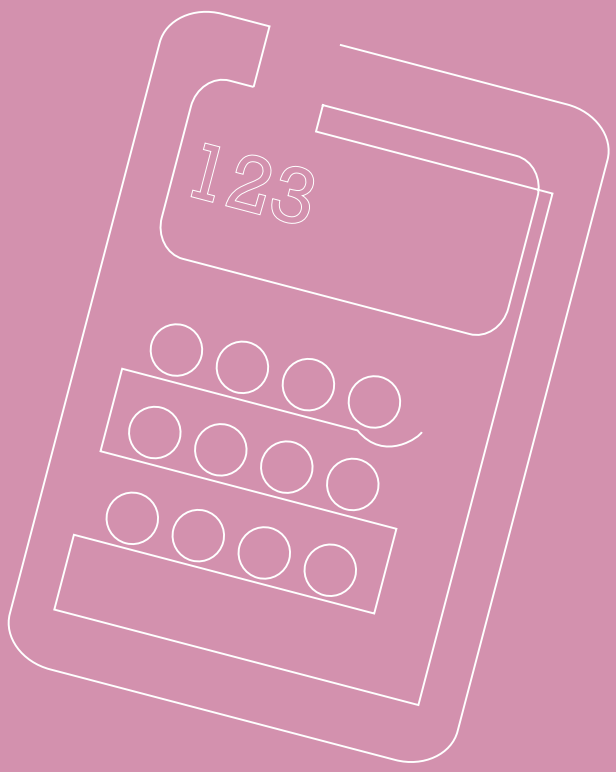
POST-PRIMARY

Mathematical Studies and Applications: Mathematics, Business Studies

Guidelines for Teachers of Students with

MILD

General Learning Disabilities



NCCA
National Council for Curriculum and Assessment
An Chomhairle Náisiúnta Curaclaim agus Measúnachta

Contents

Introduction

These guidelines are designed to support teachers of students with mild general learning disabilities who are accessing the junior cycle curriculum in the area of Mathematics.

They are part of a suite of guidelines produced by the National Council for Curriculum and Assessment with a focus on special educational needs. Each set of guidelines corresponds to an area of experience of the Junior Cycle curriculum and offers exemplars of good classroom practice in support of the knowledge and skills associated with that area of experience.

These guidelines are is designed to support the teacher of Mathematical Studies and Applications for students with special educational needs, within the context of a whole school plan.

In addition to the guidelines presented here, similar materials have been prepared for teachers working with students accessing the Primary School Curriculum. Continuity and progression are important features of the educational experience of all students, but they are particularly important for students with special educational needs. Therefore, all the exemplars presented here include a reference to opportunities for prior learning in the Primary School Curriculum.

The exemplars have been prepared to show how students with mild general learning disabilities can access the curriculum through differentiated approaches and methodologies. It is hoped that these exemplars will enable teachers to provide further access to the other areas of the curriculum. A range of assessment strategies is identified in order to ensure that students can receive meaningful feedback and experience success in learning.

Approaches and methodologies

In Approaches and Methodologies individual differences are emphasised, and potential areas of difficulty and implications for learning are outlined and linked with suggestions for approaches and methodologies for classroom use.

Individual differences in talents, strengths, and needs

All students will benefit from a variety of teaching styles and classroom activities. Students with mild general learning disabilities will benefit particularly if the teacher is aware of their individual talents, strengths, and needs before embarking on a new activity.

Consultation and/or involvement in the Individual Education Planning process as well as teacher observation will assist the teacher of Mathematical Studies and Applications in organising an appropriate learning programme for a student with mild general learning disabilities. Such an approach will assist the teacher in selecting suitably differentiated methods for the class. If learning activities are to be made meaningful, relevant, and achievable for all students then it is the role of the teacher to find ways to respond to that diversity by using differentiated approaches and methodologies. This can be achieved by

- ensuring that objectives are realistic for the students
- setting short and varied tasks
- ensuring that the learning task is compatible with prior learning
- providing opportunities for interacting and working with other students in small groups
- allowing students to spend more time on tasks
- organising the learning task into small stages
- ensuring that the language used is pitched at the students' level of comprehension and does not hinder understanding the activity
- using task analysis in outlining the steps to be learned/completed in any given task
- modelling task analysis by talking through the steps of a task as it is being done
- posing key questions to guide students through the stages/processes, and to assist in self-direction and correction

- using graphic symbols as reminders to assist students' understanding of the sequence/steps in any given task/problem
- creating a congenial learning environment by using concrete and, where possible, everyday materials, and by displaying word lists, laminated charts with pictures.

Mathematical Language

Mathematics should be seen as a language with its own vocabulary of both words and symbols.

Many students confuse mathematical language with 'ordinary' language. They say *'He's bigger than me'* when they mean older, or '*My table is longer than his'* when they mean wider. It is important to teach this language actively to the students and to reinforce it on a daily basis. Students will need to be exposed to mathematical language and have it reinforced at a receptive level in a variety of situations before they will develop the ability to use it themselves.

The vocabulary of mathematics, symbols, and tools are used in particular circumstances. In general the student is unlikely to hear or read much mathematical language outside the classroom. The teacher, as the mediator between the student and the world of mathematics, needs to examine the classroom use of mathematical language carefully. Is it consistent, accurate, and unambiguous? Will students experience the same use of language as they move from one class to another? Are students able to use appropriate mathematical language precisely? Can students relate some mathematical language to real-world situations?

Such errors can be avoided if a range of different examples is used to explain a concept. For example, if a student is taught that Figure 1 is a right-angled triangle and promptly labels Figure 2 a left-angled triangle the presentation of a range of triangles in different orientations can help correct the misconception.

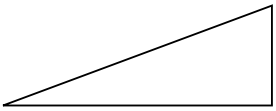


Figure 1

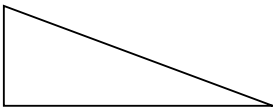


Figure 2

It is important to teach mathematical language actively to the students with mild general learning disabilities and to reinforce it on a daily basis, since they may have general language difficulties. A mathematical dictionary of words, symbols, and diagrams can be kept by the teacher and by the students themselves and can be presented as a wall chart display.

Teachers need to be aware of the danger of using mathematical *'tricks'* and *'short cuts'*. Certain phrases have become common in the mathematics classroom, particularly in the areas of arithmetic and algebra, but they often serve to conceal the concept behind what is occurring.

Language that describes transformations in terms of the surface structure only should be avoided, because it focuses attention on the form rather than the meaning which gives rise to the transformation. Examples of this would be:

Take it over to the other side and change the sign.
Cross multiply.
Move the decimal point over.
Turn it upside down and multiply.
Collect all the x's on one side of the equation.
Always do to the top what you do to the bottom.
To multiply by ten add a nought.

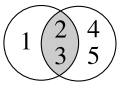
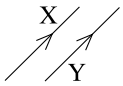
These descriptions tell someone only what to do, with the result that there is little impetus to examine them to see why they might be helpful.

Consistency of approach is vital. It is important that all teaching staff who are in contact with the student and parents are aware of the terminology being used. For example, where appropriate planning has occurred the mathematics teacher can use the language of measurement (length, perimeter, area, longer, shorter, etc.) while at the same time the English teacher can adopt reinforcement activities that incorporate the same words and the science and/or woodwork teacher can engage the students in practical measuring activities. Parents can also be encouraged to use the words at home. Keeping parents informed of the words being used and the importance of using them frequently will help the student to use them in real contexts.

The following is an example of a note that could be sent to parents:

> This week's keywords in mathematics are:
> *measure, size, length, distance, units, centimetre, metre, kilometre, longer, shorter, how long?*
>
> Please use them often and encourage your child to use them in appropriate situations.

Students may have difficulties with mathematical symbols. Charts in the classroom showing the symbol, the word, an example, and a diagram can help to reinforce a correct interpretation of a symbol. Where possible a real-world link to the symbol should also be included. Students can build up a dictionary of symbols as they progress through the course.

Symbol	Word	Example	Diagram	Real-world
∩	intersection	A∩B={2,3}		A road intersection is where two roads cross each other.
‖	parallel	X‖Y		Train tracks go on without ever meeting.

Background to the Junior Certificate Foundation Level mathematics course

These guidelines are written in the context of the area of experience Mathematical Studies and Applications as outlined in the Junior Cycle Review (1999). The topics referred to in the exemplar material are drawn from the foundation level of the Junior Certificate mathematics course. Links to the relevant primary school topics and the corresponding statements in the Junior Certificate School Programme are mentioned. This section outlines the rationale, aims, and content of the foundation level mathematics course.

The foundation level Junior Certificate mathematics course is designed for students who are not ready for, or who are unsuited to the ordinary level course. Students may not be ready to deal with some of the more abstract mathematical concepts; they may be finding the transition from primary to post-primary school particularly difficult; or they may have learning styles that are not met by the traditional approach at post-primary level. This challenges teachers to extend and diversify their teaching styles.

These students still need to learn mathematics to help them in everyday life (social mathematics), further study or training (vocational mathematics), or perhaps to enhance their thinking skills and problem solving skills. The foundation level course is designed to help the student to

- construct a clearer knowledge of basic mathematics
- develop improved skills in basic mathematics
- develop an awareness of the usefulness of mathematics
- feel she/he is making progress through the introduction of new material
- engage in a range of learning styles through, for example, the visual, spatial, and numerical aspects of mathematics.

The particular target group may respond well to activities that

- improve students' self-confidence (I can do mathematics)
- improve students' confidence in the subject (mathematics makes sense, mathematics is useful)
- support the acquisition and consolidation of fundamental skills
- embed mathematics in meaningful contexts
- create opportunities for students to experience success
- create opportunities for students to reflect on their own experience and performance.

The specific aims of the foundation level course, as stated in the syllabus, are that the course will provide students with

- an understanding of the basic mathematical concepts and relationships
- confidence and competence in basic skills
- the ability to solve simple problems
- the experience of following clear arguments and of citing evidence to support their own ideas
- an appreciation of mathematics both as an enjoyable activity through which they experience success, and as a useful body of knowledge and skills.

The assessment objectives, also stated in the syllabus, deal with mathematical knowledge, understanding, and application, and with the student's psychomotor skills and the ability to communicate what they are learning.

The content of the Primary School Curriculum is taken as the prerequisite for students following the foundation level course. As will be seen from the exemplars that follow, many of the primary strands have been revised and treated in greater depth. In this way there is a natural continuity from the primary curriculum to the post-primary curriculum.

Outline of the course

This table outlines the course content under each topic. For more detail refer to the *Junior Certificate Mathematics syllabus* and the *Junior Certificate Guidelines for Teachers: Mathematics.* These are accessible on www.education.ie

Topic	Content details
Sets	1. Listing of elements of a set. Membership of a set defined by a rule. Universe, subsets. Null set (empty set). Equality of sets. 2. Venn diagrams. 3. Set operations: intersection and union (for two sets only), complement. 4. Commutative property for intersection and union.
Number systems	1. The set **N** of natural numbers. Order ($<$, $\leq$, $>$, $\geq$). Idea of place value. Sets of multiples. Lowest common multiple. The operations of addition, subtraction, multiplication and division in **N** where the answer is in **N**. Meaning of a^n for a, $n \in \mathbf{N}$, $n \neq 0$. Evaluation of expressions containing at most one level of brackets. Examples: $2 + 7\ (4 - 1)$ $6 + 10 \times 3$ $3(14 - 5) - (7 + 2)$ Estimation leading to approximate answers. 2. The set **Z** of integers. Positional order on the number line. The operation of addition in **Z**. 3. The set $\mathbf{Q}^+$ of positive rational numbers. Fractions: emphasis on fractions having 2, 3, 4, 7, 8, 16, 5, 10, 100 and 1000 as denominators. Equivalent fractions. The operations of addition, subtraction and multiplication in $\mathbf{Q}^+$. Estimation leading to approximate answers. Fractions expressed as decimals; for computations without a calculator, computation for fractions with the above denominators excluding 3, 7 and 16. Decimals: place value. The operations of addition, subtraction, multiplication and division. Rounding off to not more than three decimal places. Estimation leading to approximate answers. Percentage: fraction to percentage. Suitable fractions and decimals expressed as percentages. Example: $\frac{32}{100}$; 32% Equivalence of fractions, decimals and percentages. Example: $\frac{42}{100}$; 0.42; 42% 4. Squares and square roots. 5. Commutative property. Priority of operations.

Applied arithmetic and measure	1. Bills: shopping; electricity, telephone, gas, etc. Value added tax (VAT). Applications to meter readings and to fixed and variable charges. Percentage profit: to calculate selling price when given the cost price and the percentage profit or loss; to calculate the percentage profit or loss when given the cost and selling prices. Percentage discount. Compound interest for not more than three years. Calculating income tax. 2. SI units of length (m), area (m^2), volume (m^3), mass (kg), and time (s). Multiples and submultiples. Twenty-four hour clock, transport timetables. Relationship between average speed, distance and time. 3. Calculating distance from a map. Use of scales on drawings. 4. Perimeter. Area: square, rectangle, triangle. Volume of rectangular solids (i.e. solids with uniform rectangular cross-section). $\frac{\text{Length of circumference of circle}}{\text{Length of diameter}} = \pi$. Use of formulae for length of circumference of circle ($2\pi r$), for area of disc (i.e. area of region enclosed by circle, πr^2). Use of formula for volume of cylinder ($\pi r^2 h$).
Statistics and data handling	1. Collecting and recording data. Tabulating data. Drawing and interpreting pictograms, bar-charts, pie-charts (angles to be multiples of 30° and 45°). Drawing and interpreting trend graphs. Relationships expressed by sketching such graphs and by tables of data; interpretation of such sketches and tables. 2. Discrete array expressed as a frequency table. Mean and mode.

Algebra	1. Formulae, idea of an unknown, idea of a variable (informal treatment). Evaluation of expressions of forms such as $ax + by$ and $a(x + y)$ where $a, b, x, y \in \mathbf{N}$; evaluation of quadratic expressions of the form $x^2 + ax + b$ where $a, b, x \in \mathbf{N}$. Examples: Find the value of 3x + 7y and of 6(x + y) for given values of x and y. Find the value of $x^2 + 5x + 7$ when x = 4. 2. Use of associative and distributive properties to simplify expressions of forms such as: $a(x \pm b) + c(x \pm d)$ $x(x \pm a) + b(x \pm c)$ where $a, b, c, d, x \in \mathbf{N}$. Examples: $3(x - 2) + 2(x + 1)$ $x(x + 1) + 2(x + 2)$ 3. Solution of first degree equations in one variable where the solution is a natural number. Examples: Solve $3x + 4 = 19$. Solve $4(x - 1) = 12$.
Relations, functions and graphs	1. Couples. Use of arrow diagrams to illustrate relations. Example: "is greater than" 2. Plotting points. Joining points to form a line. 3. Drawing the graph of forms such as $y = ax + b$ for a specified range of values of x, where $a, b \in \mathbf{N}$. Simple interpretation of the graph. Example: Draw the graph of $y = 3x + 5$ from $x = 1$ to $x = 6$.

