Nguzu Nguzu Mathematics

Teacher's Guide Book 2

Standard 6

First Edition 2005

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Foreword

This Standard 6 Mathematics Teacher's Guide has been developed to make Mathematics teaching and learning more relevant to the needs of Solomon Islands' pupils and teachers.

This Teacher's Guide and the related Pupil's Resource Books have been developed locally by Solomon Islands' teachers and curriculum developers. They place mathematics in a local context, using examples and situations which are familiar to Solomon Islands' children. I regard the development of these teaching and learning approaches as another important step in our efforts to provide high quality, meaningful learning experiences for our primary pupils.

All the Nguzu Nguzu Standard 6 Maths materials build on the ideas and methodologies which have been used in Standard 1 through to Standard 5 Nguzu Nguzu Mathematics. The underlying principle is that learning takes place when pupils are involved in practical activities. This Teacher's Guide therefore includes teacher led activities and child centred practical activities which consolidate new skills and knowledge.

To achieve numeracy pupils need to be able to think flexibly and apply their knowledge to new situations. This includes solving practical problems, experimenting with mathematics and developing the ability to reason mathematically and to communicate their ideas to others. A child is not 'functionally numerate' if they can only answer theoretical maths questions. They also need to be able to abstract and generalise from specific situations to demonstrate their mathematical thinking.

As Permanent Secretary responsible for education services in Solomon Islands I endorse this Standard 6 Mathematics Teacher's Guide for use in primary schools throughout the country. I recommend it to teachers and encourage you all to implement this curriculum in your classrooms.

Dr. Derek Sikua
Permanent Secretary
Ministry of Education and Human Resource Development
September 2005

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Important Note

This Teacher's Guide, the Pupil's Resource Books and all supporting materials for the Nguzu Nguzu curriculum are the property of the school. They have been freely donated to the school. They must not be sold or removed from the school. Teachers who are transferred to other schools must not take books with them when they move.

Standard 6 Mathematics

Teacher's Guide Two

Contents

The Mathematics Units — Page

The Mathematics Syllabus

The Mathematics Syllabus is the Ministry of Education approved syllabus for Primary Mathematics teaching from Standards 1 – 6. The Teacher's Guides and pupils' resources in the Nguzu Nguzu series are all designed to assist teachers to cover the syllabus objectives for each Standard. Copies of this syllabus have been distributed to all education offices and should be available in all schools.

Rationale for the Inclusion of Mathematics in the Primary Curriculum

Knowledge of mathematics is essential for all Solomon Islanders if they are to fully participate in life, both at school, and in the future, as adults.

Mathematics is part of everyday life for all of us. We use mathematical skills and understanding, in many situations, to make judgments about quantity, distance, size, time and shape. Many children's games and activities also involve the use of mathematical skills and concepts.

As pupils near the end of their primary education, the level of mathematical skills they require increases in range and sophistication. Whether they continue on to secondary education or not they require a good foundation in mathematical thinking. In order to cope with the changes they will face, pupils must be able to adapt their skills to suit different situations and they must be able to solve problems using many different strategies.

At the beginning of each unit in this Teacher's Guide, the rationale for each topic is explained. Teachers should try to keep this in mind as they work through the activities with the pupils.

Assessment of pupils' progress, understanding and practical skills should also be made with this rationale in mind.

Aims of Mathematics Education

The Mathematics Syllabus has the following aims:

1. To introduce mathematical concepts through relevant first-hand experience in real situations, working from the real to the abstract.
2. To make mathematics relevant to the local environment and culture.
3. To involve pupils in practical activities and games which are relevant to their age and experience.
4. To encourage the planning and presentation of lively, varied and interesting lessons.
5. To encourage pupils to use mathematical skills in practical and problem solving situations.
6. To encourage pupils to appreciate and enjoy the aesthetic nature of mathematics.
7. To encourage exploration and investigation.
8. To encourage children to talk about their mathematical activities, describing what they do and why they do it, so as to deepen their understanding of mathematical concepts.

At the beginning of each unit in the Teacher's Guide, these aims are made more specific to help teachers understand what pupils are expected to know and do.

A sequence of objectives is provided to help the teacher achieve the aims.

Mathematical Themes and Topics

The body of mathematical concepts, skills and knowledge contained in the Mathematics Syllabus is divided into six different **themes**. These are:

1. Number	2. Shape
3. Graphs	4. Measurement
5. Time	6. Money

Within each theme there are a number of topics, which are numbered and arranged in sequence. For example in Standard 6 the **Shape** theme contains four topics as follows:

Topic 6 Angles
Topic 7 Triangles
Topic 8 Tessellation
Topic 9 Three Dimensional Shapes

These topics should be taught in the order in which they are presented, as a good understanding of each is required before moving onto the next topic.

The complete list of syllabus objectives for Standard 6 is included for your reference on the following pages.

Theme, scope and sequence objective tables for Standard 5 and Standard 6 are also included on pages 8 - 10. These detail the knowledge, skills and attitudes pupils should develop as they work through each theme. The Standard Five tables are included to give the teacher a record of what the pupils should have covered already, as well as what they will cover in Standard 6.

Standard Six Syllabus Objectives	
Theme: Number	
Topics	**Objectives**
1. Whole Number Calculations	1. Adding and subtracting large numbers, up to 5 and 6-digits. 2. Making estimates in addition and subtraction. 3. Multiplying, including multiplication of 3 and 4-digit by 2-digit numbers. 4. Dividing 3 and 4-digit numbers by 2-digit numbers. 5. Making calculations and solving problems involving more than one operation. 6. Making calculations which give negative answers, e.g. 25 – 32 = -7.
2. Fractions	**1.** Recognising equivalent fractions and reducing fractions to their simplest form, e.g. $\frac{8}{12} = \frac{4}{6} = \frac{2}{3}$ **2.** Adding and subtracting fractions with the same denominator, e.g. $\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$ $\frac{7}{10} - \frac{3}{10} = \frac{4}{10}$ **3.** Adding and subtracting fractions with unlike denominators, e.g. $\frac{2}{3} + \frac{3}{9} = \frac{6}{9} + \frac{3}{9} = \frac{9}{9} = 1$ $\frac{5}{8} - \frac{1}{4} = \frac{5}{8} - \frac{2}{8} = \frac{3}{8}$
3. Decimals	1. Changing common fractions to decimal fractions, e.g. $\frac{3}{4} = 0.75$. 2. Recognising place value in decimal fractions, e.g. the 3 in 2.35 = 3 tenths. 3. Rounding decimals to the nearest whole number and nearest tenth. 4. Adding and subtracting decimal fractions including tenths and hundredths, e.g. 2.53 + 0.75 = 3.28, 6.20 – 4.68 = 1.52. 5. Multiplying decimal numbers by whole numbers. 6. Dividing the remainder in division calculations to give an answer including tenths, e.g. 16 ÷ 5 = 3.2. 7. Using decimal notation when recording measurements and money.
4. Percentages	1. Making simple calculations involving percentages, e.g. 17 as a percentage of 50 = 34% and 40 as a percentage of 200 = 20%. 2. Calculating a percentage increase, e.g. if the number of children in a school increases from 50 to 60 this is a 20% increase. 3. Solving problems involving percentages.
5. Ratios	1. Comparing values using number ratios, e.g. in a school with 75 children and 3 teachers, know that the ratio of children to teachers is 25:1. 2. Knowing that quantities can be expressed as a ratio, e.g. the mixture of petrol and oil used in a chainsaw.

Theme: Shape	
Topics	**Objectives**
6. Angles	1. Measuring and comparing angles using a protractor. 2. Investigating the total of the angles inside triangles and quadrilaterals. 3. Plotting a course using bearings.
7. Triangles	1. Classifying and naming different triangles, including right-angled, equilateral, isosceles, and scalene. 2. Drawing triangles from given instructions, e.g. draw a right-angled triangle with a base of 12 cm and a height of 7 cm.
8. Tessellation	1. Creating tessellating patterns using two-dimensional shapes.
9. Three dimensional Shapes	1. Using nets to make three-dimensional shapes from two-dimensional drawings.
Theme: Graphs	
Topics	**Objectives**
10. Pie Charts	**2.** Reading information from pie charts. **3.** Drawing simple pie charts to display information.
11. Bar and Line Graphs	1. Collecting and showing data on bar and line graphs. 2. Reading and interpreting information from bar and line graphs and calculating totals and averages. 3. Representing information such as population and weather statistics on bar and line graphs.
Theme: Measurement	
Topics	**Objectives**
12. Speed, Distance and Time	1. Introducing the concept of speed and distance travelled. 2. Understanding and using the formula, distance = speed x time. 3. Calculating the time taken to cover a distance and the distance travelled in a given time.
13. Mass, Volume and Capacity	1. Recognising commonly used containers and their mass or capacity, e.g. know the weight of a bag of rice, the capacity of a drum of petrol, etc. 2. Calculating and comparing the volumes of different containers. 3. Solving problems involving capacity and weight.
14. Probability	1. Investigating the probability of events, e.g. finding the probability (written as a fraction) of scoring 12 when throwing two dice and adding the numbers.
Theme: Time	
Topics	**Objectives**
15. Investigating Time	1. Using a calendar. 2. Understanding longer units of time: years, decades, centuries. 3. Investigating time zones: knowing that other parts of the Pacific and the World have different time zones; working out the current time in another country.
Theme: Money	
Topics	**Objectives**
16. Calculating Money	1. Dividing and multiplying amounts of money. 2. Solving money problems, e.g. finding the average cost per kg of fish at the market.

Scope and Sequence Objectives Tables

Standard Five Syllabus Objectives			
	Knowledge	**Skills**	**Attitudes**
Themes	**Pupils should have knowledge of..**	**Pupils should be skilled in..**	**Pupil's attitudes should include..**
Numbers	• the nature and structure of the number system 0 – 1,000,000 • the concept and properties of whole numbers and their place value • addition and subtraction of 5- and 6-digits numbers • multiplying 2- and 3-digit numbers by 2-digit numbers • dividing by a single digit number with remainder • the concept of equivalence in fractions and decimal fractions • the concept of percentages	• reading, writing and ordering numbers up to one million • exploring, recognising and sequencing negative and square numbers • adding and subtracting 5 and 6-digit numbers • multiplying 2 and 3-digit numbers by 2-digit numbers • developing mental strategies in addition, subtraction and multiplication • the use of division algorithm • adding and subtracting fractions with the same denominator • recognising, and investigating equivalence and decimal fractions • investigating relationships between fractions and percentage equivalence	• the recognition that mathematics is relevant to their daily lives • an appreciation of mathematics as a useful tool • an appreciation of the structure and patterns of negative and square numbers • the recognition that algorithms are necessary in addition, subtraction, multiplication and division • the willingness to solve addition, subtraction, multiplication and division problems • the recognition that fractions, decimals and percentages are relevant in their daily lives
Shape	• constructing circles and circle patterns • the properties of a circle and irregular shapes • the concept of reflection of irregular shapes in square grids • pyramids and prisms • the nature and structure of two-dimensional irregular shapes • the nature and structure of three-dimensional solids • the concept of angles: acute, obtuse, reflex, etc. • the concept of degrees as the standard measurement of angles • the concept of locating points on a map using 'x' and 'y' axes co-ordination	• drawing circles and circle patterns using devices such as, tins and coins • identifying properties of two-dimensional shapes including symmetry and angle properties • identifying, measuring and estimating, diameter, radius and circumference of a circle • constructing pyramids and prisms from nets • strengthening simple two and three-dimensional structures • classifying angles such as obtuse, acute and right angles • using a protractor to measure angles • finding and locating points on a map using number co-ordination and 'x' and 'y' axes co-ordination	• an appreciation of the presence of circles and circle patterns in their local environment • the recognition of the properties of circles • the appreciation of irregular shapes in the local environment • an appreciation that reflection is a way of constructing irregular shapes • an appreciation of the nature and the structure of two-dimensional shapes • a willingness to construct pyramids and prisms from nets • the recognition of pyramids and prisms in the local environment • the recognition of angles in the local environment • an appreciation that angle measurement and location are relevant in their daily lives
Graphs	• of the concept of line graph as a method of representing data	• distinguishing line graphs from horizontal and vertical bar graphs • reading and interpreting information in line graphs • constructing line graphs from tables of information • constructing line graphs using co-ordinates.	• an appreciation that information can be collected, represented and readily retrieved and interpreted from line graphs • the recognition that a line graph is another way of representing data collected from tables of information

Measurement	• the appropriate units in measuring lengths and weights • the concept of scale drawings and plans • decimal notation as it relates to 0.5 = $\frac{1}{2}$ • the relationship between units of weight: g/ kg, kg/ tonnes • the concept of weight and volume and their appropriate units of measurement • calculating areas of squares, rectangles and triangles • the use of degree Celsius as a measure of temperature • using fractions to describe the probability of events • the probability of $\frac{1}{2}$ as the representation of 'even chance'	• calculating lengths including cm, mm and m and weights in grams and kilograms including 2.5m, 3.5kg • calculating distance on a map using a scale • constructing scale drawings and plans • using the formula for calculating volumes of boxes (v = l x b x h) in m^3 and cm^3 • the use of formula a = l x w to calculate areas of squares and rectangles and composite shapes in cm^2 and m^2 • the use of formula Area = $\frac{1}{2}$ base x height to calculate areas of a triangle • using a thermometer to measure temperature and recording air temperatures • using fractions to describe the probability of an event	• the recognition that standard units are necessary in measuring and calculating lengths, weights and volumes • an appreciation that a special formula is used to measure and calculate areas of triangles and volumes of boxes • the recognition that there is a relationship between units of measurement in length, weight and volume • an appreciation that scale drawings, plans, thermometers and probability are relevant in our daily lives
Time	• the concept of the standard notation of the 24 hour clock • the 24 hour clock schedules and timetables • measuring time using non standard units of measurement	• interpreting and recording 24 hour clock using the standard notation of time • writing and saying the 24 hour time and reading from timetables and schedules • calculating time intervals in the 24 hour clock • devising non standard ways of measuring time	• an appreciation that 24 hour time is relevant to daily life • an appreciation that measuring, recording and saying 24 hour time intervals in seconds, minutes and hours is relevant in their daily lives. • the recognition that devising non standard ways to measure time is useful in daily life
Money	• money computation	• solving problems involving computation of money	• the recognition that computation is relevant in solving money problems in their daily lives

Standard 6 Syllabus Objectives

	Knowledge	Skills	Attitudes
Themes	**Pupils should have knowledge of ..**	**Pupils should be skilled in..**	**Pupil's attitudes should include..**
Numbers	• the nature and structure of a number system up to 5 and 6-digits • adding and subtracting large numbers up to 5 and 6- digits • the concept of estimates in addition and subtraction • multiplying and dividing 3 and 4-digit numbers by 2-digit numbers • calculating and solving problems involving more than one operation • the concept of a negative answer calculation • simplifying a fraction to its lowest form • calculating fractions with like and unlike denominators • the concept of rounding decimal fractions and their place value	• reading, writing and ordering numbers up to 5 and 6-digit numbers and decimal fractions • adding and subtracting 5 and 6-digit numbers • making accurate estimates in addition and subtraction • division and multiplication of 3 and 4-digit, by 2-digit numbers • making calculations and solving problems using more than one operation • making calculations which give negative answers • reducing fractions to their simplest form • adding and subtracting fractions with like and unlike denominators • rounding, adding and subtracting decimal fractions and multiplying and dividing simple decimal fractions	• the recognition that mathematics is relevant to their daily lives • an appreciation of mathematics as a useful tool • the recognition that algorithms are useful in mathematical operations • a willingness to use more than one operation to calculate and solve mathematical problems • the recognition and appreciation of negative answers in subtraction • an appreciation of fraction equivalence and how to simplify fractions • an appreciation that percentages and ratios are useful in their daily lives

	• calculating percentages • the concept of number ratio	• making simple calculations and solving problems involving percentages • calculating increases and decreases involving percentages • comparing values and quantities using number ratios	
Shape	• using a protractor for measuring and comparing angles • angles in triangles and quadrilaterals • the concept of right angled, equilateral, isosceles and scalene triangles • how to draw certain triangles from given instructions • the concept of plotting using bearings • the concept of tessellation using two dimensional shapes • creating three-dimensional solids from nets of two-dimensional drawings	• measuring and comparing angles using a protractor • investigating the sum of angles in triangles and quadrilaterals • classifying and naming triangles: right angled, equilateral, isosceles, scalene, etc. • drawing triangles from given instructions • plotting a course using bearings • creating tessellation patterns using one or more two-dimensional shapes • using nets from two-dimensional shapes to make three-dimensional solids	• the recognition that a protractor is a useful tool for measuring angles • the recognition and appreciation of the different angles in triangles and quadrilaterals • the recognition and appreciation of the properties and patterns in regular shapes • a willingness to construct solid shapes from nets • an appreciation that plotting courses is a useful life skill • the recognition and appreciation of tessellation patterns around the local environment
Graphs	• the concept of pie charts as a method of representing data • organising information on bar and line graphs	• reading information from pie charts • drawing simple pie charts to display information • reading, collecting and showing data on bar and line graphs • calculating a total and average from bar and line graphs • representing information such as population and weather on bar and line graphs	• an appreciation that a pie chart is a useful tool for representing and organising information • an appreciation that information can be collected, represented and readily retrieved from a pie chart, bar and line graph
Measurement	• the concept of speed, distance and time • the commonly used weights, capacity and volumes for containers and drums • decimal notation as it relates to 0.58 = 58/100 • the probability of events	• using the appropriate formula to calculate distance, speed and time travelled; i.e. distance = speed x time • recognising commonly used containers and their weights and capacities • calculating and comparing volumes and solving problems involving capacity and weights • using decimal notation, e.g. 2.53 m = 2 m 53 cm • investigating the chances in an event	• an appreciation that the calculation of time, speed and distance travelled is a useful tool in their daily lives • the recognition that there is a need for a standard formula to calculate time, speed and distance travelled • an appreciation of commonly used containers for weight and capacity • an appreciation that solving problems with capacity and volume is useful in daily life • a willingness to investigate, observe and predict chances of events using probability
Time	• time and its use in the calendar and different part of the world	• using the calendar to express the date • explaining and differentiating time: years, decades and centuries • investigating time zones	• the recognition of different terms in the units of time • an appreciation that time is relevant to their daily lives • an appreciation of where they live in relations to world time zones
Money	• money calculations	• adding, subtracting, multiplying and dividing money	• the recognition that calculating money is necessary and useful in their daily lives

The Four-Term Arrangement of Units and Topics

Pupils learn at different rates and in different ways. Although these materials are designed within a unit structure, it is important that teachers respond to the needs of their pupils rather than rigidly following the programme unit by unit, if this does not seem appropriate. The four-term arrangement that follows, suggests how the twelve units might be taught throughout Standard 6 to ensure that all the syllabus objectives are addressed. Teachers should use this flexibly, as a guide, whilst they allow as much time as is needed for pupils to master the skills and concepts with confidence. For each of the first three 10 week terms, four units are suggested. The time allowed for each unit is approximately two weeks, but this will vary from unit to unit and from class to class.

Term 4

For the fourth term, there is no clear unit structure to follow. A range of creative, cross curricula mathematics activities are provided for the teacher to use as they choose in the final term. These activities are suitable for the weeks following the Standard 6 examination. They allow pupils to explore their maths in exciting ways and extend their skills and confidence. This volume of the Teacher's Guide explains in more detail how these activities can be used in the I**ntroduction to Term 4**. Do not leave it until the end of the year to read these activities, however. You may enjoy using these activities with your class throughout the year alongside the work you are doing in other units.

Term 1	Term 2	Term 3	Term 4
Unit 1: Number Topic 1: Whole Number Calculations	**Unit 5: Number** Topic 3: Decimals	**Unit 9: Number** Topic 5: Ratios **Measurement** Topic 14: Probability	**Cross Curricular Maths Projects** **1.** Fun with Numbers **2.** Fun with Words and Numbers **3.** Challenges in Shape and Space **4.** Census Project **5.** Environmental Projects **6.** Investigating Time **7.** Shopping Survey **8.** Puzzles
Unit 2: Measurement Topic 12: Speed Distance and Time	**Unit 6: Graphs** Topic 10: Pie Charts Topic 11: Bar and Line Graphs	**Unit 10: Time** Topic 15: Investigating Time	
Unit 3: Number Topic 2: Fractions	**Unit 7: Number** Topic 4: Percentages	**Unit 11: Money** Topic 16: Calculating Money	
Unit 4: Shape Topic 6: Angles Topic 7: Triangles	**Unit 8: Measurement** Topic 13: Mass, Volume and Capacity	**Unit 12: Shape** Topic 8: Tessellation Topic 9: Three-Dimensional Shapes	

The Standard 6 Mathematics Materials

The Teacher's Guide

The Teacher's Guide is designed to help you plan and teach mathematics lessons. It contains advice, activities and ideas for lessons under each of the objectives of the syllabus. The activities are divided into teacher led activities and pupil focussed activities as follows:

Teacher Led Activities

At the beginning of each lesson there are **T** activities labelled as shown on the right. These activities are led by the teacher and form the introduction to each lesson. After the **T** there is a **number** which tells you which **objective** this activity covers, followed by a **lower case letter** which tells you which **lesson** it is.

Thus the box in the example on the right, refers to the first **(a)** teacher led activity **(T)** for objective one **(1)**.

The **purpose** of these teacher led activities is to teach new concepts, new vocabulary and notation, and to explain how these concepts are applied. This may include:

- an introduction to the topic
- teaching or explaining new skills, strategies or rules
- demonstrating new methods or rules.

The **focus** of the teacher led or **T** activities is usually on the whole class working as a group.

Child Centred Activities

In the Teacher's Guide the teacher led activities are always followed by **C** activities. They are labelled as shown on the right.

The **C** refers to the fact that it is a child centred activity and, in this example, **2** tells you that it supports objective 2 and the **b** tells you that it is the second lesson for this objective. These activities are usually done in groups, sometimes in pairs or sometimes individually.

Learning is through practical activities and exploration, and is led by the pupils themselves. The teacher takes a supervisory role in these activities.

The **purpose** of these child centred activities is as follows:

- to consolidate what the teacher has taught in the teacher led activity.
- to give the pupils time to practice and understand new concepts in a practical way.
- to encourage pupils to talk about their mathematics, with each other and their teacher.
- to encourage group work, cooperation, working together, following rules.
- to encourage enquiry, extension and conceptual thinking.

C activities **may,** or indeed **may not,** be followed by further activities in the Pupil's Resource Book. Activities in the Pupil's Resource Book are referenced to the Teacher's Guide as shown by the box on the right.

This example shows that the activity follows activities **T1b** and **C1b** in the Teacher's Guide. It supports objective 1 **(1)** and is part of the second lesson on that objective **(b)**.

Pupil's Resource Book activities are usually provided to give the pupils more practice in applying and using the skills they have learned in the **T** and **C** activities.

Here is a summary of the difference between teacher led activities and child centred activities. These tables may help you when you are planning your lessons.

Teacher's Activity	Purpose	Comments
• Led by the teacher. • The teacher teaches the pupils a new skill, method or concept. • Probably a whole class activity (though not always).	• To introduce the topic. • To teach new skills. • To explain new ideas, mathematical language or concepts. • To do demonstrations.	The teacher must be sure that the pupils have understood the mathematical concepts which they will go on to practice in the children's activity. Pupils should participate by discussion and asking questions. Child centred / exploratory activities will **not** work effectively to reinforce children's learning if they do not understand the concepts involved.

Children's Activity	Purpose	Comments
• Pupil focussed. • Learning is through activity and exploration, and is led by the children themselves. • The teacher takes a supervisory role. • Probably done in groups, pairs or sometimes individually.	• To consolidate what the teacher has taught in the teacher led activity. • To give the pupils time to practice and understand new concepts in a practical way. • To encourage enquiry, extension and conceptual thinking. • To encourage group work, cooperation, working together, following rules.	Pupil's activities should be motivating. Pupils should enjoy doing them and find them rewarding. They include games, puzzles and practical tasks. Pupils will not always have the teacher with them when they do the children's activity. The teacher must give clear instructions so the pupils can get on by themselves.

Teaching Materials Boxes

Materials

Shells or stones
Place Value Game Cards
Dice

At the beginning of each **T** activity there is a box with the heading **Materials** as shown on the right. This lists all the things the teacher will need for the lesson. It may include equipment such as scissors or protractors, locally available teaching aids such as stones, shells, games or posters provided by the Nguzu Nguzu programme and charts or teaching aids that the teacher needs to make.

It is a checklist of everything the teacher needs to prepare for the lesson. If you have added other activities to your lesson, you may need to add to this list when you do your lesson preparation.

The list does not include materials such as pupils' exercise books, Pupil's Resource Books or blackboard and chalk as it is assumed that these will always be available.

Extension and Support Activities

At the end of each unit in the Teacher's Guide there are ideas for extension and support activities. These are **not** just more of the same activities which have already been covered in the lesson. They are different activities with a different purpose. They are included to help you differentiate your teaching to meet the different needs of pupils in your class. They do this by extending the skills of the most able and supporting the learning of the least able pupils.

Extension and support activities **may be used at any time during the unit** to help the pupils grasp and apply the concepts. They are not intended always to be left until the end, even though they appear at the end in the Teacher's Guide.

Extension Activities

The purpose of extension activities is to allow pupils to apply and extend the concepts taught. Usually these activities involve independent investigations. These may take the pupils beyond the syllabus objectives.

Pupils with a firm grasp of the concepts taught in a particular topic and who have achieved the objectives are encouraged to work independently, to take their understanding further.

Type of Activities

- Activities which only need the teacher to introduce them and then allow pupils to work independently. They do not contain large amounts of work for the teacher (e.g. writing things up on the board).
- Activities which may take pupils beyond the syllabus objectives or link the topic with other topics.
- Activities which rely heavily on pupils asking their own questions, finding things out for themselves and exploring mathematical concepts independently.

A range of suggestions and examples of activities, relating to the different objectives is included.

Support Activities

The purpose of support activities is to revise and practice concepts taught in the unit again, to make them easier to understand or to provide more practice. These support activities are aimed at pupils who are having trouble grasping the concepts and achieving the objectives. They are for pupils who need more practice, or more time to fully understand all the objectives in a particular unit. A range of suggestions and examples for the teacher to choose from is included.

Type of Activities

- Activities which require teacher input. The teacher can use them to work with small groups who need extra help.
- Activities that teach the same idea in a different way.
- Activities that give more practice, such as practical activities and games.

Answers

The answers to all the exercises in the Pupil's Resource Book are found in the Teacher's Guide in purple at the end of the lesson in which they are completed.

When marking pupil's work, however, the right answer is not always the most important thing to look at, especially in problem solving activities. Check pupil's working as well as their answers as this tells you a lot about whether they have understood the lesson or not.

Teacher's Assessment Reminders

At the end of each set of activities, **assessment reminders** are provided for the teacher to use to evaluate whether the pupils have achieved the objective and are ready to move on to the next step. They look like this:

Can all the pupils add and subtract larger numbers with up to 5 and 6-digits?

These refer back to the syllabus objectives and remind the teacher to assess pupil's progress continuously. The assessment reminders ask the teacher to make a judgment as to whether the pupils have achieved the objective. If they have not, you may choose to use some of the support activities to review the concepts before moving on.

The Pupil's Resource Books

The **purpose** of Pupil's Resource Books is to provide activities which the teacher can use to give the pupils more practice with the concepts taught in the maths lesson. It includes a range of activities from straightforward practice of new skills through to application of skills to real life situations and problem solving.

The Pupil's Resource Books support the Teacher's Guide but can **never** be used in isolation. Pupils will not learn Maths by working independently through the Pupil's Resource Book. All the teaching of new concepts and skills comes in the teacher led activities (**T** activities) and child centred activities (**C** activities). Pupil's Resource Book activities are for further practice and application of what has been taught.

Graded Activities

In the Pupil's Resource Books the activities are differentiated or graded. This means that they are set at three different levels. By matching the level of the activities to each pupil's ability, teachers can ensure that all pupils make progress, whatever level they are at. In the Standard 6 Pupil's Resource Books the activities are differentiated as follows:

Activity A Straightforward practice of what has been taught in the lesson. These activities give pupils repeated examples of using a method or rule until they are confident with it.

Activity B At this level, pupils are asked to demonstrate a higher level of understanding. These activities ask pupils to apply new concepts to different situations or vary the method that they have learned in some way. They also sometimes provide extra practice like Activity A, but, at this level, more difficult figures, or more difficult examples are used.

Activity C Activities at this level focus on using and applying the concept, method or skill to real, practical problems. These activities require a higher level of conceptual thinking and problem solving and may ask pupils to complete a number of different operations, including what has been taught in the lesson.

The teacher must decide which of the activities in the Pupil's Resource Book to use and when to use them, as well as with which pupils. This will vary between topics. This will also vary according to individual pupil needs.

All pupils are **not** expected to do all the activities in the Pupil's Resource Book. You may choose to miss out Activity A for some pupils and have them do only Activities B and C, or you may have some pupils who only do Activity A, for example. It is important for teachers to use their knowledge of each pupil to make these decisions.

The Teacher's Guide gives advice about how and when to use Pupil's Resource Book activities. You should follow this, as there are some examples where Activities A, B and C need to be done in sequence.

Speech Bubbles

In the Pupil's Resource Book there are **speech bubbles** like this, containing tips and reminders for the pupils. The purpose of these is to remind the pupils of important aspects, or key points of the lesson. Things that they will need to remember in order to complete the activities.

Their **focus** of these is on the key information from the lesson.

They often start with a heading such as:

Be Careful! Remember! Watch Out! Don't Forget! Think! Tip!

Teachers should encourage their pupils to get into the habit of reading these before they start their activities, as they will help them as they work.

Check Up Pages

At the end of every unit there is a **Check Up Page**. This is a tool which teachers can use to check that the pupils have mastered the skills they have taught.

The **purpose** of these pages is to help teachers with ongoing assessment. The questions are designed to allow pupils to demonstrate their understanding and apply their skills.

Each Check Up Page contains at least one question assessing each objective in each topic covered in the unit. Sometimes more than one question per objective is included. In this case the questions allow pupils to demonstrate different levels of achievement. One might be for a basic use of the concept, and the second might be for a higher application of that concept.

All the answers to the Check Up Pages are included in the Teacher's Guide.

These Check Up Pages serve as a very good continuous assessment tool. They can be used at the end of each unit to review progress. This will inform the teacher as to whether each pupil has understood the concepts taught.

Teachers should record the pupils' performance in the Check Up Pages at the end of each unit. One way of recording pupil's scores is suggested on page 31. Teachers may also devise their own record keeping system.

Other methods of continuous assessment are discussed further on page 26 in the section on assessment.

Additional Materials

Together with the Teacher's Guide and the Pupil's Resource Book there is a set of other resources. These include posters, games and resource cards. They are referred to in the Teacher's Guide, in the materials boxes, so that they can be used at the appropriate time.

Teachers need to prepare these ready for the lesson in which they will be used. Sometimes they need to be cut up and pasted onto card to make them last longer. The instructions for how to prepare each card are written in the bottom left hand corner. They should be labelled and stored carefully so that they can be used again the following year.

Where posters are provided, it may be tempting to display these around the classroom just to make the place look attractive. Teachers should not do this. They contain specific information to be used in specific lessons. Teachers should use the posters to support the teaching activities at the appropriate time rather than leaving them on the classroom wall for the whole term.

Teaching Methodology

Active Learning

In the Nguzu Nguzu Mathematics materials, learning is based on **practical activity.** Pupils learn best by doing things, by experimenting, by playing games, by exploring and finding out for themselves. Learning is active not passive.

This approach should make learning **enjoyable** for pupils.

Teachers need to create an atmosphere in the classroom where pupils are used to working in this way, doing things for themselves and actively exploring maths concepts with confidence. Pupils must learn that making mistakes is OK! It is acceptable to get things wrong and to try again, this is how pupils learn with confidence.

Above all they must feel free to talk about their maths, both with each other and with their teacher. Teachers should constantly be asking pupils to explain the concepts they are learning, encouraging them to discuss their ideas and to ask questions about the lesson. This kind of active participation supports sound understanding.

The active approach to teaching and learning maths is reflected in the whole Primary Maths Syllabus. Learning is achieved through developing three different aspects of children's ability - **skills, awareness** and **knowledge.** This approach integrates learning with doing.

Pupils who have been studying Nguzu Nguzu Mathematics and English in Standards 1 to 5 will have learnt to study and learn in a certain way. For example:

- They will be used to working in small groups as well as, as a whole class;
- They should be used to getting on with some work by themselves, while the teacher works with another group;
- They will be used to practical activities and will expect to do these as part of most lessons;
- They will understand that the teacher expects them to talk in class and to discuss their work with each other;
- They will be developing their confidence in speaking up in class to ask questions or to contribute to discussions;
- They will enjoy playing games to reinforce their learning and they will be able to follow the rules of simple games;
- They will know that it is OK to make mistakes and that they learn a lot from getting things wrong and trying again!

During Standard 6 they will be developing further. They will be:

- becoming more independent in their learning and taking responsibility for their own learning. This may mean doing research to find things out and thinking things through for themselves;
- developing their own ideas and mathematical strategies and learning how to explain these to other people with confidence;
- developing their mathematical thinking so that they can apply it to decision making and problem solving;
- growing in confidence and self assurance.

Teachers are encouraged to **teach** first, and then let the pupils **consolidate** what has been taught through pupil focussed activities. They then allow the pupils to **practice** what they have learnt.

Nguzu Nguzu materials combine both **teacher led** and **child centred** learning approaches according to which are best suited to the topic or activity. Lessons should always have a balance between listening to the teacher and doing practical activities.

When pupils become familiar with this way of learning they will not be afraid to make mistakes. This will help them learn with confidence in other subjects too. In this way pupils learn through exploration, investigation and discovery.

What does this Active Learning Approach Mean in Practice?

Under the guidance of the teacher, the pupils **work out rules and patterns for themselves** instead of the teacher telling them what they are. It means they experiment, get things wrong and find the right way in the end. It means they suggest their own ideas for how to solve problems and try them out to see if they work.

In mathematics we teach pupils formulae and algorithms, such as:

The volume of a rectangular prism is length x breadth x height (v = l x b x h).

The area of a triangle is half the base x the height (a = $\frac{1}{2}$ b x h)

These formulae are useful tools, but pupils remember and use them properly, only if they have worked them out for themselves. It is in the process of working them out, that they come to understand the idea behind the formula. They are then able to adapt the formula and apply it to other situations and problems.

As well as teaching pupils how to do things, the good teacher teaches the pupils to work out how to do things for themselves and to ask **why?** This encourages them to question, explain and talk about what they do. We know as adults that if we try something for ourselves we are

more likely to understand and remember it, than if we watch someone else do it or listen to someone talk about how it is done.

Our pupils are no different. To learn with confidence, they need to **do things themselves**, not watch the teacher do them or listen while the teacher talks about doing them.

Working in Groups

In the Teacher's Guide it is often suggested that teachers organise the pupils to work in small groups, or in pairs, as well as working together as a whole class. If your pupils have used Nguzu Nguzu Mathematics materials before they will be familiar with this.

There are many reasons for group work:

- It allows pupils to learn at different levels according to their ability;
- It trains them to cooperate with each other, help each other and work together;
- It helps them to talk about their work and discuss and explain what they are doing;
- It gives them the chance to practice skills they have learnt in class until they are confident with them. In a group of five, pupils have more 'turns' than in a class of 20;
- It frees up the teacher to concentrate on those pupils who need extra help;
- It encourages independent learning;
- It can overcome the problem of scarce resources, by rotating activities between groups.

It can sometimes be more difficult to organise and manage the class when they work in groups. Organising the groups carefully and planning the work they will do thoroughly helps to make it successful.

Here are some suggestions for successful group work.

Organising Groups

Grouping children by **ability** can be useful for teaching skills at different levels, but it may be discouraging for them to always be grouped by ability if they feel they are put in the 'worst group'.

Mixed ability groups can also be useful where more able pupils can help less able ones. This is a good way of approaching practical tasks.

Different activities may be suited to different ways of grouping children. Vary your groups to suit the activity.

Children should know what groups they work in, so they can quickly get into their groups. Do not mix the groups around too often as it will waste too much time.

Give groups **names** such as islands, birds or colours not numbers or letters as this encourages them not to see one group as 'top' or 'bottom'.

You could, for example, have two different groupings for your class. The **colour groups** which are formed **by ability**, Red for the most able pupils, Green for the mid level group and Blue for the less able pupils; and the **fish groups** for **mixed ability** work, the Marlin group, the Bonito group and the Yellow Fin group, for example. Then when you are ready for the class to work in groups all you need to say is, 'Work in your colour groups today', or 'Work in your fish groups'.

Managing Groups

Give **clear instructions**. Pupils in groups must understand what to do before they start the task. **Monitor** the groups. The teacher must be aware of what all the groups are doing, even if he or she is working more closely with one of the groups. Make sure they are all concentrating on their work.

Don't worry about the noise! Group work may be noisy because pupils should be talking to each other and discussing their work, this shows that they are learning. Plan some strategies to manage a working noisy classroom. This may be by giving an agreed signal such as clapping your hands three times for pupils to stop work and pay attention, when needed.

Teach pupils to take responsibility for their own learning. Training them to get out and put away equipment, to tidy their group area and so on, will make it easier for you to manage group work.

Teachers are sometimes reluctant to group their pupils. However if pupils have been using the Nguzu Nguzu materials they will already be familiar to working co-operatively in groups. As long as groups are well organised and managed by you as the teacher they are a very useful way to promote learning in the classroom.

Using Games as a Learning Tool

In Nguzu Nguzu Mathematics games are often used in the pupil focused activities or suggested as support activities. They are helpful because:

- they allow pupils to learn as they play;
- pupils enjoy themselves;
- games hold pupils' attention so they can concentrate for longer;
- playing games encourages children to talk to each other and discussing mathematical concepts helps them to understand them better;
- through games pupils also learn other skills like following rules, cooperating with each other and taking turns;
- playing games helps pupils to develop a strategy or plan. This actively develops their strategic thinking skills;

When games are suggested in the Teacher's Guide they may involve some teacher time to prepare before the lesson.

When you have taken the time to make a game (or any other teaching aids) make sure that you store it carefully after you have used it. Label your materials with the unit number and the name of the game so that you can use them again the following year. Games are very valuable teaching aids, especially in the teaching and learning of mathematics.

Planning in Mathematics

Careful planning is the key to success in teaching. The table summarises four stages of planning:

Stage 1	**Yearly Planning**	The teacher must study the Syllabus to become familiar with the material that is to be covered in the year. The four term arrangement on page 11 of this Teacher's Guide helps you to plan how to cover the syllabus.
Stage 2	**Termly Planning**	The teacher must plan which topics he/she will teach in each term. Discuss this with other teachers. If you are sharing equipment you may need to rearrange some units. The four term arrangement will help again.
Stage 3	**Weekly Planning**	The teacher decides what will be covered in each lesson of the week. Objectives for each lesson are written down as well as the activities planned. The Teacher's Guide helps here, but teachers must plan additional activities too, to meet the needs of their class.
Stage 4	**Lesson Preparation**	In this final stage the teacher must make sure that all the work, materials and teaching aids are ready for each lesson. This should be done every day.

A suggested format for a lesson plan is shown below. Teachers all plan their lessons in different ways, which is fine. Teachers should use the lesson plan format which is most suited to their own way of working. The suggested format can be used as a guide as to what should be included.

In order to plan a lesson successfully a teacher must be familiar with the objectives of the topic to be taught. In other words the teacher must know exactly what he/she is trying to teach.

A teacher must think about how long each activity within a lesson will take. This is determined by how long the pupils can concentrate for, the type of activity and the need to balance listening and participation in a lesson. Timing is very important.

A good teacher responds to the pupils, if things go well and they are motivated an activity can be extended. If an activity is not going well then the teacher must be flexible and change that activity.

In planning lessons, teachers should include a variety of teaching methods to keep the pupil's attention and make sure they understand and practice the new skills you want them to learn.

Sample Lesson Plan

Title of Lesson	
Objective (s)	Select these from the Teachers' Guide. The box at the beginning of each unit outlines the objectives. There may be only one objective, or more than one for each lesson. There may also be more than one lesson on the same objective. Sometimes teachers will plan extra lessons for revision or extension of an objective in the Teachers' Guide. Remember to think about **Knowledge, Skills** and **Attitudes** **What is this lesson going to teach the pupils?**
Materials	Use the materials' boxes in the Teacher's Guide to help. List teaching aids, charts, equipment and books you will need to have prepared or made before the lesson. **What do I need to teach the lesson effectively?**
Introduction	An introductory activity led by the teacher. This may include revision of previous work on this topic, finding out what pupils already know. This may be in the form of a game, a brainstorm, or a discussion. This is a good time for the teacher to talk about the rationale for learning the skills included in this lesson. **What are we learning and why are we learning about this?**
Activities Teacher Led Activities: Pupils' Activities:	Some will be selected from the Teacher's Guide, some will be planned by the teacher to reinforce learning. Remember: • to balance listening and doing • to follow the sequence of teaching, consolidation and practice of new skills. **What will we do in the lesson?**

Organisation	How will pupils be grouped for each activity? How will the teacher's time be divided up? How will the teacher supervise and monitor the pupils as they work? What teaching methods will be used? How long will each part of the lesson take? What will early finishers do?
Conclusion	It is helpful to bring the class back together for the end of the lesson. A good concluding activity might be a game, an opportunity to show/share work completed or a class discussion.
Evaluation	After teaching the lesson the teacher should note down how it went. This may include ideas for the next lesson. This is a record, which the teacher can refer to for ideas to improve their teaching.

