go west to the Cinema 200m stop
 then go west 300m then go South 100m
 then go west to the Bus Station 100m then you have finished your drive

Holly and Lara's work

Georgia Activity 1: Plan a route 2

Start at the bus station. then go 450m west and stop at the school. next go 200m west and turn south at the next junction. go South 100m and stop at the sports stadium. go 50m South and turn at the next junction and go 100m east and stop at beach. go 300m east to the leisure centre. go 650m east and turn at the next junction. go north 150m and stop at sea world. go 850m north and turn at the next junction. go west 150m and stop at the post office. go 150m west and go into the bus station and stop.

Georgia's work

Teacher's guide | Developing **number** | Dinasfawr – Plan a route

The diagram indicates how learners' work can provide evidence for the assessment of **Gathering information**. The commentary provided alongside the learners' work also links the evidence with **Recording and interpreting data and presenting findings** and **Talking about and explaining work**.

Gathering information appears in the skills framework as follows.

Gathering information	Count a small number of objects.	Collect data systematically by counting and by measuring. Read, understand and extract data presented in lists, tables, charts, simple graphs and diagrams.	Gathering information in a variety of ways, including from questionnaires or databases. Choose data from given information presented in a variety of numerical and graphical ways.	Recognise the difference between, and the implications for, gathering discrete and continuous data. Access and choose data from information presented in a variety of ways and from different sources.	Get relevant information from different sources, including written material, and graphical first hand by measuring or observing.	Choose how to obtain relevant information from different sources.
						

What to look for (task-specific criteria):

When considering the map of Dinasfawr and planning their bus routes, were learners able to:

- relate the information given on the map to the task presented on the activity sheet in order to produce an appropriate route?

- choose from the information available in order to produce a further bus route of their own?

Holly and Lara used the map to help them decide on the best order in which to visit the bus stops. On their first attempt, they planned a route that began at the Bus Station and travelled via the Post Office to the Cinema. However, Lara realised that this route went the wrong way down a one-way street and pointed out that making the Church the third stop would solve this problem. They were then able to include the other bus stops (Laser Zone, Railway Station and Cinema) in a logical way (Gathering information, Cell 3).

The girls then discussed the best way to record their route on paper. They rejected coordinates as they felt that this might be too confusing for the bus driver. Instead, they decided to combine directions with distances, producing the set of written instructions shown on page 15 (Recording and interpreting data and presenting findings, Cell 3).

Both Holly and Lara worked accurately, demonstrating their ability to produce an appropriate route, use compass directions and distances. When asked to present their work to the class, they used the language of position, movement and measures to describe the methods they had used (Talking about and explaining work, Cell 3).

Having completed the activity sheet with a partner in the previous session, Georgia worked individually to design a further bus route of her own.

Georgia explained that 'although there are lots of different routes possible', she had chosen one that visited the beach and the leisure centre, 'because it will be very popular' (Gathering information, Cell 4).

Georgia's presentation of her route is quite eye-catching, while she has consistently and accurately used both compass directions and distances to record it (Recording and interpreting data, Cell 3). When talking about what she had done, Georgia was able to use co-ordinates to identify the position of the various bus stops on the map, as well as explaining how she had worked out distances using the given scale (Talking about and explaining work, Cell 3).



Dinasfawr – Timetables

Learners plan and construct a bus timetable (see **Dinasfawr** activity booklet, pages 13 to 24).

The following task-specific criteria are used to consider the evidence generated.

Gathering information

When discussing, reading and/or completing their timetables, are learners able to:

- demonstrate some understanding of the information shown, e.g. by identifying the time the bus leaves a bus stop (Cell 1)
- read, understand and extract the information given, e.g. when considering an actual timetable (Cell 2)
- read and interpret the scale of the map to work out distances between bus stops (Cell 3)
- access and choose data from the information presented on the activity sheet and on the map in order to work out a full-day's bus timetable (Cell 4)?

Talking about and explaining work

When discussing their timetables and/or the factors that affect bus timetables, are learners able to:

- talk about what they have done, showing an awareness of the need for the times to be listed chronologically on their timetable (Cell 1)
- use the language of number and the symbols for addition, subtraction, multiplication and division, e.g. when calculating distances and estimating times (Cell 2)
- use the language of position, movement and measures when talking about their work (Cell 3)?