Geometry	1. Synthetic geometry: Preliminary concepts: The plane. Line *ab*, line segment [*ab*], l*ab*l as the length of the line segment [*ab*]. Angle; naming an angle with three letters. Straight angle. Angle measure; l∠*abc*l as the measure of ∠*abc*. Acute, right and obtuse angles. Parallel lines; perpendicular lines. Vertically opposite angles. Triangle (scalene, isosceles, equilateral), quadrilateral (convex), parallelogram, rectangle, square. Practical, intuitive approach, for example using drawings and paper-folding. For constructions, the use of compasses, set squares, protractor, and straight-edge are allowed unless otherwise specified. Use of geometrical instruments—ruler, compasses, set squares and protractor—to measure the length of a given line segment, the size of a given angle and the perimeter of a given square or rectangle. *Construction*: To construct a line segment of given length (ruler allowed). *Construction*: To construct a triangle (ruler allowed) when given: • the lengths of three sides; • the lengths of two sides and the measure of the included angle; • the length of a base and the measures of the base angles. *"Fact"*: A straight angle measures 180°. (For interpretation of the word *"Fact"* see Guidelines for Teachers.) *"Fact"*: Vertically opposite angles are equal in measure. *"Fact"*: The measure of the three angles of a triangle sum to 180°. *Construction*: To construct a right-angled triangle, given sufficient data (ruler allowed). *"Fact" (Theorem of Pythagoras)*: In a right-angled triangle, the square of the length of the side opposite to the right angle is equal to the sum of the squares of the lengths of the other two sides (verification by finding the areas of the squares on the three sides or otherwise). *Construction*: To construct a rectangle of given measurements (ruler allowed). *"Fact"*: A diagonal bisects the area of a rectangle (verification by paper-cutting or otherwise). *Construction*: To draw a line through a point parallel to a given line. *Construction*: To divide a line segment into two or three equal parts. *Construction*: To bisect an angle without using a protractor. Meaning of distance from a point to a line.

Geometry	Meaning of base and corresponding perpendicular height of a parallelogram. *"Fact"*: The area of a parallelogram = lbasel x (corresponding) perpendicular height. 2. Transformation geometry: Central symmetry, axial symmetry. Use of instruments to construct the image (rectilinear figures only) under (i) axial symmetry and (ii) central symmetry.

Using Calculators

The use of calculators is a regular feature in the daily mathematics lesson in post-primary schools. Calculators are an invaluable aid for all students and especially those with mild learning disabilities. Most importantly, calculators enable students with mild general learning difficulties to achieve success in mathematics. For some of these students memorising number bonds can be a problem. This can be offset by using a calculator, as long as the underlying operations and concepts are understood by the students.

The overall aim in the use of calculators in the mathematics class is to enable students to know when it is appropriate to use mental methods, written methods, and calculator methods, or a combination of these.

A simple drill of *Think first, write, use the calculator, write, and then compare the results against the original estimate* should be practised. Rounding off and writing the estimate before using the calculator can ensure that cognitive skills are being developed and will avoid mechanical use of the calculator.

The teacher will choose whether a scientific calculator or a simpler model will suit the student. The latter usually has large keys and is most effective in performing the four basic functions. However, in dealing with fractions the scientific models offer great relief from lengthy and complex algorithms. The calculator can enable the student to keep up with learning in the system of natural numbers, integers, rational numbers, and real numbers. The teacher will familiarise himelf/herself with the various brands of calculators being used by the students, and assist them with minor differences in operating them. The following are some approaches that teachers may find useful.

Pair and small group work

This can be of great benefit when students are learning how to manipulate the calculator and when solving problems .

Encouraging estimation

Through skillful questioning students can be encouraged to use estimation. Interesting questions such as, *'Are 150 hours more or less than a week?'* will encourage an estimated answer followed by calculator work.

Entering correctly

Entering the decimal point needs careful attention, especially in relation to money problems, for example €20 is entered differently to 20c, and in turn to 2c.

The fraction symbol

Using the fraction symbol on the calculator $a\frac{b}{c}$ can make fraction calculation achievable for students. Once mastered, a problem like $\frac{1}{2}+\frac{1}{4}+\frac{2}{3}$ can be answered easily. Equivalences can be explored and large fractions simplified. The teacher will need to show this to the class and to individual students. Students working in pairs or threes can help each other.

Interpreting display correctly

Pair work helps greatly with this. Questions like, *'What does 12.3 mean in a money problem?' 'How would 3 cents be represented on the display?' 'How would you key in twelve euro and three cent?'* will stimulate a correct reading of the display. Students should write their answers on paper.

In using the memory button a teacher can judge the readiness of a student for calculations involving more than one stage. For example, in calculating the wall area of a room 250cm X 500cm X 300cm seems impossible for the student with general learning difficulties, yet 2 X 3 X 5 when stored to memory M+ (2 X 4 X 5 M+) can be accessed by pressing Recall Memory. This is an algorithm that can be practised and used for larger numbers. Pair work is very useful in this context in developing confidence and in exploring methods.

Checking answers

The calculator offers the teacher ways of showing the student how to check answers using inverse operations, thus reinforcing the learning of basic operations. For example, 27 - 15 = 12 can be checked by 12 + 15.

Identifying students' misconceptions and errors

By observing the student and by engaging with him/her in calculator work the teacher can ascertain at what stage in the problem-solving process a misunderstanding may have occurred, and can deal with it rather than getting bogged down in calculation processes. If an error occurs as a result of operating the calculator incorrectly, it can be dealt with on an individual, group, or class basis.

Using ICT

Many computer programs can be used at different levels within one group or class. Useful software is available commercially and can be invaluable in reinforcing concepts, in assisting calculator usage in computation, in providing problem solving opportunities and in making mathematics fun and enjoyable. Students working, using ICT, in groups or pairs often make significantly greater progress than those who work individually, and this should be borne in mind in classroom planning. The organisation of ICT facilities varies enormously from school to school, yet the opportunity for students with mild general learning difficulties to avail frequently of ICT in the development of their mathematical skills is highly recommended.

Teaching strategies

When planning for teaching and learning in the area of Mathematical Studies and Applications a variety of teaching strategies needs to be considered.

These will respond to the particular challenges students with mild general learning disabilities experience in engaging fully with, for example, mathematical language, oral and written communication, problem-solving, and the retention of facts and concepts. The tables that follow list some of the potential areas of difficulty, and suggest appropriate strategies for classroom use.

It is important to remember that not all students with mild general learning difficulties face all of these challenges. Neither is it an exhaustive list. These are the most commonly found potential areas of difficulty.

Addressing potential areas of difficulty for students with mild general learning disabilities

▲ Potential area of difficulty	= Implications for learning
Short-term memory	Retention of facts and definitions can be a problem.

+ Possible strategies

- Encourage the use of visual clues to aid memory, for example a verbal or written definition of an isosceles triangle could be accompanied by a diagram with two sides and two angles marked as equal.
- Encourage students to invent rhymes, songs or mnemonics to help them to recall facts and practise estimation skills, so that a calculator can be used efficiently.
- Work on making certain operations automatic through using fun games such as table-darts or fraction-decimal equivalence dominoes.

▲ Potential area of difficulty	= Implications for learning
Short attention span and poor concentration	The student finds it difficult to stay on a task, may rush the task, and be easily distracted.

+ Possible strategies

- Provide shorter tasks with clear rewards for staying on the task and for completing it. For example, allow a student to try a mathematical puzzle when the task is completed.
- Use a variety of teaching methodologies; keep periods of instruction short and to the point, and recap frequently.
- Use teacher observation efficiently and note achievements, strengths, and preferred learning styles in planning future work.
- Encourage students to keep portfolios of work in which they record their mathematical achievements.

▲ Potential area of difficulty	= Implications for learning
Understanding mathematical concepts and abstractions	The student finds mathematics difficult and has particular difficulty with certain abstract concepts necessary for algebra and geometry.

+ Possible strategies

- Group discussion can help the student to listen to and work with others. This is very useful when introducing a theme or concept to promote a discussion with students.
- In learning concepts activities should be varied through the use of games, ICT, and real-life problems relevant to the student's experience.
- Learning can be made fun by using funny names, silly scenarios. or unlikely settings.
- Encourage co-operative learning activities, including pair-work and small group exercises.
- Teach the topic in *'chunks'* rather than as a single block.

▲ Potential area of difficulty	= Implications for learning
Spatial awareness	• The student may have difficulty organising materials. • She/he may display left/right confusion when recording and may not recognise shapes if inverted or rotated. • Topics such as geometry, applied arithmetic (area and volume) and graphing will be more challenging for this type of student.

+ Possible strategies

- The student should be given plenty of work with three-dimensional objects and particular attention should be paid to the language of spatial awareness.
- Encourage the student to make simple models (from cardboard or using a dynamic geometry computer package) when learning the properties of geometrical shapes.
- When discussing area or volume of a shape ensure that the student has access to a model of the relevant shape.
- Using puzzles, tangrams, and shape-making kits in a fun way can help the student with this area of difficulty.
- Encourage students to be aware of their own personal space.
- Keep the patterns of classroom organisation consistent.

▲ Potential area of difficulty	= Implications for learning
Applying previously learned knowledge	The student may find it difficult to apply a skill or concept already acquired in a different setting, for example measuring in Geography, Science, or Home Economics.

+ Possible strategies

- Revisit and review previously learned knowledge regularly.
- Encourage students to revisit skills and knowledge learned in a previous class, for example *'Yesterday we learned how to do a survey and make a tally chart to show the results …'.*
- Use a cross-curricular approach to the teaching of skills or concepts that are common to different subjects, for example measuring angles in mathematics and technical graphics or weighing in mathematics and home economics.
- Draw the students' attention to what is happening, for example *'This is just like the measuring we did last week. What did we use to measure our books? How did we place the ruler?'*
- Reinforce mathematical concepts encountered in other areas of the curriculum and encourage the student to make connections, for example *'How did you find the volume of something in science?'*

▲ Potential area of difficulty	= Implications for learning
Transferring of learning to real-life	The student may not use mathematics in real situations. For example, she/he may not use arithmetic when buying goods in a shop, may not see the need to measure when cooking, or may not recognise shapes in the environment.

+ Possible strategies

- Use real-life objects and coins in appropriate situations.
- Discuss with the students how they spend money.
- If possible, provide students with opportunities to handle real-life materials in real-life contexts; for example, money in a real shop or in the school shop.
- Ensure that parents are aware of the importance of counting and handling money or of measuring at home, for example sharing equally, weighing for cooking, or measuring when doing DIY.

▲ Potential area of difficulty	= Implications for learning
Visual sequencing	The student may not be able to copy from the board or from a book and may have difficulty with sequencing and mirror writing.

+ Possible strategies

- Teach the student how to *'chunk'* information and how to check if it is correct; for example, copying only one part of the sum at a time.
- Present board work carefully, give clear instructions as to what the student needs to copy, and use worksheets where appropriate.
- Use rhymes, songs, mnemonics and mind- maps to reinforce sequences.
- Use visual cues.

▲ Potential area of difficulty	= Implications for learning
Confusion with signs and symbols	The student may not *'read'* symbols and may ask questions such as *'Is this an add sum?'*

+ Possible strategies

- Use charts to relate mathematical symbols to everyday symbols; for example, egg + chips, price, 20% off.
- Encourage students to verbalise what they are doing first; for example, looking for and identifying the symbol, or applying the correct symbol if it is a written problem.
- Encourage students to keep a symbol and keyword dictionary.

▲ Potential area of difficulty	= Implications for learning
Language	• The student cannot follow complex sentences or multiple meanings and may process only part of the instruction. • The student finds it difficult to verbalise what she/he is doing in mathematics. • The student has difficulty in relating the vocabulary of mathematics to real-life situations.

+ Possible strategies

- Identify specific mathematical terms and ensure that these are reinforced in different settings and in other areas of experience.
- Encourage the student to use relevant mathematical terms when appropriate.
- Ensure that the mathematical language used each week is communicated clearly to students and their parents.
- Use a Key Word approach by displaying a wall chart of mathematical terms used each week, thus enabling the student to build up a personal mathematical dictionary.

▲ Potential area of difficulty	= Implications for learning
Reading	Reading difficulties can prevent the student from engaging with mathematics. He/she may be capable of completing the mathematical task but may become frustrated and confused by printed words.

+ Possible strategies

- Present problems pictorially.
- Ask the students to pick out the parts of the problem they can read and to focus on relevant information. There is often a lot of redundant information in a written problem.
- Avoid presenting the student with pages of textbook problems by giving modified worksheets (with diagrams) or verbally delivered instructions.

▲ Potential area of difficulty	= Implications for learning
Following instructions	The student becomes confused when faced with more than one instruction at a time.

+ Possible strategies

- Get the student to repeat the instruction(s).
- Give short, clear instructions, and use pictorial cues.
- Give verbal/written hints. For example, use graph paper. What kind of problem is it? What do you need to know? What do you do next?
- Present clear guidance on how and when assistance will be given by the teacher/ other students during the lesson.

▲ Potential area of difficulty	= Implications for learning
Being overwhelmed by the learning process	The student becomes overwhelmed when presented with new information or skills and consequently cannot learn.

+ Possible strategies

- Adapt the materials given to a group. For example, have some compare the measure of angles using a protractor while others use cut-out cards.
- Adapt teaching styles. For example, use more discussion at both the beginning and end of the lesson to help both teacher and student to understand how they are learning.
- Adapt the responses required. The same activity can often be done with a group or class but some students will answer orally, some by using symbolic representation, or some by using a pictorial response.
- Adapt the requirements of the task. One group or individual may only have to do six of the questions, whereas another may have to do ten or more. Set personal targets for the students so that they do not feel others are getting less to do than they are.

Exemplars

These exemplars demonstrate how certain strategies outlined in the previous section can be used when teaching a selection of topics from the syllabus.