Making Teaching Aids

Using teaching aids helps pupils to explore and understand mathematics better. Nguzu Nguzu Mathematics cannot be taught properly unless the teacher makes teaching aids and uses locally available materials to provide practical activities. Nguzu Nguzu Mathematics cannot be successfully taught with only a blackboard and chalk!

At first it may seem as if there is a lot of work involved in making teaching aids for Nguzu Nguzu Mathematics lessons. However, if you look after the teaching aids you make, they can be used for many different lessons and should last for the whole year, and for following years too.

There are different kinds of teaching aids:

1. **Aids provided by the Nguzu Nguzu programme**. These include cards and games, posters and pictures. These are printed by the Curriculum Development Centre and will be distributed along with the Teacher's Guides and Pupil's Resource Books. Teachers will need to prepare them for use by cutting and pasting the teaching aids, following the directions on each card.
2. **Things which can be collected** by teachers, pupils and parents from around the school community and environment. These things are mostly freely available.
3. **Things which teachers need to make**. These, too, can be made from locally available resources but they require time and effort to put them together. If teachers do not know how to make things there is usually someone in the community who can be asked to help.

Some teaching aids require special tools, skills or equipment to make them e.g. a balance. Teachers will need to be resourceful and maybe ask the local Community High School or a Rural Training Centre to make equipment in their workshop. Teachers may be able to borrow tools from a Community High School or a Rural Training Centre or from a local carpenter. Teachers may also be able to borrow resources from the local clinic such as a thermometer or scales when investigating measurement.

Pages 14 – 17 of **Ideas into Practice** give some useful suggestions of how teachers can begin their collection or teaching aids. This book should be available in your school.

A list of the teaching aids, games and posters needed for each unit in this Teacher's Guide is included on page 22. Use this table as you plan your teaching in each unit to make sure that you have everything that you need.

Teaching Aids and Materials required for Standard 6 Maths				
	Nguzu Nguzu Cards and Games Provided		Things the Teacher Should Collect or Borrow from the Environment or Community	Things the Teacher Should Make
	Charts and Posters	Group Teaching Aids and Games		
Unit 9		Probability Number Spinners Colour Spinners	selection of stones, shells, seeds, lemons, buttons, bottle tops, 20 cent coins set of containers, tins, plastic boxes empty rice bags butterfly clips dice pack of cards (Extension)	
Unit 10	2005 Calendar Poster		old calendars torch World Map globe ball	Prepared Quiz questions
Unit 11		Money Bingo Game Boards	counters or small stones	
Unit 12	Two Polygon Tessellations Poster Multi Polygon Tessellation Poster	Regular Polygon Shapes 3D Game Cards Complex Nets cards 1-4	3D shapes	Constructed polyhedra

Storage and Display Ideas

The way the teacher organises resources is important. There are many different ways of organising a classroom and there are many different types of classroom too. Teachers must adapt or change to suit the circumstances they find themselves in.

Often the resources that teachers have are poor. Not enough books, no cupboards, not enough space, few teaching aids and poorly maintained classrooms. It would be very easy, faced with these problems, to just give up and not bother with how the classroom looks. But if teachers do not look after their classrooms, they give the pupils the impression that school doesn't matter and learning isn't important.

Storage is a real problem in many classrooms especially in rural schools. Often classrooms are not secure, so materials can be stolen, cupboards and shelves are not available for materials to be stored neatly and where classrooms are not well maintained equipment can be spoiled by the rain and wind, this can be especially damaging for books.

There is a lot that teachers can do however, with a little help from the community, to improve the storage facilities in their classrooms to help them make the most of the books they do have and look after the teaching aids they have spent time making.

Ideas into Practice (pages 18 - 19) has some good ideas on how to store equipment. All these storage ideas are easy to make. They can be made from locally available materials most of which are cheaply or even freely available. They all look attractive and will help pupils to take a pride in their classroom environment.

It is especially important to store books so that they last a long time. **Ideas into Practice** (pages 6 – 11) gives some good ideas on how to store books. The pupils must be taught to look after books as well as having them readily accessible so that the pupils can use them for research or choose to read when they have free time.

Displaying Pupils' Work in the Classroom

There are many reasons for displaying pupils' work in the classroom, for example:

- it makes the classroom look attractive;
- it reminds pupils of what they have learned;
- it encourages pupils to talk about their work;
- it helps pupils to take a pride in their work;
- it reinforces and supports learning.

Every classroom should have some display areas where pupils' work as well as posters and other learning aids are neatly and attractively displayed.

Displays should be changed regularly to keep them interesting and in good condition.

Displays can be used to reinforce learning of new topics. For example the equipment used for teaching measurement and capacity in mathematics can be displayed on a table during the teaching of that unit to allow pupils to experiment with it.

Pupils should be encouraged to look at and talk about displays with their teachers and with each other and to ask their parents and family members to come in and see their work too.

Teachers should be careful however that their classrooms are not too crowded or cluttered. One or two interesting displays that are changed regularly are probably better than 20 displays that remain the same all year round. Teachers should use display to support the work they are **currently** doing with their class.

Mathematical Language

Teachers often use informal, everyday language in maths lessons alongside technical mathematical vocabulary. Although this is a good way to help pupils to grasp the meaning of different words and phrases, a structured approach to teaching mathematical vocabulary is essential if pupils are to use the correct terminology with confidence.

Teachers first need to teach new mathematical terms in a suitable context, for example, with relevant, real objects, mathematical apparatus, pictures and/or diagrams.

Teachers should then use correct mathematical language with the class all the time to reinforce what they have taught.

Then they must encourage the pupils to use the technical terms they have learnt when working in groups, in pairs and individually. Careful questioning can encourage pupils to use these terms. They should use them orally first, and, when they are confident with the meaning, they can begin to read and write this new vocabulary.

This process of learning mathematical vocabulary through a cycle of oral work, reading and writing is outlined below.

Start by using the terms orally during practical work.	Pupils develop a practical understanding of what mathematical words mean in a variety of contexts, using real materials
Develop pupils' understanding through more oral and discussion work, and during practical tasks.	This might include opportunities to: ▪ listen to adults and other pupils using the words correctly; ▪ participate in discussions where they are required to use technical vocabulary; ▪ describe, define and compare mathematical properties, positions, methods, patterns, relationships, rules; ▪ discuss how to tackle a problem, collect data, and organise their work; ▪ hypothesise or make predictions about possible results; ▪ present, explain and justify their methods, results, solutions or reasoning, to the whole class or to a group or a partner;
Introduce them to reading technical terms.	This may include reading: ▪ numbers, signs and symbols, expressions and equations from the board; ▪ instructions and explanations in the Pupil's Resource Books. ▪ labels and captions on displays, in diagrams, graphs, charts and tables; ▪ definitions in dictionaries in order to discover meanings, origins of words, and words with similar roots (such as triangle, triplet, tricycle, trisect).
Teach pupils to use mathematical vocabulary in a variety of ways in their writing.	This may include: ▪ labelling diagrams; ▪ writing sentences to describe, compare, predict, interpret, explain or justify their maths work; ▪ writing formulae, first using words, then symbols; ▪ drawing and labelling graphs, charts or tables, and interpreting and making predictions from the data in them.

Problem Solving

Problem solving promotes reasoning and logical thought. It tests the pupil's ability to apply their knowledge of algorithms and transfer theoretical knowledge into practice.

Problem solving is an essential part of Nguzu Nguzu Mathematics. It reinforces learning by helping pupils to apply it to real life situations. It promotes real understanding of rules and methods and, by using real-life relevant problems, shows pupils the relevance and importance of maths.

Nguzu Nguzu Mathematics uses a problem solving approach to ensure that each new mathematical concept taught is applied to real-life problems. These allow pupils to demonstrate their understanding of concepts by tackling problems and finding the solutions.

Problem solving is a process or a series of processes. The process is usually just as important as arriving at the right answer. It involves the following common steps:

1. Identifying the problem to be solved;
2. Selecting a suitable strategy (or strategies);
3. Choosing which mathematical operations are needed;
4. Working through the problem to find an answer;
5. Checking the answer against reasonable estimates.

All of these can be thought through individually or done through discussion. There are no clear rules. Problems can be solved in many different ways, using more than one strategy.

Teaching problem solving therefore, means teaching pupils to think broadly and flexibly about different approaches. It means developing their confidence to try different strategies and encouraging them to work through the problem when faced with difficulties. It also requires plenty of time. Sometimes pupils will need to work on problems over several lessons, before they find a solution.

Teachers have to specifically teach pupils **how** to solve problems. This will include teaching and developing the following skills:

- Reading the problem carefully two or three times until pupils are sure that they know what it is about;
- Deciding what the problem is asking them to discover;
- Identifying and writing down any useful information that is given in the problem;
- Identifying any information that is given that is not useful;
- Thinking about which method or strategy to use;
- Choosing an alternative strategy if the first one doesn't work;
- Using a range of problem solving tools such as estimating, drawing pictures, making tables, making lists, working backwards, drawing graphs, estimating and checking and trial and error;
- Showing their working out and using this to work through the problem;
- Presenting their final answer clearly;
- Checking to see if their answer is a sensible one.

When pupils are familiar with problem solving approaches to mathematics they learn not to be afraid of new problems. When they meet a problem they have never encountered before they can have a go at solving it using a variety of strategies that they have learned.

Assessment in Mathematics

Assessment involves collecting information about each pupil's mathematical skills and making judgments about their strengths, weaknesses and progress.

The assessment advice given in this Teacher's Guide is **assessment for learning**. It is not designed to help teachers compare pupils or rank them in relation to the rest of the class. It simply asks teachers to make judgments about each individual's attainment in order to help them improve and to make accurate progress reports.

Assessment is an ongoing process. The teacher should constantly observe and evaluate the pupils' achievements, collecting data on areas of improvement and new skills acquired. This data will then be used for planning appropriate new teaching activities.

Assessment serves a number of purposes as follows:

- **identifying pupil's strengths and weaknesses**. The teacher can then plan more effectively to address these and give more help where needed;
- **grouping**. It can help teachers to identifying a pupil's general ability level so that they can be placed in the right group for more effective teaching and learning;
- **reporting**. This includes providing feedback information for pupils, parents, the next class teacher, curriculum developers, overall class standard, overall school standard, Ministry of Education, etc.

Assessment may also be used for selection purposes to determine which pupils move on to the next school or class.

Assessment for learning is part of the ongoing cycle of teaching and learning. It is important that teachers remember to build assessment into their daily cycle of planning, teaching and evaluation. The Standard 6 Nguzu Nguzu Mathematics Teacher's Guide helps teachers to do this by:

a. setting out the **Sequence of Objectives** clearly at the start of each unit to help the teacher be clear about what to teach;

b. providing **assessment reminders** at the end the activities for each objective. These link the work completed to the syllabus objectives and remind the teacher to check on pupil's grasp of the concepts taught;

c. providing a **Check Up Page** at the end of each unit of work. These are tools to help the teacher monitor each pupil's progress against the objectives taught;

d. providing **extension and support activities** to feed into lessons when assessment activities show that pupils need more support, or need a further challenge.

Assessment for learning focuses on **formative assessment**. This means that it informs the teacher as well as the pupil and leads to the most appropriate strategies being chosen for future teaching and learning. This type of assessment is used to plan and direct teaching. Formative assessment happens all the time in the classroom.

Summative assessment, on the other hand**,** is designed to look at overall progress over a longer period of time such as a term or a year. The results from summative assessments, such as Check Up Page scores, can be used for grading and reporting on individual pupils as well as on overall class achievement. Summative assessment is also a good tool for evaluating teacher effectiveness. For example, If your class have all got a very low score in the Check Up Page, this suggests you have not covered all the teaching points in that unit effectively.

An example of summative assessment is when the teacher gives the pupils a written or oral test on a topic that has been taught. This is usually done individually and the pupil does not get help from the teacher to answer the questions. The teacher can therefore find out whether the pupil can answer the questions in the test. Understanding mathematics, however, goes deeper than the ability to answer test questions.

There is a place for tests as one form of assessment and the Check Up Pages at the end of each unit can be used in this way.

For more information on constructing summative tests refer to the test blue-print information, which is included as an Appendix in Standard Four Teacher's Guide.

A **test blue-print** is a tool designed to help teachers plan and construct balanced tests. It takes the form of a grid into which the teacher places the questions they want to include in their test and assesses the level at which these are testing mathematical knowledge. The grid can also be used to decide what mark will be allocated to each question in order to properly weight the marking schedule. The Test Blue Print Appendix in the Standard 4 Teacher's Guide, provides guidelines for teachers on how to prepare mathematics' tests at the end of a unit, a term or a year to supplement the judgments they make on children's progress through continuous assessment. Suggestions for recording test results are also given.

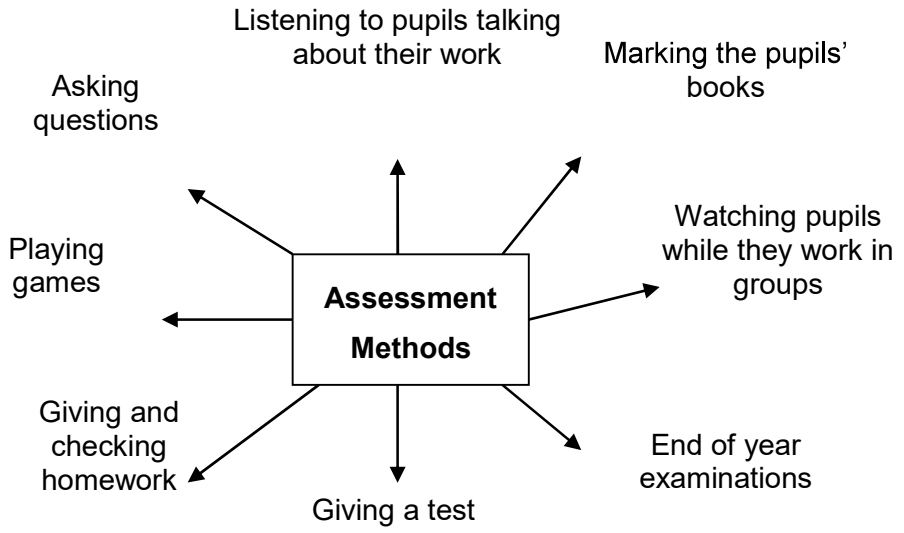
There are some serious problems, however, with using tests as the **only** method of assessment. Here are some, which many teachers will recognise:

- The language may be too difficult. The pupil may not understand what is being asked even if he or she does know the correct answer;
- The pupil may get the correct answer by guessing. The teacher cannot tell whether this has happened or not. This is especially a problem with true or false questions and multiple choice type questions;
- The pupil may have copied the correct answer from a friend;
- The pupil may be unwell on the day of the test;
- The pupil may know a lot of things that are not included in the test, but the test results will not reflect this;
- Tests often only show whether a pupil has got the answer right or wrong, not **where** he/she has gone wrong so they do not help the teacher to plan more effectively or to help the pupil to correct their own mistakes.

All these issues affect the accuracy and the fairness of tests.

The Check Up Pages should always, therefore, be used along with other continuous assessment techniques.

Different methods of assessment are shown in the diagram below.



The Skill of Questioning

Using well thought out questions is an important assessment technique for teachers as well as an important teaching tool. The right questions, asked in the right way can help teachers both to teach new ideas and to check that pupils have learnt and understood them.

Different types of questions assess different levels of mathematical thinking, from simply recalling facts, to the ability to apply these facts and use them for reasoning, hypothesising and problem solving. The table below explains the different types of questions by giving examples.

Question Type	Examples
Recalling facts	What is 3 add 7? How many days are there in a week? How many centimetres are there in a metre? Is 31 a prime number?
Applying or using facts	Tell me two numbers that have a difference of 12. What unit would you choose to measure the width of the table? What are the factors of 42?
Hypothesising or predicting	Estimate the number of stones in this jar. If we did our survey again on Friday, how likely is it that our graph would be the same? Roughly, what is 51 times 47?
Designing and comparing procedures	How might we count this pile of sticks? How could you subtract 37 from 82? How could we test a number to see if it is divisible by 6? How could we find the 20^{th} triangular number? Are there other ways of doing this?
Interpreting results	So what does that tell us about numbers which end in 5 or 0? What does the graph tell us about the most common crops grown? So what can we say about the sum of the angles in a triangle?
Applying reasoning	The seven coins in my hand total $1. What could they be? In how many different ways can four pupils sit round a table? Why is the sum of two odd numbers always even?

Supporting and Monitoring Group Work

As part of their ongoing assessment for learning activities teachers can use the time while pupils work in groups to go around and discuss their work with them.

Careful questioning can be used both to extend pupil's thinking and assess their understanding while they work on their maths in small groups. The table on the following page includes some suggestions for the type of questions that might be asked at different stages in the lesson.

Questions to ask pupils who are just getting started with a piece of work:	Questions to ask pupils who are stuck and do not know what to do next:
How are you going to tackle this? What information do you have? What do you need to find out or do? What operation/s are you going to use? Will you do it mentally, with a pencil and paper, using a number line, with a calculator? Why? What method are you going to use? Why? What equipment will you need? What questions will you need to ask? How are you going to record what you are doing? What do you think the answer or result will be? Can you estimate or predict?	Can you describe the problem in your own words? Can you talk me through what you have done so far? What did you do last time? What is different this time? Is there something that you already know that might help? Could you try it with simpler numbers… using a number line…? What about putting things in order? Would a table help, or a picture, diagram or graph? Why not make a guess and check if it works? Have you compared your work with anyone else's?
Questions to check on progress while pupil's are working independently:	**Questions to ask at the end of the lesson:**
Can you explain what you have done so far? What else is there to do? Why did you decide to use this method or do it this way? Can you think of another method which might have worked? Could there be a quicker way of doing this? What do you mean by ….? What do you notice when….? Why did you decide to organise your results like that? Are you beginning to see a pattern or a rule? Do you think that this would work with other numbers? Have you thought of all the possibilities? How can you be sure?	How did you get your answer? Can you describe your method/pattern/rule to us all? Can you explain why it works? What could you try next? Would it work with different numbers? What if you had started with … rather than….? What if you could only use …? Is it a reasonable answer/result? What makes you say so? How did you check it? What have you learnt or found out today? If you were doing it again, what would you do differently? Having done this, when could you use this method/information/idea again? Did you use any new words today? What do they mean? What are the key points/ideas you need to remember for the next lesson?

Marking

Marking pupil's work is an important part of assessment. When you look at a pupil's work you can identify success, progress, mistakes and areas needing further teaching.

The following marking guidelines can help the teacher to approach marking with a focus on assessment for learning. They help the teacher to use marking to collect evidence of pupils' progress and attainment.

- Where possible **mark work with the pupil there**, so that you can talk through it with them. This will help you identify what mistakes the pupil is making as well as what he / she got wrong.
- Indicate which answers are wrong and which are right clearly. Make sure the pupil understands how you have marked their work.
- If a pupil has got a whole exercise wrong, they clearly have not understood the concept. Do not mark the whole page wrong. Instead **make time to talk to the pupil individually** and discuss the work. Give them the chance to try the exercise again.
- If you write comments for the pupils make sure that pupils can read them. Avoid writing 'good' or 'well done' on their own. Write **why** a piece of work is good.
- Add comments which give you and others information about the amount of help a pupil needed to complete a task. e.g. 'John worked with Martha on this problem' or ' Selwyn needed some help with the long division to work out this problem.
- If you are not sure what a pupil has done when you look at his / her work, do not mark it. Set aside some time to talk to the pupil individually.
- Do not only mark work at the end of the lesson or when the work is finished. Sometimes going around the class and marking pupils work when they are halfway through an exercise is a good way to check for, and correct, mistakes before they become a habit.
- If possible try to use a pen or pencil for your marking which is a different colour to the pupils' work.

Recording Check Up Page Scores

Every unit has a **Check Up Page** as the last activity. This checks pupils' understanding of each objective that has been taught. If two topics have been taught in the unit, both sets of objectives are assessed in the Check Up Page.

Each Check Up Page is made up of a different number of questions. When you have marked these, you could change each pupil's score into a percentage. This will make it easier to compare pupils' progress in different units.

For example:

Unit 4 has two topics; Topic 6, Angles and Topic 7, Triangles. The Check Up Page which can be found in the Pupil's Resource Book page 54 has 10 questions. Some have a. b. c. parts in them so there are 66 answers altogether. If a pupil scores 33 out of 66 then 33 is the raw score. To change this raw score into a percentage, multiply it by 100 as shown:

$$\frac{33}{66} \times 100 = 50\%$$

On the following page, is an example of how you could record these percentages. This sheet is designed for the first two terms of Standard 6. The unit numbers are written across the top. The names of the pupils in your class are listed down the left hand side. You will have to make another record sheet for term 3.

Check Up Page Record Sheet - Term 1 and Term 2 Scores Recorded as Percentages										
Names	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Term Aver-age**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Term Aver-age**
John Wale	45%	55%	50%	60%	**50%**	55%	60%	63%	61%	**59.7%**
Nerinda Base	68%	72%	80%	75%	**73.7%**	65%	72%	68%	65%	**67.5%**

Managing Composite Classes

A composite class is a class in which one teacher teaches pupils from different standards at the same time. This usually happens because of teacher shortages, or because the intake of pupils into each year group is small, so classes are combined.

Composite classes are the reality for most schools, especially smaller, more rural schools where yearly intakes of pupils are small.

All teaching is, in a way, composite class teaching since, even within one Standard 6 class there will be a wide range of ability, interests and needs.

Some teachers see teaching a composite class as a **problem** because they have to manage pupils working at different levels and often on different subjects or topics. But composite classes have many **advantages** too:

- The teacher can focus more on the individual needs of the pupils and provide learning activities at the right level for each pupil.
- The pupils have the opportunity to develop good social relationships with pupils of different ages in their class.
- A family atmosphere can be created in the class, with older pupils helping younger ones. Each pupil can feel part of the group. This is sometimes called **peer teaching** which means pupils teaching other pupils.
- In a composite class teachers often get to know pupils over a longer period of time because they teach the same class for two or sometimes three years. This means that they can work more effectively with them and build a good working **relationship** with the pupils.
- Pupils learn to study more **independently** in a composite class when they cannot always have the attention of the teacher. Pupils become less reliant on the teacher.
- Pupils take more **responsibility** for their own learning in a composite class. Teachers can appoint group leaders, or class monitors to assist with classroom organisation. Pupils can be given different jobs to do, such as preparing the materials, arranging the desks for group work and so on. All of these tasks are time consuming for the teacher, but build a sense of responsibility and maturity if they are given to pupils to do.
- Teachers become more flexible and more skilled at managing the learning process when they are experienced at managing composite classes.

Tips for Managing Composite Classes

The way in which Nguzu Nguzu Mathematics is arranged around six repeated themes, helps teachers to manage their composite classes. Teachers can organise the four-term arrangement

so that the different groups that they teach, study the same themes and topics at the same time. This will allow whole class work to introduce the topics and group work at the appropriate level for groups within the class.

A number of basic principles make managing composite classes easier:

The composite class teacher **must be well organised** and well prepared.

As far as possible the class should be treated as **one group**. For example, for registration in the morning, for sports and games and art activities they can all do the same activity.

For learning new skills such as in mathematics, pupils should be grouped for teaching, but the groups need not always follow year groups, they may be **ability groups**.

The teacher must share his/her time fairly between all the pupils, and not focus on exam groups or ignore the less able members of the class.

An alternative is to teach **two different lessons** by year or ability groups. One year/ability group working independently on a set activity, while the teacher teaches the first lesson to the other group. Once this lesson is underway and the pupils have been set an independent task, the teacher then teaches the second lesson to the other group.

If you have some input into how composite classes are organised in your school below are some guidelines which should be considered carefully.

Guidelines for Organising Composite Classes

- The composite class should not be too big.
- Year groups that are combined should be close in age, for example Standards 1&2 not Standards1&5.
- Composite classes should, as far as possible, be taught as one class not as two separate classes.
- More experienced teachers should be allocated to composite classes, not probationers.
- It is helpful if a composite class teacher has had experience of teaching both year groups in his/her class before.
- The largest classroom should be allocated and the furniture should be suitable to be moved around for flexibility.
- If one teacher takes responsibility for the composite class other teachers should assist by teaching certain lessons or taking groups at certain times in the week.
- It is important that parents understand how these decisions have been made and why their child has been placed in the class they are in.

Teaching a composite class is hard work. All members of staff should share the responsibility by offering additional support to the composite class teacher, by taking the composite class for certain lessons to allow the teacher additional preparation time and so on.

It is the principal's responsibility to ensure that the composite class is organised in the best possible way for the school and that the teacher of that class (or classes) gets the support they need.

References

Two books, which should be available in all schools, offer a lot of ideas to support composite class teachers:

Ideas into Practice (Nguzu Nguzu Guide to Whole School Development) and

Multiclass Teaching in Primary Schools, (Ian Collingwood, published by UNESCO).

Teachers should refer to these for a wide range of practical ideas on how to teach composite classes more effectively.

Unit 9

Number — Topic 5: Ratios
Measurement — Topic 14: Probability

Aim:

To help pupils understand and apply the concept of ratio and to extend their understanding of probability. They will develop skills and confidence when working with ratios and probability and apply these skills to real-life situations.

Sequence of objectives:

Topic 5: To

1. compare values using number ratios.
2. know that quantities can be expressed as a ratio.

Topic 14: To

1. investigate the probability of events happening.

Rationale:

In this unit, pupils compare values by expressing them as ratios of each other. This skill will be useful to them when analysing data as well as in practical situations.

Analysing the probability of events happening extends the pupils mathematical thinking, develops their problem solving skills and links investigation with predicting outcomes.

T1a

Materials
selection of stones, shells, seeds, etc.

This lesson introduces a new numerical concept, the concept of **ratios**.

This is a new concept, pupils have not looked at comparing quantities in this way before.

A ratio is the relationship between two amounts or measurements and it is given in terms of the lowest possible whole numbers.

Ratios are used for comparing quantities in different ways for example:

- To express the number of times one quantity contains another quantity, such as the ratio of fertilizer to water is 9:1 (This means there is 9 times as much fertilizer as water in the mix).
- To describe the number of one thing in relation to the number of another thing, such as: the ratio of boys to girls in our school is 5:3. (This means that, for every 5 boys in the school, there are only three girls.)
- To show how one thing is shared between another thing, such as: the ratio of teachers to students in our school is 1:35. (This means that 35 students share one teacher.)

Introduce **ratios** by asking 3 girls and 1 boy to come up to the front of the class. Ask the class how many boys and girls are standing at the front of the class.

(1 boy and 3 girls or **3 girls and 1 boy)**

Write their answers on the board. Ask the class which of the two is correct. Pupils should be able to say that both are correct and are the same. Tell the pupils that we can make a comparison here by linking the two.

Tell the class that this is called a **ratio**. Explain that **a ratio is a comparison of two quantities**.

Show pupils how to write this ratio using a **colon** and **how to read, or say it** as follows:

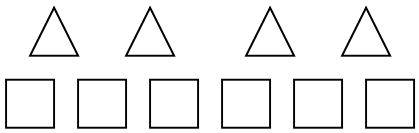
If we ask, **How many boys are there compared to girls?** The ratio is 1:3.
We write **1:3**. We say **one to three**.
This means that for every one boy there are three girls.

If we ask, How **many girls are there compared to boys?** The ratio is **3:1**.
We say **three to one**.
This means there are three girls to every one boy.

Work through some more examples to reinforce pupil's understanding of the concept.

Example 1

Draw these shapes on the board;



Ask the pupils, What is the ratio of triangles to squares?

Ask someone to write the answer on the board **(4:6).**

Now ask, What is the ratio of squares to triangles?

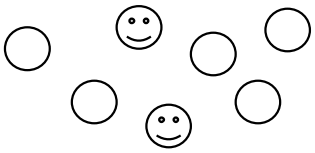
This time the answer is **6:4**. Ask the pupils to say the ratios aloud, check they say them correctly.

The ratio of squares to triangles is six to four.

The ratio of triangles to squares is four to six.

Example 2

Now draw this on the board:



Ask the pupils, "What is the ratio of faces to circles?" **(2:5)**

Ask them to explain what these means in their own words.

(There are two faces compared to five circles.)

Draw more examples if you think the pupils need more practice in using the correct mathematical language and writing the ratio.

Example 3

Write this recipe on the board. Ask the pupils to tell you the ratio of flour to sugar **(400:200 or 4:2)** and the ratio of butter to flour **(100:400 or 1:4).**

This example is included to help the pupils realise how ratios can be useful in real life situations.

Cake Recipe

200 g sugar 100 g butter

400 g flour 4 eggs

C1a

As pupils participate in the whole class discussion they should start using the vocabulary associated with ratios, including words such as **comparison**, **ratio**, **colon** and **quantities**.

Let the pupils work in pairs. Give out some of the materials (stones, shells and seeds) you have prepared. Write up these ratios one at a time on the board. Tell the pupils to make the ratios using seeds, shells, stones, etc. Go round and check that the pupils are showing the ratios correctly before you go on to the next one.

a. 3:5 **b.** 2:1 **c.** 1:4 **d.** 4:2 **e.** 3:4

When you are satisfied that pupils are confident in recognising the number ratio and can relate it to a concrete representation, ask them to complete the activities in the Pupil's Resource Book on page 5.

Pupils should work individually to complete the activities. They need not all do Activity A, you can start some pupils on Activity B if you think they have a good understanding of what they have been taught. Choose an activity that is appropriate to their ability level.

Move around the class and assist pupils who may still have difficulties.

Answers

Activity A

1. 7:6 6:7
2. 3:7 7:3
3. 1:8 8:1
4. 9:3 3:9
5. 4:10 10:4
6. 8:4 4:8
7. 3:2 2:3
8. 5:8 8:5

Activity B

1. won : lost, 6:9
2. teachers : pupils, 4:120
3. girls : boys, 12:18
4. hens : roosters, 25:15
5. won : lost, 8:3
6. mamula : snapper 6:9

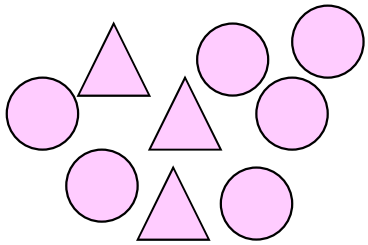
Activity C

1. 4:3
2. 7:2
3. 6:5
4. 16:11
5. 14:16
6. 30:27

T1b

In this lesson you introduce the idea of **simplifying ratios**. Ratios are always expressed in terms of the lowest possible whole numbers, therefore pupils need to learn to simplify them in a similar way to simplifying fractions.

Draw the diagram on the right on the board;



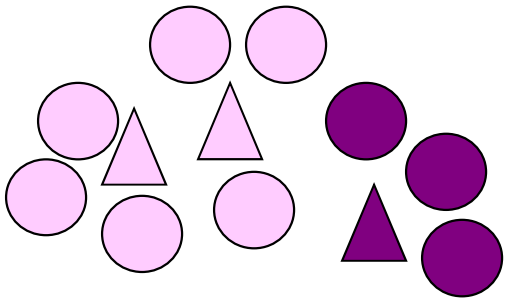
Ask someone to write the ratio of triangles to squares on the board **(3:6)**. Make sure that the pupils can say this correctly.

The ratio of triangles to squares is three to six.

Tell the pupils to look at this ratio 3:6. Can they explain what it means in their own words? **(For every three triangles there are six squares.)**

Tell them to look at 3 and 6. Ask them if these numbers have a **common factor**. (Can they both be divided by the same number without leaving a remainder?) Yes, they have a **common factor of 3**. Explain that dividing both sides by a common factor is a way of **simplifying ratios**.

Show the pupils how to simplify the ratio 3:6 by dividing both sides by 3. **(1:3)**



Now let the pupils compare the two ratios. Is 3:6 the same as 1:3?

Are three triangles to six circles the same as one triangle to three circles? The answer is **yes** they are exactly the same.

Check the pupils' understanding by drawing another triangle on the diagram.

Now ask, "How many more circles must **I** draw to make the same ratio?" **(3)**

Go through some more examples of simplifying ratios to help pupils understand.

Write some ratios on the board and ask the pupils to look for common factors and then write them in their simplest form.

For example:

a. 3:9 = **1:3**
common factor 3

b.100:25 = **4:1**
common factor 25

c. 8:40 = **1:5**
common factor 8

d. 6:20 = **3:10**
common factor 2

e. 100:10 = **10:1**
common factor 10

f. 25:5 = 5:1
common factor 5

Introduce some practical examples too, to remind pupils how they can apply ratios in real life, such as:

1. To mix enough cement to cement a grave, you need two buckets of cement and sixteen buckets of sand. What is the ratio of cement to sand? **(This is a ratio of 2:16 which can be simplified to 1:8 by dividing by a common factor of 2.)**
2. In our school there are 6 teachers and 300 children. What is the ratio of children to teachers? **(This is a ratio of 300:6 which can be simplified to 50:1 by dividing by a common factor of 6.)**

C1b

To play this 'Bingo' game, the class can prepare their own game cards. Tell them to draw a square and divide it into 4 boxes as shown.

2 : 1	6 : 4
2 : 4	1 : 3

Write the ratios from only the **first row** of the table below on the board. Ask pupils to choose 4 of these and write them on their Bingo card. It might look like the one on the right:

ratios for Bingo cards	**4:1**	**2:4**	**1:3**	**1:4**	**4:7**	**5:1**	**3:9**	**6:9**	**2:1**	**6:4**
ratios to call out	16:4	1:2	4:12	5:20	8:14	15:3	1:3	2:3	12:6	3:2

Next, call out the ratios from the second line in random order.

Pupils must check their Bingo cards to see if they have a matching ratio. If they have, they tick the box. When they have ticked all 4 boxes, they call out 'Bingo!' Check the winner's card to make sure the correct ratios have been matched.

Get the pupils to complete the activities in the Pupil's Resource Book on page 6. Move around the class and assist those who may need help and answer any questions pupils ask.

Answers

Activity A

1. 1:2
2. 2:1
3. 1:3
4. 1:2
5. 1:1
6. 4:1
7. 1:3
8. 8:1
9. 1:2
10. 1:4

Activity B

1. 28:1
2. 3:2
3. 1:3
4. 3:1
5. 1:2
6. 13:6

Activity C

1. 11:9
2. 1:2
3. 3:4
4. 3:11
5. 11:35
6. 35 :9

T1c

In this lesson pupils learn how to work out quantities by using a given ratio.

Write down 2:5 on the board. Tell the pupils that this is the ratio of girls to boys in Standard One. Ask:

If there are 6 girls in Standard One how many boys are there? **(15)**

Let the pupils explain how they arrived at their answer, or explain the process to them if they cannot get the answer themselves, as follows:

Look at the ratio first 2:5. What is the relationship between the 2 in the ratio and the 6 (the number of girls)?

2 x 3 = 6. Multiply the other number (5) in the ratio by the same number to get the number of boys;

5 x 3 = 15 Show pupils how to check their answer by asking, 'Is the ratio of girls to boys, 6:15, the same as 2:5?' **(Yes)**

Can anyone now tell you how many pupils are in Standard One altogether? **(23)**

Go though some more examples.

Example 1

The ratio of triangles to squares is 3:1. If I draw 5 squares how many triangles must I draw to make my ratio correct? **(15)**

If I draw 9 triangles how many squares must I draw? **(3)**

Example 2

The ratio of men to women who attended the football match was 5:1. If 150 women were there how many men attended? **(750)**

If there were also 250 children how many people were there altogether? **(1,000)**

Example 3

The ratio of flour to sugar in a recipe is 2:1. If I use 600 g of flour, how much sugar will I need? **(300 g)**

Go through these examples and others too until the pupils understand the process. Make sure you use the correct mathematical language and let the pupils talk through the steps too. Remember that **talking about maths** is one of the best ways for the pupils to understand and use their mathematical skills.

C1c

Ask pupils to conduct a survey in your school. Put the pupils into groups of four and tell each group to go to a different class in the school. They will need to take a notebook and pencil.

Let them go to the classes ask the following questions:

a. How many teachers in the class?
b. How many pupils?
c. How many girls
d. How many boys?

When they get back to class have them write down the following ratios for the class they have visited:

a. The ratio of teachers to pupils.

b. The ratio of girls to boys.

Conclude the lesson with a whole class feedback session. Record all their information on the board. All the skills you have taught so far in this unit can be reinforced here. Let the pupils simplify the ratios to their simplest forms and then study the data. Encourage them to analyse their information and draw conclusions. Tell them to write a short report about the information they have found out in their exercise book.

Pupils could complete the activities on page 7 of the Pupil's Resource Book to give them some extra practice.

Answers

Activity A

1. 2:1

a. 4:2
b. 6:3
c. 8:4
d. 10:5

2. 3:2

a. 6:4
b. 9:6
c. 12:8
d. 15:10

3. 4:5

a. 8:10
b. 12:15
c. 16:20
d. 20:25

4. 3:4

a. 6:8
b. 9:12
c. 12:16
d. 15:20

Activity B

1. 2 squares
2. 12 circles
3. 50 A
4. 15 circles
5. 15 crosses
6. 18 stars

Activity C

1. 40 pupils
2. 5:4
3. **a.** 4
b. 28:1
4. **a.** 1:3
b. 12:11
c. 1:40
d. 328
e. 1:5

? Can all the pupils identify and compare two quantities and express this as a ratio?

T2a

Materials

Different sized containers such as margarine or ice-cream containers, Milo or paint tins, etc.

In this lesson, pupils look further at how ratios are used in many different practical situations.

Begin by asking pupils to name as many activities that they can think of which might use ratios. They should be able to think of some from the examples they have studied while working on the last objective. Here are some suggestions:

Cooking	(e.g. enlarging a recipe, mixing cordial)
Sharing food	(e.g. planning a feast, 1 kilo rice for every 3 people)
Building	(e.g. mixing cement, paint)
Presenting Data	(e.g. comparing statistics in a report)
Gardening	(e.g. mixing fertiliser or compost)

Ask pupils this question and allow them to discuss it, sharing their ideas:

How does a builder know how much sand to add to cement to make concrete blocks or to lay a concrete path or base?

During this discussion, pupils will probably suggest different units of measurements, such as kilograms, sacks or bucketfuls. If a pupil suggests that builders measure the sand and cement-mix in kilograms, ask them,

How many kilograms of sand and how many kilograms of cement-mix should they use?

Explain that builders mix cement using a ratio of 1:6 (cement to sand). Some pupils may know this from watching or helping people working with cement.

Ask the class to use this ratio to answer the following questions:

1. If a builder has 2 kg of cement, how much sand does he or she need to add? **(12 kg)**.
2. If a builder has 1 bucket of cement, how many buckets full of sand does he or she need to add? **(6)**
3. If the builder has nothing to measure his cement in at all, how could he or she calculate the right amount of sand to add to two bags of cement? **(Use the empty cement bags to measure the sand, 2 bags cement to 12 bags sand, or a ratio of 1:6.)**

Line up the different containers and empty tins you have prepared on you table for the class to see. Use one of your containers, for example, a Milo tin. Ask:

Can I use this Milo tin to measure cement mix? **(yes)**

Explain how? **(1 Milo tin of cement for every to 6 tins of sand.)**

Repeat this with other containers that you have. When you feel that the class understands how builders use the ratio, ask them to discuss whether the ratio is useful to builders or not and why. **(Exactly the right mix results in good quality cement.)**

Pupils should also be able to see that, if they know the ratio, builders can use anything they like to measure their mix with as long as they use the same container to measure both quantities.

C2a

Ask pupils to work with a partner. Each pair has to think of something where they use a ratio for mixing. For example:

- 20 mL of cordial to 250 mL of water to make 1 glass of cordial. **(2:25)**
- 4 L of petrol to 20 mL oil for fuel mix for a chainsaw. **(200:1)**
- 1 measure of powdered milk to 3 measures of water to make milk. **(1:3)**

After 5 minutes discussion bring the whole class back together again. With the pupils build up a list of practical things they have thought of. When pupils are clear about the practical uses of ratios, let them complete the activities in the Pupil's Resource Book on page 9.

Answers

Activity A

1. 6 measures of milk, 18 measures of water
2. 8 lemons, 1 L of water
3. 1 kg sugar, 1,200 mL or 1.2 L of coconut water
4. 1.5 kg of flour, 2 L milk
5. 4 bottles of cordial

Activity B

1. 200 mL of dye, 800 mL of water
2. 500 mL
3. 3 kg
4. 4
5. 250 L

Activity C

1. 5:1
2. 5:6
3. 1:10
4. 12:1
5. 11:5

? Can all the pupils express quantities as ratios?