Using the number system

When discussing the activity and drawing up their timetables, are learners able to:

- choose the appropriate operations for solving addition and subtraction problems, e.g. by completing the timetable on the worksheet (Cell 2)
- recognise the number operations needed to solve problems, e.g. by calculating the times the bus takes to travel between stops and rounding up answers to the next minute (Cell 3)?

Dinasfawr
Activity 2: Timetables
Worksheet

Name(s): Helen & Jessica

Here is a timetable for the Number 100 Bus.

Dinasfawr Bus Company	Number 100 Bus Station/Beach/Bus Station
Bus Station	8:30
School	8:33
Sports Stadium	8:36
Beach	8:39
Leisure Centre	8:41
Sea World	8:45
Post Office	8:50
Bus Station	8:52

The Number 101 Bus travels in the opposite direction.
Complete the timetable for the Number 101 Bus.

Dinasfawr Bus Company	Number 101 Bus Station/Sea World/Bus Station
Bus Station	9:00
Post Office	9:02
Sea World	9:07
Leisure centre	9:11
Beach	9:13
Sports Stadium	9:16
School	9:19
Bus Station	9:22

Explain how you worked out the times. *We reversed the places, then found out the differences with the times then added on to the time before.*

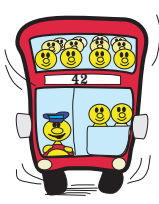
Helen and Jessica's work

Service number 42

	Bus Station	Post Office	Church
D Bus Station	8:30	8:56	9:24
D Post Office	8:32	9:00	9:28
D Church	8:35	9:04	9:33
D Laser Zone	8:38	9:08	9:38
D Railway Station	8:46	9:12	9:43
D Cinema	8:48	9:15	9:47
A Bus Station	8:53	9:20	9:50
P Bus Station	11:24	12:27	13:28
P Post office	11:29	12:30	13:32
P Church	11:34	12:35	13:36
P Laser zone	11:39	12:40	13:42
P Railway station	11:44	12:45	13:48
P cinema	11:48	12:49	13:52
A Bus Station	11:54	12:52	13:55
D Bus Station	14:40	15:02	15:24
D Post office	14:43	15:05	15:27
D Church	14:47	15:09	15:31
D Laser Zone	14:51	15:13	15:35
D railway station	14:55	15:17	15:39
D cinema	14:58	15:20	15:42
A Bus station	15:01	15:23	15:45
D Bus Station	17:14	18:05	18:45
D Post Office	17:21	18:06	18:48
D Church	17:28	18:14	18:52
D Laser Zone	17:36	18:22	18:56
D Railway station	17:44	18:30	19:00
D Cinema	17:50	18:36	19:03
A Bus station	17:53	18:39	19:06

Dinasfawr
Activity 2: Timetables
Activity sheet

The first Number 42 Bus leaves the bus station at nine o'clock.



Work out a timetable for this bus to follow.

Use the route you planned in Activity 1.

Dinasfawr Bus Company	Number 42 Bus Station/Railway Station/Bus Station
Bus Station	9:00
Post Office	9:02
Church	

Some things to think about:

- On busy roads the bus takes about 10 seconds to travel 50 metres.
- Passengers need at least 1 minute to get on and off the bus.
- Times are usually shown in hours and minutes.

Explain how you worked out the times.

Timetable No. 42 bus

Bus station	9:00	
		1 min 1 min
Post office	9:02	
		2 min 1 min
Church	9:05	
		2 min 1 min
Lazer Zone	9:07	
		1 min 30secs 1 min
Railway station	9:11	
		1 min 1 min
Cinema	9:13	
		2 min 50secs
Bus station	9:16	

Ben and Tracey's work

Teacher's guide | Developing **number** | Dinasfawr – Timetables

The diagram indicates how learners' work can provide evidence for the assessment of **Using the number system**. The commentary provided alongside the learners' work also links the evidence with **Gathering information** and **Talking about and explaining work**.

Using the number system appears in the skills framework as follows.

Using the number system	Join in with familiar rhymes and songs.	Choose the appropriate operations when solving addition and subtraction problems.	Recognise the number operations needed to solve problems. Order large numbers to develop an awareness of size/magnitude and chronology.	Order negative numbers and decimals.	Identify suitable calculations to get the results needed for the task. Convert measurements between systems, e.g. currencies and mass.	Choose appropriate methods to get the results needed, including grouping data when appropriate.
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What to look for

(task-specific criteria):

When discussing the activity and drawing up their timetables, were learners able to:

- choose the appropriate operations for solving addition and subtraction problems, e.g. by completing the timetable on the worksheet?