These exemplars are not intended to cover the course or any one part of the course entirely. Teachers using them are encouraged to choose the learning outcomes, supporting activities, and assessment strategies that best suit the needs of their students. Some students may only achieve the first one or two learning outcomes while others may achieve the full range of outcomes. The important factor is their inclusion in the experience.

The *Junior Certificate Guidelines for Teachers: Mathematics* contains further exemplar material that can be adapted to suit the needs of a variety of students. The guidelines also contain useful references to mathematical resources and websites.

Structure of the exemplars

Each of the exemplars is preceded by an outline of the relevant sections of the Primary School Curriculum, the Junior Certificate (foundation/ordinary level) and the Junior Certificate School Programme (JCSP). Some of the potential difficulties experienced by students with mild general learning disabilities that relate specifically to the area covered in the exemplar are outlined, and suitable strategies are suggested. In addition, an approximate time scale, a list of resources, suggested outcomes, supporting activities, and assessment strategies for a lesson or series of lessons are provided. The exemplars are organised in the order in which the topics occur in the foundation level mathematics syllabus.

Exemplar 1: **Mathematics**

Syllabus topic: Mathematics: Number systems | Fraction attraction

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Number Strand unit: Fractions	Number systems: The set **Q** of rational numbers. Decimals, fractions, percentages. Decimals and fractions plotted on the number line. The operations of addition, subtraction, multiplication and division in **Q**.	Use of number: Apply the knowledge and skills necessary to perform mathematical calculations

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to ten class periods.

Potential areas of difficulty

- → Short term memory
- → Understanding concepts
- → Spatial awareness
- → Transfer to real-life
- → Vocabulary/language difficulties

Strategies used in this exemplar

- Specific targeting of mathematical language
- Applying fractions to real-life situations
- Using reinforcement techniques
- Using games to reinforce concepts and operations
- Using concrete materials and manipulatives
- Using cross-curricular links to home economics, materials technology, and science.
- Using pair and group work in specified tasks

Exemplar 1: **Mathematics**

Resources

- Bars of chocolate, pizzas or cardboard/plastic models that can be easily divided
- Card, paper, material that can be folded, torn, and cut
- Sets of fraction strips
- Sets of fraction dominoes
- String/wool, post-it notes, and scissors
- Kitchen weighing scales
- Soft drinks containers
- All activities are based on students working in pairs or groups of three or four. Activity 1 can be conducted as a whole class discussion, as the teacher chooses.
- There is commercially available software on Fractions which is useful for reinforcing students' understanding of fraction concepts, such as *'Display it Yourself Series: Fractions and Maths made Easy'*.

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. state where fractions are used in everyday life 2. split a variety of items into different fractions, using fraction words and terms appropriately 3. fold, tear, or cut a variety of items into different fractions, using words and terms appropriately.	1. Discuss where fractions occur in everyday life. 2. Sharing among friends 3. Folding activities	1. Students draw a poster of an advertisement or copy a recipe that shows the use of fractions in everyday situations, and give oral explanations of the meaning of the fractions used in their posters. 2. Students self-assess their work by asking questions such as: 'Was this sharing done equally?' 'What problems arose?' 3. Observe the students discussing whether the folding/tearing/ cutting task been accomplished and what difficulties arose.

Exemplar 1: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
4. understand the concept of fractions in terms of arranging them in order, and as a way of describing how two things relate to each other	4. A series of group tasks using real and meaningful contexts to explore fraction concepts	4. Observe the students engaging with tasks and the extent to which they accomplish them. Encourage self and peer monitoring and intervene when necessary.
5. write fractions and equivalent pairs of fractions	5. Students in pairs use counters to explore fraction relationships	5. Observe whether students can write fractions correctly on work-cards, using numerator and denominator.
6. understand the need for multiple and LCM in addition – list multiples – identify the LCM	6. Discuss the need for multiples, using examples 7. Play equivalent dominoes games and fraction bingo.	6. Observe whether the students can – explain the need for LCM – create lists of multiples and select the lowest – solve practical problems using LCM.
7. recognise equivalent fractions.		7. Observe whether the student matches equivalent fractions.

Cross-curricular links: These skills may be reinforced if similar concepts in home economics, materials technology, and science are treated at the same time.

Exemplar 1: **Mathematics**

Activity 1

Spot the fraction

Using appropriate visual aids, such as advertisements and labels, discuss where fractions occur in everyday life and what expressions such as ½ price ⅓ extra free, add ¼ tsp of salt, half a metre, first half, half time, last quarter mean.

Activity 2

Sharing with friends

The purpose of this activity is to give students the opportunity to understand the concept of simple fractions by sharing out items of various shapes among various numbers of people. Students experience and discuss sharing chocolate bars, pizzas, etc. with friends. The activity can be made simple (for example, sharing everything between two people) or more complicated as appropriate.

Resources

- Various bars of chocolate (A large 4x8 square bar of chocolate is a useful resource for this activity and has enough squares to make a nice reward for everyone at the end of the lesson.)
  Note: A chocolate orange has 20 segments and so can be used to demonstrate the concepts of halves, quarters, fifths, tenths, and twentieths.
- A pizza and pizza slicer
- Cardboard or plastic shapes that can be used to represent bars of chocolate or pizzas when it is not possible or appropriate to use the real thing

Language use

Throughout the activity the teacher should listen to the language that the students use to explain what they are doing. In addition to using their own words and phrases students should be encouraged to understand and use other appropriate keywords. Depending on the actual activity, keywords may include *share, split, slice, divide equally, how many pieces, what fraction, what is left, half, quarter, eighth, sixteenth.* Skilled questioning by the teacher can assist students to move from the concept of sharing or dividing to the concept of fraction.

Some sample sharing activities

Students may begin sharing using the 'one for you, one for me' method. Some students may move on to working out how many pieces there are, and then how many each person should get, without having to 'deal' the pieces out one at a time.

1. A bar of chocolate has 6 squares, how would you
   (a) share it equally between 2 people?
   (b) share it equally between 3 people?

2. A bar of chocolate has 32 squares. How would you
   (a) share it equally between yourself and a friend (2 people)?
   (b) share it equally between 4 people?
   (c) share it equally between 8 people?
   (d) share it equally between 16 people?
   (e) If you share it so that for every square you give a friend you get 3 squares, what fraction will your friend get and what fraction will you get?

Exemplar 1: **Mathematics**

3. Sharing a pizza among friends. Use a real pizza or cardboard or plastic segments.
   (a) 4 friends want to share a pizza.What fraction does each get? Show the size of slice that each will get.
   (b) 8 friends want to share a pizza.What fraction does each get? Show the size of slice that each will get.
   (c) 6 friends order a pizza. Eoin and Frances are very hungry and want two slices each. Anne, Brendan, Carmel and Des want only one slice each. How many slices should the pizza be cut into? Show how much (and what fraction) each will get.
   (d) A pizza is sliced into 8 equal pieces. Áine has one quarter, Sue has one half and Séamus has what is left. Show how many slices each person gets.

Activity 3

Folding activities

The purpose of this activity is to give students the opportunity to understand the concept of simple fractions by folding, tearing, or cutting items of various shapes.

Language use

As explained in the previous activity students should be encouraged to use and understand appropriate words, including fold, half, quarter, eighth, what fraction of, five out of eight, length by breadth, lengthways, square.

Some sample activities

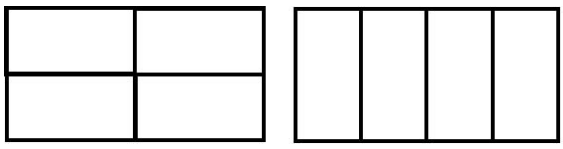
Paper folding of different shapes

1. Folding a rectangle into quarters in different ways:
   (a) Fold a rectangular (or square or circular) piece of material in half lengthways and cut along fold. Do the same with the two pieces produced and do the same again. You should have 8 equal pieces of material. Measure the length and breadth of each piece of material.

   (b) Take a rectangular (or square or circular) piece of paper. Fold it in thirds (this may require some assistance), and then in half. What fraction of the original piece of paper is the folded piece? Unfold and count how many sections have been created. Colour in three of the sections. What fraction of the paper is coloured? What fraction of the paper is not coloured? Is there another way of naming this fraction?

   (c) Similar conversations can be built around folding shapes split into different fractions in different ways.

   (d) Note that this paper-folding method is useful when teaching multiplication of fractions. For example (b) above demonstrates that half of a third is a sixth.



Cutting sections of material for a patchwork quilt.
Take a piece of material measuring 32cm by 16cm. Fold material in half lengthways and cut along the fold. Do the same with the two pieces produced and do the same again. You should have 8 squares of material. Measure the length and breadth of each piece of material (8cm by 8cm). By linking with the Home Economics teacher it might be possible to make a patchwork quilt and students could see what fraction of the quilt is made up from their colour or pattern of material.

Exemplar 1: **Mathematics**

Activity 4:

Group Activities (one-two class periods)
Measuring and recording fractions in different contexts
Students will work in groups, moving on the completion of one task to the next, but staying until a task is completed. Co-operative learning is the key approach here.

Task 1: *'How long is a piece of string?'*
Students are required to measure and label string/wool lengths as directed on task cards, for example ⅓m, ¼m, $^{300}/_{1000}$m, ⅖m, $^{3}/_{10}$m, $^{40}/_{100}$m, $^{1}/_{10}$m, ½m, ⅓, ½m, ⅕m, etc.

Students place these on a wall-chart, appropriately labeled. They arrange the strings in ascending/descending order, writing the list of fractions underneath. Pieces of the same length are recorded in a section called equivalent fractions, for example ¼m = $^{250}/_{1000}$. Calculators can be used to simplify fractions and to assist in exploring equivalences.

Task 2: *'The weight of knowledge'*
Testing and recording equivalences and relationships.
Weigh schoolbooks using kitchen style scales. Record the weights on a wall chart, for example:
Maths book : 400g
A4 copy : 200g
Write down relationships, for example a Maths copy weighs 200/400 or 1/2 the weight of a book.

This could be made into a fun exercise as follows:
Add all weights and see how much you carry every day.
If you were allowed leave your copies at home what fraction would that be of your bag's total weight? What fraction do your books make?

Weigh the books you like. What fraction of the total are they? Record all these.

Allow students to record this information in their Maths copies or record books. They will probably want to do this and bring it home to discuss it with their parents.

Task 3: Thirsty work
Comparing volume of soft drink bottles, cans, and cartons.

Using 2l, 1.5l, 1l, 500ml, 330ml, 250ml and 200ml bottles make out fraction relationships (placing one number over the line and the other number under the line).

Ask the students to consider how many 500ml bottles would give the same amount as the 2l bottle?
So, a 500ml bottle is a ?/? of the 2000ml bottle?

$$\frac{\text{500ml bottle}}{\text{2000ml bottle}} = \frac{500}{2000} = \frac{1}{4}$$

Calculators should be used to check simplified fractions.

Other bottles, cans and cartons can be dealt with similarly.

This could be extended to include prices and value for money.
Prices could be compared also using fractions.

Exemplar 1: **Mathematics**

Activity 5

Working with counters and filling work-cards

Discuss with the students that, for example, one third means dividing into three parts. Encourage them to talk through what they are doing.

For example, Group 1 could use 12 counters/items and complete cards such as

$\frac{1}{3} = \frac{\quad}{12}$ $\frac{2}{3} = \frac{\quad}{12}$

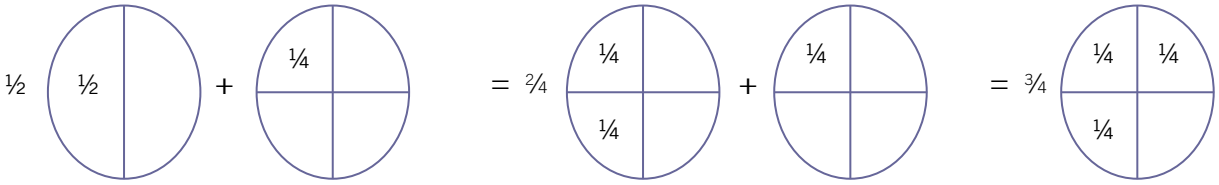
$\frac{1}{2} = \frac{\quad}{12}$ $\frac{1}{4} = \frac{\quad}{12}$ $\frac{2}{4} = \frac{\quad}{12}$ $\frac{3}{4} = \frac{\quad}{12}$

Based on16 and 20 counters (and other numbers) similar workcards can be made out and students can explore and record equivalences.

Activity 6

Learning multiples

Explain or discuss the need for multiples, using a simple example:



The students list the multiples of 2 and write them in their copies.
This is repeated with the multiples of 4.
They circle the lowest one that is common to both lists and write:

LCM = ☐

This can be repeated for other pairs of numbers.
Some students might have a problem because they do not know their multiplication bonds. The teacher can work on that with those students, or encourage them to use a calculator in completing their lists.

When learning multiples the students list the multiples of various numbers.

Exemplar 1: **Mathematics**

Working in pairs or groups of three the students can complete the following lists.
Calculators can be used

Multiples of 2 = 2,__, 6, 8, __, ___, ____, ____, ____, 20, ___, ____, ____

Multiples of 3 = 3,__, 6, __, 12, ___, ____, 21, ___, 27, ____,____, ____

Multiples of 4 = 4, 8, ____, _____, 20, ___, ____, 32, ____, _____ .

Multiples of 5 = ___, ____, 15, 20, ____, 30, ____, _____, _____, 50.

Multiples of 6 = ____, 12, ___, ____, 30, ____, 42, ____, 54, 60.

Multiples of 7 = 7, ____, _____, 28, 35, 42, ____, ____, _____, 70.

Multiples of 8 = ___, 16, ____, _____, 40, ____, _____, 64, ____, ____.

Multiples of 9 = __, ___, ___, ____, 45, 54, 63, ___, ____, 90.