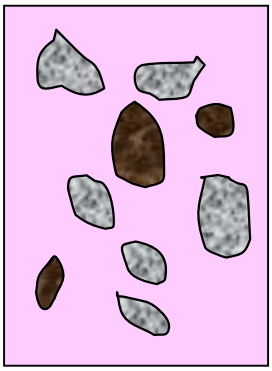
Extension and Support Activities

Support Activities

Support activities are designed to help pupils who have not yet grasped some of the concepts in this topic. You do not need to leave them to the end of the unit, you can use any of these activities at any time during this unit to help pupils to understand the concepts better.

Activity 1

Using concrete objects is a good way to give extra practice to those pupils who need support. Find a range of different objects such as stones, shells, bottle tops, coloured pens and pencils, etc. The example below uses different coloured stones.



Place a number of different coloured stones on the table as shown. Ask questions such as:

What is the ratio of dark stones to light stones? **(3:6)**

Add more stones or take some away and then ask the pupils the ratio again.

Ask pupils to place the stones themselves to show a given ratio, for example:

Show the ratio of 2:8 (dark to light)

Show the ratio of 1:5 (light to dark)

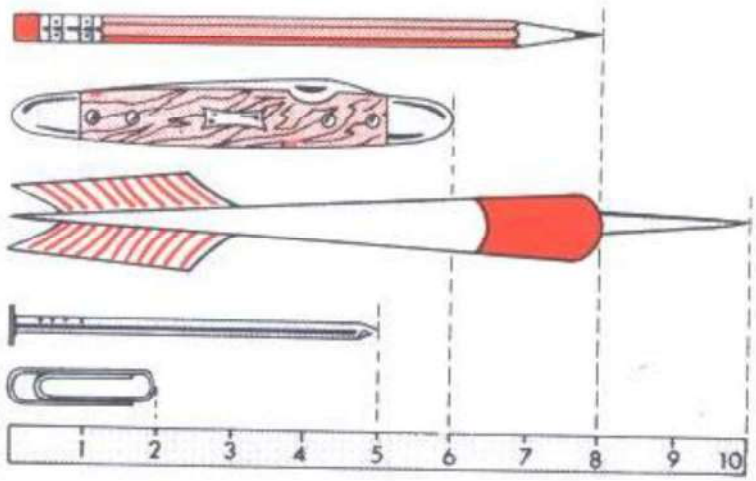
And so on.

You could extend this activity by giving the pupils a ratio, say **3:1** (light to dark). Put out 3 dark coloured stones on the table. Ask them how many stones they need to add to make the ratio correct. **(9)** Continue this with different ratios and different quantities.

Activity 2

Before the lesson you will need to prepare 5 different objects all measuring different lengths.

For example: Here we have used a pencil, a pen knife, a dart, a nail, a paper clip and a ruler.



Arrange your five objects as shown in the picture. Notice they are aligned with 0 on the ruler. Ask pupils to look at the objects and give the length of each object.

Ask pupils to compare the lengths of these objects and tell you the ratio of one to the other.

Do the first one together so the pupils know what you expect them to do.

For example:

"What is the ratio of the length of the paper clip to the length of the dart?" **(2:10)**

Let the pupils work in pairs and make as many comparisons as they can. Here are some they will come up with.

- pen knife and dart **(6:10)**
- nail and pencil **(5:8)**
- pen knife and nail **(6:5)**
- nail and paper clip **(5:2)**
- pencil and nail **(8:5)**
- dart and pen knife **(10:6)**
- pencil and nail **(8:5)**
- nail and pen knife **(5:6)**
- paper and clip nail **(2:5)**
- nail and pencil **(5:8)**

When the pupils have worked out the ratios tell them to make sure each one is in its simplest form. In the example above pen knife and dart (6:10) can be simplified to **3:5** and dart and pen knife (10:6) can be simplified to **5:3.** Paper clip to dart (2:10) can be simplified to **1:5.**

All the other ratios above are already written in their simplest form.

Extension Activities

Class Survey

Pupils will choose one class in the school and design and conduct a survey. Their survey will include comparisons in the form of ratios.

Pupils should decide themselves what to investigate and compare. Here are some ideas. You and the pupils will be able to think of many more.

- girls and boys
- long hair and short hair
- wearing slippers and not wearing slippers
- going to church at the weekend and not going to church at the weekend
- having an older brother and not having an older brother

Pupils should compare their data using ratios making sure they are in their lowest terms, and write a brief report of what they have found out.

A Pack of Cards

If you have a pack of cards available give it to the pupils and ask them to think of as many ratios as they can to compare the make up of the pack. Here are some to start them off.

Red cards to black cards **(1:1)**
Aces to the rest of the pack **(4:48 or 1:12)**
Hearts to the rest of the pack **(13:39 or 1:3)**
Picture cards to the rest of the pack **(12:40 or 3:10)**

Rewrite the Recipe

Give pupils the recipe on the right and have them rewrite it using only the measures given below:

a. a table spoon

b. a cup

c. a handful

Recipe

400 g flour
100 g butter
200 g sugar
100 mL milk
200 g mashed bananas

T1a

Materials
empty rice bags, some lemons, stones, shells, buttons, bottle tops

Pupils were introduced to probability in Standard 5. This first lesson is a revision of what they have already covered.

Introduce the lesson by asking if anyone can name an event that is **absolutely certain** to happen. Write up pupil's suggestions on the board. These might include:

- Christmas Day will be on the 25th December this year.
- This evening the sun will set.
- Tomorrow morning, the sun will rise.

Now, ask the pupils to suggest an event that is certain not to happen. Discuss the pupils' ideas as you write them up on the board. Pupils should be able to give examples like:

- Our class will all take a trip to the moon tomorrow.
- We will all grow one metre taller this year.
- Tonight the sun will not set.

Now ask pupils to name an event that may or may not happen.

Allow pupils to discuss their ideas and write their suggestions on the board. Pupils should give examples such as:

- It will not rain tomorrow.
- My mother will catch some fish tomorrow.
- I will go to secondary school.

Explain that all the answers they have given are estimates or guesses at the chances of things happening. The **probability** of an event is a way of describing the chance of an event happening.

Revise the way in which we measure probability using the following example:

> If I pick one potato from a bag containing only potatoes, it is certain that I will get a potato. **The probability of an event that is certain is 1.**
>
> If I pick again from the same bag, it is impossible that I will pick a cassava. **The probability of an event that is impossible is 0.**
>
> The potato I pick from the bag might be rotten or it might not be rotten. **The probability that it is rotten is somewhere between 0 and 1, depending on how many potatoes in the bag are rotten.**

Revise some of the vocabulary that pupils have used when talking about probability. Build up a list together on the board. Here are some of the words:

possibly	**probably**	**likely**	**unlikely**
maybe	**might**	**fifty-fifty**	**even chance**
99%, sure	**certain**	**equal chance**	**impossible**

Go through these in turn and make sure the pupils understand what they mean. Some of them you will have used already during this lesson.

Here are some explanations of the others:

Fifty-fifty, even chance, equal chance: These all mean the same. The chance of something happening or not happening is exactly the same. For example if you flick a coin there is an even chance of it landing head up or tails up. The chances are fifty-fifty.

99%: Explain that people sometimes describe probability in terms of a percentage. Pupils might have heard people say thing like this: "They only have a 20% chance of winning the game." Ask the pupils to discuss what this means. Is a 20% chance very likely to happen? Explain to the class that the team has a chance of winning the game but the chance only small.

Ask the pupils to discuss this statement. "There is an 80% chance of rain today." Pupils should be able to identify that 80% means a very likely possibility.

So a 99% chance of something happening means it is very likely, or almost certain to occur, but not 100%.

C1a

Bring a bag into the classroom such as a rice bag. Show the class five lemons and then put them inside the bag so they can no longer see them.

Now ask them some questions, such as:

a. If I pick one fruit from the bag, what is the probability that it will be a lemon? **(1)**

b. What is the probability that I will pick a mango from the bag? **(0)**

Add some more fruits to the bag, say 5 cut nuts. Ask:

c. If I pick one fruit from the bag what is the probability that it will be a lemon? **(0.5)**

Vary the number of each kind of fruit and introduce a third fruit as well if you think pupils are confident with using the probability scale from 0 – 1.

Put the class into small groups. Give each group a bag and a selection of objects e.g. lemons, stones, shells, nuts, bottle tops, buttons etc.

Let them put a selection of objects into the bag.

Let them take turns in discussing the probability of what they will pull out. For example, if they put in 5 lemons and 1 stone, what is the probability of pulling out a lemon?

- Is it high or low?
- Is there more chance of pulling out a stone than a lemon? Can they explain their answer?
- Can they express their answer using the probability scale of 0 – 1?

Let them experiment and see what they find out. Go around the class and listen as they talk.

Ask the pupils to complete the activities in the Pupil's Resource Book on page 11. They should work on these individually and write their answers in their exercise books.

Answers

Activity A

1. between 0 and 1
2. 0
3. 0
4. between 0 and 1
5. 0
6. between 0 and 1
7. 1

Activity B

1. d
2. c
3. b
4. b
5. c
6. a
7. e
8. b

Activity C

1. Both teams are just as likely to win or to lose.
2. There is a slight chance of rain this evening.
3. It may or may not rain tomorrow. The chances are even.
4. It is certain that you will not find a mermaid in the sea. This is a mythical creature.
5. It is very likely that you will be late. However it is not impossible to be on time.
6. There is an even chance that the coin will land on tails.
7. It is certain that one of the 4 teams in the semi finals will win the cup.

T1b

Materials

20 cents coins, chalk, coloured spinner, empty rice bag, shells, stones, bottle tops Nguzu Nguzu Colour Spinners.

In this lesson pupils prepare to predict probability by looking at the number of possible outcomes in an event. They also revise how to write probability as a fraction as well as a decimal.

Begin with this example: Show the pupils a coin and ask how many different things can happen **(outcomes)** when you toss the coin in the air and it lands.

There are two possible outcomes. - It will either land with the heads side up or the tails side up.

Explore the possibility of different outcomes further using other examples, as follows:

> If I pick one object from a bag of four different objects how many different outcomes are there? **(4)**
>
> If I pick one object from a bag containing four each of two different objects how many possible outcomes are there? **(only 2)**
>
> If I throw a six-sided dice how many different outcomes are there? **(6)**

Now show the pupils an empty rice bag. Into the bag put 4 stones. Ask the pupils how many outcomes there are. **(1 - a stone will be picked out of the bag every time.**)

Now add two shells to the same bag. How many possible outcomes are there now? **(2 - you could pick either a stone or a shell from the bag.)**

Follow this by asking if the chances of picking out a stone are the same as picking out a shell. Pupils should be able to tell you that there is more chance of picking out a stone because there are more stones than shells.

Ask pupils to suggest what the chances of picking out a stone or a shell could be? They may need some help to come up with the answer. You could write this sequence on the board and talk through it with the pupils:

- How many objects are in the bag altogether? **(6)**
- How many are stones? **(4)**
- How many are shells? **(2)**
- What are the chances of picking out a stone? **(4 out of 6 =** $\frac{4}{6}$**)**
- What are the chances of picking out a shell? **(2 out of 6 =** $\frac{2}{6}$**)**
- What are the chances of picking out a stone or a shell? **(6 out of 6 =** $\frac{6}{6}$**, 1, certain)**

Make sure pupils understand the use of fractions here.

Remind them that the scale of probability is from 0 to 1 with 1 being certain. If the fraction is very near 1 then the event is highly likely. If the fraction is very small then the event is highly unlikely. If the fraction is 🗁 (as when you flip a coin) the probability is even. There is as much chance of getting one outcome as the other.

Revising the vocabulary used in the last lesson is a good way to talk through the use of fraction notation to express probability.

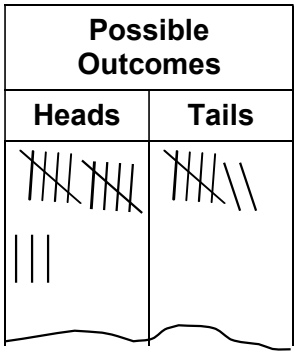
This links in closely with the work pupils did in Unit 5 on changing fractions to decimals.

C1b

This activity gives pupils the opportunity to experiment and investigate what happens to probability when you repeat an event many times.

Let the pupils work in small groups. Tell them that they are going to investigate the probability of a coin landing on heads or tails when they flip or toss it 40 times.

Draw a table on the board as shown. Give the pupils a few minutes to copy the table into their exercise books for recording their results. They will record using a tally as shown.



Organise the class into small groups to carry out the experiment. Tell the pupils to take turns at both flipping the coin and recording the outcome. Tell each group to flip the coin 40 times.

Bring the class back together again and get each group to read out their results. Record the results on the board. Make sure each group has a complete set of 40 outcomes. This means that if they add their heads tally with their tails tally that should come to 40. Your finished chart might look like this.

Outcomes of 40 tosses	Heads	Tails	Total of group tally
Group 1	24	16	40
Group 2	18	22	40
Group 3	19	21	40
Group 4	20	20	40
Group 5	15	25	40
Total of 200 tosses	**96**	**104**	**200**

Ask the pupils how they can express their combined results as a fraction. They should be able to tell you that the probability of throwing tails is half or .

At the end of this experiment, pupils should realise that every time a coin is tossed there is always a or one out of two chance of getting a head or a tail. The probability does not change when you repeat the event.

If you have dice available you could do the same experiment to explore another event, such as throwing a dice. In this case there are 6 possible outcomes so the probability each time is one in six or $\frac{1}{6}$. Allow pupils to throw the dice 60 times and record and compare their results as before. They should see that the probability remains the same, however many times the event (throwing the dice) is repeated.

Ask pupils to complete the activities in the Pupil's Resource Book, page 12.

Answers

Activity A

Mark each pupil's work individually.

Activity C

1. T **4.** F
2. T **5.** T
3. F **6.** T

Activity B

Pupils' answers will vary but it is important that pupils can make good estimates. If pupils' estimates are close to 10 out of 40 for each colour, it shows that pupils understand that the number of times the spinner lands on a colour depends on the number of outcomes.
The actual results will also depend on the quality of the spinners you use. The probability of each colour is . The pupils should include this in their write up.

T1c

Materials
Nguzu Nguzu
Probability Number Spinners

In this lesson, you will teach pupils how they can use their knowledge of probability to predict outcomes more accurately.

Use this example:

To pick a day for a picnic, I closed my eyes and marked an X on this page of my diary.

How many possible outcomes are there for which day of the week the picnic would be on?

January 2006						
Mon 2	Tue 3	Wed X4	Thu 5	Fri 6	Sat 7	Sun 8

Discuss the pupils' answers then explain that there are 7 possible outcomes. This is because there are 7 days on the calendar and any one of them could be the one picked.

Now ask: **What is the probability of picking Thursday?**

The probability of picking Thursday is **1 out of 7**. This can be written as $\frac{1}{7}$

Now ask: **What is the probability of picking a weekend day?**

There are 2 weekend days (Saturday and Sunday) so the probability is $\frac{2}{7}$.

Ask, **What is the probability of picking a week day not a weekend?**

There are 5 other days so the probability is $\frac{5}{7}$.

Ask the pupils to look again at the fractions we have come up with. Can they try and come up with a formula to describe these? Do not tell them the formula straight away – try to lead them to work it out for themselves by careful questioning.

To determine the probability of an outcome, we use the following formula:

$$\textbf{Probability} = \frac{\textbf{number of favourable outcomes}}{\textbf{total number of possible outcomes}}$$

Write the formula up on the board and ask pupils to explain it in terms of examples as follows:

1. Throwing a 6 when you throw a dice

The **number of favourable outcomes** is one, as there is only one 6 on the dice;

The **total number of possible outcomes** is six, as there are 6 different numbers on the dice;

So the probability of throwing a 6 is $\frac{1}{6}$.

2. The chance of picking a king out from a pack of cards.

The **number of favourable outcomes** is four, as there are 4 kings in a pack;

The **total number of possible outcomes** is 52 as, there are 52 cards in the pack;

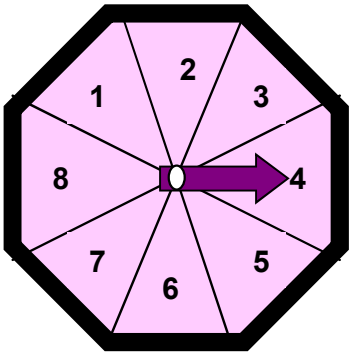
Therefore the probability of picking a king is $\frac{4}{52}$, which can be simplified to $\frac{1}{13}$.

Test out the formula using a number spinner like the one shown in the diagram on the next page. Show a spinner to the class.

Ask the class these questions and record their responses on the board:

When you spin the arrow:

1. How many possible outcomes are there? **(8)**
2. What is the probability of getting number 3? **($\frac{1}{8}$)**
3. What is the probability of getting either a 2 or a 3? **($\frac{2}{8}$ or $\frac{1}{4}$)**
4. What is the probability of getting an even number8? **($\frac{4}{8}$ or $\frac{1}{2}$)**



Go through each answer with the pupils using the formula.

Explain that first, they must identify what they want to happen, this is the **favourable outcome.**

Next they must identify the **total number of possible outcomes** which could happen. In the case of this spinner, this is 8, since it is divided into eight segments.

They can then use the formula to predict the outcome of certain events.

C1c

Let the pupils work in pairs or small groups. Each group will need a number spinner. Tell pupils to choose a number or a group of numbers, say 6; even numbers; numbers less that 5 and so on. Their **favourable outcome** will be the spinner landing on the number or one of the numbers they have identified.

Try to encourage different groups to choose different favourable outcomes to make the activity more interesting.

Using the formula they have learnt, have them make a prediction of the probability of the event they have identified happening.

After they have made their prediction, and written it down as a fraction, they should conduct the following experiment to check the accuracy of their prediction.

Let the pupils follow this procedure. You could write it up on the board.

Probability Experiment – How Accurate are your Predictions?

1. Write down the probability of the event you have chosen happening when you spin the spinner. Use the formula. Write the probability as a fraction.
2. Test your prediction by spinning your spinner 40 times and recording the results.
3. Use the formula to write your result as a fraction.
4. Discuss your results with your partner.
5. Write a short report in your exercise book. Explain what you did and what you found out.

While the pupils are conducting their experiment, go round the class and discuss what they are doing and why. Ask them about their prediction. You could ask some of the following questions:

1. How did you arrive at the fraction?
2. Would you get a more accurate result if you spun the spinner 80 times instead of 40?
3. Why might your result not be exactly the same as your prediction? **(Make pupils aware that the spinner might not be reliable. Think of some other reasons too.)**

T1d

Materials
dice

The concept of probability may be a difficult one for some pupils. How far you go with this lesson will very much depend on your assessment of the pupils' understanding so far. You may choose to do part of this lesson as an extension activity for the pupils who are confident with the work so far.

The first part of the lesson should be covered by everyone since it reinforces the last lesson.

Show the pupils a dice. Ask them what the total number of possible outcomes is when this dice is rolled. **(6)** Ask them to explain their answer. **(Because there are 6 faces on the dice.)**

Now ask: What is the probability of throwing a 5? **(one out of six or $\frac{1}{6}$)**

What is the probability of throwing a 3? **($\frac{1}{6}$)**

What is the probability of throwing a 6? **($\frac{1}{6}$)**

What is the probability of throwing another 6 if I have just thrown one?" **($\frac{1}{6}$)**

Remind pupils that this probability remains the same however many times the dice is thrown.

C1d

Split the class into groups according to ability. You will give each group a different one of the following probability problems to work out. The first one is easiest, the last one is hard – only use this for pupils with a good grasp of probability who are able to carry the concepts further.

1. Using one dice, predict and then test the probability of the following events:
   - **a.** throwing an odd number — $\frac{3}{6}$ or $\frac{1}{2}$
   - **b.** throwing a number between one and six — 1
   - **c.** throwing a number less than 5 — $\frac{4}{6}$ or $\frac{2}{3}$
   - **d.** throwing a multiple of 2 — $\frac{3}{6}$ or $\frac{1}{2}$
   - **e.** throwing a 7 — 0
2. Work out the probability of throwing a six when you throw two dice.
3. What is the probability of throwing two sixes at the same time, when you throw two dice? Predict your answer first and then test your prediction

Here are some guidelines for you to use to take pupils through problem 3 which is the most difficult.

First, talk about what the problem is asking you to find out.

We know the probability of throwing a 6 with each dice. It is $\frac{1}{6}$. However, what is the probability of throwing a six with both dice **at the same time**? This is a more complicated problem.

The table on the next page will help pupils explore the possible outcomes of throwing 2 dice. They should count these to give the **total number of possible outcomes**.

Dice A	Dice B	Dice A	Dice B
1	1	**4**	1
	2		2
	3		3
	4		4
	5		5
	6		6
2	1	**5**	1
	2		2
	3		3
	4		4
	5		5
	6		6
3	1	**6**	1
	2		2
	3		3
	4		4
	5		5
	6		**6**

Talk through the table on the left as you draw it up on the board.

Explain that you have named the dice, Dice A and Dice B.

If you throw a 1 with Dice A, how many possible outcomes are there for Dice B? **(6)**

If you throw a 2 with Dice A, how many outcomes are possible with Dice B? **(6)**

This is the same for all 6 numbers. So what is the total number of possible outcomes? **(36)**

How many **favourable outcomes** are there?

Throwing a 6 with both dice is the favourable outcome. There is only one favourable outcome since no other two numbers added together equal 12.

Now tell the pupils to use the formula.

Probability = $\frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}} = \frac{1}{36}$

This is the same probability as throwing two of any other number too. You could use the table for the pupils to check this.

You could finish this activity by asking pupils to design their own probability experiment using two dice. Tell them to predict their results by working out the probability using the formula. Then test their predictions. Encourage them to discuss what they are doing and why with each other.

With the probability of throwing a double as low as $\frac{1}{36}$ they would need to make a large number of throws to get a reasonable result in their test. Can they explain why? The larger the sample of events we look at, the more accurate our test result is likely to be.

Go around the class and talk to the pupils as they do their practical work. They could write a few sentences about their experiment in their exercise book.

There are some activities for pupils to work through on page 13 of the Pupil's Resource Book.

Answers

Activity A

1. 1 out of 8, $\frac{1}{8}$
2. 2 out of 8, $\frac{2}{8}, \frac{1}{4}$
3. 3 out of 8, $\frac{3}{8}$
4. 2 out of 8, $\frac{2}{8}, \frac{1}{4}$
5. 4 out of 8, $\frac{4}{8}, \frac{1}{2}$
6. 2 out of 8, $\frac{2}{8}, \frac{1}{4}$

Activity B

1. $\frac{1}{6}$
2. $\frac{3}{6}, \frac{1}{2}$
3. $\frac{2}{6}, \frac{1}{3}$
4. $\frac{3}{6}, \frac{1}{2}$
5. $\frac{6}{6}$ or 1
6. $\frac{3}{6}, \frac{1}{2}$

Activity C

1. a. $\frac{1}{5}$
   b. $\frac{4}{5}$
   c. $\frac{2}{5}$
   d. $\frac{3}{5}$
2. $\frac{1}{4}$
3. $\frac{3}{4}$

? Can all the pupils investigate and predict the probability of events?

Extension and Support Activities

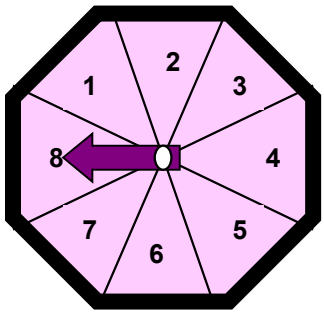
Support Activities

To help pupils who are struggling with probability, use activities in which the possible number of outcomes is limited, such as to two (tossing a coin); to six (throwing a dice); to 7 (days of the week) and to eight (spinning an eight number spinner).

Work with a small group and provide more explanation and more time for pupils to develop the concepts. The more practical experience the pupils get in designing and carrying out investigations the more they will understand the concept of probability.

Spinner Predictions

Discuss the possible outcomes for the spinner. There are 8, because there are 8 numbers that the arrow could land on.



Get pupils to work together and investigate the chances of different numbers coming up when the spinner is spun. Revise the use of the formula first to come up with their prediction of the probability. Work with the group to analyse their results.

Birthdays

Conduct a survey of al the pupils in the class to see what day of the week their birthday will fall on this year. There is a probability of $\frac{1}{7}$ that a birthday will fall on any given day. Explore why.

Bags and Fruits

More practice with predicting possible outcomes using bags containing different numbers of objects will also help pupils to understand and apply the formula for predicting probability. You could introduce three different items into a bag in different numbers and discuss the possible outcomes. Work out a prediction together and allow pupils to test it with trials each time, recording their results and checking them against their predictions. For example:

In your bag you could place 10 Coke bottle tops, 20 Solbrew bottle tops and 5 Fanta bottle tops.

The **total possible outcomes** if you pick only one top is **35.**

The **possible number of favourable outcomes** is different for each type of top.

Ask pupils to tell you what they are, then apply the formula to make their predictions.

Games of Chance

Pupils use their knowledge of probability when they play games of chance such as card or dice games. Making simple games and discussing the probability of events as pupils play is another good way to reinforce concepts of probability. You might try the following:

Snakes and Ladders.

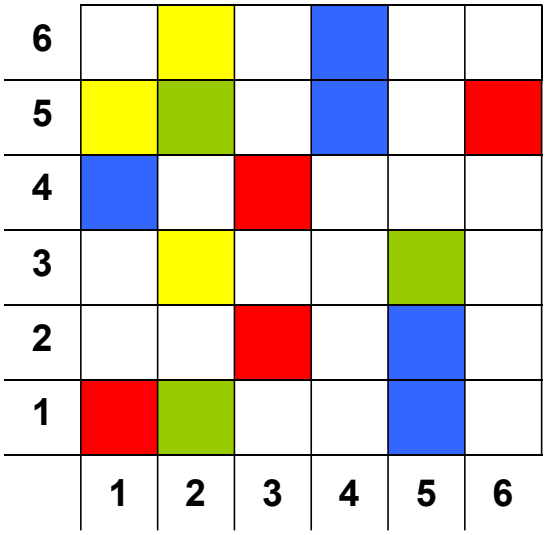
Memory card games using different numbers of card sets.

Ludo.

Lucky Squares

This is a game of chance that pupils will enjoy whilst also thinking and talking about probability as they play. It can be played by 2, 3 or 4 players at a time. It also reinforces the work pupils did in Standard 5 on coordinates.

Draw a 6 x 6 grid on a piece of paper as shown on the next page. Each player is to choose a colour, or if you do not have colours, have them write the first letter of their name instead.



Players take turns to throw the two dice. They look at the two numbers and use these as coordinates to find a square on the grid. If the square is empty they colour it with their colour or write their initial on it. The next player then has a turn. This continues until all the squares are taken. The winner is the one with the most squares coloured in.

Once a square has been coloured in, it cannot be used again.

In the sample game on the left, if the next player throws a 1 and a 5, they cannot claim any squares, because both 5,1 and 1,5 are taken already.

Extension Activities

Complex Investigations

Designing and carrying out more complicated investigations is a good way of getting the pupils to extend their knowledge of probability.

Here are some suggestions:

- Using two dice, what is the probability of throwing two even numbers?
- Using an eight-colour spinner and an eight number spinner what is the probability of spinning a red and a 2?
- If a pack of cards is dealt equally between 4 people, what is the probability that one player has the ace of spades?
- What is the probability that a player has two aces? Three aces?
- Using two or three coins, calculate the probability of throwing all heads or all tails.

Depending on the materials you have available in your classroom you will be able to come up with other investigations for the pupils to work on.

Lucky Squares

Pupils could also play Lucky Squares as an extension activity. If they do, ask them to answer the following questions after they have finished the game:

1. Why does the game seem to get harder as it goes along?
2. Which squares were coloured in first?
3. Which squares were last to be coloured in?
4. Is there a reason for this?
5. When there is only one square left on the board what is the probability that a player will throw the correct numbers to claim that square?
6. Why is it difficult to finish this game?

Check Up Page: Answers

1. **a.** 3:4
b. 6:7
c. 8:12 or 4:6 or 2:3

2. 1:30

3. 10

4. 36

5. **a.** 1 L
b. 1:50

6. 4 kg

7. **a.** likely event
b. an impossible event
c. an even chance
d. certain event
e. an unlikely event

8. **a.** $\frac{1}{6}$ **b.** $\frac{1}{6}$ **c.** $\frac{1}{2}$ **d.** $\frac{1}{2}$

9. **a.** $\frac{4}{16}, \frac{2}{8}, \frac{1}{4}$
b. $\frac{3}{16}$
c. $\frac{7}{16}$

10. Probability = $\frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$

Unit 10

Time Topic 15: Investigating Time

Aim:

For pupils to know how to use calendars, to calculate longer units of time and to understand and be able to calculate time in different parts of the world.

Sequence of objectives: To

1. use a calendar.
2. understand longer units of time such as years, decades and centuries.
3. investigate time zones and understand that other parts of the Pacific and the world have different time zones.

Rationale:

In this unit, pupils learn about features that make up our calendar. They also learn about the measurement of longer periods of time. Pupils study time zones and learn how to calculate the time in another country. These concepts are important in everyday life. The skills pupils acquire are useful in practical situations such as making an international phone call, or travelling to another country. There are cross curricula links with other subjects in the curriculum, such as geography, too.

T1a

Materials
Calendars
Nguzu Nguzu
Calendar Poster

In this lesson pupils build on their knowledge of calendars and have some practice reading a calendar. Begin by asking pupils what a calendar is. Have as many examples of calendars as you can find to show the class. You could have examples of wall calendars as well as diaries.

Organise the pupils to work in groups of four. Explain to the class that in their groups, they are going to discuss and list down different things for which a calendar can be used. What sort of things could they record on a calendar?

After a few minutes, bring the class back together brainstorm their suggestions. Record all their ideas on the board. Your pupils could might come up with ideas like these:

birthdays	school sports day	school holidays
public holidays	visitors	crop planting times
cyclone season	pay days	appointment e.g. at the hospital

You will be able to think of more ideas to add to this list.

Now show pupils a page from a calendar. Here is an example. If you do not have a calendar you can copy the one on the right on to a chart, or use one month from the Nguzu Nguzu Calendar poster, which shows the whole of 2005.

Ask some revision questions to encourage pupils to recall facts that they already know about calendars.

May 2006						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Ask pupils what they can tell you about the particular month shown on the calendar. Write up their responses on the board. They could come up with facts like these:

- There are 31 days in this month.
- The month starts on a Monday.
- The month finishes on a Wednesday.

Now go on to talk more generally about how a yearly calendar is organised. Pupils should be able to give you some facts about calendars such as:

- There are 7 days in a week.
- There are 12 months in a year.
- There are 365 days in a year and 366 days in a leap year.
- A leap year happens every four years.
- There are 52 weeks in a year.
- Some months have 30 days and some have 31 days.
- February is the shortest month with either 28 or 29 days.

Ask pupils to tell you which months of the year have 30 days and which have 31 days. Remind the pupils that February has 28 days except in a leap year when it has 29 days.

One way of remembering the number of days in each month is by learning the rhyme on the right.

30 days has September,
April, June and November.
All the rest have 31,
except February clear
which has 28
and 29 each leap year!

You or your pupils might know a different rhyme or useful way to remember this information. Talk about this with the pupils. You could write the rhyme out on chart paper and put it up in your classroom.

Now ask the pupils to tell you how often we have a leap year. If pupils don't know, write these years on the board and tell the pupils that these years are leap years.

1992 1996 2000 2004

Ask pupils to look at the years on the board and ask them to look for a pattern

They should be able to see that **leap years occur every 4 years.**

Ask them to tell you what will be the next leap year after 2004, **(2008)** and the one that came before 1992 **(1988).**

Revise with the pupils how leap years affect the total number of days in the year. Pupils should know that **a year has 365 days** which means **a leap year has 366 days.**

C1a

This activity teaches pupils a quick method of finding whether a particular year is a leap year.

Organise pupils into pairs. Ask each pair to write down all the years starting from 1992 to 2004 on a piece of paper as shown below. Tell them to divide each year by 4 and write the answer beside the year.

1992 **(498)** 1993 **(498 r 1)** 1994 **(498 r 2)** 1995 **(498 r 3)**
1996 **(499)** 1997 **(499 r 1)** 1998 **(499 r 2)** 1999 **(499 r 3)**,
2000 **(500)**, 2001 **(500 r 1)**, 2002 **(500 r 2)**, 2003 **(500 r 3)**,
2004 **(501)**.

When each pair has finished doing this, bring the class together and ask them to look at the answers and see if they notice anything.

Pupils should be able to see that **only leap years can be evenly divided by 4.**

Ask pupils to work out a leap year which occurred before 1992. Is this year a leap year? Let the pupils check. If it is not can they work out when the next leap year will be? Work through their answers on the board.

Now ask pupils to complete the activities on page 17 of the Pupil's Resource Book. These give them more practice using a calendar.

Answers

Activity A

1. 31 days
2. 5
3. 4
4. Mondays, Tuesdays, Wednesdays
5. 3
6. 23
7. Thursday
8. Monday

Activity B

1. 19th January
2. Thursday 25th January
3. Wednesday 14th February
4. Monday 15th January
5. 7th February
6. Monday 5th February

Activity C

1.

February 2007						
Sun.	**Mon.**	**Tue.**	**Wed.**	**Thu.**	**Fri.**	**Sat.**
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

2. You will need to mark the four facts individually.
3. No
4. 3 leap years: 1996, 2000, 2004
5. 2100, 2400

Can all the pupils use a calendar and identify specific dates?

In this lesson pupils learn about longer units of time, how they are measured and the terms used to describe them.

Start the lesson by writing up these words on the board:

decade **century** **millennium**

Ask the pupils to work in groups of three or four. Tell each group to discuss and write down what they think the words on the board mean. You could allow them to use a dictionary if you think the words are new to them.

Give the groups enough time to do this before bringing them back as a whole class. Ask each group to feedback what they have come up with during their discussion.

Record all the responses from the groups on the board. Then write the correct definition for each term on the board as follows:

decade	a period of 10 years
century	a period of 100 years
millennium	a period of 1,000 years.

Tell the pupils that **a period of time** is another way of saying **a length of time**.

Now ask these questions to encourage the pupils to calculate time using the terms they have just defined.

- How many years are there in 3 decades? **(30)**
- How many decades are there between 1960 and 1980? **(2)**
- If the missionaries came to the Pacific two centuries ago how many years ago is that? **(200)**
- The new millennium began on January 1st 2000, when will the next millennium begin? **(January 1st 3000)**

Some Background Information

The terms **dec**ade, **cent**ury and **mill**ennium all begin with groups of letters which give a clue as to what the word means. You could ask the pupils if they know any other words which start with these letters. Write these on the board and see if they are linked to the terms they have learnt today. Here are some examples:

decathalon	an Olympic event where the athlete has to take part in **ten** different sports
decimal	dividing into **tenths**
decagon	a **ten** sided shape
decahedron	a **ten** sided solid
cent	**100** cents in a dollar
centimetre	**100** centimetres in a metre
centigrade	temperature scale with boiling point **100º**
centenary	a **100th** anniversary
million	1,000,000 (**one thousand thousands**)
millimetre	one **thousandth** of a metre
millilitre	one **thousandth** of a litre

Remembering that the prefix **dec-** often means **ten**, the prefix **cent-** often means **hundred** and the prefix **milli-** often means **thousand** can help pupils to remember the meaning of these new words.

C2a

Tell pupils to work with a partner to work out answers to the following questions. Write the questions on the board. These will help them to use the terms they have learnt.

1. Which decade were you born in? **(probably 90s)**
2. If 2000 and onwards is the 21st century, what century was 1845? **(19th Century)**
3. If this year is the first year of a decade, when will the last year be? **(if it's 2005 it will be 2015)**

When you feel confident that pupils are confident using these terms let them complete the activities in the Pupil's Resource Book on page 18.

Answers

Activity A

1. 90 years
2. 25 years
3. 31st December 1999
4. 17th Century
5. 43 years old

Activity B

1. 20 years
2. 20th Century
3. Year 3000
4. 2 decades (This answer will change to 3 after 2008)
5. 2100

Activity C

- 1657 – Solomon Islands discovered by Alvaro de Mendana.
- 1893 – Solomon Islands became a British Protectorate.
- 1910 – First missionaries sent to Rennell Island.
- 1944 – Second World War reached Solomon Islands.
- 1977 – Big earthquake in Solomon Islands.
- 1978 – Solomon Islands became an independent country.
- 1981 – The South Pacific Mini Games held in Honiara.
- 1986 – Cyclone Namu struck Guadalcanal.

T2b

In this lesson pupils will look at historical time periods which include years before and after the birth of Christ. The calendar we use in Solomon Islands is known as the Christian Calendar because it dates from the birth of Christ.

Write **AD** and **BC** on the board. Ask the pupils if they have seen these letters before.

Pupils should have come across AD and BC in English texts such as in Unit 7: World Heritage, for example. Ask pupils to work with a partner to talk about what these letters mean.

After a few minutes, get everyone back together and allow them to share what they have talked about. Record their ideas on the board before giving the definitions on the board as follows;

AD stands for **anno domini.** This is Latin for, 'in the year of our Lord'.

> This time period runs from the time Christ was born to the present day. So if a date is given as 456 AD, it means that it is the year 456 or 456 years after the birth of Christ. Therefore the correct way to write 2005 is 2005 AD.
>
> We usually miss out AD when we are writing current or recent dates.

BC stands for **before Christ**.

> This is the time before the birth of Christ counting back from 1. So if a date is given as 109 BC, it means 109 years before year 1, which was the year Christ was born. Any BC dates mean that we count backwards from 1.

Work through some examples on the board until the pupils are confident with AD and BC. Here is an example: Write **597 AD** and **43 BC** on the board. Now ask questions like these:

a. How many years ago was 597 AD?

(Take away 597 from the present year to get the answer. For example in 2005 the answer would be **1,408** years ago).

b. How many years ago was 43 BC?

Add 43 to the current year to find the answer. For example if it is 2005, the answer would be 2,048 years ago)

Make sure pupils understand and can explain in their own words why we add and subtract in this way to get the answers.

Point out that, when we write a year like 2005 we do not have any commas in it, however when we write 2,048 years we separate the thousands from the hundreds with a comma as usual.

C2b

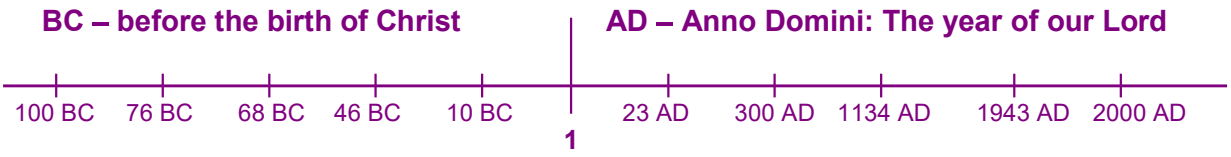
Write the following years on the board and ask pupils to practice calculating how long ago they were. Pupils could work in pairs and discuss how they will calculate each answer. The answers given here are calculated for 2005. You will need to adjust these answers for the year in which you are working.

1. 221 BC **(2,226 years)**
2. 234 AD **(1,771 years)**
3. 98 BC **(2,103 years)**
4. 1066 AD **(939 years)**

Check through the answers as a whole class activity and then complete the activities in the Pupil's Resource Book on page 19.

Answers

Activity A



Answers for Activities **B** and **C** will vary depending on the present date. Work out the correct answers as follows:

Activity B

1. 54 + present year
2. present year – 43
3. present year – 602
4. present year – 991

Activity C

1. 1800 + present year
2. 1800 + 1631 = 3,431 years
3. present year – 876
4. 100 + present year
5. 1350 + 100 = 1,450 years

? Can all the pupils calculate differences in long periods of time?

T3a

Materials

torch, world map, time zone map, globe or ball, prepared quiz questions

In this lesson pupils look at why it is there are different time zones in different parts of the world.

Do some revision of time facts first. Here are some questions you could use:

1. How many hours are there in a day? **(24)**
2. What makes night and day? **(The earth rotating on its axis. When we are facing the sun we have day and when we are not we have night.)**
3. How long does it take the earth to orbit around the sun? **(365 days. This is why we have a leap year every four years.)**
4. Does everywhere in the world have night and day at the same time? **(no)**

To understand time zones, it is essential that pupils understand the movement of the earth around the sun, so spend plenty of time explaining this.

Demonstrate the movement of the earth in relation to the sun. You could do this by asking two pupils to come out to the front of the class. Tell one pupil that he/she is the sun and another that he/she is the earth. The earth must orbit around the sun and at the same time spin around (rotate on its axis.) Ask the sun to stand still and the earth must now move in both ways. You could say that when the earth pupil is facing the sun it is day. When they have their back to the sun it is night.

You could also do this experiment to help pupils understand the concept that time varies in different parts of the world. If you have a globe, make sure that pupils know where Solomon Islands is on it. If you do not have one use a ball to represent the earth. Make a mark on the ball and say that the mark represents Solomon Islands.

Ask someone to shine the torch directly on to Solomon Islands. Explain that the torch is the sun. Ask questions like these:

- What time do think it is when the sun is right over Solomon Islands? **(midday)**
- What about the countries west of Solomon Islands. Is it midday there as well? **(Still morning going towards midday.)**

Remind the pupils that the time there will still be written as **a.m.**. Pupils should remember learning about this in Unit 11 in Standard 5.