- recognise the number operations needed to solve problems, e.g. by calculating the times the bus takes to travel between stops and rounding up answers to the next minute?

We reversed the places, then found
out the differences with the times
then added on to the time before

Helen and Jessica completed the worksheet to produce a timetable for the Number 101 Bus. Their written explanation, along with the responses made to their teacher's questions, shows that both learners were able to choose the appropriate operation to use when completing similar tasks. For example, both learners were able to explain how to find the time it takes the bus to travel between two named stops using subtraction, as well as recognising that addition was needed to predict arrival times when a start and journey time were given. (Using the number system, Cell 2). Although the two learners went on to draw up a day's timetable for the Number 42 route they had planned earlier (Gathering information, Cell 2), these calculations did not provide any new evidence.

During the reporting back session, both Helen and Jessica were able to use the language of position, movement and measures appropriately to talk about their work (Talking about and explaining work, Cell 3).

Timetable No. 42 bus

Bus station	9:00	1 min	1 min
Post office	9:02	2 min	1 min
Church	9:05	2 min	1 min
Leazer Zoo	9:07	1 min	30secs
Railway station	9:11	1 min	1 min
Cinema	9:13	2 min	30secs
Bus station	9:16		

Ben and Tracey decided to use the map they had been given and the information on the activity sheet (10 seconds for the bus to travel 50 metres, one minute to allow passengers to get on and off the bus), to construct an accurate timetable for the route they had planned earlier.

As they worked, the teacher asked questions about their reasoning. Ben explained that they had calculated the times between each stop by counting along the grid lines on the map (six from the Bus Station to the Post Office, 12 from the Post Office to the Church, etc.) and multiplied these numbers by 10. He said that this would give the time in seconds, so dividing by 60 gave the time in minutes. Tracey agreed, but explained that if they counted in sixes this would give the times in minutes straight away. The learners also explained that, where necessary, they had rounded up the answer to the next minute since the timetable needed to be in whole minutes (Using the number system, Cell 3).

The evidence shows that the learners were able to interpret the scale of the map and the information on the activity sheet (Gathering information, Cell 3) and to use the language of position, movement and measures (Talking about and explaining work, Cell 3).

Secret codes – Number codes

Learners use number codes to interpret and encrypt messages (see **Secret codes** activity booklet, pages 5 to 16).

The following task-specific criteria are used to consider the evidence generated.

Using numbers

When discussing number codes, interpreting messages and/or encoding messages, do learners recognise that:

- numbers can be used as a way of representing letters (Cell 1)
- simple sequences of numbers, e.g. 1, 2, 3, ... or 26, 25, 24, ... can be used to encode messages (Cell 2)
- more sophisticated coding systems can be created by using a simple key, to transform the numbers 1, 2, 3, ..., e.g. 'multiply by 2 and add 3' or 'multiply by 3 and subtract 2' (Cell 3)
- other methods can be used to create number codes that are more difficult to crack, e.g. using different keys to transform odd and even numbers or using a key to transform the sequence 1, 3, 5, ... (Cell 4)?

Talking about and explaining work

When discussing number codes, working collaboratively or reporting back, are learners able to:

- talk about what they have done, referring to some of the numbers they have used (Cell 1)
- use the language of number and comparatives, and the symbols for the four operations (Cell 2)
- use correct mathematical language, symbols and notation when presenting work (Cell 4)?

Using a variety of methods

When discussing number codes, interpreting messages and/or encoding messages, are learners able to:

- match numbers with letters (Cell 1)
- use a variety of mental strategies to add and subtract small numbers (Cell 2)
- use a variety of methods of mental and written computation, e.g. when transforming numbers using keys (Cell 3)
- use inverse operations to 'unlock' a key (Cell 4)?

The teacher observed Bethany and Joshua as they worked together to interpret the coded messages shown on the activity sheet.

To begin with, Joshua wrote out the alphabet and numbered the letters from 01 to 26. As Bethany had been rather passive, the teacher intervened and asked her why she thought Joshua had done this. Bethany was quite clear that this was needed, 'To work out the words'. When pressed further on what she meant, Bethany explained that, 'The 20 stands for t, the 08 stands for h and you can keep doing this to find out the message'. Bethany and Joshua then took turns interpreting each of the numbers to reveal the first message on the activity sheet.