Still in pairs, students take turns highlighting/picking out the lowest common multiple (LCM) in two rows, completing workcards such as the following :

Write the LCM of the following numbers

LCM of 2 and 3 is _____

LCM of 2, 3 and 4 is _____

LCM of 5 and 7 is _____

LCM of 8 and 6 is _____

Exemplar 1: **Mathematics**

Activity 7

Fraction games

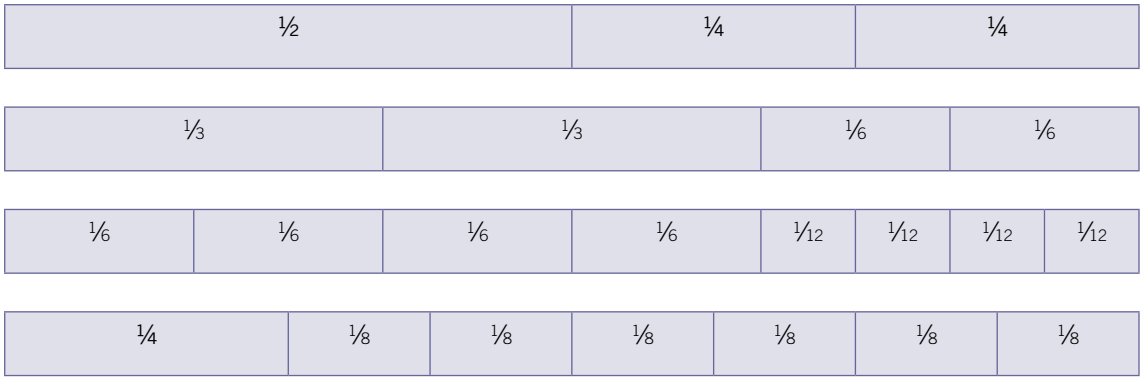
Resources

Each student playing the game needs a set of fractional parts. Each set of cards should be marked with a different initial (A, B, C, etc.) so that the sets can be re-formed at the end of the game. The game can be played by between two and four students.

1. Cut from light-weight cardboard five rectangular sections measuring 24cm by 6cm.

2. Mark one strip as a unit measure.

3. Mark the other four strips into fractional parts as shown below. Cut along the lines, mark each piece with the same initial, and place the pieces into an envelope for storage.



4. The fractional pieces can be made more robust by laminating them.
5. A number of different games are possible using these fractional pieces. Two games are described below.

A. Make one!

1. Each player is given an envelope of fractional parts as described above. Each player retains his/her unit strip as a measure. All players empty the rest of their pieces into a common pile and the pieces are mixed up.
2. Each player in turn draws a piece from the pile until all the pieces are gone.
3. Each player then assembles his/her pieces to make as many unit strips as possible.
4. The first player to construct three unit strips (or whole) is the winner.

B. Make half!

1. The game begins as above, but a time limit of three minutes is set.
2. The player who can make the greatest number of strips equivalent to a half is the winner.

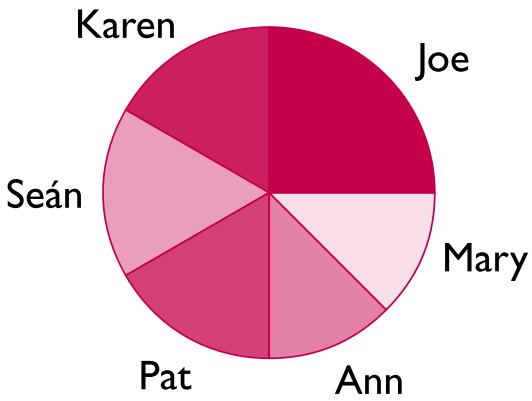
Other activities

As an initial introduction to dealing with fractional parts, students can be encouraged to solve real-life problems based on splitting a pizza or a bar of chocolate into various fractional parts. Paper folding activities such as those outlined in the *Primary School Curriculum: Mathematics — Teacher Guidelines* are also useful.

Exemplar 1: **Mathematics**

Pizza Problem

Joe cooked a large pepperoni pizza for his friends. He has a quarter of the pizza himself. Mary and Ann share another quarter between them. Pat, Seán, and Karen share the rest between them. Draw a picture of the pizza and show the size of the slice that each person ate.



More theoretical games such as that outlined here can provide reinforcement of the concepts learned. Additional variety could be provided by constructing five circular regions, which are marked and divided into the same set of fractional parts as the rectangular strips shown above. It is important that students see a variety of fractional values represented in a variety of ways.

More games: Equivalent fraction dominoes

Resources

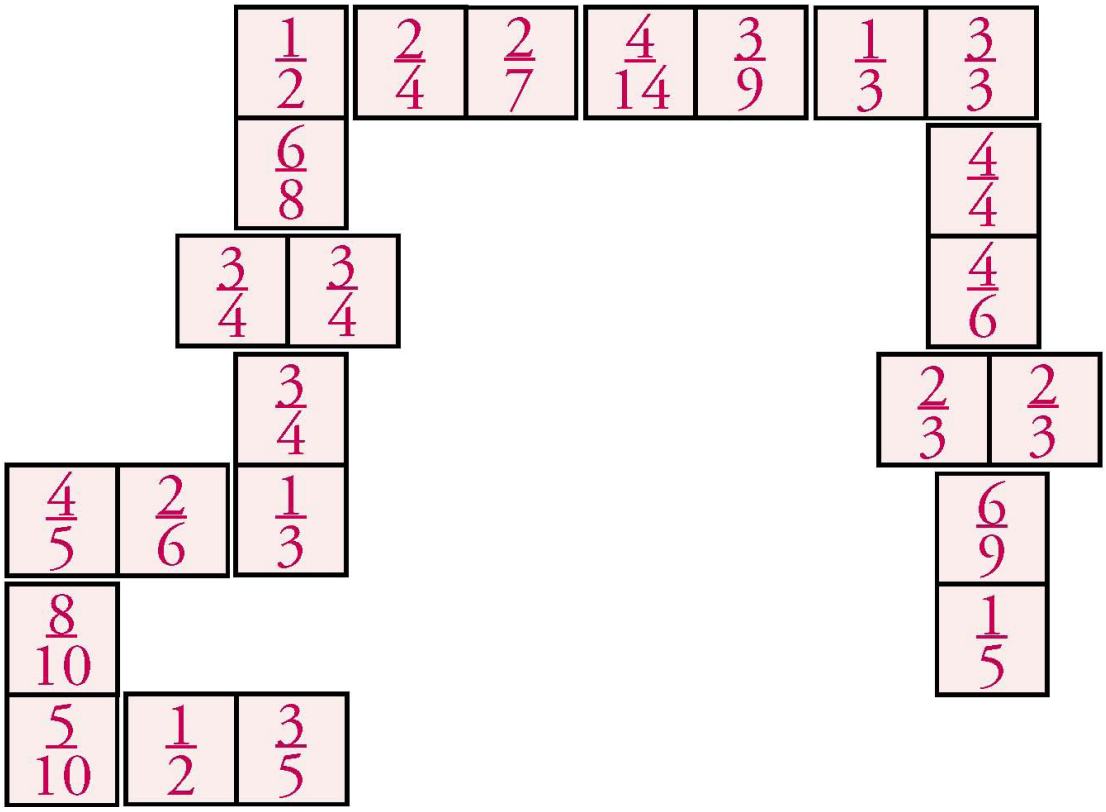
Sets of dominoes can be purchased from good educational suppliers. Alternatively, a set of dominoes can be made from cardboard. This game is based on a set of equivalent fraction dominoes. Percentage and decimal versions of dominoes are also commercially available.

Basic rules

- This is a game for two to four players. All of the dominoes are placed face down in the centre of the table. Students draw the same number of tiles each and spare tiles are left to one side.
- Players take turns in playing a tile. (Usually, whoever has the highest double goes first.) Dominoes are played at either end of the row of tiles by matching the adjacent halves of the tiles using equivalent fractions (matches with). Doubles (dominoes with the same fraction on both halves) are usually placed at right angles to the other dominoes.
- The winner is the player who gets rid of all of his/her dominoes first.

Exemplar 1: **Mathematics**

A sample game



Note: Students will need to understand the concept of equivalent fractions before playing this game. Once the basic rules of dominoes are understood the group of students tends to act as a self-checking mechanism, and the teacher is usually only called on to judge a play if the group cannot agree.

Exemplar 1: **Mathematics**

Yet more fun! Fraction bingo

Resources

A set of bingo cards such as the one shown below can be made on sheets and photocopied before being cut out individually. Alternatively, they can be produced as laminated sheets and students can mark them with soluble markers. The crosses can then be erased before the next game is played.

1. Students are given various grids of fractions as bingo cards. One such grid is shown below.
2. The teacher writes one fraction at a time on the board. The teacher will need to choose suitable fractions based on the range of fractions appearing on the bingo cards. A call-out card could be produced as a guide.
3. Students put a cross on any fractions on their bingo card equivalent to the one called out.
4. The first student to mark off a full row or column on his/her card is the winner and gets to act as caller for the next game. Cards are collected and redistributed for subsequent games.
5. When someone wins the game the marked bingo cards can also be swapped in pairs, and students can check each other's work based on the list of fractions on the board. Students who are having difficulty with the activity may need to engage in further work to assist their understanding of equivalent fractions.

$\frac{3}{4}$	$\frac{3}{8}$	$\frac{2}{3}$	$\frac{2}{10}$
$\frac{2}{5}$	$\frac{4}{5}$	$\frac{5}{10}$	$\frac{4}{6}$
$\frac{3}{6}$	$\frac{6}{8}$	$\frac{6}{10}$	$\frac{4}{10}$
$\frac{8}{12}$	$\frac{6}{16}$	$\frac{8}{10}$	$\frac{4}{8}$

Exemplar 2: **Mathematics**

Syllabus topic: Mathematics: Applied arithmetic and measure | What's the time

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Strand: Measures Strand unit: Time	Applied arithmetic and measure: Twenty-four hour clock, transport timetables	Time, Speed and Scale: Demonstrate and apply an understanding of time, speed and scale

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to fourteen lass periods.

Potential areas of difficulty

- Short term memory
- Procedures
- Understanding concepts
- Spatial awareness
- Application of previously learned knowledge
- Transfer to real-life
- Confusion with signs and symbols

Strategies used in this exemplar

- Group discussion activity drawing out the language of time, why we need to keep track of time, etc.
- The use of storytelling
- Using visual representations of time (for example poster, clock, timeline)
- Situating mathematics in real-life contexts
- Using concrete materials
- Using students' personal experiences (for example timeline, TV guide)
- Encouraging students to use relevant mathematical language
- Using appropriate ICT resources

Resources

- A large poster of a clock (12-hour and 24-hour) with movable hands
- A variety of clocks (both analogue and digital), calendars, transport timetables (relevant to the geographical area of the student), TV and radio schedules
- Provincial bus timetables (available at http:// www.ireland.com/dublin/visitor/around /bus)
- Train timetables (found at http:// www.irishrail.ie)
- TV listings (accessed through The Irish Times online at http:// www.ireland.com
- The mathematics teacher can link with the home economics teacher to encourage the use of time in a practical situation, for example cooking and baking, while time is being taught in the mathematics class.

Exemplar 2: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. engage in discussion about the importance of keeping track of time 2. use words related to time appropriately 3. apply a basic knowledge of time to their everyday activities 4. change time between a 12-hour clock and a 24-hour clock 5. work out the difference between two given times 6. use a transport timetable accurately, for example work out the train to catch in order to be on time for a meeting.	1. Question and answer session about time 2. Students take part in the *'Time for a story'* 3. Timetable and timeline activity 4. 12- and 24-hour clocks activity: Air Traffic Control 1 and 2 5. Following a TV guide 6. Catch that train!	1. Teacher notes students' responses 2. As students take part in the *'Time for a story'*, (see Activity 2 page 36) the teacher can assess the students' ability to complete a storyline at the various levels of the activity and their ability to use the keywords appropriately. 3. Observe students draw a personal 12-hour timeline marking what they did on a particular day. 4. The personal timeline activity may be repeated using a 24-hour clock. Teacher records whether students can successfully record their activities using the 24-hour clock, and notes where difficulties arise. 5. Note what method the student is using: estimation, basic counting technique, subtraction. Students who can use a variety of methods may be able to check their answer more successfully. 6. Role play: one student phones to inquire about train times and another student is the information service. Can students communicate their query and their reply accurately?

Cross-curricular links: Skills can be reinforced if similar concepts in other subjects, for example timing a cake in the oven in home economics, are treated at the same time.

Exemplar 2: **Mathematics**

Activity 1

Students provide answers in response to the teacher's questions: How would we know a day/month/year has passed if we did not have a clock (sun/moon/seasons)? Why do we need to keep track of time? How do we keep track of time? Do some people's jobs depend on time? How do we measure time? What words relate to time?

Activity 2

Time for a story

Resources
Prepared cards

Students take turns to add a line to a story about time. Each line of the story starts from where the previous person finished and mentions a time interval and a finishing time. Cards such as those shown can be distributed to students initially to help suggest a story line. The challenge to students is to listen to the person speaking and know when it is the right time to read out their line.

Sample cards for *'Time for a story'*

I got up at 8 o'clock and spent 15 minutes getting washed and dressed. I was ready at 8.15am

At 8.15am I started breakfast. This took me 30 minutes. I finished breakfast at 8.45am

At 8.45am I left the house. It took me 10 minutes to walk to school. I got to school at 8.55am

I got to school at 8.55am and classes started at 9am. I had classes for 2 hours and then had a break at 11am

At the 11am break I met my friends for 15 minutes and then went back to class at 11.15am

Exemplar 2: **Mathematics**

Further activities

As students experience success with this activity a new set of cards can be distributed with one piece of information omitted that the student must supply, for example the finishing time.

This activity can progress with students inventing their own stories and times. At this stage the use of certain keywords can be encouraged by distributing cards containing a word that students must include in their story line. Such keywords may include *time, seconds, minutes, hours, days, months, years, clock, timetable, on time, late, early, a.m., p.m.*

Activity 3

Complete your personal timeline

Timetables

Students examine a copy of their school timetables and ask and answer questions. For example, 'What time do we have our morning break?' 'For how long, does the break last?' 'What time do we have English on Mondays?' This activity can be extended by using a variety of timetables.