- What about the countries east of Solomon Islands? **(past midday)**
- If before noon we write the time as **a.m.**, what do we write when it is past noon? **(p.m.)**
- What about the countries on the other side of the globe. What time of day do you think it is? **(middle of the night)**

Ask pupils to look at the globe with the sun shining on it and ask them:

- Do all countries have the same time or not? **(no)**

When pupils give this answer, ask them to explain.

Ask pupils to look at the globe and show which countries are experiencing what part of the day.

Ask the pupils, “How long does it take for the earth to rotate on its axis?” **(24 hours)**

Tell the pupils that this is **the length of one day**.

Continue exploring the relationship between the earth and the sun until you are sure that pupils have understood.

Review some of the time work done today by organising a quiz. Choose two teams by randomly selecting them. You could put all the pupils’ name into a bag and then get some one to pick out the two teams of three. Give both teams a name. Choose another pupil to keep the score. They could do this on the board so everyone can see how the quiz is going.

Make sure you have prepared a set of quiz questions before the lesson. There are some sample questions below. 12 questions are enough for two rounds. You may want to prepare some more.

Rules of the Quiz

Tell the pupils that you are going to ask each member of each team a question in turn. If they get the answer right they get 2 points, if they get the answer wrong it is passed over to a member of the other team. If that pupil gets the question right then they score a bonus point.

Remind the competitors and the audience that there must be no calling out. If someone calls out you will award a penalty point to the other side.

When the quiz has finished add up the points to see which team are the champions!

Sample Quiz Questions

1. How many hours are there in two days? **(48)**
2. How long does it take for the earth to rotate on its axis? **(24 hours)**
3. What does 'orbit' mean? **(take a path around)**
4. What is another word for 'rotate'? **(spin)**
5. What time is noon? **(midday, 12 o'clock, 1200h)**
6. How many hours of the day are p.m.? **(12)**
7. What does a. m. mean? **(in the morning)**
8. How many hours difference is there between 10 a.m. and 10 p.m.? **(12)**
9. If I am 15 minutes late for school, which starts at 8.30 a.m., at what time do I arrive? **(8.45 a.m.)**
10. The ship was leaving at 2245h. I get there 1½ hours early. What time did I arrive? **(2115h)**
11. How many hours in 180 minutes? **(3)**
12. How many seconds are there in 5 minutes? **(300)**

There are activities in the Pupil's Resource Book on page 20 to give the pupils more practice.

Answers

Activity A

1. 72 hours
2. mark this answer individually.
3. 6:30 a.m.
4. Tuesday 8:30 a.m.
5. midnight 2400h

Activity B

1. 1:30 p.m. Tuesday
2. 16 hrs 25 minutes
3. 4 rotations
4. 0905h
5. 84 hours

Activity C

Pupils will answer 1 & 2 from observation so they will not be exact.

1. Possible answers: Vanuatu, Australia or eastern part of Australia, PNG, Fiji, even New Zealand.
2. No – Canada not in the same part of the globe so has day and night at different times.
3. Possible answers: Countries in South America Europe, Africa
4. day – very close so nearly the same
5. a.m. for morning and p.m. for afternoon.

T3b

Materials
globe

In this lesson, you teach some difficult concepts.

Before teaching this lesson, you need to familiarise yourself with the concept of time zones to make sure that you explain it clearly to the pupils. Some background information is provided for you to study before the lesson.

The Background Information is written for you. You do not need to teach all of this to the pupils.

Background Information

It used to be common for many cities in the world to keep their own time according to the position of the sun in the sky. When the sun was at its highest that would be noon, before that would be the morning and when the sun started to go down again would be the afternoon. However when it became possible for people to travel quickly all this had to change. Train travel over large distances prompted people to look at **standardising time** throughout the world.

About a century ago, this problem was addressed at an international meeting and **twenty-four standard time zones** were adopted. All the clocks in a given **time zone** were set to the same time, and adjacent time zones differ by one hour. We still use the same time zones today.

Each time zone is centred about a **line of longitude**. Since it takes twenty-four hours for the earth to rotate and a rotation is 360°, the width of each time zone is **one hour** or **15° longitude** (360º ÷ 24 hours).

The establishment of standard time zones is linked with the establishment of the **standard grid of latitude and longitude**. The **prime meridian**, corresponding to longitude 0° and passing through Greenwich, England, is the centre of time zone zero. Coordinated Universal Time (UTC) is the time at time zone zero and is often given as a standard time for astronomical and navigational purposes.

Since the earth rotates to the east, time zones to the east of time zone zero are ahead; time zones to the west are behind. So the time zone to the west of Greenwich, is centered about the 15°W meridian and is one hour behind (-1) Greenwich. Similarly, the time zone centered about 15°E is one hour ahead (+1) Greenwich.

The boundaries between time zones are not always straight. This is so that they do not divide countries in half so that they have two time zones.

The **International Date Line** corresponds to the meridian at **longitude 180°**, and mostly passes through a sparsely populated part of the Pacific Ocean. The calendar date jumps across this line, moving ahead one day from east to west and moving back from west to east.

Solomon Islands is very near the International Date Line.

The map showing the time zones is in the Pupil's Resource Book on page 23.

Activity

Show the pupils a map or a globe and show them the lines of longitude and the lines of latitude. Explain that it is the lines of longitude (the ones that divide the globe vertically) that are important when looking at time differences around the world.

Let the pupils find **longitude 0º**. This line runs through Greenwich in London and is also called the **Greenwich Meridian**.

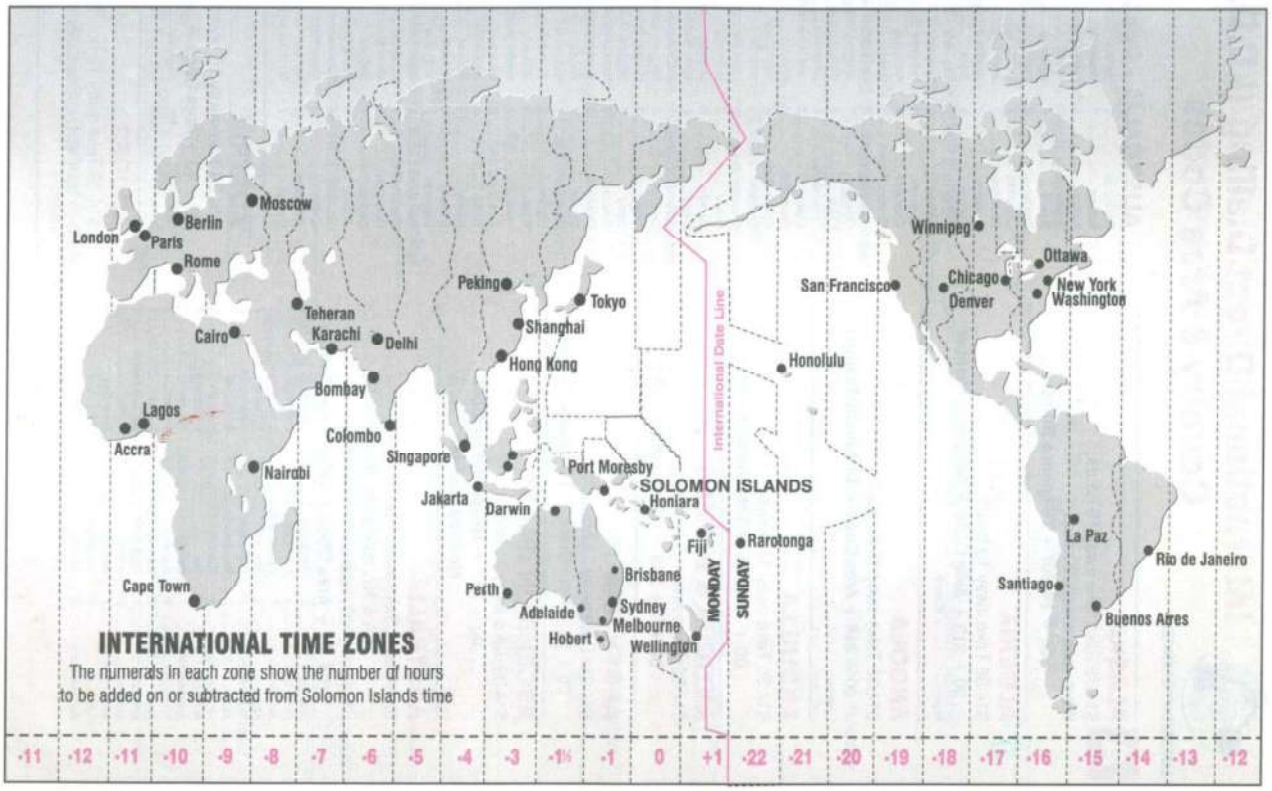
Explain that this line divides the eastern and the western hemispheres of the earth in the same way that the equator divides the northern and the southern hemispheres.

Now talk about the **International Date Line** with the class. Explain that the International Date Line is at longitude180º. This is where the calendar date changes, moving ahead one day from east to west and moving back from west to east.

Get the pupils to turn to the time zone map in their Pupil's Resource Book on page 23. Help them to find Solomon Islands on the map. Then, help them to find London, UK.

Show the lines of longitude. Let the pupils find Solomon Islands, the International Date Line and London where longitude 0º or the Greenwich Meridian is located.

Talk about the + and – red numbers at the bottom of the map. These show the number of hours to be added to or subtracted from Solomon Islands time when we calculate the time in another place.



To help pupils interpret the information on this map, ask questions such as:

1. If it is 3 p.m. in Solomon Islands what time will it be in Hong Kong?

   (The pupils should see that Hong Kong is –3 hours from Solomon Islands so it will be 12 noon.)

2. If it is 4 p.m. in Solomon Islands what time will it be in Fiji?

   (Fiji is +1 hour from Solomon Islands so it will be 5 p.m. in Fiji.)

3. If it is 10 p.m. in Solomon Islands what time will it be in London?

   (London is -11 hours so it will be 11 a.m. in London.)

Carry on with simple examples such as these and then talk about the **International Date Line** again.

Give an example like this: If it is 12 noon in Solomon Islands on Monday what time will it be in Rarotonga.

Explain that, from the map, Rarotonga is – 22 hours different to Solomon Islands so Monday 12 noon – 22 hours = 2 p.m. on Sunday.

This is a very difficult concept for pupils to understand. Tell them that if they travelled in an airplane from Solomon Islands leaving at 12 noon and flying directly to Rarotonga, they would arrive there the day before they started their journey! This is because they have crossed the **International Date Line.** On the other side of the line it is not only the time that is different, the date is different too. The date in Raratonga is one day earlier than the date in Solomon Islands.

Give the pupils more practice at working out different times and let them complete the activities in the Pupil's Resource Book on page 20.

Answers

Activity A

1a. 6 a.m. **b.** 2 a.m. **c.** 9 a.m.
2a. 7 a.m. **b.** 10 a.m. **c.** 7 p.m.
3a. 3 p.m. **b.** 7 p.m. **c.** 9 p.m.

1a. Delhi – **India** **b.** Cape Town – **South Africa** **c.** Perth - **Australia**
2a. Paris – **France** **b.** Nairobi - **Kenya** **c.** **Fiji**
3a. Karachi – **Pakistan** **b.** Shanghai – **China** **c.** Brisbane – **Australia**

Activity B

1a. Tuesday 3 p.m. **b.** Tuesday 8 p.m. **c.** Tuesday 8 p.m.
2a. Saturday 10 a.m. **b.** Saturday 7 p.m. **c.** Sunday 2 a.m.
3a. Thursday 5 a.m. **b.** Thursday 10 p.m. **c.** Thursday 5 p.m.

1a. Honolulu – **Hawaii** **b.** Santiago – **Chile** **c.** Ottawa - **Canada**
2a. San Francisco – **U.S.A.** **b.** Rome - **Italy** **c.** Peking **- China**
3a. New York – **U.S.A.** **b.** Wellington – **New Zealand** **c.** Jakarta – **Indonesia**

Activity C

1. Friday **2.** midnight **3.** 3 time zones **4.** 6:30 p.m. **5.** Sunday 1 a.m.

T3c

This lesson provides more practice working out international time differences. Pupils will learn how to work out what time it is in Solomon Islands when they are given a time at a different place.

Remind pupils that, in the last lesson, they worked out what time it was in another place when given the time in Solomon Islands. In this lesson they are going to do this the other way round. They will work out the time it is in Solomon Islands from given times in other countries.

Work through these examples with the class.

Example 1 If it is 5 p.m. in Fiji what time is it in Solomon Islands?

Fiji is +1 hour compared to Solomon Islands so if it is 5 p.m. in Fiji it must be 4 p.m. here.

Example 2 If it is 12 noon in Singapore what time is it in Solomon Islands?

Singapore is – 4 hours or 4 hours behind Solomon Islands so at 12 noon it will be 4 p.m. in Solomon Islands.

Example 3 If it is Tuesday 9 a.m. in Denver U.S.A. what time is it in Solomon Islands?

Denver is –18 hours or 18 hours behind Solomon Islands so when it is 9 a.m. Tuesday in Denver it will be 3 a.m. on Wednesday in Solomon Islands.

(Show the pupils how to check their answer by calculating in 12 hour sectors. Solomon Islands Wednesday 3 a.m. back to midnight = **3 hours**. Tuesday midnight to noon = **12 hours**. **12 + 3 = 15 hours** so far. So, noon back 3 hours = 15 + 3 = **18 hours behind** = **9 a.m. in Denver**. The answer is correct.)

Example 4 If it is Friday noon in Rarotonga, Cook Islands what time is it in Solomon Islands?

Rarotonga is – 22 hours or 22 hours behind Solomon Islands so when it is Friday noon in Rarotonga it will be Saturday 10 a.m. in Solomon Islands.

(Check by calculating in 12 hour sectors. Solomon Islands Saturday 10 a.m. back to midnight Friday is **10 hours**. Midnight back to noon Friday is **12 hours**. So, **10 + 12 = 22 hours** behind = noon in Rarotonga. The answer is correct.)

This may be a good time to mention **daylight saving**. Here is some background information. Remember the background information is for you to understand this topic better and be able to discuss it confidently with the class. **You do not have to teach all this information to the pupils.**

Daylight Saving

Background Information

Pupils may have heard of **daylight saving**. Many countries move the time on their clocks forward one hour just before summer and backwards on hour back just before winter. In many countries winter and summer does not only bring a change in temperature and rainfall but also a change in the hours of daylight. What 'daylight saving' time really does is 'save' that early morning light until more people are awake.

That extra hour doesn't affect many people in the morning, but the extra hour of light in the evening when most people are awake lessens the demand for electricity, therefore saving energy. And it is energy, not daylight, which daylight saving time is really intending to save in countries where vast amounts of electricity are used.

Other arguments that some people put forward for changing the clocks is that there is more daylight when pupils are going to and from school so in countries were there are more vehicles on the road this is safer for the children.

C3c

The best way for the pupils to become confident when working with time zones is to practice working through examples. You could put the pupils in ability groups to work through the activities in the Pupil's Resource Book on page 24. You will need to work with any pupils who are finding this work difficult.

The more able pupils will be able to work through these examples by discussing them with each other and working out the answers together.

Answers

Activity A

1. a. 2 p.m.
b. 6 p.m.
c. 2 p.m.
d. 8 p.m.

2. a. 7 p.m.
b. midnight
c. 10 p.m.
d. 8 p.m.

Activity B

1. a. Tuesday 7 a.m.
b. Saturday 5 a.m.
c. Wednesday 8 p.m.
d. Monday 3 a.m.

Activity C

The answers depend on the date and time at which you complete this work. Mark each pupil's work individually and discuss their answers with them.

? Can all the pupils identify the different time zones and calculate the time accordingly?

Extension and Support

Support Activities

Here are two activities you could use to give more practice for those pupils who are having difficulty with some of the objectives in this topic. They are designed to revise the information in the unit again and will require you to spend time with the pupils explaining, discussing, evaluating their understanding and going over the explanations again if necessary.

Activity 1: Calendar Work

Show the pupils a calendar for this year and choose a month, say December. Look at December and ask questions such as:

- How many days are there in is this month?
- How many Mondays are there in this month?
- Can you see some dates on the calendar that are important?
- What is the last day of the month?
- What day will New Year's Day fall on?
- Which month comes after December?
- Which month comes before December?

Ask the pupils to study this calendar page carefully and then draw a calendar page for January of the next year.

Activity 2: Time Zones

Again this activity goes over what you have covered in the unit again. The emphasis should be on having pupils explain the concepts themselves. Putting things into their own words is a very good way of organising the information in their heads and understanding difficult concepts.

You will need a world map or a globe as well as the time zone map for this activity.

Start a discussion by asking the pupils these questions:

- Why do different places have different times?
- How can we calculate the time in another country?

Ask someone to point out Longitude 0º. Ask someone to point out the International Date Line. Locate Solomon Islands on the time zone map. Orally go through simple examples of different times in neighbouring countries. Can the pupils find countries where the time is the same as in Solomon Islands? Some pupils may have travelled or know someone who lives in a different time zone. Let them share this with other pupils.

Talk through a number of examples, since doing the calculations together is a good way of reinforcing this difficult concept.

Extension Activities

Here are 2 activities you can give as extension work, for pupils who have understood the concepts in this unit with confidence.

Activity 1

Ask pupils to work with a partner and discuss some things they think should be improved with the current calendar. They should write down all their ideas. When they have finished, they are going to use their ideas to make their new improved calendar on a sheet of plain paper.

Activity 2

Tell pupils to work with a partner and discuss the following scenario. The Solomon Islands time zone will now become Longitude 0º. Discuss and list how that change will affect the world – where will the 180º Longitude or International Date Line be?

Let them sketch out a new time zone map.

Time Challenges

Challenge pupils to find out the answers to the following problems. Remind them to include leap years in their calculations.

What Day were you Born On?

Pupils will probably know the date of their birthday and the month in which they were born, but do they know what day of the week they were born on?

Challenge them to work it out!

40th Anniversary of Solomon Islands Independence

Solomon Islands became independent on Friday 7th July 1978. On what day of the week will the 40th anniversary of independence fall?

(The answer to this one is Saturday 7th July 2018)

Pupils could make up some more similar challenges and try them out on each other too.

Check Up Page: Answers

1. **a.** Friday
   b. May 16th , June 20th , July18th
   c. 9 weeks and 6 days
2. every 4 years
3. 366 days
4. 30 or 31 days
5. **a.** 48 + present year =
   b. present year – 113 =
6. 130 years
7. 300 years
8. 50 years
9. Cook Islands, Samoa, Hawaii, Niue, Tokelau, Tahiti,
10. Honiara is 1 hour behind Port Moresby.
11. Friday 12 midday
12. Sunday 11 a.m.
13. 11 p.m. Wednesday
14. 10 a.m. Tuesday

Unit 11

Money Topic 16: Calculating Money

Aim:

To extend the pupils' practical skills for using money. For pupils to understand division and multiplication of amounts of money and to apply these and other calculating skills in a practical way to solve money problems.

Sequence of objectives: To

1. divide and multiply amounts of money.
2. solve money problems.

Rationale:

Being able to work accurately, quickly and confidently with money is essential in all walks of life, from the bank clerk to the market seller, everybody needs to be able to use money effectively.

Pupils need to use a range of number skills and apply these to problem solving with money in this unit. The unit also, therefore, provides valuable revision of basic number calculations.

T1a

Materials

Bingo Game Boards
counters or small stones

Start this unit with a revision activity about the units of money used in Solomon Islands, i.e. dollars and cents.

Begin the lesson by revising how to change cents to dollars and dollars to cents. Check that the pupils can remember what they have learnt using some simple questions:

1. How many cents there are in a dollar? **(100)**
2. How many cents are there in $2.50? **(250)**
3. How do you change cents into dollars? **(divide by 100)**
4. What is the value of 600 cents in dollars? **($6.00)**
5. How many dollars and cents are there in 435 cents? **($4.35 or $4 and 35 cents)**
6. How many dollars are there in 2,250 cents? **($22.50)**
7. How do you change dollars into cents? **(multiply by 100)**

Remind the pupils of the correct notation for writing amounts of money as follows:

- The dollar sign ($) is placed immediately **before** the amount, e.g. **$5.00;**
- The **decimal point** is used to separate dollars from cents;
- Two digits are **always** written after the decimal point **(tenths and hundredths)** even if one of them is 0. e.g. $2.05, $3.50;
- The cents sign is written immediately **after** the amount. e.g. 25c
- If a decimal point is used we do not write cents at the end. ($3.50, not $3.50c)

Now write the examples below on the board and go through them with the pupils. Tell them they must write down these amounts in dollars and cents using a decimal point in their answer.

a. nineteen thousand four hundred and twenty-five cents **($194.25)**
b. two thousand four hundred and sixty–five cents **($24.65)**

c. three hundred and twenty thousand and ten cents	**($3,200.10)**
d. 43,590 cents	**($435.90)**
e. 270 cents	**($2.70)**
f. 95 cents	**($0.95)**
g. 5 cents	**($0.05)**

Reinforce what they have learnt by pointing out the following points in their answers:

- that if they write **$** they do **not write cents**.
- the comma **(,)** is used to separate the thousands from the hundreds.
- That there are **always two digits after the decimal point**. These are tenths and hundreds. They are there **even if the digit is 0**.

C1a

Use the Bingo game boards provided, prepare these before the lesson and make sure you have enough. Pupils should work in pairs and each pair should have a Bingo card. There are some examples of Bingo boards below, copy these if you need to make your own.

$10.00	**$2.70**	**$22.05**
$51.00	**$13.25**	**$22.50**
$12.65	**$100.00**	**$11.10**

$17.70	**$10.00**	**$7.15**
$22.05	**$2.70**	**$100.00**
$11.10	**$13.60**	**$9.55**

$22.05	**$13.60**	**$22.50**
$9.55	**$1.00**	**$13.25**
$17.70	**$10.00**	**$3.85**

Callers Card			
cents			
1,000	**10,000**	**2,205**	**715**
5,100	**1,110**	**1,000**	**955**
1,265	**2,250**	**270**	**100**
1,325	**1,770**	**1,360**	**385**

You will need to keep a list of all the amounts which appear on the cards so that you know what to call out. The list on the left covers the three cards above. The amounts on the callers' card are written in cents.

How to Play

Call out an amount from the callers' card in cents. At the same time tick or cover it on your card to show that it has been called already. This stops you from calling the same number twice and makes it easier for you to check the winner's answers.

If the pupils have the equivalent amount in dollars and cents on their Bingo board they cover that square with a counter or a small stone.

The winner is the first pupil to cover a line on their card. This line can be horizontal, vertical or diagonal. They then call out, **Bingo!** You must check that their line is correct. Tell the other pupils not to move their counters until you have checked and declared the winner. You could play this game through a few times to give the pupil practice at converting cents to dollars.

Now write the following activity on the board and ask the pupils to do it in their exercise books. Alternatively you could read out the questions one at a time and allow pupils enough time to calculate and write their answers.

Tell them to number down to eight and write only the answer to each of the questions.

1. How many cents are there in $28.55? **(2,855)**
2. Change fifteen thousand three hundred and twenty-five cents into dollars. **($153.25)**
3. Write nine hundred and five cents as dollars. **($9.05)**
4. Change two hundred and sixty cents into dollars. **($2.60)**
5. If I have eighty four thousand cents how many dollars do I have? **($840.00)**
6. Write one hundred cents as dollars. **($1.00)**
7. Express $289.70 in cents. **(28,970 cents)**
8. Express 125,440 cents in dollars. **($1,254.40)**

When the pupils have finished you could go through the activity and let the pupils mark each others answers as a whole class activity.

In this activity the pupils will revise division and use the method they have learnt to divide amounts of money.

First revise division with the pupils. Divide whole numbers by whole numbers first.

Write these examples on the board. Talk through the process as you work out the answers.

Example 1: 656 ÷ 8

We start by dividing the hundreds, then the tens and then the ones, working from left to right.

First 8 into 6 will not go, so we say 8 into 65 = 8 (tens). 8 x 8 = 64 so write **8** in the answer line. Write 64 under the 65 then take away. 65 - 64 = 1. Bring down the 6 ones and put them with the 1 ten so that the number becomes 16.

8 into 16 = 2. Write the **2** in the answer line. 2 x 8 = 16. Write 16 under the 16 and subtract. 16 -16 = 0

Answer: **656 ÷ 8 = 82**

```
  82
8)656
- 64
  16
- 16
  00
```

Now introduce dividing money with a whole number. Tell the pupils that the process is exactly the same.

Example 2: $26.00 ÷ 8

Start by dividing the tens and ones then the tenths and hundredths.

First 8 into 2 we cannot so we use 26 ÷ 8 = 3 (ones). Write **3** in the answer line. 3 x 8 = 24. Write 24 under the 26 then take away. 26 - 24 = 2.

Put in the decimal point in the answer line.

Bring down the 0 tenths and put it with the 2 so that the number becomes 20.

8 into 20 = 2 (tenths). 2 x 8 = 16 so write **2** tenths in the answer line. Subtract the 16 from 20 = 4. Bring down the 0 hundredths and put it with the 4 tenths so that the number becomes 40.

8 into 40 = 5 (hundredths). 8 x 5 = 40 so write **5** in the answer line.

Subtract 40 from 40 = 0 Answer: **$26.00 ÷ 8 = $3.25**

```
 $3.25
8)$26.00
- 24
  20
- 16
   40
- 40
   00
```

Now go through an example of dividing an amount of money by a 2-digit number. Explain that this is exactly the same process. The pupils have divided using a 2-digit divisor before.

Example 3: $818 ÷ 25

First 25 into 8 (hundreds) we cannot so we use 81 (tens) ÷ 25 = 3 tens. Write **3** in the answer line. 3 x 25 = 75. Write 75 under the 81 then take away. 81 - 75 = 6. Bring down the 8 ones and put it with the 6 tens so that the number becomes 68.

25 into 68 = 2 . 5 x 2 = 50 so write **2** (ones) in the answer line. Subtract the 50 from 68 =18. Bring down the 7 (tenths) and put it with the 18 (ones) so that the number becomes 187 tenths.

Put in the decimal point in the answer line.

25 into 187 = 7 (tenths). 25 x 7 = 175 so write **7** in the answer line. Subtract 175 from 187 = 12 (tenths). Bring down the 5 (hundredths) and put it with 12 (tenths) so the number becomes 125 hundredths. 25 into 125 = 5 so write **5** in the answer line. 125 – 125 = 0

$$
\begin{array}{r}
\$32.75 \\
25\overline{)\$818.75} \\
-\,75 \\
\hline
68 \\
-\,50 \\
\hline
187 \\
-\,175 \\
\hline
125 \\
-125 \\
\hline
000
\end{array}
$$

Answer: **$818 ÷ 25 = $32.75**

You may need to work through more examples to ensure that all pupils are confident with the method. Asking pupils to come to the board and talk through an example themselves is a good way to check that they have understood. Allow the class to help them with suggestions too.

C1b

Write these examples on the board and ask pupils to try them in pairs first, before you work through them together. You could ask the pupils to come to the board and complete a step at a time. They should talk about what they are doing as they complete each part of the calculation.

a. $7\overline{)\$28.35}$ = \$4.05 **b.** $4\overline{)\$38.60}$ = \$9.65 **c.** $6\overline{)\$73.50}$ = \$12.25

There are some activities in the Pupil's Resource Book on page 26 for the pupils to work through. These will give them more practice with division of amounts of money.

Answers

Activity A

1. \$2.75
2. \$3.45
3. \$4.05
4. \$5.35
5. \$2.85
6. \$1.70
7. \$2.50
8. \$4.15
9. \$12.05
10. \$8.95

Activity B

1. \$1.20
2. \$3.45
3. \$23.85
4. \$9,108.00
5. \$101.30
6. 39.95

Activity C

1. \$148.00
2. a. \$78.60
b. \$6.55
c. 288
3. \$25.65
4. \$2,241.75
5. \$205.75

T1c

In this lesson the pupils learn to multiply amounts of money. As in division, the process is the same as the one they learnt for multiplying number. Write the following examples on the board and work through them with the pupils.

Example 1: $43.60 x 8

```
  24
 $43.60
x     8
$348.80
```

Multiply 8 (ones) by 0 (hundredths). Record the answer **0** in the answer line. Then multiply 8 (ones) by 6 (tenths) = 48. Write down **8** in the answer line (tenths) and **put in the decimal point** then regroup 4 (ones) on top of 3 (ones).

Now multiply 8 by 3 (ones) 8 x 3 = 24. Add the 4 (ones) 24 + 4 = 28 (ones). Record the **8** in the answer line and regroup the 2 on top of 4 (tens). Then multiply 8 by 4 (tens) = 32 add the 2 = 34. Record the **34** in the answer line.

Answer: **$43.60 x 8 = $348.80**

Remind the pupils that, to be able to multiply quickly and accurately, they need to be confident with their multiplication tables.

Multiplying an amount of money is exactly the same as multiplying a number which has two decimal places in it. They must remember the **decimal point** as well as the dollar sign, **$,** in their answer.

Example 2: $12.50 x 23

```
  1
  1
 $12.50
x   23
  37 50
+ 250 00
 $287.50
```

This example involves multiplication by a 2-digit number so pupils need to multiply by the ones and tens separately then add the two lines and put in the decimal point to get the answer.

First multiply 3 (ones) by 0 (hundredths) 3 x 0 = 0. Record the **0** in the answer line. Then multiply 3 (ones) by 5 (tenths) 3 x 5 = 15. Write down **5** in the answer line (tenths) and **put in the decimal point**. Then regroup 1 (one) on top of 2 (ones).

Now multiply 3 by 2 (ones) 3 x 2 = 6 and add the 1(one) = 7(ones).

Record the 7 under the ones column. Then multiply 3 x 1 (ten) = 3. Record the **3** in the answer line. So $12.50 x 3 = **$37.50**

Now you are going to **multiply $12.50 x 20**. Begin by multiplying by 10. Do this by writing in a **0** in the answer line under the hundredths column.

Now multiply 2 (tens) by 0 (hundredths) = 0. Record the **0** in the answer line. Then 2 x 5 tenths = 10. Record **0** in the answer line and regroup the 1 to 2 ones.

Next 2 x 2 = 4 add 1 = 5. Record the **5** under the 3 tens in the answer line. Then 2 (tens) x 1 (ten) = 2 hundreds. Record this **2** in the answer. So **$12.50 x 20 = $250.00.**

Now add the two answer lines together. Begin with the hundredths 0 + 0 = **0**. Then the tenths, 5 + 0 = **5**. Count how many decimal places there were in the original sum and put the same number in the answer. **Put in the decimal point**. Add the ones, 7 and 0 = **7**. Next the tens, 3 + 5 = **8**. Then add the hundreds 2 + 0 = **2**. So the answer to **$12.50 x 23 = $287.50**.

Go through some more examples until all the pupils are confident of the method. You could choose different pupils to come out to the board and work through examples one step at a time. Let them talk through the steps as they do them.

A very good way of understanding mathematical processes is explaining **what you are doing and why**. This will help the pupils when they come to solve money problems. It encourages them to think things through.

C1c

Let the pupils work in pairs. Write the examples from the next page on the board and ask them to do them together in their exercise books. As they work, go around the class and check on the pupils' work. Encourage them to talk through the steps as they work with their partner.

This is a good chance for you to identify the pupils who are confident with the process as well as those who are having difficulties. Some support help from you could be necessary here.

a. $25.15 x 9 = **$226.35**

b. $30.60 x 25 = **$765.00**

c. $40.05 x 34 = **$1,361.70**

After the pupils have completed these examples go through them on the board with the pupils to check their answers as well as their working out.

There are more activities in the Pupil's Resource Book on page 27 that pupils could complete for extra practice.

Answers

Activity A

1. $173.00
2. $268.65
3. $730.20
4. $3,865.50
5. $399.00
6. $374.00
7. $190.80
8. $204.10
9. $32.40
10. $1,849.95

Activity B

1. $2,232.50
2. $464.40
3. $2,779.40
4. $21,793.20
5. $5,142.50
6. $5,785.00
7. $427.35
8. $27,148.40

Activity C

1. $2,155.40
2. $630.00
3. $780.00
4. $1,220.70
5. $1,652.30

? Can all the pupils divide and multiply amounts of money?

T2a

In this lesson pupils begin to solve problems involving money. Tell the pupils that the problems they will look at today involve either multiplication or division. They also learn about **rounding to the nearest 5 cents**.

Remind the pupils to read the problems carefully before attempting to work out the answers. They must be clear about what the problem is asking them to find out.

Teach pupils about the process of **rounding to the nearest 5 cents** when dividing amounts of money. Explain why we do this first as follows:

In Solomon Islands the currency we use is in multiples of 5 cents. Ask the pupils to name all the coins that are used. They should name coins of $1, 50 cents, 20 cents, 10 cents and 5 cents. The 5 cents coin is the lowest denomination we use.

The pupils' parents and grandparents may remember using coins of lower denomination namely 1 cent and 2 cent coins. Nowadays these are not used anymore.

Ask the pupils what this means about the pricing of goods. **All goods have to be priced to a multiple of 5 cents.**

Therefore if the pupils are working out a division calculation e.g. **$8.30 ÷ 6** they will find they answer **is $1.3833333…….** and the 3 goes on and on. What they must do is round this to the nearest 5 cents which means rounding it to the nearest 5 hundredth.

So **the answer is $1.40**. This is because $1.38 is nearer to $1.40 than $1.35**.**

The pupils have not rounded to the nearest 5 before. Give them some practice of doing this by writing a series of examples on the board and working through them as a class.

Explain that the amounts on the next page need to be rounded to the nearest 5 cents.

$1.30	$1.31	$1.32	$1.33	$1.34	$1.35	$1.36	$1.37	$1.38	$1.39	$1.40
$1.30	**$1.30**	**$1.30**	**$1.35**	**$1.35**	$1.35	**$1.35**	**$1.38**	**$1.40**	**$1.40**	**$1.40**

Explain the process as follows: Look at the digit in the hundredths place:

1, 2 round down to 0
3, 4, round up to 5
6, 7 round down to 5
8, 9 round up to the next 10

Repeat this a few times with other amounts until pupils are confident with rounding up or down.

Now go through an example of a problem with the class. Write it up on the board. As you talk through what to do remind the pupils of the guidelines they have used before when solving problems. You could refer back to the Ask, Think, Do Poster that you used in Unit 8.

Copy the poster on the right on to the board and allow pupils to study the information on the poster.

It shows the price of tickets to watch the Christmas show.

Discuss the poster with the class and then answer the questions together. Pay special attention to how you set out the calculations.

Christmas Show
Tickets for Sale

Adults	$15.00
Students	$10.50
Children under 10 years	$5.00

1. What would it cost for 15 children to attend the show?

$5.00
x 15
25.00
+ 50.00
$75.00

2. What would it cost to buy tickets for a family of 2 adults, 3 students and 4 children?

$15.00 x 2 = **$30.00** + $10.50 x 3 = **$31.50** + $5.00 x 4 = **$20.00** **Total cost = $81.50**

Ask pupils to work with a partner. Tell each one to make up a multiplication question of their own about the poster and then swap their question with their partner and find the answer.

C2a

Tell the pupils to work in pairs. Write the following problems on the board and ask the pupils to talk with their partner about how they would solve each problem. Tell them that in each problem there is more than one step to get to the answer. They need to identify the different steps and work out a strategy before they work out the answer.

a. A ticket to the football match costs $15.00. All of Tomasi's friends want to go but they do not have enough money. Tomasi has $155.00 and he wants to share this among his 12 friends to help them. How much money will each friend have to pay on top of what Tomasi gives them? **($1.10)**

b. If 30 books cost $364.50, how much money will we need to raise at our fundraising event to buy 78 books which would be enough for the whole of Standard 6? **($947.70)**

c. Our headmaster bought 26 books for our class. Each book cost $33.00. If he had $966.00 in the school fund, how many pens could he buy with the money he had left over, if pens cost $3.60 each? **(30)**

After the pupils have had enough time to tackle these problems work through them together as a class activity, explaining each step carefully and asking pupils to explain how they arrived at their answers in their own words.. Make sure you have worked these out before the lesson so that you are confident with the method.

Ask the pupils to turn to page 28 of the Pupil's Resource Book and do the activities in their exercise books.

Answers

Activity A

1. $8.40
2. $2,400.00
3. $15.30
4. $3.70
5. $10.50
6. $155.40
7. $731.25
8. $16.65
9. $22.00
10. $39.25

Activity B

1. a. $192.00
b. 13 tickets and $4.50 left over
2. a. $271.00
b. 8
c. 5
d. $15.05
3. a. $1,848.00
b. $1,155.00
c. $1,320.00

Activity C

1. a. $1,942.50
b. $23,310.00
c. $1,110.00
2. Solomon $216.00, Wilson $108.00, Patrick $36.00
3. a. $504.00
b. $49.20
c. $555.65
4. $1,350 before interest paid, $1,485 after interest paid

T2b

Materials
Nguzu Nguzu Problem Solving Poster

The last lesson in this unit will reinforce different approaches to problem solving and provide more revision of division and multiplication of money.

You may do this activity with a small group of pupils, who need more practice while others continue with Pupil's Resource Book activities. You decide according to the needs of your class.

The best way for pupils to become confident in solving problems is by having lots of practice. They should talk with each other about strategies to use. The **process** of problem solving is as important as finding out the right answer. This is why pupils must be encouraged to set out all the calculations they do in their exercise books.

With the class, draw up some problem solving guidelines. Write the pupils' ideas on the board and then put them into a sensible order. Your guidelines might look something like this:

Problem Solving Guidelines

1. What is the problem asking me to find out?
2. What information does it give?
3. Do I have enough information?
4. Do I have too much information?
5. Do I need to assume anything?
6. What should I do first?
7. Will this give me the answer?
8. If not, what shall I do next?

You could also refer back to the problem solving poster that you used in Unit 8 to help pupils think of other strategies and activities to try as they work on their problems.

C2b

Ask the pupils to solve the problems in the Pupil's Resource Book on Page 30. Let the pupils work with a partner or in a small group. Some pupils may need extra help and you could group the pupils so that you can spend time with these groups.

Ask the pupils to read the problems carefully before deciding on which operations to use. Remind them that some problems may require more than one operation.

Answers

Activity A

1. $50.00
2. $1,500.00
3. $20.70
4. $640.00
5. $13.05
6. $12.80
7. $180,000.00
8. $315.00

Activity B

1. $123.70
2. 77
3. $108.00
4. $22.50
5. $1.80
6. $17.40

Activity C

1. $942.00
2. $18.40
3. $125.00
4. $1,665.00
5. 8 months

Can all the pupils read, understand and then solve money problems?

Extension and Support

Support Activities

Calculation Bingo

You could design a Bingo game using multiplication and division facts where the answer is on the bingo card and pupils have to cover each answer as they work it out. Tell them they can work out the cards in any order. The first pupil to work out a vertical, diagonal or horizontal line of answers is the winner.

Your cards could look like this.

Example of a Bingo Card

$13.85	**$11.75**	**$5.75**
$12.00	**$11.20**	**$25.00**
$2.50	**$138.50**	**$20.05**

Prepare playing cards like this:

$140.35 ÷ 7	**$100 ÷ 4**	**$72 ÷ 6**
$141 ÷ 12	**$60 ÷ 24**	**$554 ÷ 4**
$110.80 ÷ 8	**$92 ÷ 16**	**$56 ÷ 5**

Problem Solving Strategies

Talking through problem solving strategies is a good way of encouraging pupils to tackle problems. Often pupils are confident at doing mechanical calculations but are not keen to apply their skills when deciding how to solve problems. You should encourage pupils to try things out and not be afraid of making a mistake.

Prepare a set of problems on cards. Work with a small group. Let the pupils read the problem and talk about what they would do. Talking through strategies is a worthwhile exercise. Do not get the pupils to work every single problem out but let them tell you what they would do first, then and how they would arrive at the answer. You could use some of the problems in the Pupil's Resource Book to talk through. Pupils could also make up their own money problems and try them out on a partner.

How Much are you Worth?

This is a game for practicing addition (and some multiplication) of amounts of money. Each letter of the alphabet is given a money value. You can make these easy or harder depending on the level of your pupils, here is a moderately difficult example. Write your values on the board or on a chart as these can be used for some of the extension activities below too.

Now tell pupils to calculate their own value by spelling out the letters of their name and totalling the value of each letter. For example:

SARAH would be worth:

$22.45 + $91.00 + $9.50 + $91.00 + $100.00

or a total of **$313.95**

A	**$91.00**	**N**	**$64.10**
B	**$6.40**	**O**	**$3.95**
C	**$15.85**	**P**	**95c**
D	**$2.10**	**Q**	**$11**
E	**$1.00**	**R**	**$9.50**
F	**$28.30**	**S**	**$22.45**
G	**$1.05**	**T**	**$41.85**
H	**$100**	**U**	**$78.10**
I	**$68.65**	**V**	**$11.35**
J	**$1.50**	**W**	**$93.60**
K	**$14.75**	**X**	**80c**
L	**55c**	**Y**	**$13.20**
M	**$12.50**	**Z**	**$45.00**

Pupils could play this game in groups of four, each adding up the value of their own name to see who is 'worth the most'.

Extension Activities

These activities are designed for pupils who are confident with managing calculations involving different amounts of money. They are designed to extend their understanding and challenge them to apply their skills in different ways.