The two learners then turned their attention to the second message on the activity sheet. It was quickly evident that both learners recognised a different sequence of numbers had been used and that this sequence was generated by multiplying by 3 and subtracting 2. Once again Joshua wrote out the alphabet and numbered the letters, but this time the process was slower as the learners took turns to do the necessary calculations and check each other's results.

The teacher found it interesting that the learners treated each number individually and did not recognise that successive numbers in the sequence could be generated by adding 3. However, she decided not to intervene as the learners were providing useful evidence of their ability to carry out written and mental calculations. The teacher's patience was rewarded a little later when, having completed the number sequence, Joshua commented that, 'The numbers go up in threes. That would have been an easy way to get the answers!'.

Secret codes	Activity 1: Number codes	Activity sheet
a = 01 b = 02 c = 03... x = 24 y = 25 z = 26	I can use these numbers to write secret messages Ayeshia Can you read Ayeshia's message? 20080919 0919 01 22051825 190913161205 03150405	
To make the code harder, I can multiply each number by 3 and subtract 2	a = 01 b = 04 c = 07... x = 70 y = 73 z = 76 Paul Can you read Paul's message? 404367 582225401955 015213 19135858254019 2540581352135558254019 Make up your own number code and write some secret messages.	

a	b	c	d	e	f	g	h	i	j
1	4	7	10	13	16	19	22	25	28
k	l	m	n	o	p	q	r	s	t
31	34	37	40	43	46	49	52	55	58
u	v	w	x	y	z				
61	64	67	70	73	76				

Once the learners had interpreted the second message, the teacher told them they should work individually to devise their own secret code and use it to write a message. Joshua decided to use the rule, 'multiply by 5 and add 3' as his key, while Bethany chose the key 'multiply by 9'. Once they had written their messages the two learners exchanged their keys and the messages they had written for their partner to interpret. Having completed this task, the learners were asked to explain what they had done.

Teacher's guide | Developing **number** | Secret codes – Number codes

The diagram indicates how learners' work can provide evidence for the assessment of **Talking about and explaining work**. The commentary provided alongside the learners' work also links the evidence with **Using numbers** and **Using a variety of methods**.

Talking about and explaining work appears in the skills framework as follows.

Talking about and explaining work	Talk about or show an awareness of activities involving number.	Use the language of number, shape and comparatives, and the symbols for addition, subtraction, multiplication and division when talking about work.	Use the language of position (including coordinates and compass points) and movement, data and measures when talking about work.	Use correct mathematical language, symbols and notation when presenting work.	Use mathematical terminology and notation correctly when describing and explaining methods and findings.	Describe results, highlighting main findings and explaining how they meet purpose.
						

What to look for (task-specific criteria):

When discussing number codes, working collaboratively or reporting back, were learners able to:

- use the language of number and comparatives, and the symbols for the four operations?

- use correct mathematical language, symbols and notation when presenting work?

Bethany said that she had 'made' her message by 'using the nine times table'. She explained that, to begin with, she had multiplied 1, 2 and 3 by 9, but had then decided it would be easier to write her message first and then just work out the numbers needed.

18 35 117 28 171 117 225 64 162 281 265 126 236
T O M I S B Y F R I E N D

When asked to explain what she meant by this, Bethany explained that she looked at the alphabet Joshua had written earlier and, 'Because t is 20, o is 15 and m is 13, I used a calculator to work out t equals 180, o equals 135 and m equals 117. So Tom is 180, 135, 117'. The teacher then asked Bethany to explain how she had interpreted the message Joshua had written using his new rule of 'multiply by 5 and add 3'. Bethany said that she had written out the alphabet, numbered the letters 1 to 26 and then multiplied each number by 5 and added 3. Bethany was able to demonstrate this by working out some examples on the whiteboard, for example, 'c = $3 \times 5 + 3 = 18$, n = $14 \times 5 + 3 = 73$ ', etc. She said that she had then 'used the new numbers to find out what each of Joshua's numbers stood for'.

The evidence suggests that Bethany is able to use the language of number and comparatives, and the symbols for the four operations (Talking about and explaining work, Cell 2). It also indicates that she recognises more sophisticated coding systems can be created by using a simple key (Using numbers, Cell 3) and that she can use a variety of methods of computation (Using a variety of methods, Cell 3).