Resources

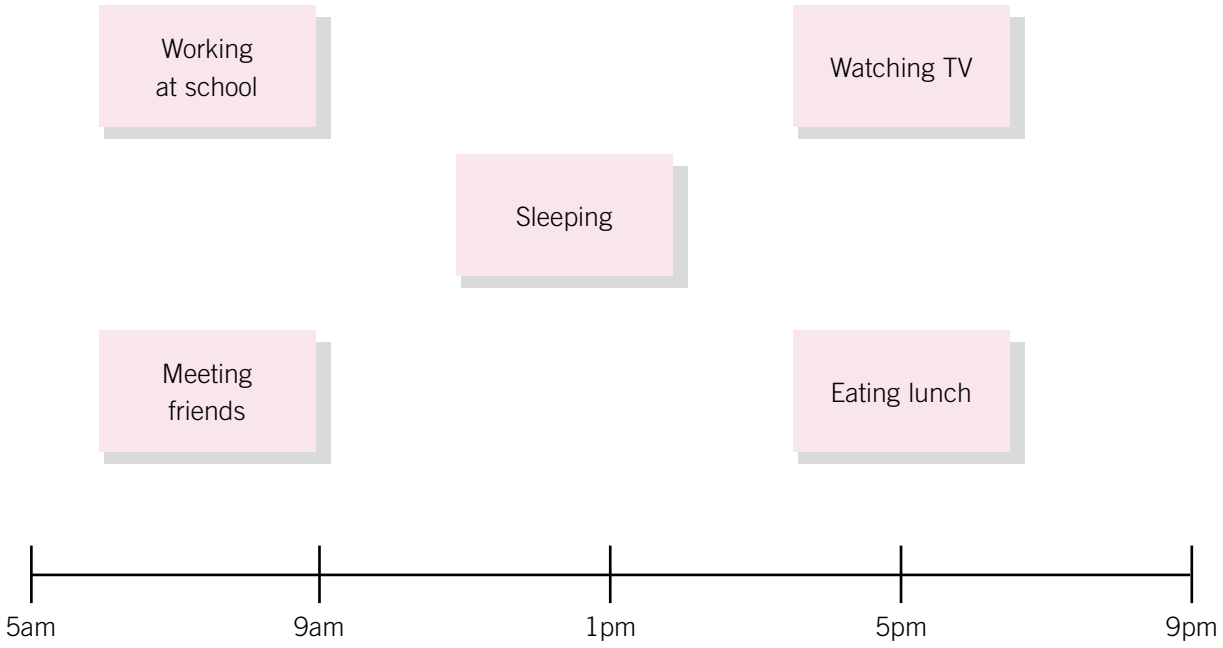
- A simple timeline
- Cards showing action words or pictures
- Glue

Students are given a blank timeline and a range of cards with pictures or action words on them. Students stick the cards at an appropriate place along the timeline. When the timeline is completed, students discuss in pairs the reasons why they placed each card at a particular point on the timeline. The activity as presented uses words rather than pictures.

Time for sleeping?

What time do you normally spend in bed asleep? Cut out the card with the word '*sleeping'* on it and place it on the timeline at a time when you would normally be asleep. Do the same for each of the other cards.

Exemplar 2: **Mathematics**

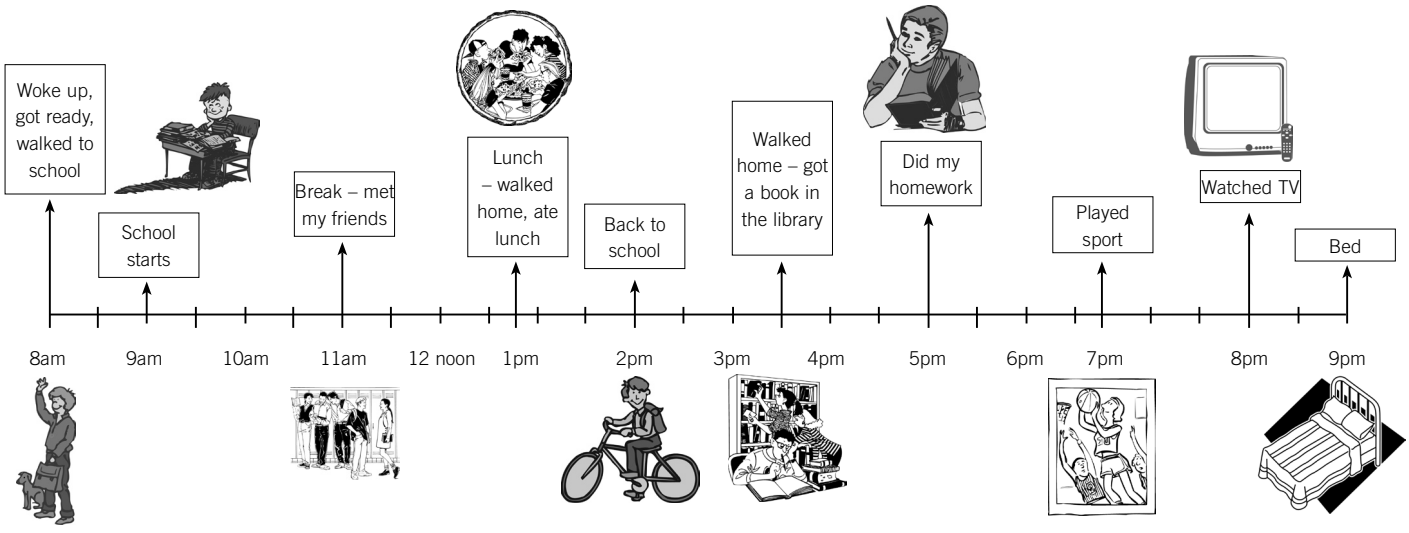


When you are finished, talk to the person beside you about why you placed each card at that time on the timeline.

Assessment strategy 2: Personal timeline

Students make a timeline in words and pictures to represent their day. This can be done initially using the 12-hour clock. This activity can be used to assess the student's ability to sequence events and to estimate how long certain activities can take. Students, in pairs, can then be encouraged to ask each other questions based on their timeline. For example:

- At what time did you play sport?
- How long did you spend doing your homework?
- Did you spend more time watching TV or playing sport?



Exemplar 2: **Mathematics**

Activity 4

Air-Traffic Control 1

Note: This activity as presented is quite complicated.
It may be more appropriate to choose a smaller selection of flights to begin with.

Warning! Warning! Due to a computer error some information has been lost or mixed up. All air-traffic controllers are advised to check the departure and arrival times carefully and to put the planes in order as follows:

1. Cut out each of the flight information sheets below.
2. Arrange the strips into the correct order based on the times given.
3. Enter the flight numbers from EI 152 to EI 178 going up in even numbers.

DUBLIN TO LONDON HEATHROW, JANUARY

Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
	08:55	10:10		14:05	15:20

Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
	13:00	14:15		15:30	16:50

Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
	12:00	13:15		17:35	18:55

Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
	20:05	21:15		19:15	20:25

Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
	18:35	19:50		10:20	11:40

Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
	07:50	09:10		16:30	17:50

Flight No.	Depart	Arrive	Flight No.	Depart	Arrive
	19:55	21:05	EI 152	06:50	08:05

Exemplar 2: **Mathematics**

Activity 4a

Air-Traffic Control 2

Well done! You have managed to sort the flights into the correct order. Unfortunately, we have discovered another error in the computer system. All times must now be entered in 12-hour clock format. Your next task is as follows:

- Change all of the times shown from the 24-hour clock to the 12-hour clock.
- Don't forget to use AM or PM.
- Fill your answers into the table below.

Flight No.	Depart (24-hour)	Depart (12-hour)	Arrive (24-hour)	Arrive (12-hour)
EI 152	06:50	6.50am	08:05	8.05am
EI 154	07:50		09:10	
EI 156	08:55		10:10	
EI 158	10:20		11:40	
EI 160	12:00		13:15	
EI 162	13:00		14:15	
EI 164	14:05		15:20	
EI 166	15:30		16:50	
EI 168	16:30		17:50	
EI 170	17:35		18:55	
EI 172	18:35		19:50	
EI 174	19:15		20:25	
EI 176	19:55		21:05	
EI 178	20:05		21:15	

Exemplar 2: **Mathematics**

Vocabulary

Air-traffic controller	a person who organises the departure and arrival of planes
Flight No.	the flight number used to tell which plane is which
Depart	the time that a plane takes off from an airport
Arrive	the time that a plane lands at an airport
24-hour clock	time based on 24 hours starting with 00:00 (midnight)

Discussion topic
Why is the 24-hour clock used in airports and on many timetables?

Exemplar 2: **Mathematics**

Activity 5

TV Times

Note: This activity as presented is quite complicated. It may be more appropriate to choose a smaller selection of programmes to begin with.

Part of the TV schedule for RTE 1 on Monday, 08 January 2001

TIME	PROGRAMME
13:00–13:25	ONE O'CLOCK NEWS AND WEATHER. CINNLINTE NUACHTA
13:25–13:55	HOME IMPROVEMENT
13:55–14:25	NEIGHBOURS
14:25–14:55	DOCTORS
14:55–15:25	THE BILL
15:25–15:30	NEWS SUMMARY AND WEATHER
15:30–16:50	OPEN HOUSE. NEWS SUMMARY
16:50–17:20	SHORTLAND STREET
17:20–17:30	NUACHT
17:30–18:00	NEIGHBOURS
18:00–18:01	THE ANGELUS
18:01–19:00	SIX-ONE NEWS AND WEATHER
19:00–19:30	NATIONWIDE
19:30–20:00	WILDLIFE ON ONE
20:00–20:30	NO FRONTIERS
20:30–21:00	EAR TO THE GROUND
21:00–21:35	NINE O'CLOCK NEWS AND WEATHER
21:35–22:35	REBEL HEART
22:35–23:35	IRELAND OVERSEAS
23:35–23:40	NEWS SUMMARY AND WEATHER. AN EVENING PRAYER
23:40–01:40	ACCIDENT
01:40–02:05	GRACE UNDER FIRE

Exemplar 2: **Mathematics**

Look carefully at the TV listings shown and then answer the following questions:

1. At what time does the One o'clock News begin?
   Give your answer in the 24-hour clock and also in the 12-hour clock format.
2. How long does Wildlife on One last?
3. How long does Shortland Street last?
4. Which programme is longer, Grace Under Fire or Doctors?
5. I want to record Neighbours on video. How much space do I need on my videotape?
   Give your answer in minutes.
6. I went to sleep at 9.40 p.m., but I set the alarm for the start of Grace Under Fire. How much sleep did I get?
7. I watch a programme on RTE 2 that ends at 7.40 p.m. Then I switch over to Wildlife on One. How much of Wildlife on One have I missed?

Exemplar 2: **Mathematics**

Activity 6

Catch that Train

Note: Begin with very simple timetables and then gradually introduce more complicated examples. Using a worksheet such as below, students become familiar with a range of different timetables and can answer questions such as those suggested. In addition, students can make up their own scenarios based on a particular timetable. Students can also be encouraged to access timetables on the worldwide web.

Here is an extract from the timetable for trains running from Dublin to Cork. Use the information given in the table to answer the questions which follow.

Train	A	B	C	D	E	F
Dublin, Heuston	05: 25	08: 30	10: 50	13: 20	17: 10	19: 15
Newbridge						19: 41
Kildare		09: 00				19: 50
Portarlington				14: 02		20: 07
Portlaoise	06: 16	09: 25		14: 14		20: 19
Ballybrophy		09: 41				20: 35
Templemore		09: 55		14: 40		20: 48
Thurles	06: 51	10: 09	12: 11	14: 54		21: 03
Limerick Jct.	07: 13	10: 31	12: 33	15: 16	18: 49	21: 25
Charleville	07: 33	10: 53	12: 53	15: 37		21: 46
Mallow	07: 50	11: 21	13: 11	15: 54	19: 23	22: 03
Cork	08: 19	11: 49	13: 39	16: 22	19: 51	22: 31

1. At what time does the earliest train leave Dublin?
2. Which train makes the most stops?
3. Which train makes the least number of stops?
4. At what time does train D leave Thurles?
5. How long does train A take to travel from Dublin to Cork?
6. I arrive in Dublin to catch the 08:30 train to Portlaoise but it is cancelled due to a problem on the line. How long will I have to wait for the next train to Portlaoise?
7. If I live in Portarlington, which is the earliest train I can get to Cork?
8. If I live in Kildare, which is the earliest train I can get to Cork?
9. I need to be in Cork before 8 p.m.. What is the latest train I can catch from Dublin to get there just in time?
10. I want to travel from Thurles to Cork to meet a friend who lives fifteen minutes away from the train station. What is the latest train I can catch to meet my friend at 2pm?

Exemplar 3: **Mathematics**

Syllabus topic: Mathematics: Applied arithmetic and measure | Walking on the edge

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Measures Strand unit: Length	Applied arithmetic and measure: SI unit f length (m)	Perimeter, area and volume.

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to fourteen class periods.

Potential areas of difficulty

- Short-term memory
- Understanding concepts
- Spatial awareness
- Confusion with signs and symbols
- Language

Strategies used in this exemplar

- Frequent practice with the concept of perimeter through a variety of different activities
- The use of cross-curricular approaches
- Access to models of relevant shapes
- Practising of estimation skills
- Measuring familiar real-life objects
- Encouraging students to use relevant mathematical language
- Using worksheets with pictorial clues
- Pair work and group work.

Resources

- Various tools for measuring length, such as small rulers, metre sticks, tape measures, strings of various colours, a trundle wheel

Exemplar 3: **Mathematics**

Suggested outcomes

As a result of engaging in these activities students should be enabled to

1. engage in discussion about the purpose of measuring length
2. measure length using appropriate measuring tools
3. use string and a centimetre ruler to calculate distance from a simple map
4. use a centimetre ruler to measure straight lines
5. use a centimetre ruler to measure the edges of a variety of mathematical shapes (square, rectangle, triangle)
6. understand the concept of perimeter, for example the distance you travel when walking around a shape
7. find the perimeter of various shapes drawn on squared paper by counting the units around the edges
8. Calculate perimeter from representational diagrams.

Supporting activities

1. Students engage in a structured discussion on the purposes and methods of measuring length.
2. Students measure a range of lengths relevant to their experience.
3. Map measuring exercise.
4. Classroom measurements
5. Using cut-out shapes
6. Floor exercises
7. Measuring the perimeter of shapes on squared paper.
8. Calculating and recording accurately.

Assessment strategies

1. One student from each group reports three points from the discussion back to the class.
2. Each student challenges another student to estimate, measure, and record a length in the classroom. Students have a range of measuring tools to choose from.
3. How well do the student's measurements compare to the accurate measurements?
4. Students measure colour-coded strings of various lengths and complete a table. In pair-work: one draws a line of a certain length and the other first guesses the length and then measures it. A correct guess gets 2 points and a correct measurement gets 1 point.

Colour of string	Length of string
Red	
Blue	

5. Students assess their own accuracy.
6. Can the student explain perimeter? Can the student also work it out by adding the lengths of the sides of the shape? Peer assessment is intrinsic in this activity.

   Use the worksheet on page 53 to assess the student's understanding of calculating the perimeter of various shapes.
7. Teacher observes students' accuracy.
8. Teacher observes students' accuracy in calculation and recording.