Word Values

Extend the support activity above on finding the value of your name. Using the same set of amounts, you can give pupils the following challenges:

a.	Think of a three letter word with a value greater than $200.	**(hat, nut)**
b.	Think of a three letter word with a value less than $50,	**(fly, boy)**
c.	Think of a three letter word with a value of exactly $3.00	**(peg)**
d.	What is the most expensive 5-letter word you can think of?	**(e.g. whine $327.35)**
e.	What is the cheapest 5-letter word you can think of?	**(e.g. expel $4.30)**
f.	Which is worth more, gold or tin? **(tin, which is worth $174.60, gold is only worth $7.65)**	

Multiplying and Dividing Money Patterns

Copy out these different calculations onto cards. Let the pupils complete these number sentences and look for patterns as they do the calculations.

1. $444 x 13 **($5,772)** x 77 = **($444,444)**

2. $567 x 13 **($7,371)** x 77 = **($567,567)**

3. $813 x 77 **($62,601)** x 13 = **($813,813)**

4. $456 x 77 **($35,112)** x 13 = **($456,456)**

5. $77 x 13 **($1,001)** x 123 = **($123,123)**

6. $829,829 ÷ 91 **($9,119)** ÷ 11 = **($829)**

7. $555,555 ÷ 91 **($6,105)** ÷ 11 = **($555)**

8. $678,678 ÷ 11 **($61,698)** ÷ 91 = **($678)**

Can the pupils make up some more?

Check Up Page: Answers

1a. $152.10 **b.** $506.70 **c.** $314.60 **d.** $9,584.10

2a. $6.15 **b.** $23.00 **c.** $13.35 **d.** $44.55

3a. $360.00 **b.** $325.45 **c.** $18.00 **d.** $4.15 **e.** $928.80 **f.** $13.80

Unit 12

Shape and Space Topic 8: Tessellation
Topic 9: Three-Dimensional Shapes

Aim:

For pupils to enjoy exploring two dimensional tessellating shapes and three dimensional forms in order to further develop their conceptual and practical understanding of shape and space.

Sequence of objectives:

Topic 8: Tessellation: To

1. create tessellating patterns using one or more two dimensional shapes.

Topic 9: Three-Dimensional Shapes: To

1. use nets to make three-dimensional solids from two-dimensional drawings.

Rationale:

This unit extends the work the pupils did on two and three-dimensional solid shapes and structures in Standard 5. Through creative and practical activities it explores the way in which shapes fit together and work together in structures. Most of the work will be done through exploration and discovery rather than through direct teaching, so the pupils also develop useful enquiry and problem solving skills.

T1a

Materials

regular polygon shapes cut from the Nguzu Nguzu cards provided

In this lesson, pupils revise what they already know about **tessellation**. Refer back to Standard 4, Unit 3 to check what they have covered already before you teach this lesson.

Before the lesson, prepare plenty of regular polygon shapes from the cards provided. It is most important that pupils have real shapes to use to explore tessellation and you will use these shapes for several different lessons in this unit.

Write the word **tessellation** on the board and ask pupils to tell you, in their own words, what it means. Note down all their ideas and then bring these together into a clear definition as follows:

> **A tessellation is formed when one or more shapes fit together in a repeating pattern, without any gaps left in between.**

Ask pupils to come to the board and sketch simple tessellating patterns such as squares, triangles, and rectangles.

Remind them that, in Standard 4, they investigated which regular polygons tessellated and which did not. In today's activity they will revise this.

C1a

Draw a table on the board as shown on the next page and explain that the pupils must use the cardboard shapes to find the necessary information to complete the table.

The answers are included in the table for you – do not copy these onto the board.

Regular Polygons which **tessellate**		Regular polygons which **do not tessellate**	
squares rectangles rhombi	triangles hexagons	circles pentagons	octagons

Split the class into groups of three. Distribute the sets of regular polygons you have prepared (squares, rectangles, rhombi, triangles, hexagons, pentagons and octagons). Revise the names of the polygons and write these on the board if the pupils need reminding.

Allow each group to work with one set of shapes at a time to see whether they can make them tessellate, and then pass them on to the next group when they have finished. Remind them to fill in their table for each shape.

T1a Continued

After the pupils have finished the activity, bring the class back together. Explain that there are four **simple rules for regular tessellation.** Ask the pupils to suggest what these rules are: They should come up with the following:

1. There must be **no spaces** between the shapes.
2. Shapes **must not overlap**.
3. The shapes must be **the same**.
4. Each **vertex** must be the same.

Once they have understood these rules have them complete the activities in the Pupil's Resource Book on page 33.

Answers

Activity A

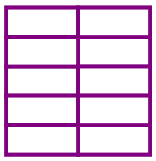
1. Octagon, does not tessellate
2. Rectangle, tessellates
3. Pentagon, does not tessellate
4. Triangle, tessellates
5. Circle, does not tessellate
6. Hexagon, tessellates

Activity B

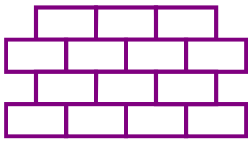
Check each pupil's work individually

Activity C – Suggested Answers

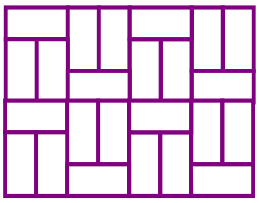
a.



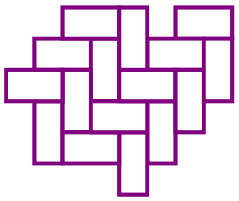
b.



c.



d.



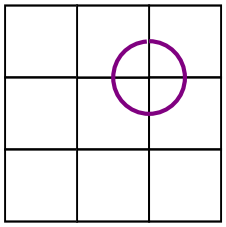
T1b

Materials

regular polygon shapes used in T1a
protractors
coloured pencils

Teach pupils that, **in order for different shapes to tessellate, the angles at each vertex must add up to 360°**.

Explain this first by looking at a square tessellating pattern. Draw this pattern on the board and identify the vertices at which each group of four squares meet as shown.

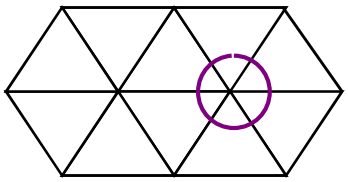


Ask pupils to tell you how many degrees there are in each angle at this vertex. **(90º)**

Ask them to add up all the angles at the vertex: **(there are 4)**

(90º + 90º + 90º + 90º = 360º)

Try the same thing with a triangular pattern as shown.

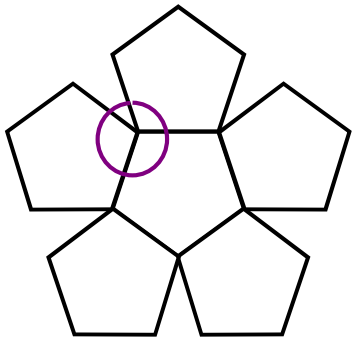


Ask how many degrees there are in each angle at the vertex? Pupils should be able to tell you that there are **60º in each angle** because these are equilateral triangles in which each angle measures 60º.

How many angles meet at each vertex in this pattern? **(6)**

So what is the total of the angles at each vertex? **(360º)**

This same idea can be used to explain why some shapes do not tessellate. Show the pupils a similar example using pentagons.



Explain that all the internal angles of a regular pentagon measure 108º.

Ask pupils to calculate how many degrees there are in the three angles that meet at the vertex shown in the diagram.

(108º x 3 = 324º)

Explain that this is less than the 360º needed to make a full turn, which is why the pentagon does not tessellate.

Can any of the pupils think of a rule to determine whether or not a regular polygon will tessellate?

The interior angle of a regular polygon must be an exact divisor of 360º in order for the polygon to tessellate.

C1b

Have pupils work in the same groups. Share out the regular polygon shapes again. This time each group should have a range of shapes to work with, rather than one set of the same shape.

Ask them to copy the table on the right from the board, and complete it.

To do this they must measure the internal angles on each shape using a protractor. They can check their answers by trying out each tessellation.

Name of the polygon	Size of each interior angle	360 º divided by the size of each angle	Does the shape tessellate?
square	90º	360º ÷ 90º = 4	yes
equilateral triangle	60º	360º ÷ 60º = 6	yes
regular pentagon	108º	360º ÷ 108º = 3.333	no
regular hexagon	120º	360º ÷ 120º = 3	yes
regular octagon	135º	360º ÷ 135º = 2.666	no

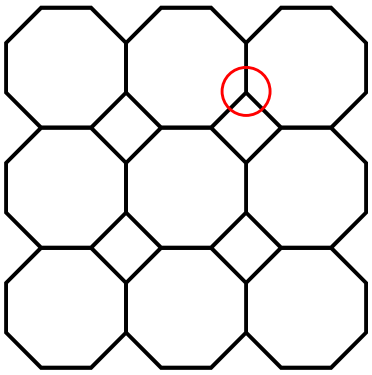
The answers are included on the table for you – do not copy these on to the board until the pupils have completed the activity.

T1c

Materials
Regular polygon shapes
Two Polygon
Tessellations Poster

Explain to the pupils that two regular polygons can sometimes be combined to form tessellating patterns.

Use the shapes you have prepared already for T1a to explore this idea with the class.



Select the octagons and squares first. Spread these shapes out on the table and ask one pupil to arrange them in a tessellating pattern. They should make a pattern like this.

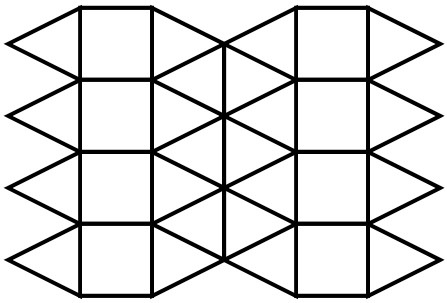
If necessary, you can revise the rule the pupils learnt in the last lesson. Explain that **this rule also applies when more than one shape is used to make a tessellating pattern**. Study the vertex marked.

The angles here are **135º + 135º + 90º = 360º**

Next give them the triangles and squares.

Explore the different ways in which these can be combined to make tessellating patterns.

One example is shown; can pupils think of other examples?



C1c

Have the pupils work in the same groups of three or four. Share out the regular polygon shapes. This time each group should have a range of shapes to work with rather than one set of the same shape.

Allow them plenty of time to experiment with combining two different shapes to form tessellating patterns. Ask them to record the patterns they come up with by sketching them in their exercise books and writing down the names of pairs of shapes that tessellate.

Move around the class as they work and discuss the task work with the pupils. Encourage them to explain their methods and their findings. Help them to think of as many different combinations of shapes as they can.

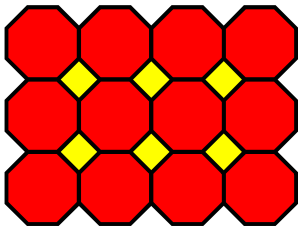
Before they move on to the Pupil's Resource Book activities, bring the class back together and show them the poster **Two Polygon Tessellations**. Discuss the patterns shown on the poster. Identify the shapes that make up each pattern and talk about how they are arranged.

Now direct pupils to complete the activities on page 33 of the Pupil's Resource Book. These activities give them more opportunities to investigate tessellations made with two regular polygons.

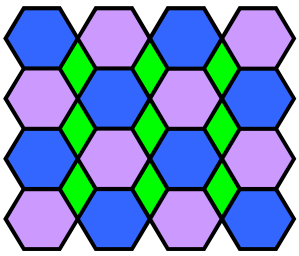
Answers

Activity A

1.



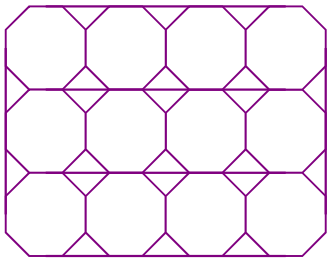
2.



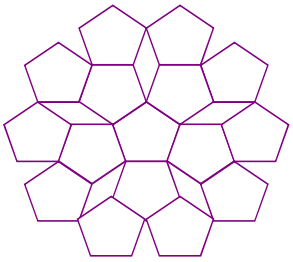
Activity B

Suggested Answers

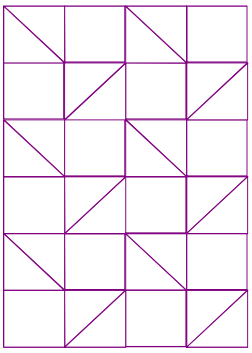
1.



2.



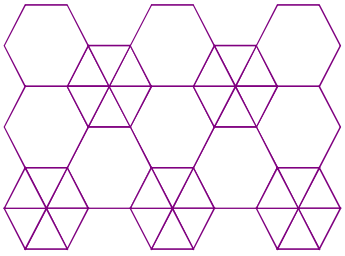
3.



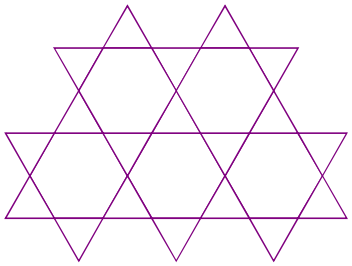
Activity C

Suggested Answers

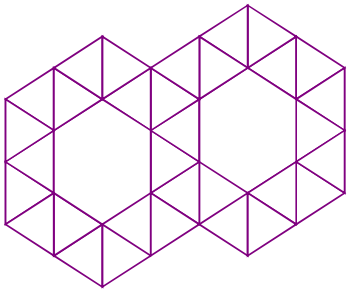
1.



2.



3.



T1d

Materials

regular polygon shapes
squared paper, colours
Multi Polygon
Tessellation Poster

This lesson builds on the last lesson by encouraging pupils to create their own tessellating patterns using more than two regular polygons.

The emphasis of the lesson is on pupils designing and discovering tessellating patterns for themselves. Allow plenty of time for them to work with the regular polygon shapes and plenty of time to draw and record their patterns.

Introduce the activity by showing the pupils the second tessellation poster, which shows designs that combine three or more polygons into a regular tessellation pattern.

Discuss the designs as follows:

Identify the shapes that make up each pattern.

Talk about where the patterns begin to repeat themselves.

Discuss how the designs can be broken down into different component parts.

C1d

When the pupils have had plenty of time to study and discuss the poster, explain that they are going to design and colour their own tessellating patterns using three or more regular polygons. They can do this in their exercise book, or, if you have squared paper available, they can do it on squared paper.

Divide the class into three groups by ability. Decide which group will do each activity. Activity A is the easiest and Activity C, the most difficult. Some pupils may have time to complete more than one activity.

Refer them to page 35 of the Pupil's Resource Book and read through the instructions for the activities with them before they begin.

Allow plenty of time and also make time for the pupils to share their designs with the rest of the class at the end of the lesson.

Their finished designs would ma

Answers

Activity A

1. Squares, triangles and hexagons.
2. Check each pupil's work individually, there is no right answer.

Activity B

1. This tessellation is made from octagons, squares, parallelograms and triangles. The triangles and squares are regular polygons, the octagons and parallelograms are irregular.
2. Check each pupil's work individually.

Activity C

Check each pupil's work individually.

T1e

Materials

squares (and other shapes) of scrap card, scissors, glue
coloured chalk
coloured crayons, pens

In this lesson pupils discover how irregular shapes can also tessellate. Pupils will design and make their own irregular tessellations following the method you teach them in the teacher led activity.

Before the lesson you will need to prepare some squares, (and other shapes) of scrap card. These should be about 6 cm square. Prepare enough for each pupil to have at least three.

First ask pupils to **predict** whether they think irregular shapes can also be made to tessellate. Discuss their ideas.

Show them a square of card about 12 cm square.

With a pencil, show them how to sketch an irregular shape on one side of the square as shown (figure 1). Cut out the shape carefully and attach it to the opposite side of the card square with sellotape as shown (figure 2). Use the new shape as a **template** to draw around on the board. Use different colours of chalk to shade alternate shapes to emphasise the pattern as shown (figure 3).

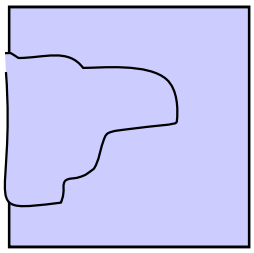


figure 1

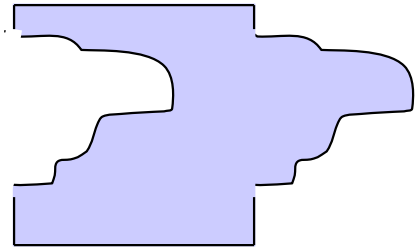


figure 2

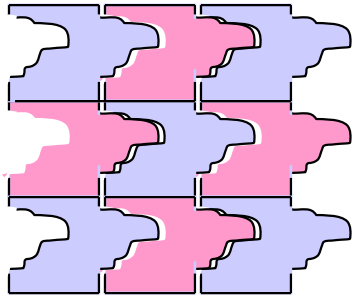
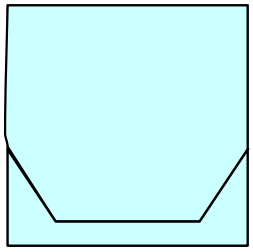
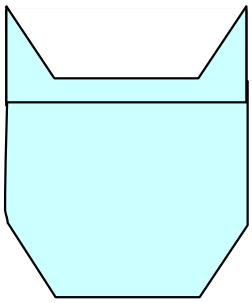
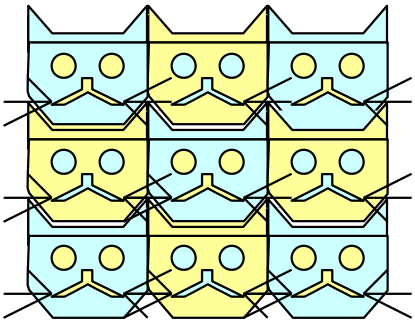


figure 3

Use another example to show how this method of tessellation can be used to make pictures as well as shapes. Follow the same process to make a tessellating cat picture as shown below.







C1e

Distribute squares of card, enough for each pupil to have two or three, and allow them to create their own tessellating patterns by making a template in this way and drawing around it.

Encourage them first to make an abstract shape, and then to try to make a picture.

There are some examples in the Pupil's Resource Book on pages 37 and 39 to give them ideas for both patterns and pictures. Encourage the pupils not to copy these but to think of their own designs.

If you have coloured paper available, pupils might also like to try making a collage tessellation, cutting out similar irregular shapes and tessellating them by sticking them on to a picture.

There are some questions in the Pupil's Resource Book on page 38 to help the pupils analyse the patterns more carefully.

Some of the examples in the pupils book use **more than one cut out** to make up the shape or picture. Encourage the more able pupils to experiment with this in their own designs.

Some pupils might also like to experiment with the same method using triangles and rectangles as the starting shape. There are also some examples of these in the Pupil's Resource Book.

Allow plenty of time for this activity. Let the pupils explore as many different shapes as they want to and let them use their imagination to develop pictures and creative designs.

Display the pupil's finished work around the classroom.

Answers

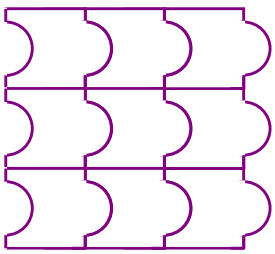
Activity A

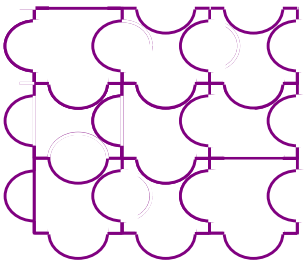
1. Tessellations 4 and 5
2. Tessellations 2 and 6
3. Tessellations 1 and 3
4. 1f, 2e, 3c, 4a, 5d, 6b.

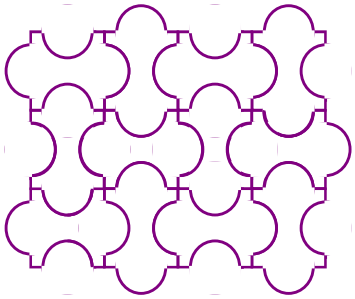
Activity B

1. Tessellation 3
2. Tessellations 4 and 6

Activity C

1. 

2a. 

2b. 

T1f

In this last lesson on tessellation you help pupils to apply what they have learned about fitting shapes together to how we use tessellation in real life tasks and activities.

Begin by asking pupils to tell you about examples of tessellation they might have seen around them in made or natural objects.

Discuss their ideas and suggestions first before looking at some of the following examples:

a woven mat or basket

a honeycomb

a soccer ball

a brick wall

bathroom tiles

Ask pupils to think of as many different examples of tessellation from the world around them as they can and to suggest activities in which they might need to use the tessellation skills they have learned. These might include:

Building and construction	Laying tiles or flooring timbers and bricklaying.
Sewing	Matching up the shapes of clothing patterns or making patchwork.
Printing	Making attractive designs on calico or paper.
Carving	Making repeated patterns from shell inlay.
Weaving	Adding repeating designs to mats and baskets.
Jigsaw puzzles	Fitting pieces of the puzzle together.

C1f

In the Pupil's Resource Book on pages 40 - 41 there are some pictures of clever tessellations that people have designed and made. These are included for interest and to give the pupils more ideas of how tessellations can be developed from mathematics into art!

Allow pupils time to look at these and discuss them with a partner.

Encourage them to see how the different tessellations have been formed and how some of them have been rotated and transformed too. You could guide their discussions with some of the following questions.

1. What images or pictures can you see in the design?
2. Which designs repeat exactly the same shape (regular tessellations) and which change the shapes?
3. Can you identify any designs that use **rotation** (that turn the shape around) to make the patterns?
4. Can you identify any designs that **reverse** the shapes to make the patterns?
5. Can you identify any **lines of symmetry** in the patterns?
6. Can you see any **reflections** of shapes?
7. How have the designers of each pattern used **colour** to make their pattern more interesting?
8. Which design do you like best and why?

?

Can all the pupils appreciate and create tessellating patterns using one or more two dimensional shapes?

T1a

Materials
Solid shapes
3D Game cards,
three-dimensional shapes

Introduce the new topic with a revision lesson to go over what pupils covered at Standard 5. Before the lesson check through **Standard 5 Unit 9**, so that you are familiar with what they should know.

Pupils should be familiar with a variety of three-dimensional shapes including **cubes, cuboids, spheres, prisms** and **pyramids**.

Revise the names of these by asking pupils to come to the board and sketch each solid. If you have a set of solid shapes you could show these to the pupils and have them name and describe them.

Discuss the shapes to revise the relevant vocabulary. Ask pupils to describe each solid by its properties including the number of **faces, edges, vertices** and **bases**, and whether it has an **apex** or not.

Next revise the idea of **dimensions** with the pupils.

Can they tell you the difference between two and three-dimensional shapes?

Discuss and clarify the following concepts:

When we work in **one dimension** we are dealing with **points**.

When we work in **two dimensions** we are dealing with **lines** and **flat planes**.

When we work in **three dimensions** we are dealing with a **body** or a **solid object**.

C1a

Three-Dimension Game

Split the class into groups of four or five players for this game.

Each group will need a set of game cards, which you have prepared before the lesson. Each card contains a series of four clues which describe a three dimensional shape.

All the cards are placed face down on the table and the first player picks up a card. He or she must not allow the other players to see the card. They read out the clues one at a time, pausing after each clue. The other players have to see if they can guess the name of the three-dimensional shape that is being described. The first player to guess correctly wins the card. The second player then has a turn. When all the cards have been used up the player with the most cards is the winner.

If you think the pupils need more revision of solid shapes, they can complete the activities on page 42 of the Pupil's Resource Book.

Answers

Activity A – Suggested Answers

1. Hexagonal pyramid has seven faces, one regular hexagonal base and an apex.
2. Hexagonal prism has eight faces, 18 edges and a hexagonal base at either end.
3. Cube, has six square faces of equal size, eight vertices and 12 edges.
4. Square based pyramid has four triangular faces and a square base opposite an apex.
5. Triangular prism has three rectangular faces and a triangular base at either end.

Activity B

1. A **cube** has six faces that are all the same and **eight** vertices.

2. On a pyramid, the point at which all the triangular **faces** meet is called the **apex**.
3. A prism has **two** bases that are **congruent**.
4. All the edges that join the **bases** of a prism are **parallel**.
5. All **pyramids** have one base and an apex.
6. A shape with sixteen **vertices**, eight rectangular faces and two **octagonal** bases is called an **octagonal prism**.

Activity C

1. A cube
2. A square based pyramid
3. A pentagonal prism
4. A triangular pyramid
5. An octagonal prism

T1b

Materials
thin card, scissors, rulers
glue or sellotape

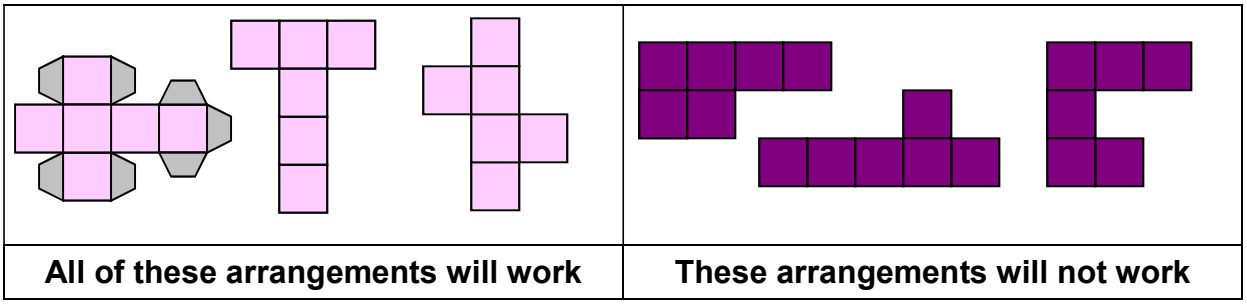
Remind the pupils that a **net** is a two-dimensional diagram, which can be folded to make up a three-dimensional object.

The pupils have used nets in Unit 9 of Standard 5 to make pyramids, prisms and cubes.

Revise this process with the pupils by going through how to construct a net to make a cube on the board as follows:

Explain that you are going to plan and draw a cube net. Ask the pupils for their suggestions as to how to do this and work through the process together until you have a finished net on the board. The following questions may be useful if the pupils need guidance:

1. How many faces will we need in our net? **(6)**
2. What shape will these faces be? **(square)**
3. How will we arrange them? Is there more than one way to do this? **(See the diagram below for alternatives.)** Make sure the pupils are able to explain why some arrangements will work and others will not.
4. Do we need to add tabs to our net? **(If you are using glue you will need tabs, if you are using sellotape, you will not need tabs.)**
5. If so how many will we need? **(7, because the cube has 12 edges, but 5 are already joined on the net.)** and where should they go? **(See diagram.)**



All of these arrangements will work	These arrangements will not work

Encourage the pupils to apply their knowledge of the properties of the three-dimensional shape to designing the two-dimensional net.

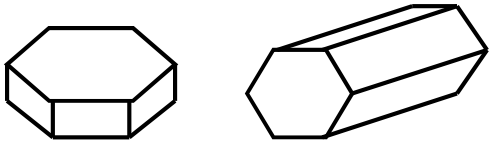
C1b

When you are sure that the pupils have understood how to design a net, introduce the following practical task.

The pupils should work in pairs to design a net for a solid shape of their choice. You could decide which shape each pair makes based on your knowledge of their ability. Give the less able pupils simpler shapes such as cubes, rectangular prisms and triangular prisms. Give the more able pupils more difficult shapes such as pyramids and hexagonal prisms. Alternatively you could have the pupils work in mixed ability pairs so that they help each other.

Here is a list of the shapes they should be able to design and make:

cube	**cuboid**	**triangular prism**
hexagonal prism	**pentagonal prism**	**octagonal prism**
triangular pyramid	**square based pyramid**	**pentagonal pyramid**
hexagonal pyramid	**octagonal pyramid**	



If you have more than one group working on the same shape, suggest that they use different dimensions so that their finished models are different. For example two very different hexagonal prisms could be made using different dimensions as shown on the left.

There are some guidelines for the pupils to follow in the Pupil's Resource Book on page 43.

Read through these first and make sure everyone understands the activity.

You will need to allow plenty of time for the activity. Practical tasks take time and it is important that pupils finish their work and are happy with it.

When they have finished their nets, pupils should use them to construct the three dimensional solid. There are some instructions to follow in the Pupil's Resource Book. This is a good way for them to check the accuracy of their own work.

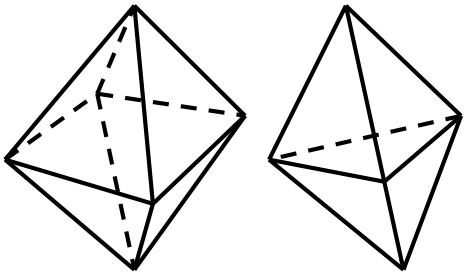
If they have not constructed their net accurately, they will find that the shape does not fit together well. If they have arranged the faces wrongly they will find overlaps and spaces. In this case **allow them to identify the problem themselves and redesign their net to correct their own mistakes**.

A good way to display the finished solids would be to make a mobile or set up a 'three-dimensional shapes table'. Alternatively you could bring the branch of a dead tree into the classroom and stand it in a bucket of sand and hang the solids from the twigs.

T1c

Materials
Polyhedra made up from Complex Nets Cards 1 - 4

In this lesson pupils use what they know about constructing solid shapes from nets to explore making more complex constructions by combining different shapes.



Ask them to look at the solids they have already constructed and to think about how they might combine these to make other more complicated shapes.

For example if we join two triangular pyramids or square based pyramids together we make crystal shapes like these.

Ask pupils to come to the board and sketch the kind of shapes that they think they might be able to make.

Teach the pupils the following new vocabulary:

The mathematical name for a three-dimensional shape is a **polyhedron**. The plural of this is **polyhedra.**

Write these new words on the board and explain that **poly** means **many** (as in polygon which means many sided) and **hedron** means **face**, so **polyhedra** are three-dimensional shapes with many faces just as polygons are two-dimensional shapes with many sides.

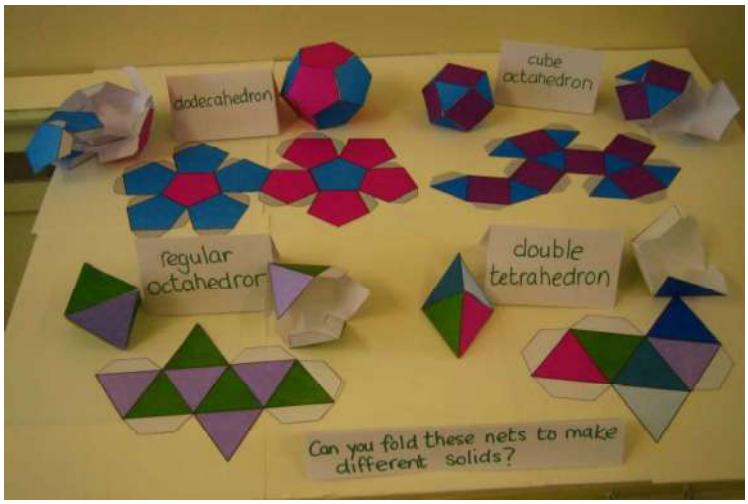
The card nets provided for this lesson provide examples of four different polyhedra as follows; write these definitions on the board:

double tetrahedron	a polyhedron with six triangular faces made up of two triangular pyramids (tetrahedrons)
regular octahedron	a polyhedron with eight triangular faces, which can be made by joining two square based pyramids at the base
dodecahedron	a polyhedron with ten pentagonal faces
cube octahedron	a polyhedron with 14 faces, six squares and eight triangles

Because you want pupils to understand the relationship between the nets and the polyhedra, you will need to have one set of shapes made up before the lesson and one set of the unmade nets for comparison in T1d below. Alternatively you could actually make the solids from the nets as an activity with the class, to help them see how the nets relate to the finished shape.

Show pupils the finished polyhedra one at a time. Pass them around the class for pupils to handle. Ask them to look carefully at each one and think about which of the definitions on the board it fits. When everyone has had a chance to look, ask them to name the polyhedra. Continue until the class have identified all the shapes.

Discuss the properties of each shape with the class. Allow them to describe it according to the number of faces, edges and vertices it has.



C1c

Split the class into groups of two or three. Each group will need at least one of the solid shapes to work with. They can pass them around from group to group when they have finished, until each group has had time to work with each shape.

Refer to the Pupil's Resource Book on page 44 where there is a blank table for pupils to copy and fill in. Read through the table and complete the first row (for a cube) together.

Then allow the pupils to work in their groups to study the polyhedra and complete the rest of the table. Encourage them to discuss their work with each other and move around the groups to assist any pupils having difficulty.

Answers

Name of the shape	No. of faces	No. of edges	No. of vertices	How many faces meet at each vertex?	Shape of the faces	Observations (Suggestions)
cube	6	12	8	3	square	
double tetrahedron	6	9	5	3 (2 vertices) 4 (3 vertices)	triangular	made up of two triangular pyramids
regular octahedron	8	12	6	4	triangular	made up of two square based pyramids joined at the base
dodecahedron	12	28	20	3	pentagonal	looks like a ball
cube octahedron	14	24	12	4	triangular (8) and square (6)	

T1d

Materials

Complex Nets Cards
plenty of thin card,
scissors, rulers,
glue or sellotape.

Show the pupils the unmade nets you used to make up the solid shapes in the last lesson. Ask them to identify which net made up which polyhedron by looking at the shape of the faces in the nets.

Discuss the nets with the pupils before explaining the C1d activity below.

C1d

Have pupils work with a partner to design and make their own model of one of the polyhedra they have studied.

If they wish they can do this by making two shapes from the nets they have already designed and joining them together. Alternatively they can design a new net to make the shape as a single model.

Allow plenty of time for this activity. Pupils may need two or more lessons to complete it properly.

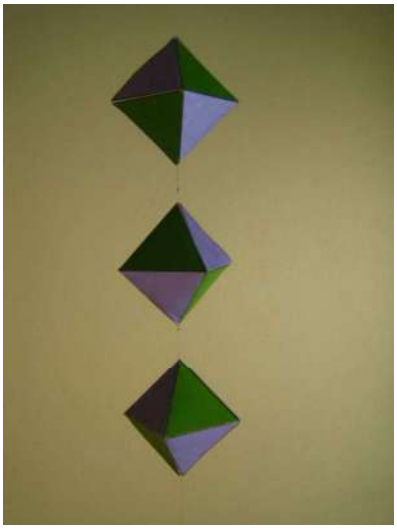
Encourage the pupils to be as creative as they like and to experiment with joining other shapes together to see what shapes they can come up with. Use some of the following suggestions to help them with their explorations:

What happens if you join two, three or more of these shapes together?

Are there different ways in which this shape can be joined?

Can this shape be joined with any other shapes to make an interesting solid?

How many of this shape would you need to make another regular solid?



Work with the pupils to plan a display of their polyhedra. There are many interesting ways they can do this, such as by threading them on a string (as shown in the picture) to make mobiles or by making a tabletop display with labels to go with each shape.

? Can all the pupils explore, design and use nets to make three-dimensional solids from two-dimensional drawings?

Extension and Support

Support Activities

For pupils who are still not confident with using the two and three-dimensional shapes they have studied in this unit, you should provide a range of support activities that give them more practice manipulating shapes and relating what they have learned to real life situations.

Allow them plenty of time to play with the regular shapes and make their own tessellations. Manipulating real shapes is easier than working with diagrams. Allow them to play the games in the unit again too, to give them more practice.

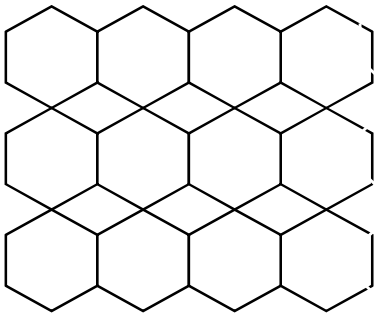
The following activities can also be used to reinforce their understanding of the concepts.

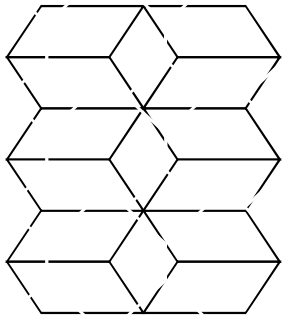
1. Tessellations in the Environment.

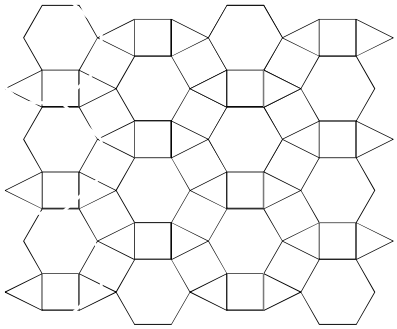
Take the pupils on walk around the school environment to look for tessellating patterns in made and natural objects. Sketch any that they find, make a note of where they were found and discuss the shapes (regular or irregular) that make them up.

2. Colouring Activities

Give pupils a tessellating pattern of two or three regular polygons and instructions on how to colour the pattern. Some examples are given here for you to copy:







3. Jigsaw puzzles

You can make simple jigsaw puzzles by mounting a picture onto a piece of cardboard case and cutting it into pieces following a tessellating pattern.

Pupils will practice the tessellation at the same time as they put the picture back together.

4. Pick a Shape Game

This is a game that can be played using the regular polygons you have used for other activities in this unit.

You will need a cloth bag or pillowcase so that pupils cannot see the shapes as they pick them out. Put a selection of shapes in the bag that make up a tessellating pattern, (say octagons and squares) but also include some shapes that do not belong to the pattern.

Groups of five or six players take it in turns to pick a shape from the bag without looking. They then have to place their shape on the table in turn to build up a regular tessellating pattern. If they pick a shape that cannot be fitted into the pattern they have to keep it!

When they have two shapes that cannot be used they have to drop out of the game. The winner is the last person in the game.

5. Folding and Unfolding Nets

Make a set of nets for the three-dimensional shapes that pupils are familiar with (prisms, pyramids and cuboids) and a set of the same shapes already made up, but not stuck together. Allow pupils to experiment with folding and unfolding the nets to see how the two dimensional pattern and the three-dimensional object relate to each other.

6. Drawing Three Dimensional Objects

Encourage pupils to study the polyhedra and other solids you have made more carefully by having them draw and shade them. Display their drawings.

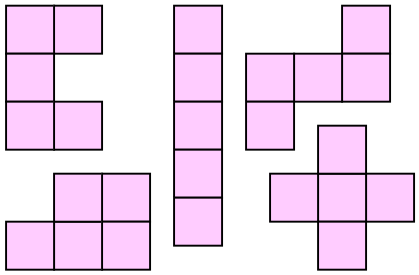
Extension Activities

Some pupils will have a good understanding of the two and three-dimensional shapes they have studied in this unit. They will find it easy to conceptualise the shapes and have no problems moving from two to three dimensions. For these pupils you should provide challenging additional activities that encourage them to extend their thinking beyond the objectives of this unit.

Extension activities are for pupils to work on independently. They encourage the pupils to find things out for themselves without the teacher's guidance. The following are suggested activities and challenges that you can give the pupils to extend their understanding:

1. Tessellating Pentominoes

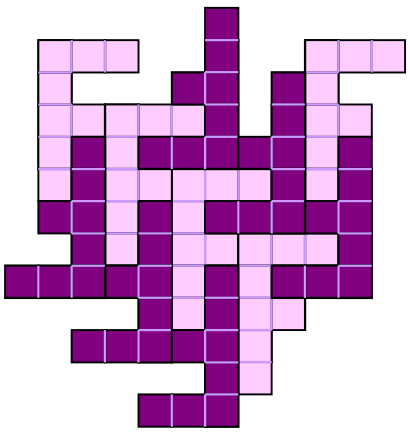
A pentomino is a shape made up of five squares, such as those shown on the right. There are 12 different pentominoes altogether. Some of which tessellate and some which do not. Ask the pupils to first identify the 12 different pentominoes, then to find out which ones can be made to tessellate. They should present their findings using sketches of the tessellating patterns they find.



2. Tessellating Other Polyominoes

Challenge the pupils to try the same thing with other polyominoes such as **trionimoes** (shapes made up of three squares) and **quatronimoes** (shapes made up of four squares) and **hexonimoes** (shapes made up of six squares).

3. Tessellating Letters



Show the pupils this tessellation made from the letter **F**.

Challenge them to find out which other letters of the alphabet can be made to tessellate.

Have them draw patterns to show their findings.

4. Other Ways of Making Three-Dimensional Models

Challenge the pupils to think of other ways that they might make models of the various polyhedra without using nets. For example: sticks and pieces of green pawpaw, clay, wire, used drinking straws, timber off cuts or other locally available materials. What about making 3D shapes by plaiting coconut leaves? Let them think of their own ideas too and display their work in the classroom.