Joshua said that he had started to use the rule, 'multiply by 5 and add 3' to work out his 'new alphabet'. However, having found that, 'a goes to 8, b goes to 13 and c goes to 18' he had decided that he could work out further numbers by 'just adding fives'. He said that this was 'really interesting', because when he had done 'multiply by 3 and subtract 2 the numbers had gone up in threes'.

To interpret the message he had been given, Joshua said he had thought about 'multiply by 9' and decided that he could get 'answers' by dividing by 9. His written work illustrates this.

I divided the numbers by 9 then thought what number the letter in the alphabet is
e.g. $54 \div 9 = 6$
6 = F

Asked whether he thought there was a similar way of reversing the rule, 'multiply by 5 and add 3', Joshua said 'You could do it by dividing and subtracting'. The teacher challenged Joshua to investigate this further and a little later Joshua produced the calculations shown below.

a b c d e f g h
8 13 18 23 28 33 38 43

$8 \div 5 = 1.6 - 3$ doesn't work

$8 - 3 = 5$ $5 \div 5 = 1$ ✓

$13 - 3 = 10$ $10 \div 5 = 2$ ✓ works

So subtract 3 and then divide by 5

The evidence suggests that Joshua is able to use correct mathematical language, symbols and notation when presenting work (Talking about and explaining work, Cell 4). It also indicates that he recognises more sophisticated coding systems can be created by using a simple key (Using numbers, Cell 3) and that he is able to use inverse operations to 'unlock' a key (Using a variety of methods, Cell 4).

Clocks – Circular clocks

Learners compare a collection of clock faces (see **Clocks** activity booklet, pages 5 to 16).

The following task-specific criteria are used to consider the evidence generated.

Comparing data

When comparing clocks, are learners able to:

- match two or more clocks with the same characteristic and/or sort the clocks according to a given criterion, e.g. identify all those clocks with Roman numerals (Cell 1)
- sort the clocks using one or more of their own criteria (Cell 2)?

Measuring

When comparing clocks, positioning numerals and/or completing clock faces, are learners able to:

- make direct comparisons of the physical properties of two or more clocks, e.g. by shape, size or design (Cell 1)
- demonstrate their ability to measure and compare length, e.g. by measuring the length of a chord of a circle or by using string to help measure the arc of a circle (Cell 2)
- choose appropriate instruments for the task and use these to an appropriate degree of accuracy, e.g. by using a protractor to measure and construct angles of 30° to an accuracy of $\pm 3^\circ$, or by using a pair of compasses to draw a circle (Cell 3)?

Talking about and explaining work

When comparing clocks, completing clock faces and/or reporting back, are learners able to:

- talk about the numbers they have encountered within the context of the activity, e.g. 'One is opposite seven', 'Two is opposite eight', etc. (Cell 1)
- use the language of number, shape and comparatives, e.g. 'All the clocks are circular; all have hands' or 'Some clocks use Roman numerals, some use numbers, some use dots and some do not mark time intervals at all' (Cell 2)
- use the language of position, movement and measures to explain the methods used, evaluating the outcomes of their own work and those of others in a constructive manner (Cell 3)?

Clocks

Activity 1: Circular clocks

Resource sheet



1



2



3



4



5



6



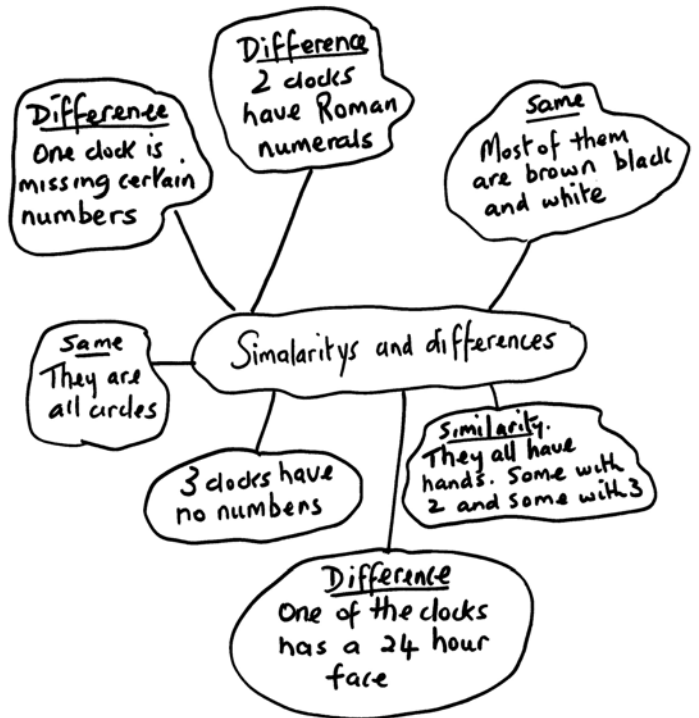
7



8



9



Clocks 1 and 7 both have numbers, but clock 1 has a frame and 7 doesn't.