Cross-curricular links: These skills can be reinforced if similar concepts in geography (maps) and PE (measuring distance jumped or thrown and perimeter of pitch or court) are treated at the same time.

Exemplar 3: **Mathematics**

Activity 1

Let's talk about length

Rules for group discussion

The establishment of a number of rules for small group discussion can assist the smooth running of structured discussion in the classroom. Ideally, the teacher and students can draw up the list of rules together. The rules should be simple, easy to understand, and be presented as positive behaviours to be encouraged rather than negative behaviours to be avoided. Some suggestions are included here, but teachers and students may include different rules that are relevant to their situations.

Rules for group discussion

1. Listen to each person as he/she is talking.
2. Involve each person in the group.
3. Wait until a person is finished before you speak.
4. Ask questions if you do not understand.
5. Make your point clearly.
6. Respect different points of view.

Structured Discussion

The teacher initiates a structured discussion about the purposes and methods of measuring length. Some possible questions to initiate the discussion might include:

- How far do you travel from home to school? Does anyone come by car? Have you ever checked the distance on the display on the dashboard?
- I live next door to another teacher in the school so it is the same distance from both of our houses to the school.We both drive to school, and I noticed the other day that it shows a longer distance on my dashboard display for the journey than on hers. Why might that be? (I take a different route, have to drop my children off on the way, etc.)
- Has anyone decorated a room in their house recently? Was any length measured for that? Why? (the height of the room to see if a piece of furniture would fit in, the length and width of room to see how much carpet was needed, the width of the window for curtains, etc.) How were the lengths measured? (measuring tape, ruler, roughly comparing to the length of the arm, etc.)
- The farmer up the road from me is building a new fence around his field. He was wondering how to find out how much wire he will need. Has anyone got any ideas? (using a measuring tape; walking around the field, counting how many steps it takes, and then measuring the length of his step; if the field is rectangular, walking around only half of the field; etc.)

Some discussion on the meaning and use of the following keywords may arise as a result of the discussion: *length, width, height, distance, perimeter, how far? nearer, farther, measure, ruler, measuring tape, millimetre, centimetre, metre, kilometre.*

Exemplar 3: **Mathematics**

The students are then given work cards that include a variety of activities and are invited to write on the card why and how length is measured in each situation. Suitable activities include: buying shoes, buying trousers, buying an envelope to post a calendar to a friend, putting up a shelf in your room, marking lines on a soccer pitch, checking the height of a tennis net, getting a ribbon to go across a door for an opening ceremony, making a wall hanging, finding out the distance between two towns on a map, finding out the distance from the school to the nearest shop/library/sports centre/bus stop, etc.

Students initially work in pairs and discuss what to write on the card. After the cards are completed, students form small groups and discuss what they wrote on their cards. The teacher circulates and reminds groups of the rules of discussion when necessary. As described in the first assessment strategy, one student volunteers to report three general points about the use of length to the class.

Activity 2

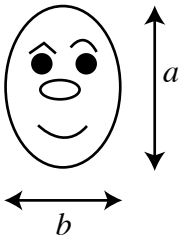
Measuring lengths

Personal lengths

Students work in threes to measure various personal lengths (one to measure, one to be measured, and one to check the measurements). Students record their own measurements on a card such as the one below. Teachers may decide to change the personal lengths mentioned below depending on the students involved, particularly if the students have physical disabilities.

The card could be changed to show pictorial clues for the lengths to be measured. Students may find it interesting to note the following approximate ratios:

Length from finger to finger with arms outstretched: Height = 1:1



Length of head: width of head = 1.6:1 (see a:b in diagram)

More details of the ratios of the body can be found in *Junior Certificate Guidelines for Teachers: Mathematics (page 31).*

Students estimate and then measure lengths in the classroom including the length of the desk, the width of the desk, the length around the edge of the desk, the dimensions of blackboard/door/window.

Exemplar 3: **Mathematics**

Students can work in pairs. Skills involved include

- How to estimate the length and compare it to some known length (for example, a metre stick, the length of a finger)
- Selecting the appropriate measuring tool for the task (a ruler, a measuring tape, a string, a metre stick, a trundle wheel)
- The accurate use of the measuring tool (where the scale starts, what to do if the length is not an exact amount of units)
- Selecting the appropriate unit of measurement (mm, cm, m, km) and finding this unit on the measuring device
- Keeping track of measurements, for example when using a ruler to measure a long distance the student needs to keep a record of the running total.

(Name) _____

Measurements

Hand-span: _____ cm

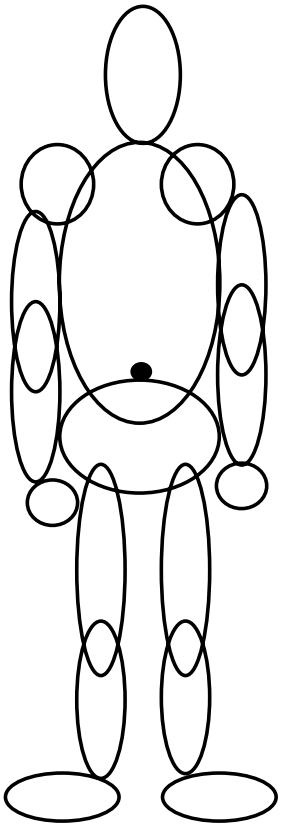
Length from finger to finger with arms outstretched: _____ cm

Length of head from top to chin: _____ cm

Width of head from ear to ear: _____ cm

Height: _____ cm

Length of foot: _____ cm

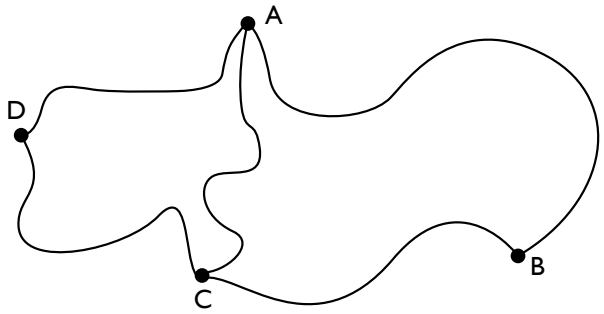


Exemplar 3: **Mathematics**

Activity 3

How far is it?

Use a piece of string or a strip of paper to find the distance from one point to another and measure the string or paper using a centimetre ruler. Fill in the table below and answer the questions.

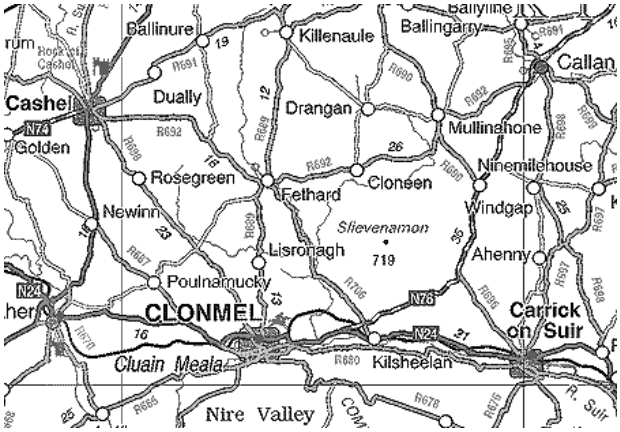


From	To	Distance (cm)	From	To	Distance (cm)
A	B		B	C	
A	C		C	D	
A	D		D	A	

1. If I go from A to B to C, how far have I travelled all together?
2. How far is it from C to A to B?
3. What is the distance from D to A to C?

Extension activity

A sample map is included below. (Note: It may be too detailed for use with many students and a simpler one could be found to replace it.) A local map would be of most interest to the students. Students can use string and a centimetre ruler to answer questions such as those below. These skills can be reinforced if similar concepts in geography are taught at the same time.



1. If you travel along the N24 from Clonmel to Carrick-on-Suir how many centimetres would you travel on the map?
2. Which is the longer distance on the map: from Fethard to Cashel along the R692 or from Fethard to Killenaule along the R689?
3. A crow flies in a straight line from Callan to Ninemilehouse. I drive along the R698 road from Callan to Ninemilehouse. What distance on the map did each of us travel? Who travelled the shorter distance?

Exemplar 3: **Mathematics**

Activity 4

Classroom Measurements

Students identify various straight lines in the classroom and, working in groups, measure them in centimeters, for example width/length of a copy; length of pencil/pen; height of teacher's marker etc. Guidance may be provided to ensure that the lengths being measured are small enough for the students to manage.

Activity 5

A range of coloured, cut-out shapes is provided with known measurements. Students measure, record and compare their answers to the accurate ones. For ease of measurement shapes should initially have lengths of whole units only.

Activity 6

Taped lines are laid on the floor in the shape of squares, rectangles and triangles. Students walk around the lines with a trundle wheel and measure the total distance walked. Other students measeure each side with a tape measure and/or metre stick and add the lengths of the sides. Students compare the results of the two methods.

Activity 7

A range of different rectangular shapes is drawn on squared paper. Students count around the edge (as if they were walking it) to get the perimeter of each shape.

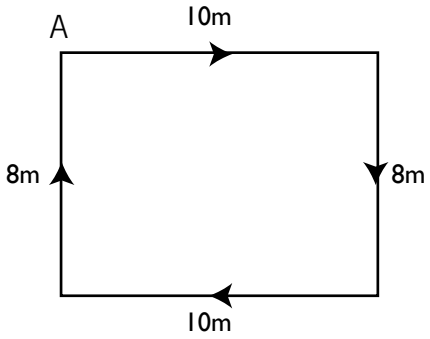
Exemplar 3: **Mathematics**

Activity 8

Finding the perimeter: walking the line

A farmer wants to measure the perimeter of a field on his farm. He knows the length of each edge of his field. Help him to find the total distance as he walks around.

Start at A and follow the arrows, writing down the distance as you walk.



Distance walked:

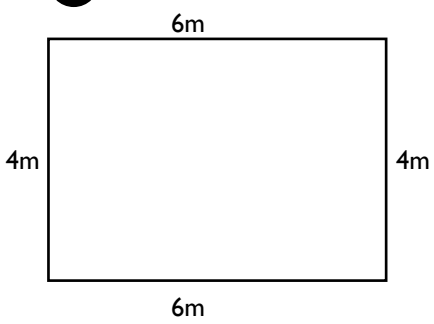
10m + _____ + _____ + _____

Perimeter = _____ m

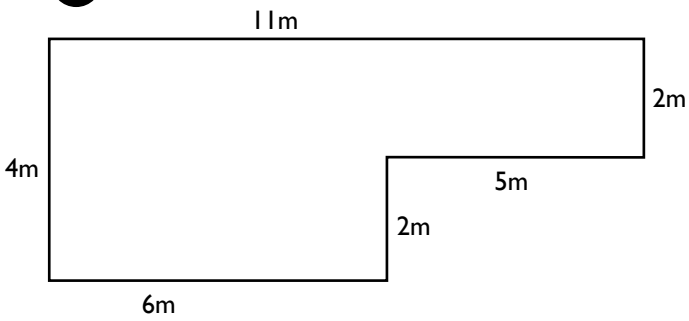
Exemplar 3: **Mathematics**

Now find the perimeter of the fields below in the same way.

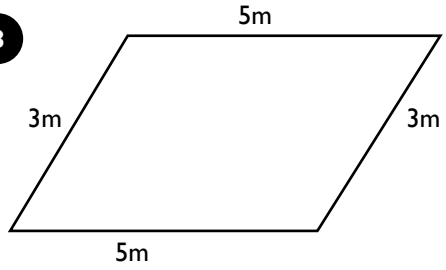
1



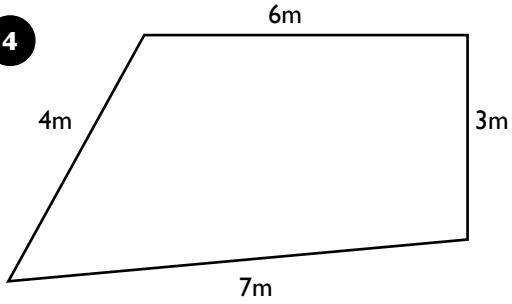
2



3



4



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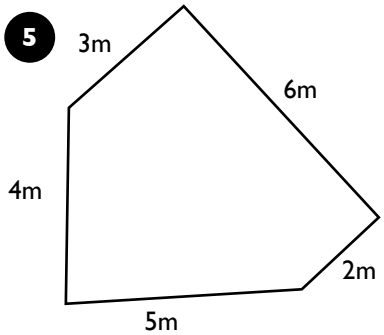
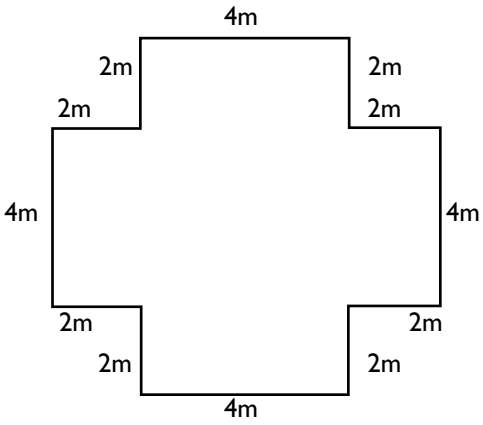


6



Exemplar 4: **Mathematics**

Syllabus topic: Business Studies: The Business of Living
Mathematics: Applied Arithmetic and Measure

Going shopping

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Number Strand unit: percentages Strand: Measures Strand unit: Money	Applied Arithmetic and Measure: Bills. Profit and Loss. Percentage profit. Percentage discount. Business Studies: The Business of Living: Budgeting	Mathematical Education: Use of calculator Apply the knowledge and skills needed to manage money in daily life.

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to six class periods, depending on the progress of the students.