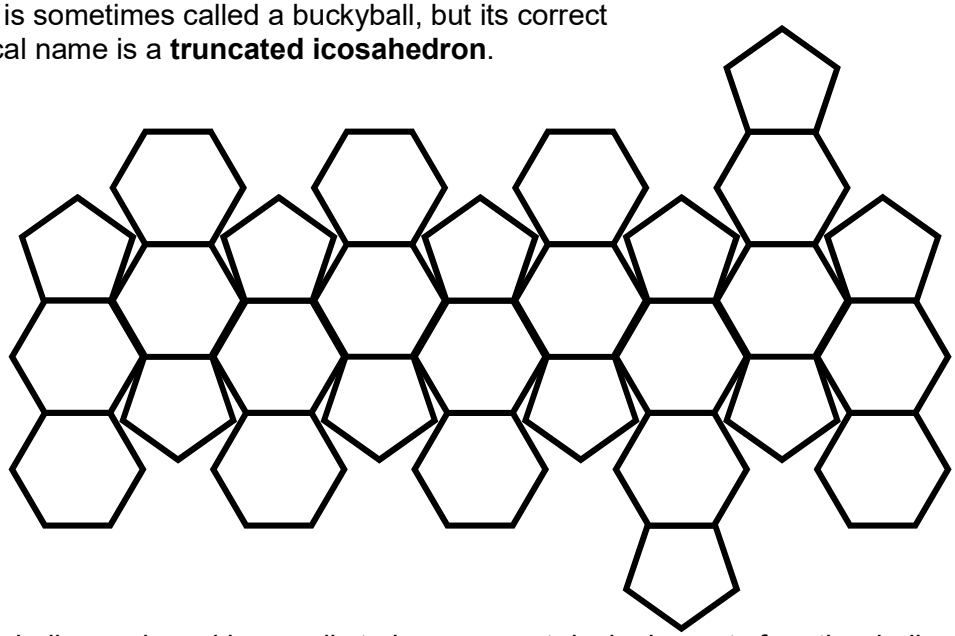
5. Cube Nets Challenge

Tell pupils that there are 11 different ways of drawing a cube net so that it will assemble correctly. Challenge them to find out and sketch all of them.

6. Making More Complex Shapes from Nets

Challenge the pupils to design nets for more complex shapes. A good one to try is the net for a soccer ball, which is made up of hexagons and pentagons. See if the pupils can work out the net design for themselves by studying a soccer ball. The correct net is drawn below to help you check their work.

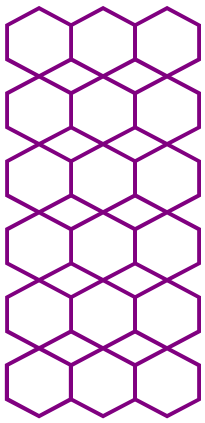
This shape is sometimes called a buckyball, but its correct mathematical name is a **truncated icosahedron**.

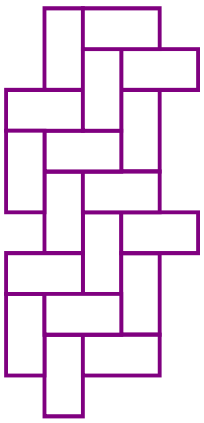


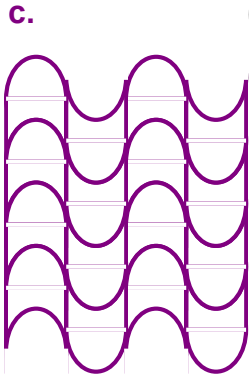
Extend the challenge, by asking pupils to have a go at designing nets for other balls such as rugby balls, tennis balls and basketballs.

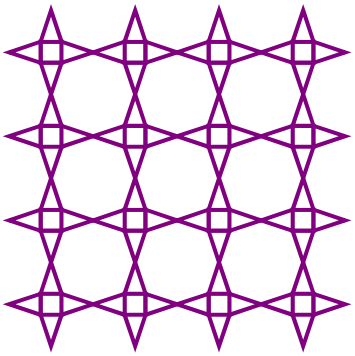
Check Up Page: Answers

1. **b.** equilateral triangle **d.** rhombus **e.** regular hexagon **f.** rectangle
2. **Suggested answers –** Check each pupil's work individual

a. 

b. 

c. 

d. 

3. **a.** 60º **b.** 120º **c.** 135º
4. **a.** Net C **b.** Net B **c.** Net B **d.** Net A.
5. **a.** The mathematical name for a three-dimensional shape is a **polyhedron** the plural of this is **polyhedra**.

   b. Another name for a **triangular** pyramid is a **tetrahedron**.

   c. A **dodecahedron** is a polyhedron with ten **pentagonal** faces.

   d. Two square based pyramids can be joined at the **base** to make an **octahedron**.

   e. A dodecahedron has **twelve** faces and twenty **vertices**.
6. **a.** cube octahedron

   b. dodecahedron

   c. regular octahedron

   d. double tetrahedron

Term 4

Creative Maths Projects

Contents

Introduction to Term 4

By the time pupils have completed Unit 12 in term 3 they will have covered the whole of the Standard 6 mathematics syllabus. Term 4 is therefore presented in a different way. The purpose of this term's work is to build on and extend mathematical skills and knowledge acquired, integrating these skills with other areas of the curricula. The approach is an investigative one where pupils are encouraged to explore and find things out for themselves either by collecting data and evaluating it or by applying their skills to problem solving.

The content is organised in eight chapters. Each chapter stands alone. This means it is not necessary to start at Chapter 1 and then go on to Chapter 2, Chapter 3 and so on. The chapters can be tackled in any order. Also within each chapter there are many strands to the same theme. Again all these do not all have to be covered and they need not be completed in the order in which they are presented.

Some chapters may run side by side. For example, while waiting for seedlings to grow (School Landscaping: Chapter 5) or waiting for butterflies to hatch (Life Cycles: Chapter 6) pupils can work on other activities in different chapters.

Read through all the chapters before you decide what you would like your class to do. Choose chapters which you find interesting and which you think will inspire your pupils too. Choose activities you are confident to teach. Provide a wide variety of activities throughout the term.

The table below summarises how each chapter integrates with different curricula areas.

Chapter		Theme	Cross Curricula Links
1	**Fun with Numbers**	number	History, Science
2	**Fun with Words and Numbers**	all	English
3	**Challenges in Shape and Space**	shape measurement	Creative Arts Design and Technology
4	**Census Project**	graphs	Community Studies
5	**Environmental Projects**	graphs shape measurement	Environmental Studies, Agriculture, Science
6	**Investigating Time**	time	History, Geography, Biology, Health, Vernacular Language
7	**Shopping Survey**	money	Community Studies
8	**Puzzles**	all	Various

Summary of Chapter Contents

Chapter 1: Fun With Numbers

The aim of this chapter is to develop pupils confidence with manipulating numbers. First of all, pupils look at the historical background of our numbering system and then they investigate and explore a variety of challenging number activities.

Chapter 2: Fun with Words and Numbers

The theme of this chapter is problem solving. The aim is to link the pupils' English language comprehension skills with the cognitive (thinking) processes involved in problem solving in mathematics.

Chapter 3: Challenges in Shape and Space

This chapter includes a number of different practical activities that encourage pupils to explore shape and space. These build on the skills and knowledge they have learnt in the Nguzu Nguzu curriculum and help them to develop their spatial awareness as well as practical and investigative skills. The teacher's role is to introduce and explain each task and to start the pupils off on their investigations. Thereafter, it is to guide and monitor them as they work.

Chapter 4: Census Project

The aim of this chapter is to get the pupils to design, plan and conduct their own census. From their census data they will analyse their findings and present these as a report, a wall display or as a booklet. Census data from the 1999 Solomon Islands census report is presented and analysed as a starting point.

Chapter 5: Environmental Projects

The aim of this chapter is twofold. Firstly, the pupils are asked to design, plan and conduct a survey to find out about a current environmental issue in their area. The aim is to find out some useful information that could be used to inform the community.

Secondly, the pupils are asked to use their mathematical measuring skills to produce landscape designs. If possible they should implement their designs as practical work outdoors. In this way they will link mathematical, environmental and agricultural skills.

Chapter 6: Investigating Time

In this chapter, pupils extend the time theme by looking at historic and scientific ways of calculating time. They perform experiments, draw up lunar calendars and integrate the passing of time with studying animal life cycles. The pupils are also encouraged to link their vernacular vocabulary with the time words they know.

Chapter 7: Shopping Survey

The shopping survey project outlined in this chapter brings together not only the pupils mathematical skills but also skills linked with community studies and English. Interviewing to find out data for research builds on pupils' confidence and develops their social skills while analysing and forming opinions based on sound research is developing their essential critical skills.

Chapter 8: Puzzles

The puzzles in this chapter are intended to challenge pupils and extend their thinking. The puzzles are varied. There are some problems that can be solved fairly quickly while others need persistence. Pupils will need to apply a range of their mathematical skills to tackle the puzzles. These skills include: sorting, reasoning, predicting and testing, working systematically, classifying information and evaluating the solutions.

For each chapter, there are a variety of teacher led activities and pupil activities. Answers are given where appropriate.

Term 4 provides a wealth of ideas. Indeed many chapters could be developed into a whole term's work in their own right. It is up to you as the teacher to decide how you will use these materials. Do not try to do it all. Work with the pupils in developing their mathematical potential while exploring the different themes in these chapters.

Chapter 1: Fun with Numbers

The History of Number Symbols

The information in the Pupil's Resource Book on page 51 introduces the pupils to the history of number symbols which they are familiar with.

It also introduces some different symbols which are sometimes used. You could read through this information as a class or the pupils could read and discuss it in small groups. Encourage the pupils to discuss the different symbols in the table in the Pupil's Resource Book on page 52 and see if they can write numbers using a different system.

There are five activities for the pupils to work through. Activity 5 asks the pupils to devise their own numbering system. They should work with a partner to do this. Their symbols should be based on sound mathematical principles. They should be symbols for a base 10 system. Let the pupils use ideas from other symbols they have looked at.

If the pupils are working well on this activity give them plenty of time to design their symbols. You could ask them to present all their information on a poster or a large chart. They could write on smaller pieces of paper and stick all their information together to make a chart. On the chart they should explain how they devised their symbols and give actual examples of how their symbols work when doing calculations.

Multiplication: Doubling and Halving

In this activity you teach the pupils a different way of multiplying two numbers together which works for both small and large numbers. Pupils will enjoy testing this method against the method they already know for multiplication.

Write this example on the board: **12 x 20**. Ask the pupils how they would do this multiplication. Now tell them you are going to show them another method, as follows:

1. Set out the two numbers in columns as shown below.
2. Work down the columns, halving the number in the first column and doubling the number in the second column. Continue until the first column reaches 1. Ignore any remainders and only use whole numbers.
3. Ignore any remainder in the first column. For example:

	12	**x**	**20**	
halve	~~6~~		~~40~~	double
halve	3		80	double
halve	1		160	double
Ignore the remainder	1			

4. Cross out any row where the number in the first column is an even number.
5. To find the answer, add up all the numbers which remain in the second or right hand column. (160 + 80 = 240)
6. Check the answer using the multiplication method you know as follows:

```
  12
x 20
---
 240
```

Ask the pupils to try the same example the other way round. 20 x 12 = ? Will this method work? Here are some other examples.

20	**x**	**12**
~~10~~		~~24~~
5		48
~~2~~		~~96~~
1		192
	total	**240**

20 x 12 = 240

56	**x**	**16**
~~28~~		~~32~~
~~14~~		~~64~~
7		128
3		256
1		512
	total	**896**

56 x 16 = 896

16	**x**	**56**
~~8~~		~~112~~
~~4~~		~~224~~
~~2~~		~~448~~
1		**896**

16 x 56 = 896

162	**x**	**36**
81		72
~~40~~		~~144~~
~~20~~		~~288~~
~~10~~		~~576~~
5		1,152
~~2~~		~~2,304~~
1		4,608
	total	**5,832**

162 x 36 = 5,832

Let the pupils think of multiplications to try for themselves.

They could work with a partner, one using this method and the other using the method they already know. Which is quicker? Have them evaluate the two methods and say which they think is best and why.

Palindrome Numbers

Explain to the pupils what a palindrome is. Tell them that **a palindrome is a word, phrase or sentence that reads the same backwards and forwards**. For example all these words are palindromes:

nun **ewe** **rotor** **pip** **eye**

Here are examples of sentences and phrases which are palindromes:

Was it a car or a cat I saw?

Madam, I'm Adam

never odd or even

Palindrome numbers follow the same rule. That is, they read the same backwards and forwards. For example:

66 **88** **121** **56,788,765** **123,321**

Introduce the pupils to some **number magic** that produces palindrome numbers. Each of these activities is followed up with further investigations in the Pupil's Resource Book on page 53.

Activity 1

$1^2 = 1$

$11^2 = 121$

$111^2 = 12{,}321$

$1{,}111^2 = 1{,}234{,}321$

Have pupils continue the sequence and see what they find out.

Activity 2

Reversing a number and adding it to the original will often result in a palindrome number. For example:

123 + 321 = 444 **92 + 29 = 121** **1,235 + 5,321 = 6,556**

142 + 241 = 383 **61 + 16 = 77** **243 + 342 = 585**

Sometimes this reversing process has to be repeated again, or in other cases several times, to end with a palindrome. For example:

458 + 854 = 1,321 + 1,231 = 3,443

156 + 651 = 807 + 708 = 1,515 + 5,151 = 6,666

Activity 3

Ask pupils to explore the following pattern:

0 x 9 + 1 = 1

1 x 9 + 2 = 11

12 x 9 + 3 = 111

123 x 9 + 4 = 1,111

1,234 x 9 + 5 = 11,111

In the Pupil's Resource Book on page 53 there are further investigations for pupils to carry out as they explore palindrome numbers.

Answers

1. 11,111² = 123,454,321
111,111² = 12,345,654,321
1,111,111² = 1,234,567,654,321
11,111,111² = 123,456,787,654,321
The result will always be a palindrome.

2. Many answers are possible. Example of a one step = 567, two step = 19, 3 step = 77, more than 3 steps = 87.

3. 12,345 x 9 + 6 = 111,111
123,456 x 9 + 7 = 1,111,111
1,234,567 x 9 + 8 = 11,111,111
The result will always be a palindrome number.

4. 2002, 2112, 2222, 2332, 2442, 2552, 2662, 2772, 2882, 2992

Heading Back to 1

In this activity pupils are going to look at more 'number magic'.

This investigation looks at the fact that every number they think of will eventually go back to one if they follow the rules below.

Write up these rules on the board:

- Choose **any** starting number.
- If the number is **even,** divide it by 2 (half it).
- If the number is **odd,** multiply by 3 and then add 1.
- Keep repeating this with each new number you get until you reach the number 1.

Work through some examples like these with the whole class.

Step 1		Step 2		Step 3		Step 4		Step 5		Step 6		Step 7		
16	(÷2)	**= 8**	(÷2)	**=4**	(÷2)	**=2**	(÷2)	**=1**						
3	(x3 +1)	**=10**	(÷2)	**=5**	(x3 +1)	**=16**	(÷2)	**= 8**	(÷2)	**=4**	(÷2)	**=2**	(÷2)	**=1**
4	(÷2)	**=2**	(÷2)	**=1**										

Some numbers quickly go back to 1 like **4.** If you try **9** you will find it takes 19 steps as follows:

9 – 28 – 14 – 7 – 22 – 11- 34 – 17 – 52 – 26 – 13 – 40 – 20 – 10 – 5 – 16 – 8 – 4 – 2 - **1**

Let the pupils carry out the investigations in the Pupil's Resource Book on page 54.

Answers

1. **1** -4-2-1
2 -1
3 -10-5-16-8-4-2-1
4 -2-1
5 -16-8-4-2-1
6 -3-10-5-16-8-4-2-1
7 -22-11-34-17-52-26-13-40-20-10-5-16-8-8-4-2-1
8 -4-2-1
9 -28-14-7-22-11-34-17-52-26-13-40-20-10-5-16-8-4-2-1
10 -5-16-8-4-2-1
11 -34-17-52-26-13-40-20-10-5-16-8-4-2-1
12 -6-3-10-5-16-8-4-2-1
13 -40-20-10-5-16-8-4-2-1
14 -7-22-11-34-17-52-26-13-40-20-10-5-16-8-8-4-2-1
15 -46-23-70-35-106-53-160-80-40-20-10-5-16-8-4-2-1
16 -8-4-2-1
17 -52-26-13-40-20-10-5-16-8-4-2-1
18 -9-28-14-7-22-11-34-17-52-26-13-40-20-10-5-16-8-4-2-1
19 - 58-29-88-44-22-11-34-17-52-26-13-40-20-10-5-16-8-4-2-1
20 -10-5-16-8-4-2-1

2. Number 19 takes 20 steps.

3. Number 4 only takes 2 steps.

Fibonacci Numbers

Background Information

Leonardo Fibonacci was an Italian Mathematician who lived from 1170 – 1250. He made some interesting discoveries about the Hindu-Arabic system of numbers and his name has come to describe the following very special sequence of numbers:

0 1 1 2 3 5 8 13 21 34

and so on to infinity.

The original series is constructed from the numbers 0 and 1 these are added to obtain the next number in the sequence (1) and then each subsequent number in the sequence is the sum of the last two numbers, as follows:

0 + 1 = **1**
1 + 1 = **2**
1 + 2 = **3**
2 + 3 = **5**
3 + 5 = **8**
5 + 8 = **13**
8 + 13 = **21**
13 + 21 = **34 …**

Fibonacci came up with this sequence after experimenting with breeding rabbits and studying the numbers of young produced. Fibonacci's number pattern is often seen in the natural world in plants as well as animals.

Introduce the work of Fibonacci to the pupils. Tell them that they are going to investigate Fibonacci's number sequence and how this sequence or pattern often comes up when studying living things like plants and animals.

A good place to start is with the honeybee.

The Honeybee

There are over 30,000 species of bees. The one most of us know best is the honeybee which lives in a colony with other bees called a hive.

Honeybees have an unusual **Family Tree**. Fibonacci numbers can be used to calculate and count a honeybee's ancestors.

First, an unusual fact about honeybees is that **not all of them have two parents**!

In a colony of honeybees there is one special female called the **queen.**

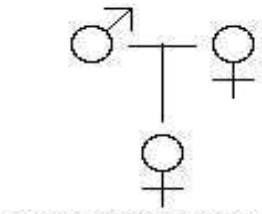
There are many **worker** bees that are female too, but unlike the queen bee, they do not produce any eggs.

There are also **drone** bees that are male and do no work.

These males are born from the queen's unfertilized eggs, so drones have a mother but no father!

All female bees are produced when the queen has mated with a male and so have two parents.

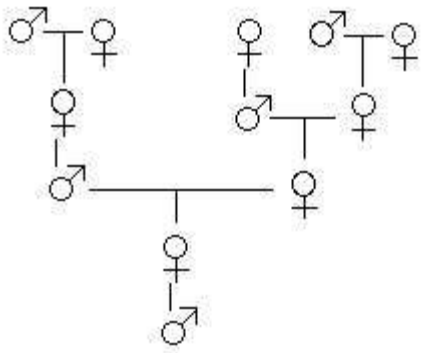
Most females end up as worker bees, but some are fed with a special substance called **royal jelly** which makes them grow into queens ready to go off to start a new colony.



Thus, female bees have two parents, a male and a female but male bees have just one parent, a female.

Explain the symbols used for male and female in a family tree.

♂ male ♀ female



The usual way of drawing a **family tree** is to put **parents above their offspring.** The most recent generations are at the bottom and earlier generations above them. This type of family tree shows the **ancestors** of the person or people at the bottom of the diagram.

The diagram on the left shows the family tree of a drone (male) honeybee. Analyse it with the class and explain that:

1. He had **1** parent, a female.

2. He has **2** grand-parents, since his mother had two parents, a male and a female.
3. He has **3** great-grand-parents: his grand-mother had two parents but his grand-father had only one.

Ask the pupils to work out how many great-great-grand parents he had. (**5**)

Together, draw another generation in this family tree. How many great-great-great grandparents will there be? (**8**)

Now fill in a table like the one below with the class. They should see the **Fibonacci number pattern** appearing**:**

Number of	parents	grandparents	great grandparents	great, great grandparents	great, great, great grandparents
male bee	1	2	3	5	8
female bee	2	3	5	8	13

The activity in the Pupil's Resource Book on page 54 asks the pupils to build up their own family tree. It also asks the pupils to investigate their own language words for different family relationships and link these with English words.

Fibonacci Rectangles and Shell Spirals

Background Information

To investigate the Fibonacci number pattern further, show pupils how to construct a diagram of rectangles showing Fibonacci's sequence as follows:

1. Start with two size 1 squares (1 unit x 1 unit) next to each other as shown in figure 1.
2. On top of these draw a square of size 2 (2 units x 2 units).
3. Now draw a size 3 square joined to the size 1 square and the size 2 square
4. Draw another square touching both the 2-square and the 3-square. This will have sides of 5 units as shown in figure 2.
5. Continue adding squares around the diagram, each new square having a side which is as long as the sum of the latest two square's sides.

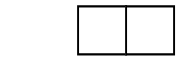


Figure 1

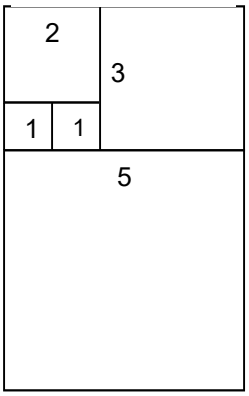
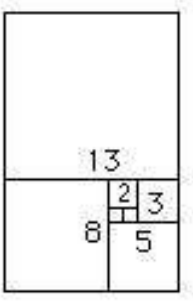
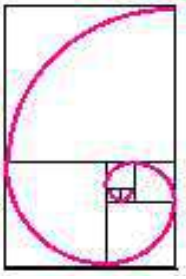


Figure 2





This set of rectangles is called the **Fibonacci rectangles**.

A Fibonnaci rectangle has sides measuring two successive Fibonacci numbers in length.

In the Pupil's Resource Book on page 56 there are examples of how Fibonacci number patterns often appear in the animal and plant kingdom. The pupils could design and carry out an investigation using fruits, seeds or plants that they can find, such as a pineapple or a sago palm fruit. This activity links science and mathematics. The practical work involved here gives pupils a lot of scope to develop a substantial piece of work. Presenting their findings in the form of a report links well with work they have done in English.

Gauss' Method of Summation

Background Information

The German mathematician Carl Friedrich Gauss (1777-1855) thought of a quick and easy way to find the sum of a string of consecutive numbers.

Write this example on the board for the pupils to work out.

What is the sum of all the numbers from 1 to 10?

It is not hard to add these. Allow the pupils to do the sum.

1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 55

Now let the pupils study the pairs of numbers below. Write them on the board.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
11	11	11	11	11	11	11	11	11	11

Ask them what they notice about the pairs of numbers. **(The sum of each pair is 11)**

Try and get the pupils to come up with a relationship between these 10 pairs of numbers. Give them some time to work in pairs to try and come up with this. **(The largest number in the series of consecutive numbers is added to the smallest, and so on).**

Now ask pupils if they can find the sum of numbers from 354 – 784. This is more difficult because there are more numbers in the sequence (430) and the numbers are larger, so pupils are more likely to make mistakes with addition. The sum would also take a long time.

Now explain **Gauss' method** to the pupils as follows:

To find the total (t) of any series of consecutive numbers:

First find the number of numbers in the series **(n).**

Then find the sum of the first and last number in the series **(s).**

Next multiply **n x s.**

Finally divide by two.

After explaining the process, show pupils how this can be expressed as a formula as follows:

$$\mathbf{t = \frac{n \times s}{2}}$$

So for the first example above: $t = \frac{10 \times 11}{2} = \frac{110}{2} = \mathbf{55}$

Ask pupils to check this answer against the addition that they did at the start of this explanation to see if it is correct. Work through another example together to see whether the method works for larger numbers. Does it work for every number?

In the Pupil's Resource Book on page 59 there are more investigations using Gauss's method for the pupils to try out.

Answers

1. $t = \frac{20 \times 21}{2} = \frac{420}{2} = \mathbf{210}$

2. $t = \frac{27 \times 72}{2} = \frac{1,944}{2} = \mathbf{972}$

3. $t = \frac{18 \times 223}{2} = \frac{4,014}{2} = \mathbf{2,007}$

Working with Numbers

This section is divided into twelve activities. The activities can be done in any order. These allow pupils to practice using all four functions +, -, x and ÷ quickly and appropriately when working with numbers. Many of the activities can be extended by pupils writing similar problems out for their classmates to solve.

Answers

Activity 1: Totals

Make 9: 2+4+3 Make 10: 2+8 Make 11: 3+8 Make 12: 4+8
Make 13: 8+3+2 Make 14: 8+4+2 Make 15: 8+4+3

Activity 2: Number Lines

There are a variety of answers. Check each pupil's work individually.

Activity 3: Investigating Magic Squares

a. All the rows, columns and diagonals have the same total of 34.
It is not a magic square if you change the numbers around.

b. The incorrect number is 89, it should be 88.

c.

17	24	1	88	15
23	5	7	14	16
4	6	13	20	22
10	12	19	21	3
11	18	25	2	9

d.

29	36	13	20	27
35	17	19	26	28
16	18	25	32	34
22	24	31	33	15
23	30	37	14	21

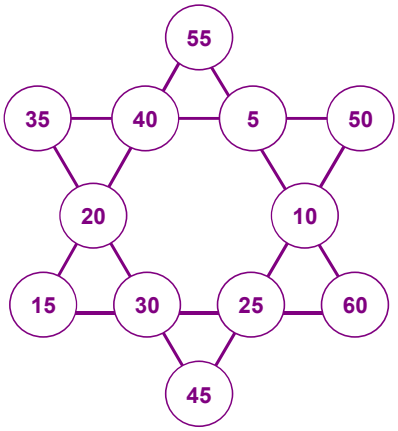
Activity 4: Benjamin's Magic Square

a. Every row and every column adds up to 260.
b. The first four numbers in any row add up to 130.
The last four numbers in any row add up to 130.
c. The first four numbers in any column add up to 130.
The last four numbers in any column add up to 130.
d. The numbers in any 2 x 2 square add up to 130.
e. In each quarter of the whole magic square, the rows and the columns add up to 520.

Activity 5: Number Placement

18	**12**	**14**
15	**17**	**13**
11	**16**	**19**

Activity 6: Star Addition



Activity 7: Make 100

12 + 47 + 14 + 27 = 100

1	**2**
4	**7**

Activity 8: Making 200

There are 22 different solutions. Eleven of the solutions are as follows:

1	9
7	2

2	8
6	3

2	9
5	3

3	5
7	4

6	1
5	7

7	1
3	8

4	1
9	5

4	2
8	5

4	3
7	5

5	1
7	6

6	2
4	7

Eleven more solutions are formed by changing over the two digits in the top right and the bottom left boxes.

Activity 9: Square Numbers

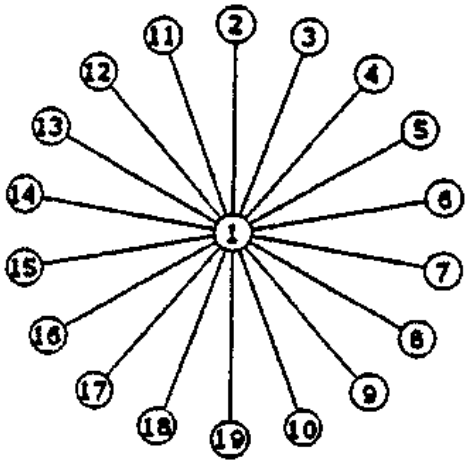
5, 7, 9, 11, 13, 15, 17, 19

Activity 10: Triangular Numbers

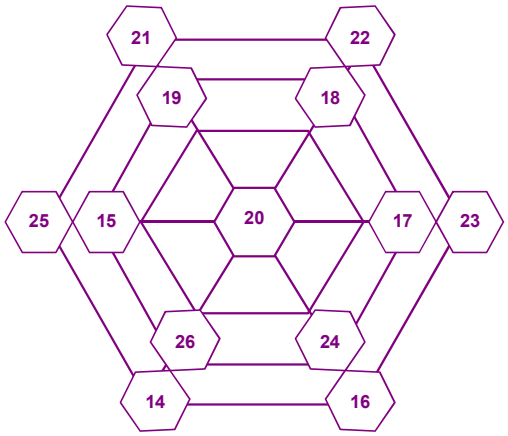
3, 4, 5, 6, 7, 8, 9, 10

Activity 11: Going in Circles

The three numbers in each line add up to 22.



Activity 12: A Magic Hexagon



Chapter 2: Fun with Words and Numbers

These activities develop pupils' problem solving skills. The aim is to link the pupils' English language comprehension skills with the cognitive (thinking) processes involved in problem solving in mathematics. This is done through a series of activities that are not only enjoyable for the pupils, but also help to use a whole range of maths skills in a problem solving context.

Each problem solving activity has three parts:

1. **The Problem**

   Tell the pupils to read through the problem a few times. They must understand the problem and be aware of what they are asked to find out. They should discuss the problem with a partner before moving on to tackle the questions.

2. **The Question**

   The pupils should understand the question and its context before they tackle the answer. The benefits here come from the process or method the pupils use not the answer. In fact many pupils will have difficulty in deciding how to attack the problem. Discussing some of the questions with a partner will help to overcome this.

3. **The Extension**

   The final task in each set of activities extends the pupils' comprehension. These activities lead the pupils into devising their own investigations. Some of the extension activities build on the pupils' English skills while others require imagination as well as a mathematical input.

Checking Pupils' Work - Assessment

In assessing pupils work, it is important to assess more than just the answers. You need to look at the processes the pupil has worked through and the strategies they have tried.

"Did the pupil understand the problem?" is probably the most important question you can ask. Questions about the pupil's accuracy with the calculations are important too, but not as important as the methods and strategies pupils use.

The answers to the activities are included below. The topics covered by each activity are stated too to help you when deciding which pages you would like your pupils to complete.

Activity 1: Rotten Rat's Lunch

Divide and multiply amounts of money to calculate percentage.

1. A rotten banana, a rotten smelly fish, a can of Taiyo with flies.
2. $3.00
3. $1.05
4. 45 cents
5. $1.50
6. 50%
7. 15% - if it costs 45 cents
8. 35% - if it costs $1.05

Activity 2: How Old are Selwyn's Parents?

Solve simple equations expressed as a word problem.

1. Individual answers
2. 40 years old
3. 37 years old
4. 40
5. 85 (Roy – 8, Dad – 40, mum – 37)
6. Check each one individually
7. 30 years old

Activity 3: Nula, the Human Fly

Calculate and compare measures of time and distance in word problems.

1. 200 m
2. 40
3. 30 m
4. 10 metres
5. 16 hours, 30 minutes
6. Check each pupil's work.

Activity 4: Tim Tiler's Incredible Tiles

Look at practical situations where measurement of area is required.

1. **a.** $5,000.00 **b.** Rectangular
2. $500.00 per m^2
3. 40 tiles
4. $10,000.00
5. Check each pupil's work individually
6. **a.** $20,000.00 **b.** 160

Activity 5: Mr. Slippery and his Worms

Mentally calculate word problems involving whole numbers and money.

1. worms
2. 4
3. 1 worm
4. 36 worms
5. 9
6. **a.** $1.00
   b. 50 cents
   c. 25 cents
   d. 5 cents
7. $1.30

Activity 6: Roy and Rob

Divide and multiply amounts of money to calculate percentages.

1. $65.00
2. $39.00
3. $26.00
4. $13.00
5. $7.50
6. 1,225
7. 52

Activity 7: Henry Heavy Duty Heron

Investigate concept of times and schedules using number problems.

1. Puts patterns on Twisties as they come out of the oven.
2. **a.** $18.00 **b.** $720.00
3. $108.00
4. $841.50
5. 320
6. 45 cents per bag

Activity 8: Spider and the Letter Flies

Read and interpret data from a table; calculate percentages.

1. Z = 38%
2. B = 30%
3. D = 20%
4. S = 2%
5. 10%
6. **a.** Z flies = greatest percentage,
   b. S flies = least percentage
7. **a.** 52% killed **b.** 48% left,
8. 52%

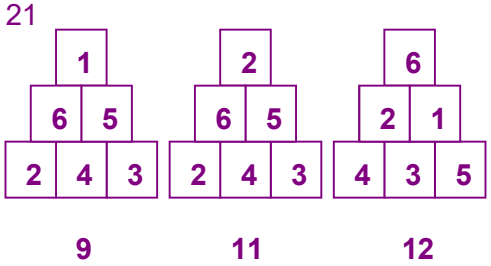
Activity 9: The Alien Space Craft

Locate points on a grid by reading coordinates.

1. G,2
2. C,-1
3. F,-3
4. B,4
5. **a.** Check each pupil's work
   b. Check each pupil's work
6. **a.** Zx99 **b.** 77 **c.** 22%

Activity 10: The Six Exciting Smiley Brothers

Mentally solve addition number problems involving two-digit numbers.

1. 21
2. 

3. 3

Activity 11: The Great Sam Yannis Slippery Snail

Calculate measurements based on a given rate, compare data.

1. 261 cm **2. a.** $19,836 **b.** $164 **3.** 43.5 cm per day

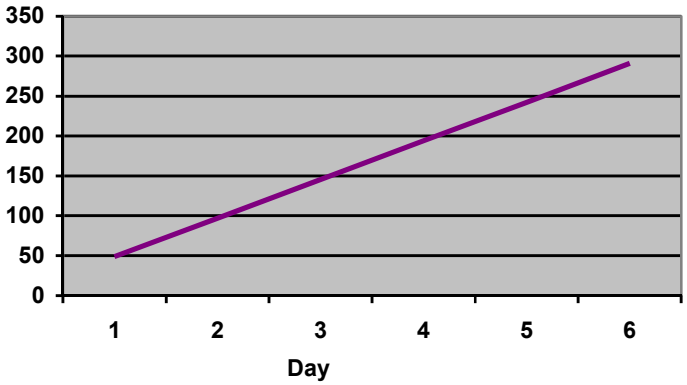
4.

day	cm/day	Cumulative total
1	43.5	43.5
2	43.5	87
3	43.5	130.5
4	43.5	174
5	43.5	217.5
6	43.5	261

5.

day	cm/day	Cumulative total
1	48.5	48.5
2	48.5	97
3	48.5	145.5
4	48.5	194
5	48.5	242.5
6	48.5	291

6.



Activity 12: Final Results of the Crash Ball Season

Interpret a table and use the information to calculate percentages.

1. P = played W = won L = lost
D = drawn F = for A = against

2. Roosters

3. **a.** Coconuts and Banyans **b.** no

4. 80, 73, 61, 32, 22, -5, -9, -131, yes

5. Reds 65% because $\frac{178}{276} \times 100 = 65\%$

6.

Order by %	Order by GD
Smashers 69	Reds 80
Reds 65	Roosters 73
Roosters 61	Smashers 61
Bulls 60	Warriors 32
Warriors 59	Bulls 22
Coconuts 49	Coconuts -5
Banyans 48	Banyans -9
Hunters 21	Hunters -131

Chapter 3: Challenges in Shape and Space

In this project there are a number of different practical activities that encourage pupils to explore shape and space. These build on the skills and knowledge they have learnt in the Nguzu Nguzu curriculum and help them to develop their spatial awareness as well as practical and investigative skills.

The tasks are designed for pupils to work on in pairs or in small groups so that they discuss their work, share ideas and try different strategies together.

The teacher's role is to introduce and explain each task and to start the pupils off on their investigations. Thereafter, it is to guide and monitor them as they work. Most of the information for these activities is therefore in the Pupil's Resource Book with only an introduction and information about the materials needed included in the Teacher's Guide.

You will not teach the pupils how to do these activities, but will help them to work things out for themselves. Careful questioning at each stage of the task will help pupils to do this. The suggested questions on page 29 of the introduction to this Teacher's Guide will be very useful for guiding pupils at each stage of the task.

There are 5 activities to choose from. You can allow pupils to work through them all, or you can choose some activities and not others. Some, such as making a model of the school or classroom, might take them more than a week to plan, collect materials and construct their models. Others might be done in a single maths lesson. Allow pupils to choose the activities that interest them most.

You will need some equipment and materials for some of these activities so make sure this is available if you plan to cover them all.

Activity 1: Optical Illusions

Materials: Rulers, pencils and paper are all that is needed for these activities.

An **optical illusion** is a picture that deceives the eye. When we look at it, our eye tells our brain that it is a certain way, but our eye is wrong, it is deceiving us. By measuring and checking we can prove to our brain that our eyes are wrong. Pages 77 – 79 of the Pupil's Resource Book introduce the pupils to some simple optical illusions. Read through the activities together and then allow the pupils to discuss them independently in pairs or small groups.

Pupils will enjoy seeing these and trying these illusions out on their friends too. Challenge them to see if they can create their own optical illusions with lines and shapes.

Activity 2: Construction

Materials: Sticks or coconut midribs and putty made from clay can be used to complete these construction activities. Pupils might also think of other materials that they could use such as matchsticks, drinking straws and playdoh or cubes of green paw paw. Encourage them to be creative with what is available to use in their own environment.

The teacher's role in this activity is to present and explain the task at the beginning and to encourage pupils to explore different ideas for constructing the shapes.

A series of challenges is presented in the Pupil's Resource Book on page 80. Allow the pupils to work on each one for as long as they wish. Have them work with a partner and encourage them to talk about what they are doing.

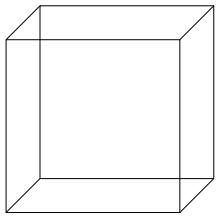
Activity 3: Exploring Volume and Surface Area

These exploration tasks build on what pupils have studied in Standard 5 and 6 and extend this to look at the relationship between volume and surface area.

Since they have not yet studied surface area, you will need to introduce this activity with an explanation of this term, as follows:

If the **volume** of an object is the amount of space it takes up, or its **body,** then the **surface area** of an object is its **skin.**

Illustrate this by using a single cube model with given dimensions, say 2 cm x 2 cm x 2 cm.



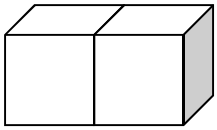
The volume of this cube is 8 cm^3, which we calculate using the formula the pupils already know. **v = l x w x h**.

To find the surface area however we need to calculate the area of each face in cm^2 and multiply this by the number of faces.

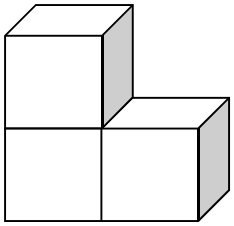
For this cube the **surface area** is 2 cm x 2 cm = 4 cm^2 x 6 faces = **24 cm^2**.

Explain that the surface area is a two dimensional measurement and is therefore measured in cm^2.

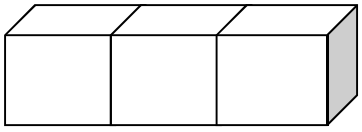
Check that pupils have understood this method of calculating the surface area by asking them to tell you the volume and surface area of some more shapes made up of cubes. You could sketch these on the board.



Volume 2 cm^3
Surface Area 10 cm^2



Volume 3 cm^3
Surface Area 14 cm^2



Volume 3 cm^3
Surface Area 14 cm^2

Before they move on to the activities in the Pupil's Resource Book, ask the pupils to predict whether objects with the same volume will always have the same surface area.

Materials If you have sets of wooden cm cubes in your class, pupils can use these to make the models in the activities to help them calculate surface area. If you do not, they can still do these activities by sketching diagrams to help them count the number of faces.

Pupils might also like to make their own cm cubes from sago palm wood, which is soft and easy to carve with a sharp knife.

Answers

1. volume 12 cm^3 surface area 44 cm^2

2. volume 7 cm^3 surface area 26 cm^2

3. volume 10 cm^3 surface area 40 cm^2

4. volume 13 cm^3 surface area 44 cm^2

Length of the Edges	Volume of the Cube	Surface Area
4 cm	64 cm^3	96 cm^2
7 cm	343 cm^3	294 cm^2
10 cm	1,000 cm^3	600 cm^2
25 cm	15,625 cm^3	3,750 cm^2

The formula for finding the surface area of a cube is the area of one face x 6. Calculate the area of a face using the formula a = l x w.

A cube measuring 6 cm x 6 cm x 6 cm has the same volume in cm^3 as its surface area in cm^2. (Volume 216 cm^3, surface area 216 cm^2)

Painted Cubes

1. 6 little cubes have only one face painted
2. 12 have two faces painted
3. 8 have three faces painted
4. 0 have four faces painted
5. 1 has no faces painted at all

1. 16 have one face painted
2. 20 have two faces painted
3. 8 have three faces painted
4. 0 have four faces painted
5. 4 have no faces painted at all

Activity 4: Modelling your School

In this activity, pupils design and make a model of their classroom, school or house. The instructions, some examples and guidelines are included in the Pupil's Resource Book on page 86. In completing these activities pupils will use many of the practical skills they have learnt in the Shape and Space theme in Standard 5 and 6, as well as measuring and number skills, acquired in other topics.

They will need plenty of time to plan and complete their models and you may need to enlist the help of a woodwork teacher, or carpenter from your community to help them by lending tools or showing them how to work with different materials.

We have deliberately not included detailed instructions in the Pupil's Resource Book because the project will be most beneficial if pupils work out for themselves the best way to use the materials they have available and design their own models.

Talking to pupils about their work as they progress through the design and construction stages will help them to think creatively about it and tackle problems that they might face as they go along.

The photos show the type of models that can be made with patience and imagination!

Activity 5: Mathematical Toys for the Early Years Classes

In this activity, pupils design and make mathematical toys for pupils in the prep class or kindy.

Introduce the activity with a discussion to decide what sort of toys would be suitable as follows:

What sort of Maths skills might young children need to learn?