Clocks 2 and 6 have Roman numerals. Clock 2 is bigger than clock 6.

4 and 5 are both modern designs. 5 has numbers and 4 doesn't.

Teacher's guide | Developing **number** | Clocks – Circular clocks

The diagram indicates how learners' work can provide evidence for the assessment of **Comparing data**. The commentary provided alongside the learners' work also links the evidence with **Measuring** and **Talking about and explaining work**.

Comparing data appears in the skills framework as follows.

Comparing data	Match objects or pictures; sort objects according to a given criterion.	Sort objects, using one or more criteria.	Describe and compare sets of discrete data, using the mode, mean, median or range as appropriate.	Compare two sets of continuous data.	Use basic ideas of correlation to determine the interdependence of two variables.	Compare sets of data in a variety of situations, using percentage, range, mean, mode and median as appropriate.
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What to look for

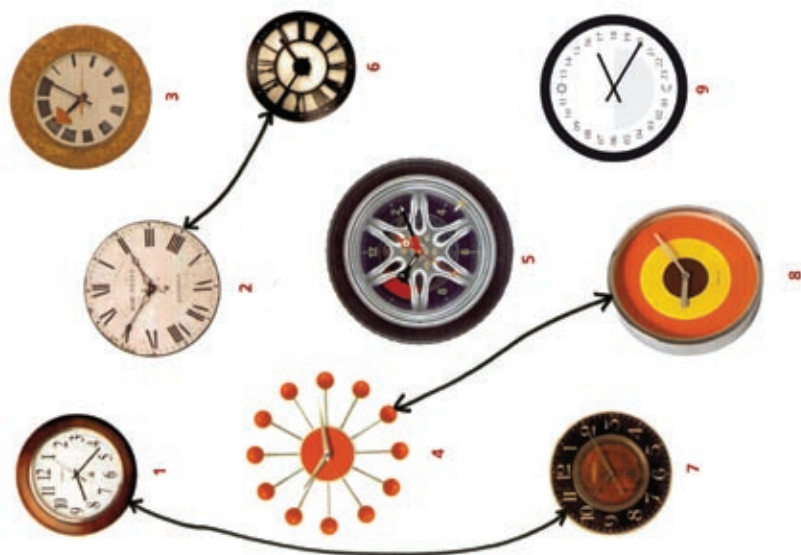
(task-specific criteria):

When comparing clocks, were learners able to:

- match two or more clocks with the same characteristic and/or sort the clocks according to a given criterion, e.g. identify all the clocks with Roman numerals?

- sort the clocks using one or more of their own criteria?

Ronan and Sara used the resource sheet to illustrate their findings. They matched pairs of clocks using three different criteria, namely those having Roman numerals, those having ordinary numerals and those without numerals (Comparing data, Cell 1).



In discussion with the teacher, both Ronan and Sara were able to compare the properties of different clocks, for example, 'All the clocks are round', 'Clock 5 is the biggest', 'Some clocks use dots instead of numbers'. When assessing their work, the teacher also felt that there was clear evidence that Ronan and Sara had been able to make direct comparisons of the physical properties of their clocks (Measuring, Cell 1). During the discussion, the learners spoke confidently, using the language of number, shape and comparatives to illustrate their understanding (Talking about and explaining work, Cell 2).

Ben, Jamal and Lucy used a two-way table to illustrate some of the similarities and differences between the clocks. They made several attempts, and experimented with different criteria, before producing the final diagram that shows their ability to sort the clocks using their own criteria (Comparing data, Cell 2).

	easy to read	not easy to read
numbers	1 2 7	5 6 9
no numbers	4	8 3

Ben was not entirely happy with the way the clocks had been sorted on the diagram as he had no experience of Roman numerals and didn't think that any of the clocks that used them was easy to read. However, Jamal and Lucy argued that Clock 2 was very clear as, 'even if you don't know Roman numbers, the I, II, III are obvious and you can work it out from there'. Although not convinced, Ben conceded the point and Clock 2 was classified as 'easy to read'.