Potential areas of difficulty

- Difficulties in understanding mathematical operations, such as addition, subtraction, multiplication, percentages
- Limited vocabulary, creating difficulty with terms like discount, total, subtotal
- Limited sight vocabulary, creating difficulty with the names of grocery items and acronyms such as V.A.T.
- Short attention span and lack of concentration and application
- Poor motor skills, creating difficulty with using calculators
- Following instructions

Strategies used in this exemplar

- Language development through listening, talking, discussion, copying, writing, reading for choice, etc.
- Reinforcement techniques, using graded extension and development of tasks
- Using *'real'* materials, for example newspaper advertisements (full page spreads of special offers), receipts from local shops, calculators (including large-keyed ones) as used in some hardware shops.
- Pair work and role playing
- Using students' personal experience
- Visual aids, such as the OHP/data projector and wall charts
- ICT

Resources

- Newspaper advertisements, shop receipts, special offer notices
- Calculators, including large-key ones
- Packaging of grocery items; stickers for pricing
- Paper and markers for students' wall charts
- Some good software is available that allows students to use a calculator on screen, for example Edmark Calculator collection, Maths Made Easy

Exemplar 4: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. engage in discussion on the uses of money 2. be aware of appropriate uses of money in their own lives and of the value of money 3. list items of personal expenditure 4. list typical items of daily grocery expenditure 5. list typical items for an evening's entertainment, and calculate the total cost 6. calculate multiples of unit prices using multiply function on calculator.	1. Money Talks activity (p 56) 2. Pair work on weekly spend together with developing coin skills 3. Class discussion on personal expenditure on a particular day 4. Role play of power cut in local shop 5. The class/group talks about going out and what it costs 6. Students plan a class outing to the cinema 7. Sales, discounts and calculator work.	1. Observe students talking about and/or illustrating four points about the uses of money. 2. Students assess their own estimating accuracy by comparison with actual costs. Pairs assess each other on coin skills 3. Observe students making a list and calculating the cost. 4. Observe students, in role, make lists and calculating the cost of their lists. 5. Observe students' participation in class/group work. - One works on estimate, the other on cost, and thay compare them. - Students list items and prices, then totals. - Discuss any problems with estimating or big differences between the estimate and the full cost. 6. Observe students' participation and involvement in activity. Note students' ability to use calculator correctly. 7. Observe students in pairs making their own sales posters and labels.

Exemplar 4: **Mathematics**

Activity 1

Money talks

Keywords

Keywords that may arise during the discussion include *money, notes, coins, euro, cent, shopping, bill, charge, change, cheque, credit card, laser card, loyalty card, save, bank, account, Post Office, credit card, holiday, bus fares, train fares, single, return, student rate, pocket money, tax, VAT, restaurant, tip, value for money, sale, discount, profit, loss.*

Pairs

Some sets of cards can be produced with keywords and their meanings. Ideally, the meanings can come from the students' understanding of the words as a result of classroom discussion.

Some sample cards are shown below. In twos or threes, students play a matching memory game by putting the cards into a words pile and a meanings pile, turning all of the cards upside-down, mixing them around (within their piles), and taking it in turns to turn over one from anywhere in each pile. If they pick a word and its correct meaning they keep the pair and get another turn. Otherwise, they place the cards back in their original positions and the next person has a go. The student who collects the most pairs is the winner of the game.

Sample cards for Pairs game

Words pile	Meanings pile
Coins	Money that is made from metal
Notes	Money that is made from paper
Value for money	It's worth what you pay for it
Discount	The price is cheaper than usual

Exemplar 4: **Mathematics**

Activity 2A

Students are presented with a card, each card showing different amounts of money in euro and cent. In pairs students discuss how they would spend their money over the course of a week. This can be followed up by a class discussion on what sort of things it is appropriate to spend money on, value for money, saving etc.

Activity 2B

You owe me …

Students work in pairs. The aim of this activity is for one student to ask for a certain amount of money and for another student to try to make it up in the least amount of coins possible. The teacher can write a list of possible amounts on the board or students can make up amounts themselves. Students can complete the second and third rows of a table such as the one below for assessment purposes. (The table is shown fully completed.)

You owe me:	List of coins received	Least number of coins possible
50 cent	50c	1
30 cent	10c, 20c	2
1 euro 15 cent	€1, 5c, 10c	3
5 euro 23 cent	€2, €2, €1, 20c, 2c, 1c	6
4 euro 61 cent	€2, €2, 50c, 10c, 1c	5

Exemplar 4: **Mathematics**

Activity 3

How do you spend your money?
In a class discussion students are invited to brainstorm all aspects of personal expenditure in a typical day. The teacher writes them on the OHP, with the costs supplied by the students.

Students select and list three/four items, with prices, bought on a typical day, selecting them from the OHP.

Students calculate the total cost. Use Work-card 1 for students who are not sure about layout.

Use calculators.

What change would you get from …?

Extension activity
Students could bring in shop receipts to check 'real' costs.
A wall chart of shop special offers could be used and the total cost of two/three items calculated.

Activity 4

Making out bills.
Make up a story about a power cut in a local shop. A calculator has to be used to work out bills.

Boxes and packaging of common products can be used, along with price stickers based on real till receipts or advertising charts from newspapers.

Students role play customers and shopkeepers, working in pairs/threes. One student can write out a list of messages with an estimate of prices and an estimate of the total, the second calculates the real cost, and the third, (a store detective perhaps) checks the bill.

The number of items can be varied to suit students' capabilities.

Work-card 2 can provide practice, if necessary.

Note: Students could bring in shop receipts to check 'real' costs.

Activity 5

Evening entertainment
The class/groups talk about going out, what it costs, where they like to go, what they can afford, hidden costs, etc.

List three items with costs and round up or round down. Calculate total estimate.

List the items with real prices, remembering to use decimal points. Calculate the total using a calculator.

Compare and discuss results.

Workcard 2 may be used as a template for this activity.

Exemplar 4: **Mathematics**

Activity 6

Trip to cinema
Students plan a class outing to the cinema.

They calculate how many tickets are needed.

If the bus costs 80c each, how much would be paid in all for the bus?

The teacher buys treats for class members. How many Tarz bars would be needed and how much each do they cost?

Estimate and then calculate using the multiply function on the calculator.

An effective assessment of this learning outcome would be to plan a real class/group outing, do all the estimates and calculations, go on the outing, and see if the estimates and calculations were right. A trip to the local pizza parlour would be just as useful.

Activity 7

Initiate a class discussion recalling percentages, discounts in sales (20%, 50% off) and supermarket or shop posters of % discounts.

Sale time!
Using a calculator to work out % discounts of 10%, 20%, 50%.

Aims: To enable each student to

- build on previous knowledge of percentages, for example 50% of €1 = 50c, 25% of €1 = 25c = €0.25, 15% of €1 = €0.15.
- use a calculator to get a % of a number.
- calculate a % discount.

The teacher instructs students to use a calculator to get 15% of €60 as follows:

Key in .15 x 60 = ANS.

Key in 60 - ANS = Discount price.

Student tasks: Make out SALE labels for items of clothing.

Make out a SALE poster for four/five special offers

Use Work-card 3 as an example, if necessary.

Exemplar 4: **Mathematics**

Workcard 1

	€	c
Crisps	_____ .	_____
Sweets	_____ .	_____
Total	_____ .	_____

What change would you have from €1?

Crisps	_____ .	_____
Bar	_____ .	_____
Fizzy drink	_____ .	_____
Total	_____ .	_____

What change would you have from €2?

Milk	_____ .	_____
Juice	_____ .	_____
Bread	_____ .	_____
Tea Bags	_____ .	_____
Total	_____ .	_____

What change would you have from €5?

Exemplar 4: **Mathematics**

Workcard 2

Write these prices to the nearest €

€1.99 | €

70c | €

€4.95 | €

€1.20 | €

Write down the total estimate. (Add the figures in the boxes.)

€

Using the calculator, add the real prices.

€

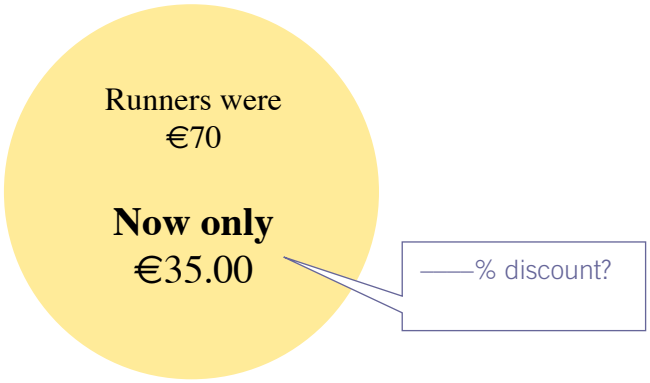
Exemplar 4: **Mathematics**

Workcard 3

PRICES SLASHED!

Not to be missed!

Up to 50% off all Stock!



Exemplar 5: **Mathematics**

Syllabus topic: Sources of income and interpreting payslips | Income and payslips

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Measures Strand unit: Money Strand: Data Strand unit: Representing and interpreting data	Section One - The Business of Living, Budgeting: Expenditure.	Business Studies Personal Finance: Manage personal finances in the areas of income, expenditure and budgeting

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to five/six class periods. The time scale can be adjusted according to the teacher's assessment of class/student achievement of targeted outcomes.

Potential areas of difficulty

- Poor vocabulary (failure to understand terminology such as gross, net, deductions, etc.)
- Delayed language development (failure to understand acronyms such as PAYE, PRSI)
- Poor understanding of concepts
- Spatial awareness (inability to interpret pie charts and figures under different headings in payslips)
- Transferring learning to real-life situations (such as identifying sources of income beyond student's experience)

Strategies used in this exemplar

- Language development (business terms such as gross, net, PAYE, etc.)
- The use of reinforcement techniques
- The use of concrete materials
- Role playing as employer and employee
- Pair work
- Class discussion
- The use of students' personal experience
- The use of visual material on the OHP and wallcharts
- Case studies/examples
- Introduction to the jobs sections of newspapers

Resources

- Play/Monopoly money
- Pens, paper, etc. for students to draw wall charts
- Jobs sections from newspapers
- Acetate for the OHP or laminated wall charts (which can be written upon several times), showing a pie chart with slices labeled PAYE, PRSI, and Net Income

Exemplar 5: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. describe ways in which people get money 2. understand the words: job/ employment, wages/ earnings/ income, unemployment benefit 3. name different sources of income 4. understand why people get social welfare payments 5. discuss the different words describing unemployment benefit, and other financial supports such as Disability Allowance, Old Age Pension, etc. 6. understand part-time work and apply different methods of payment	1. Brainstorming and discussion 2. Keyword approach 3. Groupwork using characters from TV soap. 4. Agony aunt role play 5. Discussion using examples 6. Discussion followed by examples. Calculator work in pairs.	1. Observe students describing three ways in which people can get money. 2. Observe students completing Worksheet A, matching forms of income to their sources. 3. Observe students working in groups to draw wall charts showing the possible sources of income for each of the people identified. 4. Observe students completing Worksheet B to identify the reasons why people receive Social Welfare payments. 5. Observe students completing Worksheet C, matching photocopies of benefit books to words and pictures. 6. Observe students' participation in discussion and calculator work.

Exemplar 5: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
7. Apply an hourly rate of payment • use calculators to work out a weekly wage for thirty-five hours work • discuss why some people earn more per hour than others	7. The teacher offers to pay students an hourly rate for every hour in school today. Using calculators, the students calculate how much they are entitled to earn. • Students work in pairs, using calculators, to work out a weekly wage for thirty-five hours work.	7. Observe students completing Worksheet D, in pairs, to calculate the weekly wage for given scenarios about hourly rates of payment. • Observe students' suggested answers to the final question in Worksheet D, leading to a general discussion about how much people can earn in different jobs.
8. Apply a piece rate of payment • use calculators to work out a weekly wage for a person being paid by piecework	8. The teacher offers to pay students a set rate for every page they have used in their copybooks (piece rate). Using calculators, the students calculate how much they are entitled to earn. • Students work, using calculators, work in pairs to calculate a weekly wage being paid to a person for piece work.	8. Observe students completing Worksheet E, in pairs, to calculate the weekly wage for given scenarios about piece rate payment.
9. Understand the concept of overtime	9. The teacher initiates a general discussion about the concept of working more hours than usual in a week. For example, in a school setting students may be involved in sport or other extra-curricular activity. Introduce the concepts of overtime payment and double time.	9. observe students completing worksheet F, in pairs, to calculate the overtime rates and payments for a given scenario.

Exemplar 5: **Mathematics**

Worksheet A

People get money for different reasons

Draw a line to join a newspaper advertisement with one of the words on the bottom of the page.
Do the same for each of the other advertisements too.

Person wanted to serve behind deli.	Great Aunt Maud has died and left all her money to her family. If you are one of them, you have been left €1000 by her.	Congratulations! You have won €100 in our raffle!	Newsflash! The Old Age Pension has gone up to €166 per week.	Happy Birthday! Here is €25 for you to spend on yourself.	Teacher wanted for very nice class of students. €20 per hour.

Employment	Winnings	Work	Inheritance	Social Welfare	Present

Note: This exercise could be extended by using a page from the Job Section of a current newspaper. A class discussion could take place about the different types of job that a person can get, the different rates of payment that they may earn, and so on.

Exemplar 5: **Mathematics**

Activity 1

Students are invited to brainstorm on all the ways people can get money (work, winnings, presents etc.)

Activity 2

- Write key words on board or place chart with them on the wall. Explore the meaning of each one with the students. Talk through examples of each word, its use and meaning.
- Students use the job section in a local newspaper to categorise different types of job. Teacher may use a website such as loadzajobs.ie to show the different job categories available.
- Students complete Worksheet A; this can be done in paris. The teacher will read through the worksheet so that reading doesn't present a difficulty to the students' ability to do the task.

Activity 3

Students use characters from popular soap operas of other TV programmes to identify the types of income that a teenager, a person/family on social welfare, and a person/family in employment might have. Students work in groups to draw/make wall charts showing the possible sources of income for each of the people identified.

Exemplar 5: **Mathematics**

Activity 4

Teacher reads the following example with the students. Students work in pairs to answer the questions and complete the exercise.

Worksheet B **Extract from the Agony Aunt column of a newspaper.**

1. *Dear Miss Trust,*

Having worked in a shop for 10 years I have just lost my job. I worked hard and earned €250 every week. What will I do now? I will have no money at all, so how will I buy myself food or anything else?

Yours sadly,

S Hopgirl.

Dear Ms Hopgirl,

Don't worry too much. You will get some money from the Government even though you are not working. They will give you money every week, which is called Unemployment Benefit until you start working again. Good luck with the job hunting!

Miss Trust.

Can you help Ms Hopgirl to get a job? Have a look at Worksheet A and see if you can suggest a job that she could apply for.

Can you take Miss Trust's place and answer a problem? Try to fill in the blanks using the words at the bottom of the page.

Dear Miss Trust,

I am an old man and am about to retire from work. What will I do? If I am not working, I will not earn any money. How will I pay my bills? Please help me.