This might include the following:

recognising numerals	counting to 10
sorting objects by size, colour, shape	matching things that are the same
putting things in order (e.g. smallest to largest)	recognising things that are different
learning the names of colours	learning the names of shapes
building and construction	

What sort of toys could we make?

Each of the above skills can be developed in many different ways. These are some suggestions about the kind of toys that pupils might think of making, they should be able to come up with many more.

- Building blocks of different shapes and sizes, for construction;
- Abacus or another counting toy;
- Threading beads of different shapes or colours;
- Jigsaw puzzles – e.g. in the shape of the numerals;
- Posting boxes in which different shaped objects can be posted into different shaped holes;
- Shapes for sorting and matching;
- Simple dice games to teach counting;
- Dominoes games for matching colours or shapes;
- Cups and beakers of different sizes for water play and early measuring;
- Card games for memory, recognising numbers, shapes and colours.

How do young children learn?

These are things pupils will need to consider when designing their toys:

- Young children learn maths by hands on, practical activities so the toys or games designed must be practical and must involve the children in doing something;
- Young children learn through play so the toys designed must be fun and enjoyable to play with;
- Young children learn by repeating things over and over again, so toys which allow them to do this without getting bored are good;
- Young children can be quite rough so toys must be strong so that children can play with them without being afraid of breaking them.

What materials can we use?

The short answer to this question is **anything** at all. Help pupils to see that there are many useful materials available around them. All they have to do is collect them. Here are some suggestions:

- **Things other people throw away** such as plastic bottles, cardboard boxes, drinking straws, tins and plastic containers.
- **Kitchen waste**, such as coconut shells, coconut husks, empty milo tins, rice bags.
- **Bush materials**, such as sago palm, seeds and nuts from different plants, tree bark, sticks and stones, putty, coconut leaves.
- **Builders waste,** such as off cuts of timber, masonite, empty paint tins, left over ply wood cuttings, sawdust, wood shavings.
- **Office waste,** such as paper offcuts, card pieces.

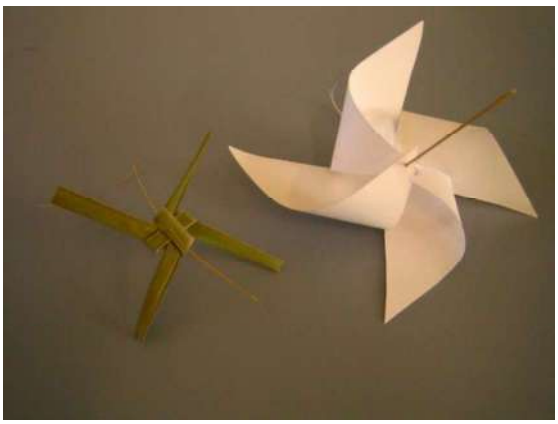
Help pupils to see that there are many different sources of useful materials and make sure that they design a toy that can be made from the materials that they have available.

When you feel the pupils have a good understanding of the task, introduce them to the guidelines on page 87 of the Pupil's Resource Book. Study the pictures of different toys shown and talk about what materials have been used to make these. Can the pupils suggest other things they could use?

When they are ready, set them to work to design and make their toys.

Below are some simple suggestions for toys that you could make with the whole class as a class activity before they try designing their own toys.

For the windmill you will need a sheet of paper, a drawing pin and a stick. Windmills can also be made using coconut fronds as shown in the picture.



When they have finished their toys, encourage pupils to take them to the kindy class to try out on younger children. They can also take them home to give to their younger brothers and sisters.

More able pupils could be asked to write a design report about their toy, describing the materials they used, the procedure they followed and explaining the purpose and educational value of their toy.

Chapter 4: Census Project

Background Information

A census is a survey, or an official count, usually of population, in a country. As well as finding out numbers of people, their ages, whether they are male or female etc. a census can find out other information at the same time. It looks at education, health, living conditions, food production, social issues, language, religion etc. When this Teacher's Guide was written the last census to be conducted in Solomon Islands was in 1999. All the data in the Pupil's Resource Book is taken from that census report.

Census Project

The aim of this project is for the pupils to design, plan and conduct their own census. From their census data they will analyse their findings and present these as a report, a wall display or as a booklet.

Census data from the 1999 Solomon Islands census report is presented in the Pupil's Resource Book starting on page 88. Pupils should study the tables and graphs. Encourage the pupils to talk about what types of information each set of data shows.

Build up a list with the class on the board. Your list will look like this:

- number of people in settlement or area
- age of people
- first language learnt
- religion
- what houses are made of
- water in the home
- amenities including piped water, flush toilets, electricity and radio in the home
- food production at home

Let the pupils work in pairs or in small groups. Let them talk about the census data in the Pupil's Resource Book among themselves. Let them analyse and interpret the data. Here are some notes on each of the eight topics the pupils will look at. These notes will guide your discussion with the pupils. They are for your information and to give you some ideas and guidance as to how the data can be interpreted.

Notes on 1999 Solomon Islands Census Report (SI Census) Data

There are 8 pieces of data in the Pupil's Resource Book. These will help pupils decide what questions to ask when they design their own census questionnaire. Pupils may think of other information they are interested in finding out too, to include in their questionnaire.

1. Settlements

This data shows that 5,919 settlements (villages and towns) were identified in Solomon Islands. The average size of a settlement was 69 inhabitants. The average number of households in a settlement was 11.

Remind the pupils of the meaning of the word **average**. They should know that to work out the average of a set of numbers they need to add all the numbers together and divide by the number of terms in their sample.

They will need to record the number of people (**inhabitants**) in their sample area. All the people living in one house are a **household**. The pupils need to find out how many households there are in their sample area.

Are their figures above or below the average figures given in the SI Census data?

2. Age Distribution by Province

The table shows all the provinces in Solomon Islands. Here the people in each province are grouped according to their age. There are four groups: children between 0 and 14; people between 15 and 44; people between 45 and 59 and finally, older people over 60.

The numbers shown are a **percentage**. Explain to the pupils that since the number of people is different in each province it is difficult to compare the numbers. To make this easier the number we actually count in each group is therefore shown as a percentage of the whole province. In the table the total number is shown as 100. The number under each age group is shown as a fraction of that 100 or as a percentage.

So in Choiseul, for example, if we add all the percentages of the four groups together we get 100%. **(43.9 + 42.4 + 8.2 + 5.5 = 100)**. The same is true for all the other provinces. Remind the pupils that, when they collect their data, they must do the same if they are to compare the figures to SI Census data.

For example, if they have a sample of 40 inhabitants then that represents 100%.
If they collect data as follows;

Total	Age	Age	Age	Age
	0-14	**15-44**	**45-59**	**60+**
(40) **100%**	($\frac{8}{40}$ x 100) **20%**	($\frac{20}{40}$ x 100) **50%**	($\frac{10}{40}$ x 100) **25%**	$\frac{2}{40}$ x 100 **5%**

Check these percentages 20% + 50% + 25% + 5% = 100%

When the pupils work out their percentages tell them to work them out to one decimal place as is shown in the SI Census data. Remind them that, to do this, they must work out to 2 decimal places and then round up or down. For example: 23.27% = 23.3%, 34.65% = 34.7%, 62.43% = 62.3%

The graph in the Pupil's Resource Book is another way of representing the data in the table. This graph is quite complicated since it shows all the provinces and all the four age groups counted. Notice the age groups are along the x-axis and the percentage is shown on the y-axis. In each age group each province is shown by colour. The colour for each province is shown in the key or the legend below the graph. For example, Isabel Province is shown as yellow in all the age groups.

The graph makes the same data shown in the table easier to analyse. Pupils should be able to come up with statements like these from looking at the graph. Here are just a few, you and the pupils will be able to think of some more.

- Most people living in Honiara are in the 15 - 44 age group. This could be because this is where there are the most jobs, so people of working age tend to move to Honiara.
- There are very few people over 60 in Honiara. Probably because old people tend prefer to live in the village.
- Most of the population of Solomon Islands is between 0 and 44 years of age. There are not that many people over 45.
- Rennell and Bellona Province has more people over 60 years of age than any other province.

2. Languages

Here there are two statistics:

> In the whole of Solomon Islands the number of children learning pidgin as their first language is 7%. This means that this is the first language they learn to speak.

In Honiara however the number of children learning pidgin first is 22%.

Pupils should be able to come up with ideas as to why there is a difference. Also they should look at the 7% figure and ask; What about the other 93%? What language are they learning as their first language?

A reason for Honiara being higher could be because in Honiara there is a mix of people from different provinces. All these have their own languages. This is sometimes called their mother tongue or their island language. People speak pidgin as the language of communication around the urban area. This common language is known as the **lingua franca**. Pidgin is the lingua franca of Solomon Islands.

Pupils could find out what language the people in their census learnt as their first language.

3. Religions

Although this data from SI Census is entitled 'Religions' in fact the list only has two religions in it namely, Christianity and Solomon Islands Customary Beliefs. In the data Christianity is however further divided into thirteen **denominations**. These are not different religions since all these believers are Christians. There are many different religions in the world e.g. Hinduism, Islam, Judaism and Buddhism but none of these appear in the SI Census data.

Again the data is shown in two ways; firstly as a percentage in a table and then as a bar graph. The key or legend is shown at the side of the graph. Again pupils should be encouraged to talk about the data and evaluate it. Here are some statements they might come up with:

- Most people in the Solomon Islands have a religion.
- Most people in the Solomon Islands are Christians.
- The graph clearly shows that the largest number of people belong to the Church of Melanesia.
- The number of people belonging to the Roman Catholic Church and the South Seas Evangelical Church are very similar.
- The number of members of the Seventh Day Adventist Church and the United Church are nearly the same.
- The percentages in the last twelve categories in the key are very small.

4. Water Sources

A water source is where the water comes from or originates. In Solomon Islands fresh or **potable water** is available to people either as piped water; rain water collected in rain tanks; underground water from bore holes, wells or springs and surface water from rivers or streams.

The graph in the Pupil's Resource Book on page 91, shows the different sources of water used by province. There is a lot of information here. The key shows the four types of water source, identified by colour. Tell the pupils to look at only one province on the graph, such as Malaita. Here 52% of people have piped water. 8% use rain water tanks. 10% get their water from a bore holes, wells or springs. (underground sources) 30 % of the population of Malaita get their water from rivers or streams. (surface water) Note that this is 100% altogether.

By looking at the graph overall it is possible to make a table of all these numbers as in 2 and 4. Ask the pupils to interpret this graph. They should come up with observations like these:

- There is no piped water in Rennell and Bellona Province.
- In Rennell and Bellona Province no one uses rivers or streams as their water source.
- Most people in Rennell and Bellona Province use rainwater tanks as their water source.
- Most people in Honiara have piped water.
- After Honiara, Isabel has more piped water than any other province.

- In Western Province more people rely on rain water tanks than on piped water.
- In Guadalcanal most people get their water from rivers and streams.

Look at the **Total** bars on the x-axis. These show a summary of the whole of Solomon Islands. Pupils' statements about this summary might include:

- About 52% of households in Solomon Islands have piped water.
- 22% of households use rivers or streams as their main water source.
- 17% of people use collected rain water as their main water source.
- 9% of Solomon Islanders use water where the source is underground such as a bore hole, well or spring.

5. Amenities

Amenities are useful things that make for better living conditions. The Solomon Islands' Census looked at four amenities, piped water, a modern toilet, electricity and a radio. The bar graph shown puts together the data collected. It shows what percentage of people had these amenities. Ask the pupils to interpret the graph. They should be able to tell you that:

- 60% of Solomon Islanders had piped water. (Notice a slight difference from the results in 5. This could be due to the way in which people filled in their census forms.)
- Only 16% of people's homes had electricity.
- 41% of households had a radio.
- 23% of households had a modern toilet.

6. Building Materials

Two sets of data are shown in this section in the Pupil's Resource Book. Both sets are to do with materials used in building a house. In **a.** roofing materials are analysed and in **b.** materials used for walls are identified.

Both sets of data are given in two ways, first as a percentage table and then from this data a graph is drawn. Notice that although this is a bar graph it is shown in 3D. This is because of the very large range of percentage results, for example, in **a.** ranging from 64.9% to values below 1%. If these are drawn as a 2D bar graph the smaller values are impossible to see on a graph drawn to the scale used here.

Encourage pupils to interpret these graphs and identify some of the following points:

- In roofs and walls the most common material used is a thatch of palm leaf.
- Most house roofs are made of palm leaf or corrugated iron.
- Not as much corrugated iron is used for walls as is used for roofs.
- Fibro is never used for roofs.

7. Food Production

The last section looks at food production in each household. This data shows the percentage of households which produced or collected these food items for their own use. It does not include what they sold only what they ate or consumed in their household. The table shows that 86% of Solomon Islanders grow their own bananas, 62% of households catch their own fish,and so on.

This table is then interpreted as a bar graph. Pupils should by now be more confident at interpreting data. Ask them what they can read from this data. Here are some ideas:

- 86% of all households produce some of their own food.
- The most common things to grow for your own family are bananas and sweet potato or cassava.
- 45% of households grow their own pigs to eat.

- 62% of households catch fish for their families.
- The main animals people keep are pigs and chickens.

Pupil's Census

Tell the pupils that they are going to conduct a census of their own village, settlement or town. Tell them that when they have conducted their own census and have their results they will compare these with the 1999 Solomon Islands Census data in the Pupil's Resource Books.

With the pupils, brainstorm about the process they will follow to conduct their census. What do they have to do? You should come up with ideas like these:

1. **Decide on the population that will make up the census sample**. If your school is in a village you must decide, depending on the size of your village, how many households you are going to include in the census. If your settlement is small you could use the whole settlement. If your school is in an urban area you could target a particular area. It could be interesting if different groups in town had different areas to study.
2. **Design a questionnaire to collect your data**. First of all you must **decide what you want to find out**. Be guided by the information in the Pupil's Resource Book.

   Remember to make a note of:

   - How many **people altogether** in your census?
   - How many **households altogether**? Census information is usually presented as a percentage. The whole therefore of 100% is the total sample of either people or households.
3. **Collect the data.** Interview all the people/households in your sample. Record all the answers to your questionnaire questions carefully.
4. **Organise all the data**. Present the data as tables and different types of graphs.
5. **Analyse the data**. What have you found out? Make notes. Think about how are you going to present these findings.
6. **Compare your census data** with 1999 Solomon Islands Census data and with other groups.
7. **Present your findings.** Decide how to do this. You could make a wall display by putting all your data and analysis on charts. You could write a report or you could produce a census booklet. Whichever method you choose remember to include a copy of the questionnaire you used.

Chapter 5: Environmental Projects

A. Environmental Research Project

Background Information

The rainforest is the source of life for many people in this country. People depend on it for building materials such as timber, bush vine and other materials, and clearing small areas of the forest provides fertile land for gardens, the main food source for people in Solomon Islands. It is also the home for wildlife.

Understanding the importance of our rain forest, and knowing how to care for it is essential for our present and future generations. Therefore, it is also important to warn pupils of the consequences of misusing forest resources now, before it is too late.

The newspaper article in the Pupil's Resource Book shows how too much logging has affected the forest in negative ways. National Forestry regulations set limits on how much timber can be harvested in order to allow the forests to grow back. This is called the sustainable level of harvesting. When logging goes beyond the sustainable rate, this means that more logs are harvested than can be replaced by replanting. The result is the loss of large areas of forest.

Outline of Forestry / Environmental Project

The aim of this project is for pupils to design, plan and conduct a survey to find out about logging, or about another environmental issue in their area. The aim is to find out some information that could be used to educate the public. The information could be communicated to the local community by:

- drawing posters and putting them up where many people can see them;
- performing drama for community groups;
- writing a report which is then available for many people to read e.g. in a newspaper or in a school magazine.

Let the pupils work in small groups. Let them first talk about the forestry information in the Pupil's Resource Book on page 95. They have read about logging and forestry in their English work this year and may find more interesting information by reading back over some of their English texts, such as those in Units 5 and 6.

Discussion Starters

Use questions like these to guide the groups' discussion:

- Why do you think there is an increase in logging?
- Who benefits from logging?
- What happens to the land after trees are cut down?
- Do you think there should be control over logging? Why?

Vocabulary

Some of the vocabulary in the article may need to be explained.

A **sustainable yield** is a manageable amount. This means that the amount of logs harvested can be replaced by new trees being planted. If only the 'sustainable' yield is harvested each year the forest will be growing back at the same rate that it is being harvested so it will not be destroyed.

When the pupils have studied the information ask their opinions by asking questions like these

- What would life be like if there were no forest?

- What has happened to the amount of logging over the last three years in Solomon Islands?
- Can you predict how many logs would have been harvested in 2005 if the trend remained the same?

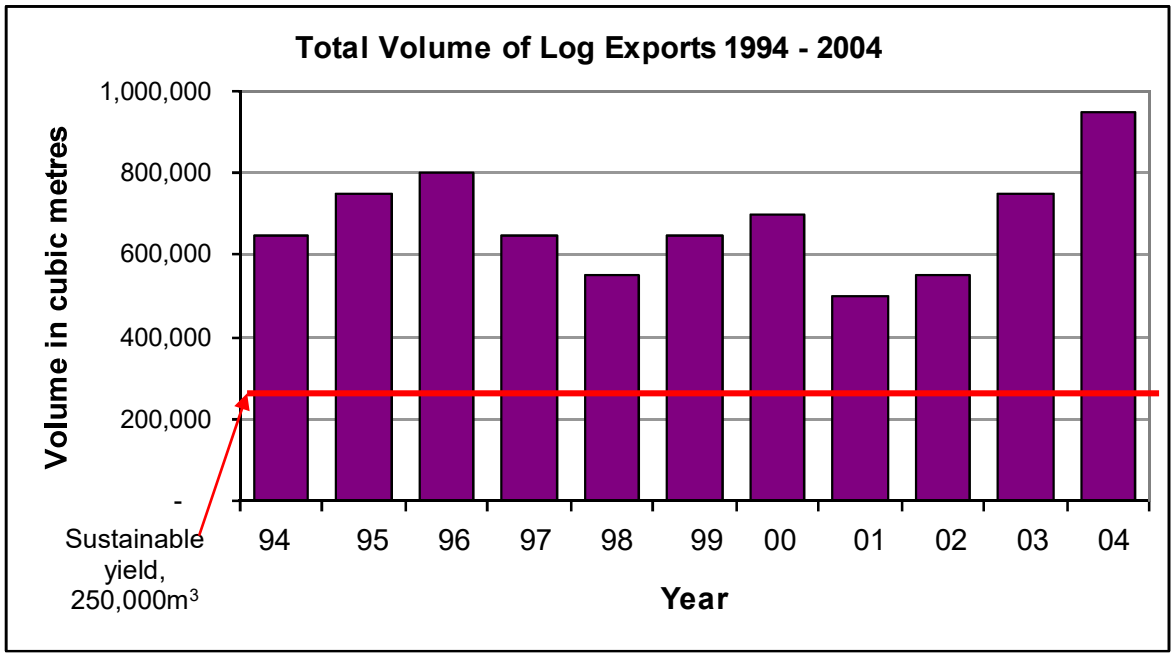
Introduce the idea of designing and carrying out a research project about an environmental issue in your area. Go through the procedure as laid out in the Pupil's Resource Book on page 96. The issue could be about logging if there has been logging in your area, or it could be about other topics such as:

- pollution of beaches;
- destruction of the reef;
- over fishing;
- bad soil management:

… and so on.

More Background Information

This is the graph which appears in the Pupil's Resource Book.



An assessment study carried out by the Forestry Division of the Ministry of Natural Resources for 1994 – 2004 revealed a frightening situation about the rate of logging in Solomon Islands.

The graph shows that the logging industry is cutting the forest far quicker than it is growing. Timber is being harvested at more than three times the **sustainable rate.** If this level of timber extraction continues then the forests will all be gone in 10 to 15 years from now.

The heavy red line across the graph shows the level of harvest that could be sustained.

The Forestry Division's report studied the remaining forests in each province and made predictions about when all the trees will have been cut down. The results show that every province will run out of timber soon.

Western Province	**2008**
Guadalcanal Province	**2012**
Isabel Province	**2012**
Malaita Province	**2009**
Choiseul Province	**2015**
Makira Province	**2014**
Central Province	**2008**
Temotu Province	**n/a**
Rennell Bellona Province	**n/a**

Western and Central Province will run out first and the other provinces will follow closely behind.

However, the good news is that many rural Solomon Islanders are planting high value trees like: teak, mahogany, and rosewood. At the moment logs of teak sell for about $1,700.00 a cubic metre and mahogany for about $1,500.00. Prices for sawn timber are much higher.

If Solomon Islands continue to plant trees at the rate of 1,000 hectares a year for 20 years then this will be enough to replace the trees at the moment. For example in 2003 landowners planted more than 1,500 hectares, so this target is possible.

It takes more than 20 years for a plantation to be ready to harvest so there will be a time when the natural forest is finished but we are still waiting for the plantations to grow.

Questions to discuss with your pupils if you give them the above information:

- in the table, n/a means **not available**. Why do you think there are no figures for when all exportable logs will be finished in Temotu and Rennell Bellona?
- What is the approximate date when each province will run out of exportable logs?
- Which provinces will run out of timber first?
- If Solomon Islands continue to plant 1,000 hectares of log trees a year, how many hectares will they have planted in 20 years?
- How many hectares of log trees did landowners plant in 2003?
- From the graph in your Pupil's Resource Book, in which year was logging at its lowest level? Why do you think this was the case?
- About how long does it take for a plantation to be ready to harvest?

Now work with the whole class to prepare a set of questions to use as guidelines for the pupils to use when they carry out their interviews to do their research.

Also discuss all places or people that are available in your area to get information from.

B: School Landscaping Project

Background Information

Landscaping is the art of arranging the soil, rocks and plants around the outside of your house, classroom, clinic or church. It is done to make the environment more attractive to live in.

Landscaping also means the addition of lawns, trees, plants, and other natural and decorative features to land to create an attractive area.

School Beautification Project

The aim of this project is for the pupils to use the measuring skills they have learnt in maths to produce landscape designs. If possible they can also link this project with their work in agriculture lessons to implement their design as practical work outdoors.

In this way they will link mathematical, environmental and agricultural knowledge and skills. They will learn the names of different plants as well as the how to grow them.

This project is also an excellent way to involve members of your community with the school. Volunteers from the community could work side by side with the pupils to beautify the school grounds, village or area where you live.

This project will give pupils opportunities to use their measuring skills. They are going to plan and mark out the gardens before planting.

You must decide which is the best area for your pupils to work on. This will depend on your particular situation. You could landscape an area:

a. around classrooms;

b. along walk ways to classrooms or from village to the school;

c. around trees in the school compound or in the village.

You and your pupils will be able to think of other ideas too. Make sure that the area the pupils choose is manageable. The project must not be over ambitious. You must be sure that the pupils can practically achieve their target in the time allowed. It is better to plan a small project that can be completed and then extend it if there is time available rather than start something big which you never have time to finish.

What will the pupils actually do?

There are two main options as to how this project could be developed;

1. The pupils could plan the gardens, peg them out, prepare the soil and then actually put in the plants or seeds. This is a practical approach. If you plan to do this is would be good to spread the project over the whole term, completing other maths projects while you wait for plants to grow and continue to work on the landscaping. You could, for example, have one maths lesson a week devoted to this project and on other days, work on other activities.
2. The pupils could just plan and design their gardens. They could do this as a written project. This is an option if you do not have much time to give to this project.

If your project is going to be a practical one then there is a lot of preparation and planning for you, the teacher, to consider.

Think about preparing nursery plants for later planting out and remember that nursery plants can take between three and four weeks to become established before they are ready to transplant into garden beds.

The landscaping project in this case could be two fold: the first part being planning, design, evaluating the designs and deciding on the practical activities. Then the actual practical tasks could be on going throughout the term with some part of each day being given to different activities in the garden as necessary.

For this reason the introduction and preparation of this landscaping project should be at the beginning of term 4 if good outcomes are expected by the end of the term.

Activities 1, 2 & 3

The pupils could do the activities in the Pupil's Resource Book on page 97 as group activities. Each group could measure, plan, design and landscape around a classroom, a tree or a walkway. You could divide the class into three groups and at different stages of the project the groups could come together to discuss their ideas. A whole class plan could then be agreed before setting out on practical tasks.

Here are some guidelines that you could write on the board to begin. Explain to the pupils that these are the things they must do before going on to the practical work.

For example if they are going to landscape around a classroom they must first:

1. Discuss and draw the plan of the area available around the classroom;
2. Indicate on the plan where to put the gardens;

   Include the measurements for each bed including length, width and overall shape of the garden.

   Encourage pupils not to always work with rectangular shaped gardens. Tell them to think of other shapes too such as: circle, square, irregular shapes that follow the shape of the land or footpath, or even spiral.

3. Make a list of materials to use: stones, timber, soil, plants, mulch etc.

Practical Work - Some Landscaping Tips

The following guidelines will help pupils to plan their project properly before planting out their gardens:

Look at the beautiful results that can be achieved in just a small landscape project

1. **Prepare well**

   Collect all materials you need before landscaping begins.

2. **Choose carefully**

   Choose plants that are suited to the conditions, that do not need too much looking after and that that grow easily and quickly are best.

   Select plants that grow to a size that is suited to the area you are landscaping.

3. **Plan ahead**

   For example, do not plant plants that can grow into big trees near the classroom windows where they might block the light. Do not plant thick bush around the classroom to create breeding ground for mosquitoes and so on.

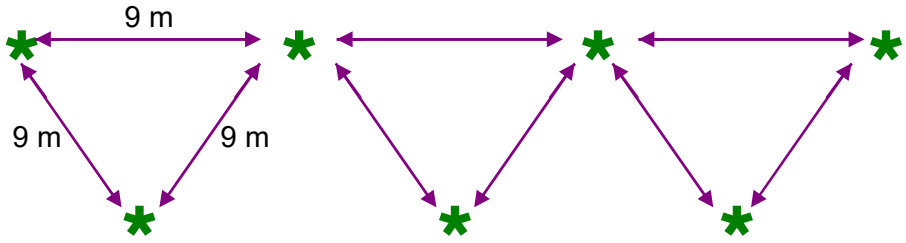
4. **Remember** to plant plants that can grow tall at the back and the shorter ones in front or at the edges. This is because if you plant the tall ones in front then the shorter ones will be hidden from light at the back and they will not grow well.

5. **Till** and then **water** the soil well before planting.

6. After planting the gardens do not forget to **water** them twice a day on days when there is no rain. Water in the mornings and before going home after school. Watering at lunch time, in the heat of the day can actually scorch the plants.

7. Plant out seedlings 30, 40 or even 50 cm apart depending on what type of plant you are planting. Remember some plants spread outwards and have good **ground cover** so do not need to be planted close together. Carefully spacing the plants allows enough room for the plants to grow and bloom without being cramped. Cramped plants will not grow healthily. Shade trees, like Christmas trees, should be planted 5 to 6 metres apart.

8. If you have a large area where you want to plant some coconut palms these should be planted nine metres apart. If there are to be two rows then plant them in a triangular pattern. See diagram below:



9. After planting do not forget to put **mulch** around the plants. The pupils could put mulch down first before planting the plants. The mulch can be dead leaves, grass or sawdust. This keeps the moisture in the soil and stops the water evaporating away. There is then more water available for the plant roots.
10. Always **prune** the plants to the height you want if they grow tall. By doing this it helps to keep the plant growing healthily and produce more leaves and flowers.

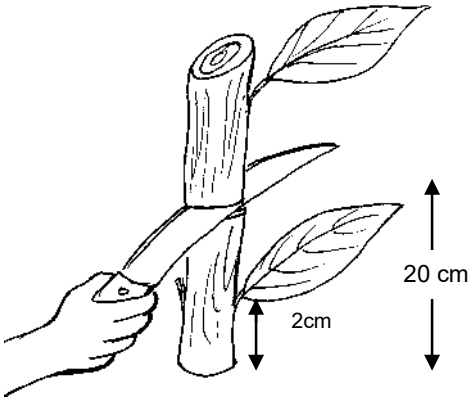
Nursery Tips

Write these on the board or on a chart, or discuss them with pupils as they work. Explain that these are tips for preparing cuttings in a nursery.

a. Do not break branches or stems using your hands. Always cut them using a knife.

b. On an adult plant measure a length of about 20 cm long for a cutting. The cut should be about 2 cm under a leaf.

c. Put the cuttings in a container half full of water and leave overnight before planting.



Tell pupils that they can plant cuttings straight into flowerbeds or put them in a nursery first before planting them out. If the cuttings are directly planted then constant care is needed. They must be watered three times a day on sunny days. Planting them in a nursery first makes them easier to manage and look after.

In a commercial nursery special **poly bags** are used for cuttings. Your pupils can improvise with sugar bags or other containers. Remind pupils to make holes in the bottom of any container they use, for water drainage. If water is allowed to sit in the container then the new roots being produced will rot. You could use:

- empty noodle packets, sugar bags, bread bags;
- drink cans cut in the middle to make two;
- lengths of bamboo.

Fill the containers with soil then put one cutting in each. For bigger bags put two or three cuttings in them but do not put them too close together. Water the cuttings once a day or only when the soil looks dry after they are established.

Keep nursery plants away from direct sunshine but not under a house where there is no sunlight.

Growing Plants from Seeds

If you have collected some plant seeds you could start these off in a nursery bed too. Plant seeds in prepared soil and cover them over with a few millimetres of fine soil. Seeds will germinate better in the dark.

Pat the surface of the soil down when you have planted the seeds. This gives the seedling roots a better chance to anchor in the soil.

When the seedlings have germinated, thin them out as they start to grow. If they are too close together they will grow long and spindly and will not be healthy plants. They grow tall since they are all competing for the sunlight. These seedlings will not do well and may not even survive being transplanted.

Take some advice from gardeners in your community.

Remember you could invite help from the community to carry out this beautification project with your class. This is a good way of getting community members involved with the school.

Chapter 6: Investigating Time

Section 1: Time Facts- Revision

Before beginning this time project you should revise the work pupils have done on **time** before. Ask them what they know about time. They should be able to explain how time is measured, why we need to be able to understand and use time facts and so on.

In the Pupil's Resource Book, starting on page 99, there are revision activities about time facts and vocabulary. You could work through some of these orally with the whole class, or you could have pupils work on these in small groups or in pairs and write down the answers.

Answers

Activity A

1.	**a.** 60 minutes	**g.** 104 weeks
	b. 120 seconds	**h.** 35 days
	c. 24 hours	**i.** 100 years
	d. 168 hours	**j.** 320 s
	e. 365 days	**k.** 50 months
	f. 14,400 seconds	**l.** 80 yrs

2. **a.** 0300 0715 2330 2030
b. 2105 1825 2210 1415
c. 1305 1650 0045 1200
3. Check pupils' work individually for
4. these questions as the answers will
5. vary from pupil to pupil

Activity B

1. **a.** 7 h 30 min
b. 45 h
2. 1220
3. 7 h 10 min
4. 45 min
5. 5 h 51 min
6. 5 h 51 min
7. 9 h 50 min
8. 2 h 23 min
9. 6 years, 4 months, 10 days
10. 4.13 p.m.

Activity C

1. Cooking Display
2. 4
3. 12.35 p.m.
4. 9.55 a.m.
5. 10.5 h
6. Weaving Demonstration

Extra Activity and **Extension Activity** to be checked by teacher individually

Section 2: The Passage of Time

This section contains a collection of open ended time tasks. These encourage pupils to think; to discuss the tasks with each other; to plan and carry out their own research, to solve problems and come up with conclusions.

A lot of the time work which the pupils have already done is about learning how to tell the time. These activities focus more on **the passage of time**. Pupils' concept of time passing is affected by events such as waiting for the weekend to come, waiting for the end of the school day, waiting for holidays, etc. The study of instruments which measure the passing of time is called **horology**. In Standard 5 pupils have devised instruments which measure time such as a candle clock, a sundial and a water clock. The activities and ideas here build on this work and encourage pupils to develop the concepts further.

Materials
clock with a seconds hand
string
pieces of coral or stones

Activity A

Investigating the Pendulum

People have come up with different strategies to estimate the passage of time. For example to count seconds some people say, "one thousand and two thousand and three thousand and four thousand," and so on.

Throughout the ages various devices have been used to measure the passage of time. Revise with the pupils the ones they can think of. They should be able to come up with:

a candle clock sand timer a water clock a sundial

Pendulum Experiment

The famous mathematician Galileo, was bored in church one day and began to watch the, lanterns swinging in the wind. This gave him an idea. He started to investigate the pendulum and how it can be used to measure time. A simple pendulum can be made from a weight and a piece of string.

Some clocks have a pendulum which swings below the clock. Ask the pupils to find out what happens if they vary the length of the string. Does a heavier or lighter weight affect the pendulum? Use the Pupil's Resource Book page 102.

Galileo discovered that the rate at which a pendulum swings depends on its length rather the distance through which it swings or the weight of what is attached. This discovery later led to the development of pendulum clocks.

Tell the pupils that they will investigate the pendulum today. Read through the information in the Pupil's Resource Book with the class. There is a lot of information here. You could get the pupils to discuss what they have read in small groups.

Introduce the pupils to the investigation they are going to do. Let them work with a partner to carry out the investigation. As they do their experiments make sure you go around and help any who are having difficulties. Also get the pupils to talk about what they are doing and why. Let them tell you about their findings too.

To complete the investigation and to do the written task well will need more than one lesson. Give the pupils enough time to discuss, do the experiment, collect their data and write up a first draft of their findings, as well as edit and produce a good final copy with a labelled diagram.

In a whole class discussion discuss the pupil's findings. Are their results the same as Galileo's?

It would be more exciting for the pupils if you did not tell them what Galileo found out until after they have done the investigation.

Section 3: The Calendar

This section of this chapter builds on the work which pupils will have completed in Unit 10 this year.

The Pupil's Resource Book contains a lot of more information about different calendars. You could divide the pupils into small groups or pairs and get them to produce a fact file or a poster about calendars. They could use information they have learnt in Unit 10 too. If you have more resources they could use these as well. There are also puzzles in the Pupil's Resource Book for them to work out, on page 105.

The main activity in this section is to make a **lunar calendar**. The 2006 phases of the moon have been included for them to work from. Information about the moon and how the phases occur along with the vocabulary is included in the Pupil's Resource Book on page 106.

The moon is the most conspicuous object in the night sky. It looks different throughout the month as it follows its cycle of phases. This makes it a natural and obvious way to track time. This activity encourages pupils to think about our calendar and alternative calendars and also raises their awareness about the moon.

Give the pupils encouragement in their project and let them have enough time to create an original product under your guidance.

Section 4: Life Cycles

This section looks at life cycles in nature. It allows the pupils to look at different life cycles and investigate the life cycle of a butterfly or moth. They explore how long it takes for a caterpillar to change into its adult form. This links their mathematical work with the natural world.

Materials
string
plastic bottles
scissors, sharp knife

The Frog

Let the pupils study the life cycle of the frog. Tell them to work out how long it takes from the time an egg hatches to when a frog develops. There are more questions in the Pupil's Resource Book on page 110 for the pupils to talk about.

The Mosquito

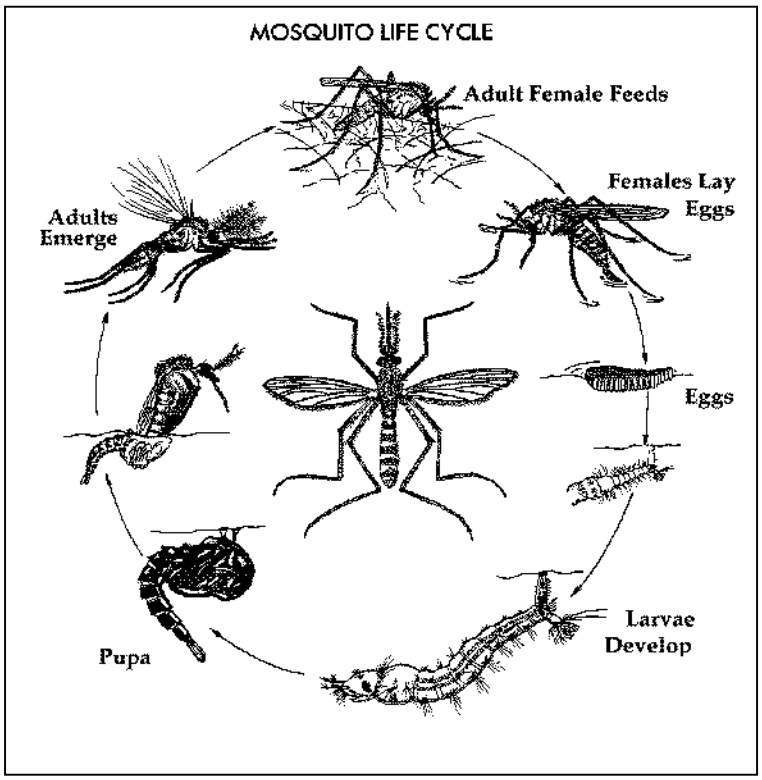
The pupils have studied the life cycle of the mosquito in Standard 5 English, Unit 10, Health Care.

Here they are asked to order a series of events in the life cycle.

They should research how long each phase of the life cycle takes and record their findings.

You could draw a diagram of the life cycle on the board or on chart paper. Encourage pupils to produce their own drawings before you give them ones to copy.

Make sure the pupils take note of the time it takes for the life cycle to be completed. They should also be aware of how long a mosquito lives for. They could compare this to life expectancy of other animals as well as people.



The Butterfly

Activity C in the Pupil's Resource Book on page 111 sets up a practical investigation where the pupils go out and collect caterpillars, create an environment for them and observe them while they go through the stages of changing into an adult butterfly or moth.

Go through the procedure with the whole class. They should work in small groups.

Their findings could be presented on charts or they could make group booklets to describe their investigation. Make sure that all pupils contribute to the data collection and discussions as well as the write up.

Section 5: Solomon Time

You could set the pupils a task of finding out different ways that people have used to measure in Solomon Islands. You could ask them to talk about this at home first. Get them to interview members of the community to see what they can find out.

If you have older people in your community they would be good people to ask. Maybe someone would come to your class and talk about this to your pupils.

Are there any special 'time' words that you use in your language? If there are build up a word bank of them and what they mean with the class.

Chapter 7: Shopping Survey

Introduction

This chapter of activities was inspired by an article which appeared in the Solomon Star newspaper. A journalist had looked at three supermarkets in Honiara and had compared the price and the quality of goods sold in each one. Pupils will look at some of this information, discuss it and draw conclusions from what they have read.

This will lead them on to conducting their own shopping survey.

The activities suggested are often **either, or** activities. This is because different shopping surveys have been suggested depending whether your school is in a rural location where there may only be one local store, or an urban setting where there may be many.

Newspaper Report

Read through the report in the Pupil's Resource Book on page 113 and discuss the information given with the pupils. Put the pupils into small groups and let them talk about the information in the article. Tell them to make notes of what they talk about. What conclusions do they come to by studying the figures?

Bring the whole class together and let them tell the class what they found out. Make sure they use appropriate vocabulary like **cheaper, dearer, expensive, more expensive, less expensive.**

Let the pupils work through the activities in pairs. Tell them to do the activities individually and then check their answers with their partner. Did they both come up with the same answers?

Activity 2, introduces the idea of **shopping around**. This is when you go to more than one store to check the price of what you want, then buy it at the cheapest store. Ask the pupils questions like these:

- Is shopping around a good thing to do?
- What could be the drawbacks?
- What if the shops are far apart, for example, how would you get from one shop to another?
- If you took a bus or a taxi would the cost of that be worth the saving?

Ask the pupils what they think? Tell them you are asking them for their **opinions**.

Ask the pupils if, **cheapest is always best**? For what reasons might it be better to buy more expensive items sometimes?

Pupils could come with ideas such as:

- food which is not fresh or out of date, stale food is not worth the money;
- food were packaging is damaged might be contaminated;
- sometimes if you pay more you get better quality goods.

Answers

1. Wings $59.90 - cheapest
   Sunrise $63.05
   Deli in the Plaza $71.60 – most expensive
2. Shopping around saves $2.70.
3. Total of all products
   Wings $142.65
   Sunrise $148.25
   Deli in the Plaza $149.30
4. Teacher to assess each pupil's work individually.

   A bar or column graph would be a good way to present the information. Make sure the graph has a title, axes are labelled and the graph is drawn accurately.

Shopping Survey

In this section in the Pupil's Resource Book on page 114 there are some suggestions for conducting a shopping survey. What you actually get the pupils to do will depend on where you live. The suggestions here could lead you to other ideas as to what the pupils could do. Remember the pupils may have some ideas of their own too.

Here is a summary of the activities.

Activity	Description	Activities and Skills
Activity 1: Shopping Survey **a. Town** **b. Village**	Research activity, using newly collected data to compare local stores or compare one local store with data in Solomon Star article.	Collect Data. List and compare goods and prices. Present results as a table or graph. Interpret results. Write a report explaining findings.
Activity 2 **Letter to Solomon Star**	Using their findings from activity 1, pupils compose a letter about their findings to the Star to argue a point or present information.	Writing a letter expressing an opinion, based on the evidence (data) they have collected. Recount of how the survey was conducted and opinions.
Activity 3 **Price Increase Over Time**	Comparing how prices of different goods change over time, pupils look at cost from 2 years ago.	Research, interviewing store keepers and customers. Evaluating findings and writing a report.
Activity 4 **Retail Survey – What shops are Available in your Area?** **a. Town** **b. Village**	Categorising shops according to what they sell, or looking at different types of items sold in one store.	Categorising different types of shops. Drawing a plan or sketch map. Drawing conclusions from findings. Writing a report about how survey was conducted and what they found out. Making recommendations and suggestions how shops could be improved in area.