Further questioning by the teacher revealed that the learners were able to make direct comparisons of the physical proportions of the clocks (Measuring, Cell 1) and could use the language of number, shape and comparatives when describing the clocks' properties (Talking about and explaining work, Cell 2).

Time – The changing year

Learners consider ways in which time might be measured if a year consisted of only 88 days (see **Time** activity booklet, pages 17 to 26).

The following task-specific criteria are used to consider the evidence generated.

Measuring

When discussing the activity sheet, designing their calendars and/or reporting back, are learners able to:

- identify the need to subdivide the year into smaller units, e.g. 'You could still have weeks and months, but they would have fewer days' (Cell 1)
- suggest a way of defining a smaller unit, e.g. 'four months in a year' or '11 weeks in a year' or 'five days in a week' (Cell 2)
- establish relationships that could be used to measure the passage of time, e.g. 'eight months in a year, 11 days in a month, five days in a week' or 'nine months in a year, three weeks in a month, four days in a week' (Cell 3)?

Recording and interpreting data and presenting findings

When presenting their results, are learners able to:

- record the number of months in their year and the number of days in each of their months (Cell 1)
- itemise in a simple table or list, the number and names of the days they have identified (Cell 2)
- construct a calendar that incorporates, in a consistent manner, the days, weeks and months they have identified and the relationships they have used (Cell 3)?

Using a variety of methods

When calculating their age in days on Earth or in years measured on other planets, are learners able to:

- use a variety of mental strategies to add and subtract small numbers (Cell 2)
- use a variety of mental, written and calculator methods to obtain answers, interpreting these by referring to the size of numbers or the context, e.g. ' $3650 \div 225 = 16.22$, so I would be just over 16 years old' (Cell 3)
- check the accuracy of their results using mental estimation, approximation and inverse operations to decide whether or not the results make sense, e.g. ' $3650 \div 225$ is a bit less than $3600 \div 200 = 18$, so the answer seems about right' or ' 16.22×225 is about $16 \times 200 = 3200$ ' (Cell 4)?

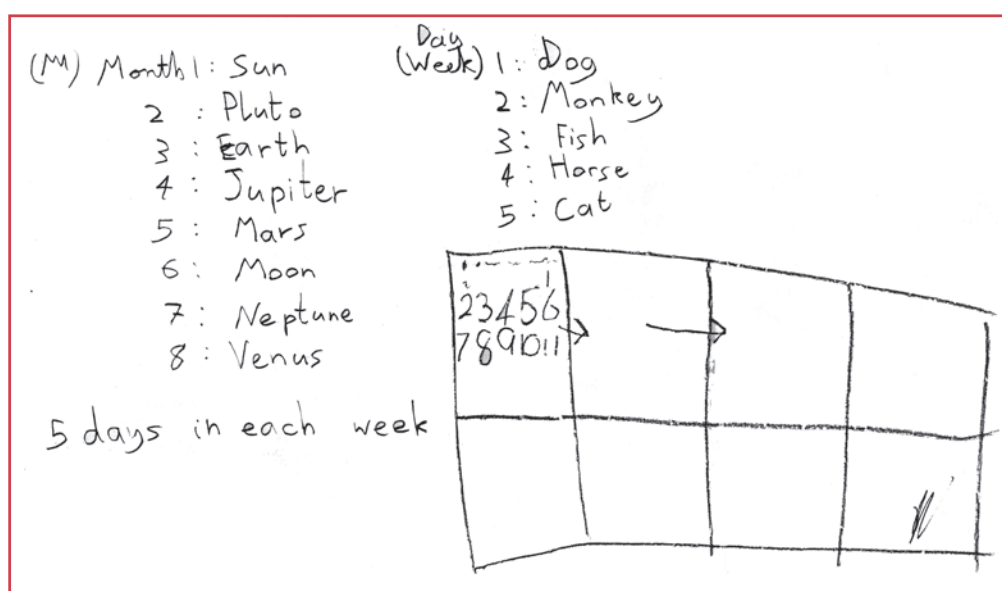
Following the whole-class introduction, the learners worked in pairs to plan their calendars. Initially, the teacher decided to observe Gavin and Karen, who were considering the number of months that would be needed. Karen said that, as there were only 88 days, they wouldn't need 12 months and suggested that they have only three as, '88 is about three times 30 and there are about 30 days in every month'. Gavin reminded Karen that they didn't need to have the same number of days as on Earth and suggested that they have eight months with