This shopping survey brings together not only the pupils mathematical skills but also skills linked with community studies, geography and history as well as English and literacy skills.

Interviewing to find out data for research builds on pupils' confidence and develops their social skills while analysing and forming opinions based on sound research is developing essential critical skills.

Chapter 8: Puzzles

The puzzles in this chapter are intended to challenge pupils and extend their thinking. The puzzles are varied. Some problems that can be solved fairly quickly, others will need persistence. Pupils will need to apply a range of their mathematical skills to work out the puzzles, including:

sorting	reasoning	predicting and testing
working systematically	classifying information	evaluating the solutions
working backwards	drawing diagrams	guess and check

Some of the problems can be extended by asking questions such as: What if there were more boxes? What if you tried three-digit numbers? and so on. The puzzles can also be extended by asking the pupils to design similar puzzles of their own to give to their friends to solve.

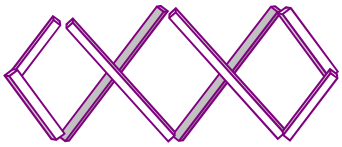
How you use these puzzles will depend on your other maths work schedule this term.

You could set a maths puzzle challenge every week so pupils have a puzzle they know they have to solve by the end of the week.

You could organise a whole set of lessons around the puzzles including pupils writing their own.

Solutions to Puzzles

1.Square it Up



2. Money Bags

Put 1 cent, 2 cents, 4 cents and 8 cents in the four bags.
Any sum from 1 cent to 15 cents can be made with these amounts.

3. Age Problems

a. I am 48 years old (or possibly 104).
b. I am now 26 years old.
c. In 38 years time, when I am 64, my age will be both a square number and a cube.
d. I am 9 years old now

4. Shape Puzzle

▲	♡	▲	○	29
♡	○	♡	▲	**25**
○	○	○	○	**20**
▲	♡	♡	▲	28
27	22	25	**26**	

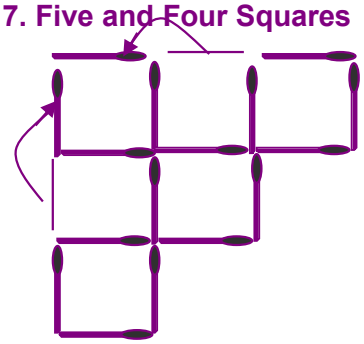
5. Money Puzzle

Jim won $540,000.00

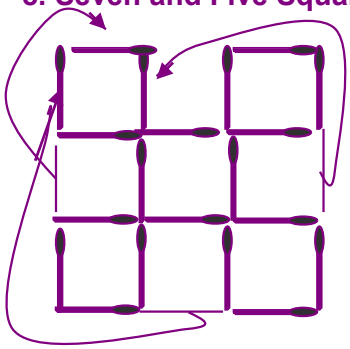
6. Coins on the Table

Anna put 12 coins on the table.

7. Five and Four Squares



8. Seven and Five Squares



9. Presents

A. $2.00
B. $4.00
C. $6.00
D. $1.00
E. $8.00

10. Gold Bars

- Move two bars from pile 1 to pile 3.
- Move one bar from pile 4 to pile 2.

11. Dan the Detective

a. 48
b. 63

12. Riddle

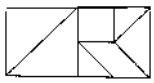
81

13. Fish

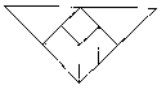
Smallest fish	13 kg
Middle fish	20 kg
Largest fish	39 kg

14. Tangram

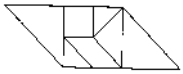
a.



b.



c.



15. Dropped Ball

4.5 m

16. Three Monkeys

There are 10 possibilities

1, 3, 21	3, 5,17
1, 5, 19	3, 7, 15
1, 7, 17	3, 9, 13
1, 9, 15	5, 7, 13
1, 11,13	5, 9, 11

17. Nick-names

Kaylen is Ace
Matthew is Curly
Jackson is Fatty
Nuatali is Spider

18. Super Cook

Over 5 days Mrs Bun made 24, 20, 16, 12 and 8 cakes. She made 84 cakes altogether.

19. Sail Away

First, the two women cross the river together. One woman stays on the other side while the other paddles the boat back.

Next one man paddles himself across the river.

The woman on the other side then paddles the boat back to pick up the other woman.

Two women cross the river together, one stays on the other side and one brings the boat back.

The second man crosses the river, then the woman on the other side goes back to fetch the other woman again. The two women cross the river together.

20. Safety Lights

All three lights will be off after 5 seconds.
All three lights will next come on together after 120 seconds.

21. Maria's Book

The book has 221 pages.
42 of the digits are a 5.

22. Flash Harry

Overall he made a profit of $200 as follows:

April	-	-$100
May	-	+$100
June	-	-$200
July	-	+$200

23. Zids and Zods

There are 3 Zids with 4 spots and 4 Zods with 9 spots.

The 5 possible ways of making 140 are:

28 Zids;
21 Zids and 5 Zods;
14 Zids and 10 Zods
7 Zids and 15 Zods;
20 Zods.

24. Franco's Fast Food

Curry costs $9

An ice cream costs $2.50

A tea costs $1.50.

The total cost of a curry, an ice cream and a tea is $13.00

25. Animal Farm

a. Benjamin sold the duck for $72 and the hen for $48. This is a total of $120.

b. The duck cost $50 and the hen cost $74, a total of $125. The duck and hen were sold for a total of $120, so Benjamin made a loss of $5.

26. Anyone for Tennis?

Kimi, Luke, Annie and Linda play tennis. Two boys can play, but Benjamin won't play if Luke plays. So the two boys must be Kimi and Benjamin or Kimi and Luke.

Kimi will only play if Annie plays. Annie won't play with Benjamin. So the two boys must be Kimi and Luke. Luke will only play if Linda plays. So the girls must be Annie and Linda.

27. Sweet Treat

Kimi bought 4 chocolate bars and 13 fruit lollipops, or 10 chocolate bars and 8 fruit lollipops.

28. Millennium

a. 00:33:20 1Jan. 2000
b. 09:20:00 2 Jan. 2000
c. 08:00 23 March 2000
d. 00:00 23 June 2005
e. 00:00 1 May 2038

29. Saving

a. $17
b. It took her 20 weeks
c. 1 year $44.20
d. 5 years $221
e. 20 years $884
f. 50 years $2,210

30. Wet T-shirt

It should take 30 minutes for the 20 T-shirts to get dry out in the sun at the same time!

Glossary of Terms

acute angle An angle which is less than 90°.

AD Stands for anno domini. This is Latin for, 'the year of our Lord'. For example: 153 AD means 153 years after the birth of Jesus Christ.

addition The process of putting amounts together to obtain a sum or total.

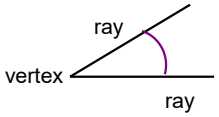
adjacent Next to.

algorithm The setting out of a mathematical problem in a certain way.

a.m. Morning. (From the Latin **ante meridiem**) Any time between midnight and noon.

analogue clock A clock face with numbers from 1 to 12 and two hands to show the time.

angle The amount of turn between two lines around a common point.



The lines are called rays. The common point is the vertex.

annual Happening once every year.

anti-clockwise The opposite direction to the normal movement of a clock.

apex The highest point of a solid (3D) shape from its base.

approximation An estimate.

For example 398 x 5 can be rounded to 400 x 5 to give an estimate or approximation of about 2,000.

arc A section of a circle or curve with two end points.

area The surface covered by any 2D shape. Area can be measured in cm², m², hectares and km².

arm A term often used to describe the rays that form an angle.

ascending order From smallest to largest.

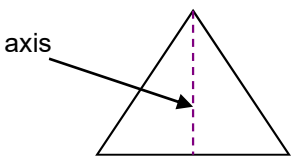
For example: 12, 21, 31, 54, 79, 103

asymmetrical Without any line of symmetry.

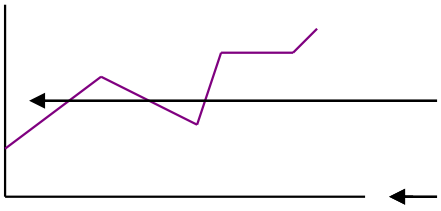
attribute A feature or characteristic by which something can be classified. For example, shapes can be classified according to the following attributes: size, colour, shape, thickness, number of sides.

average The total of a series of numbers divided by the number in the series.

axis (1) A line which divides a shape into two equal parts.



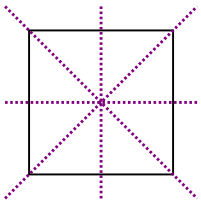
axis (2) The horizontal and vertical lines used for measurement on a graph.



The vertical line is the **y-axis.**

The horizontal line is the **x-axis**.

axis of symmetry Also referred to as **line of symmetry.** An imaginary line that divides a shape into two identical parts, also referred to as a line of symmetry.



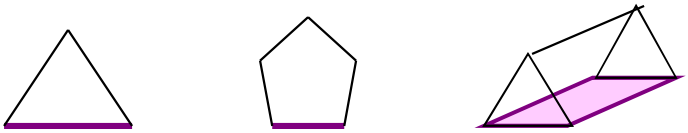
For example, a square has four axes of symmetry.

balance (1) A device used to measure the mass of objects or the act of balancing.

balance (2) This is a banking term for the total amount of money a customer has in their bank account at any specific time.

bar graph A method of recording information as a graph. This may be either in columns (vertical) or rows (horizontal) and is also called a column graph.

base (1) The bottom face or line of any face.



base (2) The number on which a number system is based. The decimal number system is a **base 10** system. (Hindu-Arabic system)

BC This stands for 'before Christ'. For example: 34 BC means 34 years before Christ was born.

bearing A direction that is taken from a fixed point using degrees.

brackets Symbols **(** and **)** used to group numbers and functions in a sum to indicate the order of operations. For example: (3 + 6) x 7 = 63

breadth The lesser measurement of a shape which is also called **width**.

C The symbol for Celsius.

calculate To work out an answer.

calculator A small machine that performs quick mathematical operations.

calendar A system of breaking the year up into months, weeks and days.

capacity The amount a container can hold. Capacity is also called **volume**. Capacity can be measured in cm^3, m^3, mL, L and kL.

Celsius A scale for measuring temperature from 0° to 100°.

For example: 0°C is the temperature at which ice begins to melt, 100°C is the boiling point of water and 37°C is healthy human body temperature.

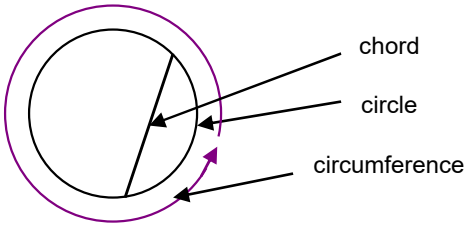
centimetre A unit of measurement of length. One hundredth of 1 metre. 100 cm = 1 m

century One hundred years.

chance The likelihood of an event happening. Used in probability.

change Money that is given back when making a purchase.
For example: If a $10.00 note is used for a $3 item, the change is $7.00.

chord A line joining two points on the circumference of a circle.



circle A plane shape bounded by a continual curved line which is the same distance from its centre point.

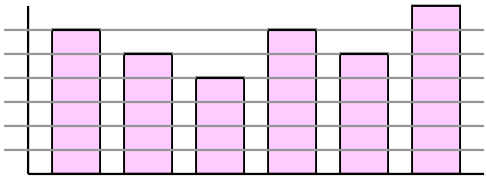
circumference The distance around a circle.

classify To arrange into groups according to given characteristics.
For example: to classify shapes according to number of sides or angles.

clockwise The direction in which the hands of the clock move.

cm The abbreviation for centimetre.

column graph A graph which uses vertical columns to represent data. Also called a vertical bar graph.



common denominator A common multiple of the numbers in two or more fractions. This is used when performing operations on fractions with different denominators. Such as, 🗎 + 🗎. The common denominator is 12.

compass (1) An instrument used for drawing circles.

compass (2) An instrument used for telling direction. (North, South, East and West).

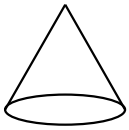
composite Made up of more than one.

computation Working out an answer.

Concentric circles Circles with the same centre.

concrete materials Real objects used to teach mathematical concepts.

cone A shape with a circular base, one vertex and one curved surface.



congruent Identical, or exactly the same.

conservation The concept that an object or group or objects will retain the same value even when rearranged.

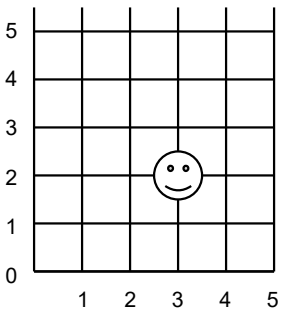
For example: A watermelon cut into two pieces has the same volume and mass as the whole watermelon.

12 objects arranged in two rows of six is the same in quantity as 12 objects arranged in three rows of four.

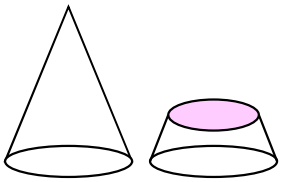
coordinates Numbers or letters used to show location on a grid.

For example (2,3). The first coordinate refers to the horizontal position (x-axis), the second coordinate refers to the vertical position (y- axis).

Maps also use coordinates.



cross section The face that is left when a three dimensional shape has been cut through.
For example: the cross section of a cone is a circle.



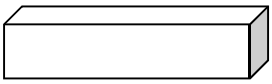
cube A three dimensional shape that has six square faces of equal size, eight vertices and twelve edges.

cube octahedron A polyhedron with 14 faces, six squares and eight triangles.

cubic centimetre A cube used for measuring volume that has sides of one centimetre in length. Written as **cm³**.

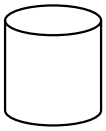
cubic metre A cube that has sides of one metre in length used for measuring volume. Written as **m³**.

cuboid A cube-like shape. Also called a **rectangular prism**.



curve A curved line.

cylinder A three-dimensional shape constructed of two congruent circular faces and one, wrap around, rectangular face. A can is a cylinder.



data Information that has been collected such as a set of numbers or facts, or the results of a survey.

day A 24-hour time period. The time it takes for the earth to rotate once on its axis.

decade Ten years.

decagon A two-dimensional shape with 10 sides.

decahedron A three dimensional shape with 10 faces.

decimal fraction Any fraction recorded as a decimal. For example, 0.1, 0.5, 2.45

decimal place The place occupied by a numeral which shows its value in a decimal number.

Thousands	Hundreds	Tens	Ones	decimal point	tenths	hundredths	thousandths
2	**4**	**5**	**8**	**.**	**3**	**7**	**9**

decimal point The point which separates whole numbers from decimal fractions, placed between the ones and the tenths decimal places.

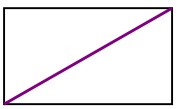
degrees (1) A unit of measurement of temperature. Represented by the symbol º. Temperature is measured in degrees Celsius or ºC.

degrees (2) A unit of measurement of an angle of turning. Based on a complete rotation of 360 degrees. Degrees are written using the symbol º.

denominator The number below the line in a fraction. It tells how many parts in the whole.
For example, in the fraction ,1 is the numerator and 3 is the denominator.

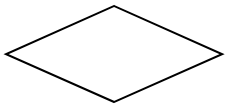
descending order Decreasing in value.
For example a number sequence starting with the largest and going to the smallest 23, 17, 15, 13, 9.

diagonal A line which joins two non-adjacent vertices of a polygon.



diameter A straight line touching both sides of a circle which passes through the centre point.

diamond A two-dimensional shape with four equal sides and two sets of matching angles. Also called a **rhombus**.



dice Cubes marked with spots or numbers.

digit A symbol used to write a numeral.

For example, 5 is a 1-digit number, 724 is a 3 -digit number.

digital clock A clock which displays the time in numerals; it has no hands.

dimension A measurement. The dimensions of a shape include its height, breadth and length. Flat shapes have only two dimensions while solid shapes have three.

direction The course, or line, along which something moves. For example, up, down, left, right, forward, north, south, east and west.

displacement A method used to measure the volume of an object by submerging it in water. The volume of the water displaced equals the volume of the object.

distance The space between two objects or points.

dividend An amount which is to be divided.

For example, in the sum 27 ÷ 3 = 9, 27 is the dividend.

divisible A number is divisible if it can be divided without remainders. For example, 12 is divisible by 4, 6, 3, 12, 2 and 1.

division The mathematical operation that involves breaking up groups or numbers into equal parts. Also called **sharing**.

divisor The number which is to be divided into the dividend.

For example, in the sum 27 ÷ 3 = 9, 3 is the divisor.

dodecagon A two-dimensional shape with 12 sides.

dodecahedron A solid (3D) shape that has twelve identical faces.

dollar A unit of money equal to 100 cents. Written as **$**.

domino A shape made up of two squares.

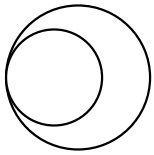
dot paper Paper covered with equally spaced dots and used for drawing graphs and shapes.

double Twice as much, multiply by two.

double tetrahedron A polyhedron with six triangular faces made up of two tetrahedrons.

dozen A group of twelve.

dodecahedron A polyhedron with ten pentagonal faces.



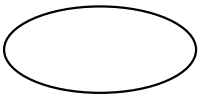
eccentric circles Circles which do not share the same centre.

edge The intersection of two faces in a solid shape.

element A member of a set.

For example, **a** is an element of the set of vowels and **4** is an element of the set of even numbers.

ellipse An oval-shaped closed curve.



enlarge To make larger or project.

equal The same in value or amount. Shown by the symbol **=**. Means the same as **equivalent.**

equilateral triangle A triangle with three equal sides and three equal angles.

equivalent fractions Fractions with the same value. For example, $\frac{1}{2} = \frac{2}{4}$

estimate An approximate calculation, performed to give a rough idea of the answer
For example, 206 x 2.1 is about 200 x 2 an estimated answer is 400.

even number Any number that can be divided by 2 without a remainder.

expanded notation A way of writing numbers to show the actual value of each digit.
For example, 2,567 = 2,000 + 500 + 60 + 7

faces The surfaces of a three-dimensional shape.
For example a cuboid has 6 faces.

factor Any whole number that can be multiplied by another number to make a given number.
For example, the factors of 12 are 6, 4, 3, 2, 1 and 12. 5 is not a factor because it cannot be multiplied by another whole number to give twelve.
A common factor is a number which is the same for two different numbers. For example the common factors of 6 and 9 are 3 and 1 because 3 x 2 = 6, 1 x 6 = 6, 3 x 3 = 9, 1 x 9 = 9.

formula A rule or principle expressed in algebraic symbols.
For example, the formula for area is **a = l x w**

fortnight The time span of 14 days or 2 weeks.

fraction A part of a whole. Written as either a common fraction or a decimal fraction
For example, 23 parts out of 100 = $\frac{23}{100}$ or 0.23

geo board A board studded with pegs or nails used to make shapes using elastic bands or string.

geo-strips Strips of card or paper that can be joined together to make shapes. They can be used to test rigidity.

gram A unit of measurement for mass. Written as **g**. There are 1,000 grams in a kilogram, 1,000 g = 1 kg.

graph A visual way of recording and presenting information. There are many types of graphs including column, bar, line and pie graphs.

greater than A symbol **(>)** used to show the relationship between numbers.
For example 25 > 18, 100 > 75

grid paper Squared paper often used for drawing graphs.

gross mass The total mass of any item including its packaging.

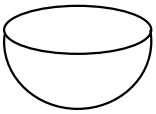
grouping Breaking things into groups, used in the teaching of division.

ha The symbol for hectare.

half One part of something that is divided into two equal parts.

hectare A unit of measurement of area used to measure land. A hectare measures 10,000 m².

hemisphere One half of a sphere.

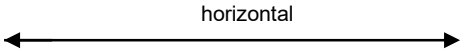


heptagon A two-dimensional shape with seven sides.

hexagon A two-dimensional shape with six sides.

hexonimo A shape made up of six squares.

horizontal A surface parallel to the horizon.



hour A unit of measurement for time. One hour equals 60 minutes.

hundredth One part of a whole that has one hundred parts.

improper fraction A fraction in which the numerator is larger than the denominator. An improper fraction has a value higher than one.
For example $\frac{7}{4}$ or $\frac{9}{9}$.

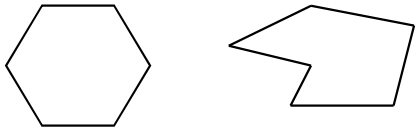
interval (1) The portion of a straight line lying between two points.

interval (2) The space of time between two events.

interest A banking term used for the amount of money the bank pays the customer for saving money in their bank account. Usually paid at a percentage rate per year.

irregular polygon A polygon which is not in its regular shape. The angles are different sizes and the sides have different lengths.

For example a regular hexagon and an irregular hexagon:



isosceles triangle A triangle that has two sides and two angles the same.

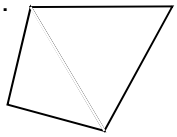
kg The symbol for kilogram.

kilogram The base unit of mass in the metric system. 1 kilogram = 1,000 grams. (1 kg = 1,000 g)

kilolitre A unit of measurement of capacity, which is equal to 1,000 litres. Written as **kL**.

kilometre A unit of measurement of length which is equal to 1,000 metres. Written as **km**.

kite A quadrilateral with two different pairs of sides of equal length.



kL The symbol for kilolitre.

km The symbol for kilometre.

L The symbol for litre.

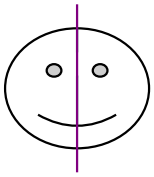
leap year A year in which there are 366 days, instead of the usual 365. This happens every four years when there is an extra day added to February.

length The measurement of a line or the longer measurement of a shape.

less than A symbol (**<**) used to show the relationship between numbers.
For example 24 < 42, 250 < 520

line graph Information represented on a graph by joining plotted points with a line.

line of symmetry A line which divides something exactly in half.



litre A unit of measurement of capacity used to measure liquids. For example, 1,000 millilitres equal 1 litre.

location A place or position of something, usually shown by coordinates.

loss To sell something for less than you paid for it.

m Symbol for metre.

magic square A number puzzle in which all numbers when added either horizontally, vertically or diagonally give the same answer.

21	21	21	21
10	**3**	**8**	21
5	**7**	**9**	21
6	**11**	**4**	21

mass The amount of substance in an object. Common mass measurements are grams, kilograms and tonnes. Mass is sometimes referred to as **weight** in maths although this is scientifically incorrect**.**

measure To work out the length, width, height, mass, volume or area of an object using a standard unit.

mental Making calculations in your head rather than writing anything down on paper.

metre A unit of measurement of length. 100 centimetres equals 1 metre. (100 cm = 1 m)

metric A system of measurement. The basic units are the metre to measure length, the kilogram for mass and the litre for volume or capacity.

millennium A unit of measurement for time, one millennium equals one thousand years.

millilitre A measure of capacity. Written as **mL**. 1,000 millilitres equals 1 litre. A one-centimetre cube (1 cm^3) would hold 1 mL of liquid.

millimetre A unit of measurement of length. There are 10 mm in one centimetre.

million 1,000,000

minus To take away or subtract. The symbol for minus is **–**.

minute A measure of time which is one sixtieth of an hour. A minute is equivalent to sixty seconds.

mirror image The reflection of an object.

mirror line A line drawn to separate an object from its reflection.

mL Symbol for millilitre.

mm Symbol for millimetre.

month A period of approximately four weeks, between 28 and 31 days. There are twelve months in a year.

multiple A number formed by multiplying one whole number by another.

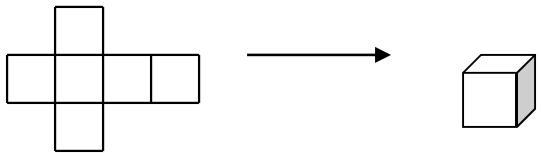
For example, 24 is a multiple of 4 because 24 is the result when 4 is multiplied by 6.

multiplication A mathematical operation where a number is added to itself a number of times. Multiplication is the same as repeated addition. The symbol for multiplication is x.

For example, 2 + 2 + 2 + 2 + 2 is the same as 2 x 5 = 10

negative numbers Numbers with a value less than zero. A minus sign is placed in front of the number to identify it. (-6, -28)

net A two dimensional shape which can be folded to form a three dimensional shape. An unfolded cardboard box is the net of the box. The example shows the net of a cube.



nonagon A two-dimensional shape with nine sides.

notation Symbols used in mathematics to represent numbers or operations, such as the numerals 0 – 9 and symbols x, +, = and ÷.

number line A line on which numbers are marked. Number lines can be used to represent operations.

For example, 3 + 5 = 8

number sequence A set of numbers which follow a regular pattern.

For example: 1, 3, 5, 7, 9, (+2)

3, 9, 27, 81, (x3)

numeral A symbol or character used to represent a number.

For example, Hindu Arabic numerals 1, 2, 3, or Roman numerals I, II, III,

numerator The number above the line in a fraction that tells how many parts of the whole.

For example, in the fraction 🗎, 1 is the numerator and 3 is the denominator.

oblong A rectangle with two sets of parallel sides of different lengths.

obtuse angle An angle that is larger than 90° but less than 180°. Obtuse angles appear blunt compared to acute angles, which are less than 90° and appear sharp.

octagon A two-dimensional shape with eight sides.

odd number A number that cannot be divided by 2.

For example, 1, 3, 5, 7, 9, 11, 13.

operations Mathematical processes such as, multiplication, subtraction, division and addition used to solve mathematical problems.

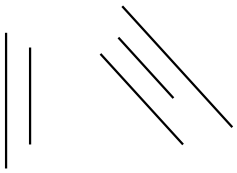
ordinal number A number which shows place or the order.

For example, 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, 6^{th},

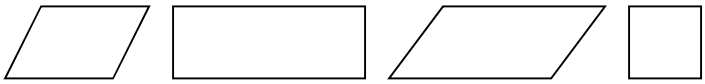
oval A two-dimensional shape in the form of an egg. An oval has only one line of symmetry. One end is more pointed than the other.

palindrome A number which reads the same forwards and backwards. For example: 121, 565, and 3,993.

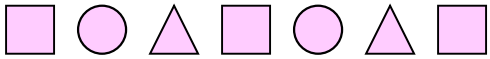
parallel lines Two or more lines exactly the same distance apart. Parallel lines do not need to be the same length.



parallelogram A four sided figure, in which each pair of opposite sides are parallel and of equal length.



pattern A series of shapes, letters, numbers or objects arranged in a recurring order.



pentagon A closed two-dimensional shape with five sides.

pentomino A shape made up of five squares.

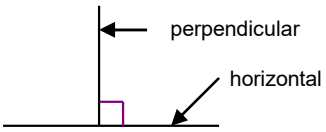
per cent % Out of a hundred. A percentage is a fraction of 100.
For example, 65% means 65 out of 100.

percentage increase When a total quantity increases by a given amount it can be calculated as a percentage increase.

percentage loss When a total quantity decreases by a given amount it can be calculated as a percentage loss.

perimeter The total distance around the outside of a shape. The perimeter of a circle is its circumference. The perimeter of a field is the sum of the lengths of each side.

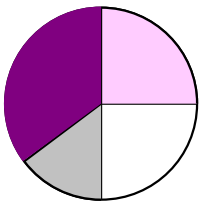
perpendicular A vertical line forming a right angle with the horizontal.



picture graph A graph using pictures or symbols to represent data.

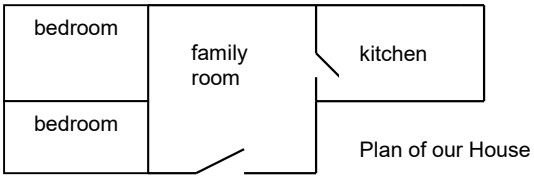
pie graph A circular graph used to represent how the whole of something is divided up. The parts look like portions of a pie or cake.

Also known as a **circle graph**, a **pie chart** or **sector graph**.



place value The value of a digit depending on its place in a number.
For example: in the number, 237, the digit 2 has a place value of 200, 3 has a value of 30 and 7 has a value of 7.

plan A diagram drawn from above showing the position of objects.



Plan of our House

plane A flat surface, such as a drawing on a page.

plane shape A two-dimensional shape. The boundary of a plane surface.
For example, a square.

plus Add. The symbol for addition (+) is often called a plus sign.

p.m. Abbreviation for the Latin, **post meridiem,** meaning after midday. Any time between 12 noon and 12 midnight.

polygon A closed shape with three or more angles or sides. For example, triangle, square, rectangle, hexagon and pentagon.

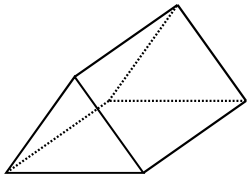
polyhedron A mathematical name for a three-dimensional shape. (Plural polyhedra).

polyomino A shape made up of two or more squares.

position The location of one object in relation to other fixed objects. For example, third from the left; north of Honiara.

prime number A number that is only divisible by itself and 1.
For example, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

prism A three-dimensional shape with two similar, parallel bases joined by rectangular faces.



probability The likelihood or chance of an event happening. The range of probability extends from zero to one. A probability of 0 means that an event is certain **not** to happen while a probability of 1 means that it is certain to happen.

problem A mathematical problem is a question which requires the application of mathematical knowledge and skills in order to find a solution.

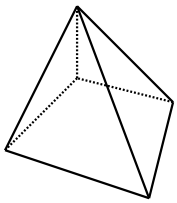
product The answer to a multiplication sum.
For example: The product of 12 and 10 is 120.

profit The difference between the amount of money earned and the amount of money spent.

properties Distinguishing features of objects or shapes, such as the number of sides, or the number of angles, etc.

protractor An instrument used to measure angles.

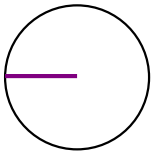
pyramid A three-dimensional shape which has one base. All other faces are triangular and meet at a single apex opposite the base.



quadrant A quarter of a circle.

quadrilateral A two-dimensional shape with four sides, such as a square or a rectangle.

quarter One of four equal parts of a whole or group. Written as ¼.



quatronimo A shape made up of four squares.

radius A straight line extending from the centre of a circle to the outside. A radius is half the diameter.

random selection A sample taken in which all items have an equal chance of being picked. No restrictions apply.

For example, drawing names out of a box.

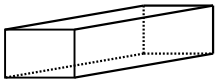
ratio The number of times one quantity contains another quantity.

For example: the ratio of petrol to oil is 9:1. This means that for every 9 parts of petrol one part of oil is added.

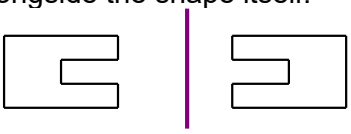
ray A line with a starting point but no end.

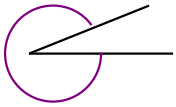
rectangle A four-sided figure with four right angles and two pairs of parallel sides. An oblong is a rectangle with two sets of parallel sides of different lengths. A square is also a rectangle.

rectangular prism A three-dimensional prism with two similar rectangular bases.



reflective symmetry The mirror image of a shape creates a symmetrical image when viewed alongside the shape itself.





reflex angle An angle between 180° and 360°.

regroup To alter the formation of a group, usually for a specific purpose.

For example, 42 may be regrouped to 30 and 12 for subtraction of a number larger than 2 from the ones column.

regular octahedron A polyhedron with eight triangular faces, which can be made by joining two square based pyramids at the bases.

regular polygon A two-dimensional shape with sides of equal length and equal angles.

remainder The amount left over after a number has been divided.

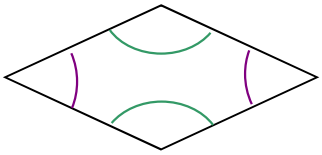
For example, 29 ÷ 4 = 7 and the remainder is 1.

repeated subtraction The process of subtracting a divisor from a number until no more can be subtracted.

For example, 24 – 8 = 16 – 8 = 8 – 8 = 0

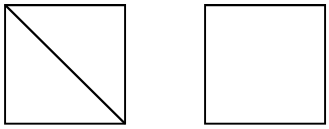
revolution A complete turn of 360°.

rhombus A four-sided shape with four equal sides. Opposite angles are equal.



right angle An angle of 90°.

rigid Strong and secure. A rigid structure is one that cannot be moved.



rigid non-rigid

Roman numerals A number system devised by the ancient Romans which uses letters to represent the numbers. I, II, III, IV, V, VI, VII, VIII, IX, X (1 – 10)

50 = L, 100 = C, 500 = D, 1,000 = M

rounding off To alter the exact value of a number by giving that number a more convenient value, usually for the purpose of estimating.

For example 96 can be rounded to 100, or 2,189 can be rounded to 2,000.

rule An instruction or pattern to be followed.

sample Some items taken from a larger group.

For example, a sample of the pupils' work was displayed. A sample of 25 out of 250 villagers was interviewed.

scale (1) A system of measurements used on instruments such as, thermometers, rulers, and speedometers.

For example the scale on a thermometer measures temperature, the scale on bathroom scales measures mass.

scale (2) A system of measurements drawn on a graph to show what data is represented by each axis. On a map the scale is shown to define the ratio by which the map has been altered in comparison with the original. For example 1 cm = 10 km.

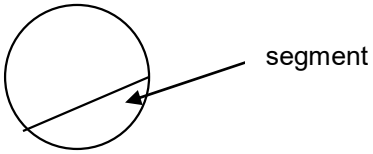
scalene triangle A triangle with sides of different lengths and angles of different sizes.

scales An instrument used to measure mass.

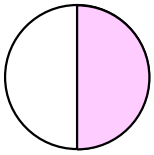
second A unit of measurement of time. There are 60 seconds in one minute.

sector Part of a circle, bounded by two radii and the arc of the circle.

segment A part of a circle formed by a line which joins any two points on the diameter.



semi-circle Half a circle.



sequence A group of numbers or objects arranged to follow a particular rule.

For example, 5, 10, 15, 20, 25, 30.

set A group of objects or numbers belonging to a distinct group.

For example: the set of prime numbers (1, 3, 5, 7, 11 …), the set of two-dimensional shapes (square, circle, triangle …), the set of Solomon Islanders.

set square A triangular instrument used for drawing.

shape The outline of an object.

sharing A method of division in which a number of objects are shared into equal groups.

side The boundary line of a two-dimensional shape. For example, a parallelogram has four sides.

side view The shape of an object when viewed from the side.
For example: the side views of a pyramid and a cone are both triangles, but the side view of a cylinder is a rectangle.

solid Three-dimensional.

sort To separate objects according to given criteria such as colour, shape or weight.

speed Distance travelled in a specific time.
For example: 60 kilometres per hour; 60 km/h.

sphere A perfectly round three-dimensional shape.

square A two-dimensional shape consisting of four equal sides and four right angles. A square is also a rectangle.

square centimetre A unit of measurement for area measuring 1 cm x 1 cm. Written as cm^2.

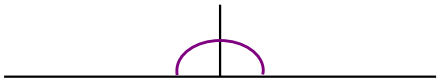
square kilometre A unit of measurement for area measuring 1 km x 1 km. Written as km^2.

square metre A unit of measurement for area measuring 1 m x 1 m. Written as m^2.

square number The product of a number multiplied by itself.
For example, $2^2 = 2 \times 2 = 4$, $3^2 = 3 \times 3 = 9$

squared paper Paper with a square grid pattern. Used for constructing two-dimensional drawings and graphs.

straight angle An angle of 180° made up of two right angles.

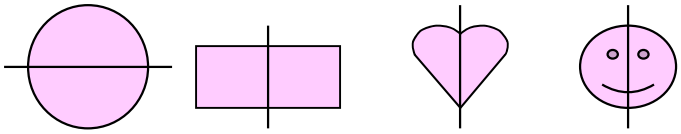


subtract To remove part of a group to find the difference in value. Also known as to **take away** or **minus**.

sum The total after addition.

surface area The total area of all the faces of a three-dimensional object.

symmetry An exact match or balance between the two halves of a shape, pattern or object. A shape has line symmetry if both of its parts match when it is folded along a line.



tables (1) Charts used to present data or information in columns and rows. For example:

A Table to Show the Hours of Sunshine in One Week						
Sun	**Mon**	**Tues**	**Weds**	**Thurs**	**Fri**	**Sat**
12	4	6	10	8	3	6

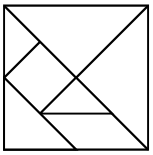
tables (2) Lists of multiplication facts used to help pupils learn.
For example, 0 x 3 = 0, 1 x 3 = 3, 2 x 3 = 6, 3 x 3 = 9

take away To **subtract**.

tally A quick way of recording and counting. One stroke represents each item. The fifth stroke usually crosses the four preceding strokes so that the tally can be easily counted.

= 18

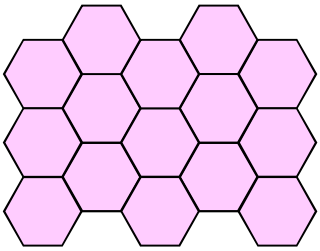
tangram A square cut into seven pieces. Tra inese tangrams are arranged to make pictures.



temperature A measure of the heat or coldness of things. Temperature is measured in degrees Celsius written as **ºC**.

tessellation A tessellation is formed by repeating one or more shapes so that they fit together without leaving gaps or overlapping. Tiles and bricks can be laid in a tessellating pattern.

For example, this tessellation uses regular hexagons.



thermometer An instrument used to measure temperature.

three-dimensional Having the three dimensions: height, length and width. Solid objects have three dimensions whilst flat shapes have only two (length and width). This term is abbreviated to **3D**.

time line A line which represents a period of time. Intervals of time within the period can be shown on the line.

tonne A unit of measurement for mass. Written as **t**, 1 tonne is the same as 1,000 kilograms.

top view The shape an object has when viewed from above.

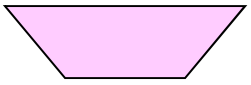
For example the top view of a cone is a circle and the top view of a triangular prism is a rectangle.

total The result of addition.

For example, 4 + 5 = 9, The total is 9.

trading A process used in mathematical operations. In subtraction for example, where there are not enough ones to subtract, a ten is traded from the tens column and added to the ones column.

trapezium A four sided figure with only one pair of parallel sides.



triangle A two-dimensional shape with three sides and three angles.

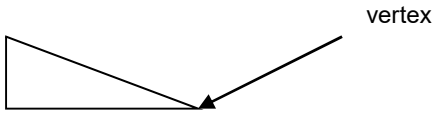
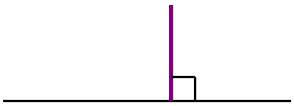
trionimo A shape made up of three squares.

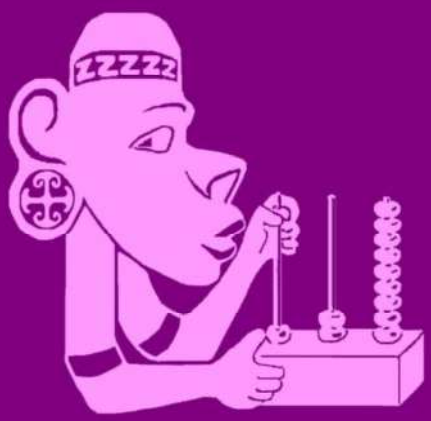
turn To rotate around a point.

twelve-hour time Traditional clocks and watches show time on a clock face that is divided into 12 hours. Two 12-hour periods (a.m. and p.m.) make up each 24-hour day.

For example: Half past three in the afternoon or 3.30 p.m.

twenty-four hour time Some digital clocks and watches display time in 24 hour intervals, to Distinguish a.m. from p.m.

	For example: 1530h
two-dimensional	Having only two dimensions. A flat or plane shape is two-dimensional having width and length but not height. (Abbreviated to **2D**.)
unit	One. The units column is the ones column in a place value chart.
units	Formal or standardised amounts agreed upon for taking and recording specific measurements. For example: a unit of length is the metre and a unit of mass is the gram.
vertex	The point where two or more lines meet to form an angle. 
vertical	Upright. A straight line at right angles to the horizontal. 
vertices	Plural of vertex. For example, a triangle has 3 vertices.
volume	The amount of space taken up a substance or object is the. The basic units for recording volume are cubic metres (m^3), cubic centimetres (cm^3), litres (L), and millilitres (mL).
week	A time period of seven days. Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, Saturday.
weight	How heavy an object is. In everyday use the terms **weight** and **mass** are used to mean the same. In Mathematics, mass is the amount of matter in an object. Weight is (more accurately) a measure of the effect of the force of gravity acting on the mass.
whole numbers	Numbers from zero to infinity without fractions or decimals. For example 0, 1, 2, 3, 4, 5, 6…….
width	The shorter side a shape. Sometimes called **breadth**.
year	A unit of time. There are 365 days in a year or 366 days in a leap year. January 1 is the first day of the year. It takes one year for the earth to orbit the sun.
zero	The numeral 0. Other terms used for this are **nought, nothing, nil** and **none.**



Nguzu Nguzu Mathematics
Standard 6