11 days in each. Karen thought that the number of months ought to be a lot less than eight, because '88 days is a lot less than 365', but agreed that eight lots of 11 would be a good way of starting as it should 'make the sums easy'. The teacher then moved on to observe another pair of learners while Gavin and Karen continued with their planning, which is shown below.

By the time the teacher reached Annie and James, the two learners had agreed that they would have four months of 22 days in their year and were enthusiastically beginning to produce a

colourful representation of each month.

The teacher asked why they had chosen to use four months and James said it was because 'four 22s make 88'. When asked whether they could have used any other numbers, Annie said they could use 11 days and eight months or 11 months and eight days.



Teacher's guide | Developing **number** | Time – The changing year

The diagram indicates how learners' work can provide evidence for the assessment of **Recording and interpreting data and presenting findings**. The commentary provided alongside the learners' work also links the evidence with **Measuring** and **Using a variety of methods**.

Recording and interpreting data and presenting findings appears in the skills framework as follows.

Recording and interpreting data and presenting findings	Record numbers initially by making marks or drawing pictures.	Record, interpret and present data in simple tables, lists, pictograms, charts, graphs and diagrams.	Record, interpret and present data in charts, diagrams, tables and graphs. Label axes appropriately. Recognise that some conclusions can be uncertain or misleading.	Choose from, construct and interpret a variety of methods of presenting data, including pie charts, scatter graphs, line graphs. Recognise that some interpretations can be misleading.	Record and present gathered data in fully labelled formats, with titles, scales, axes and keys as appropriate.	Select and use effective methods to illustrate findings, identify trends, and make comparisons.
						

What to look for (task-specific criteria):

When presenting their results, were learners able to:

- itemise in a simple table or list, the number and names of the days they have identified?

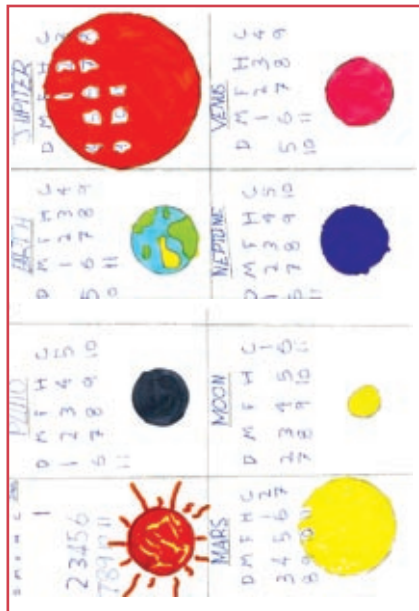
- construct a calendar that incorporates, in a consistent manner, the days, weeks and months they have identified and the relationships they have used?



Although Annie and James have produced a very colourful presentation, it is in the form of a simple table (Recording and interpreting data and presenting findings, Cell 2). To assess their skills further, the learners could be asked to design a second 88-day calendar according to given success criteria, for example, nine months in a year and four days in a week.

Although Annie and James have been able to suggest a way of defining smaller units of time, namely four months of 22 days or eight months of 11 days (Measuring, Cell 2), there is little evidence of the ability to use a variety of methods.

When presenting their calendar, Karen said that they had spent some time considering the names to use and the way in which the calendar should be set out. Gavin said that looking at the ordinary calendar the teacher provided had been very helpful.



Reviewing the evidence, it can be seen that the two learners have been able to construct an attractive calendar that is 'fit for purpose' (Recording and interpreting data and presenting findings, Cell 3). They have also been able to establish relationships between the units that could be used to measure the passage of time in the given, hypothetical situation (Measuring, Cell 3). The brief discussion noted by the teacher at the beginning of the activity also provides some limited evidence regarding Gavin and Karen's calculating skills (Using a variety of methods, Cell 3).

To assess the learners' skills further, they could be asked to consider the implications of following through Karen's assertion that '88 days is a lot less than 365', by estimating the number of months that is approximately proportional to 12 Earth months and investigating suitable numbers of weeks and days.