Yours,
P. Ensioner.

Dear Mr. Ensioner,

Do not worry. You will be able to ____ your bills. The _____ will give you money every week. It is called the Old Age _____ and you will get €166 each _____.

Miss Trust.

Week Pay Pension Government

Exemplar 5: **Mathematics**

Activity 5

The teacher leads a discussion on the purpose of financial supports using photocopies of a Social Welfare Book, on Old Age Pension book, a Child Allowance book, etc.

Welfare.ie is a useful site - if access is possuble.

Students then complete the following excersie or similar matching activity where examples are matched with appropriate services and benefits.

Worksheet C **Who am I?**

Draw a line from each description in Column 1 to a picture of a person in Column 2.

Column 1	Column 2	Column 3
I cannot work every day because I am in a wheel chair and I have to go to hospital very often.		OAP book
I used to be a manager in an office but I retired when I turned 65 years old.		Disability Allowance book
I have been looking for a job but have not found one yet.		Child Allowance book
I have three children that I love very much.		Unemployent Benefit book

Now, can you match the person with the right Social Welfare book? You can draw another line from each picture in Column 2 to the right picture in Column 3.

Exemplar 5: **Mathematics**

Activity 6

- Teacher leads class discussion on part-time jobs students may have.
- Discussion is led to explore why some people might choose to work part-time.

  They discuss

  - The wages they earn
  - How pay is organised
  - Whether they get paid weekly
  - Whether payment is by time or by piece rate

Activity 7

- The teacher offers to pay students an hourly rate for every hour in school today. Using calculators, the students, working in pairs, calculate how much they are entitled to earn.
- Students work in pairs to work out a weekly wage for 35 hours work.

Activity 8

- The teacher offers to pay students a set rate for every page they have used in their copybooks (piece rate). Using calculators, the students calculate how much they are entitled to earn.
- Students work in pairs, using calculators, to calculate a weekly wage being paid to a person for piece work.

Activity 9

- The teacher initiates a general discussion about the concept of working more hours than usual in a week. For example, in a school setting students may be involved in sport or other extra-curricular activity. Introduce the concepts of overtime payment and double time.
- Students may then work in pairs on completing Worksheets D,E, and F.

Exemplar 5: **Mathematics**

Worksheet D

Can you and your partner work out how much these people will be paid for their week's work?
Write the answer in the boxes.

1. Paul has got a job in his local shop. He will work for thirty-five hours every week and the owner will pay him €6 per hour. How much will he earn in a week?

Answer

2. Peter has been employed by the local hospital as a nurse. He will receive €15 for every hour that he works. How much will he be paid when he works for a thirty-five hour week?

Answer

3. Elizabeth is going to work in an office in town. She must work for thirty-five hours and will be paid €7.50 per hour. How much will her pay be?

Answer

4. Kylie has got a job as a singer and will earn €150 per hour. If she works for thirty-five hours per week what will she receive?

Answer

5. Robbie has joined a football club and will earn €375 per hour. At the end of a thirty-five hour week, how much will he be paid?

Answer

Which job would you like to have? Ask your partner which job they would like best.

Why do you think some people are paid more than others for an hour's work?

Exemplar 5: **Mathematics**

Worksheet E

Can you and your partner work out how much these people will be paid for their work?
Write the answer in the boxes.

1. Brendan is a good cook and he can make lovely cakes. He is paid €7 for each cake he makes.
If he makes four cakes on Monday how much will he earn?

Answer

If he makes eleven cakes on Tuesday how much will he earn?

Answer

Wednesday is his day off so he does not make any cakes at all.
On Thursday he makes eighteen cakes. What will he earn?

Answer

Friday is a busy day so he makes twenty-five cakes. What will he be paid then?

Answer

Saturday is busy too, so he makes thirty cakes. What will he be paid then?

Answer

How much will Brendan earn in the whole week? (Hint: Add together his pay for each day.)

Answer

Exemplar 5: **Mathematics**

2. In *Coronation Street* Mike Baldwin pays his staff for each item of clothes that they sew. Suppose he pays them €4 for each item.

   If a worker makes ten items in a week how much will he/she be paid?

Answer

   If a worker makes seventy-five items in a week what will he/she earn?

Answer

3. If a worker works faster will he/she earn more money or less money than before? Draw a circle around the right answer below.

   More Less

Exemplar 5: **Mathematics**

Worksheet F

Can you and your partner work out how much these people will be paid for their work?
Write your answers in the boxes.

1. Sheila's boss has asked her to work in his shop on Sundays before Christmas. She usually gets paid €6 per hour, but the boss agrees to pay her double time for working on Sundays.

   How much will she earn for every hour she works?

Answer

   If she works for seven hours on a Sunday how much will she earn?

Answer

2. Steven is working late this week. He is usually paid €15 per hour.

   If he usually does thirty-five hours work during the week how much will he earn?

Answer

   His boss has decided to ask Steven to do some extra work. He will pay him double time for working in the evenings.
   How much will his hourly rate be in the evenings?

Answer

   He works for two hours overtime on Monday evening. How much will he be paid for that?

Answer

   On Thursday evening he does five hours overtime. What will he earn for that?

Answer

   How much will Steven earn for the whole week?
   (Hint: Add up his basic wage and his overtime payment for Monday and Thursday.)

Answer

Exemplar 6: **Mathematics**

Syllabus topic: The Business of Living | Analysed Cash Books

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Measures Strand unit: Money Strand: Data Strand unit: Representing and interpreting data	**Business Studies:** The Business of Living, Budgeting: Expenditure.	Accounting:Understand and use basic budgeting and accounting methods involved in home, club and company accounts

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to seven class periods. The time scale can be adjusted according to the teacher's assessment of class/student achievement of targeted outcomes.

Potential areas of difficulty

- Short-term memory (remembering that debit side represents what goes in, etc.)
- Poor vocabulary (difficulty with understanding terminology such as debit, credit, balance)
- Spatial awareness (recognising debit and credit sides in Record Book, coping with the number of analysis columns, completing and balancing the Cash Book in the required format)
- Transferring learning to real life (recognising the usefulness of recording transactions)
- Performing calculations

Strategies used in this exemplar

- Language development (developing a vocabulary of business terms, such as debit, credit, balance)
- Role-playing shopping
- Pair/small group work
- Class discussion
- The use of Tossing the Coin game
- The use of concrete materials
- The use of structured worksheets
- The use of visual material on spreadsheets or wallcharts
- The use of reinforcement techniques
- The use of websites to reinforce the topic

Exemplar 6: **Mathematics**

Resources

- Photocopies of the class roll book, a homework notebook, and a diary
- Large cardboard or laminated discs
- Monopoly/play money
- Paper for wall charts
- Scissors
- A purse
- Calculators
- Internet access to www.skoool.ie
- Computer spreadsheet package (optional)

Exemplar 6: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of these activities student should be enabled to		
1. understand the concept of keeping records	1. Initiate a class discussion about the purpose of a class roll book, a homework notebook, and a diary, using photocopies of each as support.	1. Observe whether students can interpret a sample roll book as shown in Worksheet A.
2. explore different reasons for keeping records	2. Following on from Worksheet A, brainstorm for ideas about who might keep records. Suggestions might include school records, doctors' records, dentists' records, bank accounts, service providers (ESB), etc.	2. Observe students participating in a brainstorming session and explaining the types of records that may be kept.
3. appreciate the benefits of keeping personal financial records	3. Students work in pairs to complete Worksheet B, sorting pictures of items and money into those received and those paid.	3. Observe whether students can describe why it is a good idea to keep financial records
4. analyse expenditure under appropriate headings	4. Concentrating on expenditure, initiate a class discussion to decide on analysis headings suitable for average family.	4. Observe students using 'Family Diary' (Worksheet C) to group items of expenditure under given headings.
5. understand how to keep personal records of money received and money spent	5. Students work on worksheet D	5. Observe whether students can complete Worksheet D, dividing amounts of money into received and paid.
6. understand the terms 'debit' and 'credit'	6. Tossing the Coin game See Game 1, p 91.	6. Observe whether students can make five correct guesses as the coin is tossed.
7. transfer that knowledge to bookkeeping	7. Use a chart or spreadsheet to demonstrate the debit and credit cash columns of a cashbook.	7. Observe whether students can complete Worksheet E, recording money received and spent, using small amounts.
8. calculate the remaining balance	8. Role-play shopping. (How much money is left?)	8. Observe students, using play or Monopoly money, role-playing the scenarios on Worksheet E to calculate how much money each person would have remaining.

Exemplar 6: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
9. recognise and become familiar with the relevant terms.	9. Using play money and a purse the teacher demonstrates that money left to spend is available for spending in the future. It may be appropriate to use basic terms such as 'balance'.	9. Observe students completing Worksheet F, using a calculator to work out how much money remains in the purse.
10. apply the terms to balancing a cashbook	10. Wall chart 1 A diagram of an old-fashioned weighing scale is used to reinforce the concept of balance.	10. Observe students completing Worksheet G to calculate the balancing amounts.
11. apply the techniques of balancing a cashbook	11. Use Worksheet H to reinforce the concept of balancing.	11. Observe students completing a wall chart/spreadsheet (Wall chart 2) individually or in teams by affixing the correct amounts and terms.
12. complete an Analysed Cash Book	12. Using a spreadsheet the teacher completes an Analysed Cash Book.	12. Observe whether students can indicate the amount of money remaining in each cashbook.
13. revise what they have learned.	13. Using www.skoool.ie, students can revise the entire topic.	13. Observe whether students can allocate the expenditure to the correct analysis column And if they are able to total and balance the Cash Book. 14. Self-assessment tests and exercises are incorporated into the lesson on www.skool.ie

Exemplar 6: **Mathematics**

Worksheet A

A page from a school roll book

Name	Mon	Tues	Weds	Thurs	Fri	Mon	Tues	Weds	Thurs	Fri
1. Joe Browne	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. James Carroll	✓	✓	✓	✓	✓	✓	✓	❍	✓	✓
3. Sharon Darcy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Kevin Flynn	✓	✓	❍	✓	✓	✓	✓	✓	✓	✓
5. Ciara Glynn	✓	✓	✓	✓	✓	✓	❍	✓	✓	✓
6. Barry Hayes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7. Deirdre Kenny	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8. Joanne Kinsella	❍	❍	❍	❍	❍	✓	✓	✓	✓	✓
9. Jim Martin	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10. Fiona O Brien	✓	✓	✓	✓	✓	✓	✓	✓	❍	❍
11. Brendan Ryan	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
12. Paul Scully	❍	❍	✓	✓	✓	✓	❍	✓	✓	✓
13. Gemma Ward	✓	✓	✓	✓	❍	✓	✓	✓	✓	✓
14. Susan Ward	✓	✓	✓	✓	❍	✓	✓	✓	✓	✓

Note: The following might be some questions that the class could discuss:

- How many people in the class?
- How many boys?
- How many girls?
- Who was absent on the first Monday?
- Find someone who was in school every day.
- Who had the most absences?
- Why does a teacher keep a roll book?
- What other records does the school keep about students?
- Why does the school keep these records?

Exemplar 6: **Mathematics**

Worksheet B





Can you help Peter? He is in an awful muddle about his money and doesn't know how much he spent or whether he should have any money left.

Working in pairs cut out the pictures at the top of the page and stick them into the correct column. If Peter received money put the pictures into the Money In column. If he spent money on them put the pictures into the Money Out column.

Money In	Money Out

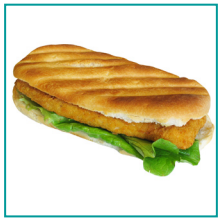
Exemplar 6: **Mathematics**

Worksheet C









Look at the things that the Mullen family bought last week. Working in pairs cut them out and stick them into the correct column.

Groceries	House	Clothes	Entertainment	Other

Exemplar 6: **Mathematics**

Worksheet D

Now you must put the figures in the correct column. If Peter received money write the amount into the Money In column; if he spent money write the amount into the Money Out column.

Peter got €30 for his birthday from his Grandmother. He bought a CD for €20 and a book for €10 with this money. Peter's Dad gave him €5 for washing the car and he also earned €30 from his part-time job. He bought a new t-shirt for €20, some sweets for €2, and a can of lemonade for €1.

Money In	Money Out

Exemplar 6: **Mathematics**

Worksheet E

Read the following stories. You have to keep the records for each person. If the person gets money in put the amount into the Credit column. If the person spends money put the amount into the Debit column.

Sarah earned €25 for her Saturday job. She bought a magazine for €3 and some make-up for €12.

Debit		**Credit**	
Magazine	€	Earnings	€
Make up	€		

Michael received €50 as a birthday present. He bought a DVD for €28, sweets for €3, and a book for €8.

Debit		**Credit**	
DVD	€	Present	€
Sweets	€		
Book	€		

Mr. Johnson received his wages of €350. He bought groceries in the supermarket for €70, spent €30 on petrol for his car, paid his mobile phone bill for €60, and bought a pair of shoes for €65.

Debit		**Credit**	
Groceries	€	Wages	€
Petrol	€		
Mobile Phone Bill	€		
Shoes	€		

This time you have to write the words as well as the amount of money in the correct column. Remember, if the person gets money in put the amount into the Debit column. If the person spends money put the amount into the Credit column.

Brona won €100 on the Lottery. She bought a pair of boots for €50 and a top for €30.

Debit		**Credit**	
	€		€
			€

Exemplar 6: **Mathematics**

Kevin earned €40 for babysitting and €25 for delivering leaflets. He bought a phone card for €20, batteries for his Walkman for €6, and a bunch of flowers for his Mum for €9.

Debit		**Credit**	
	€		€
	€		€
			€

Mrs. Maguire received her wages of €500. She paid €40 to the dentist, bought groceries in the supermarket for €80, and paid €44 for the family to go to the cinema. She won €10 on a Lotto card.

Debit		**Credit**	
	€		€
	€		€
	€		

Exemplar 6: **Mathematics**

Worksheet F

How much do I have left?

Use your calculator to work out how much money is left in each purse when the things below it have been bought. Write the answer in the box given.

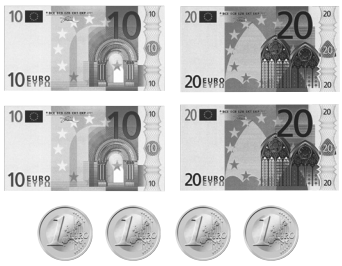
Answer:

Answer:

Answer:

Answer:

Exemplar 6: **Mathematics**



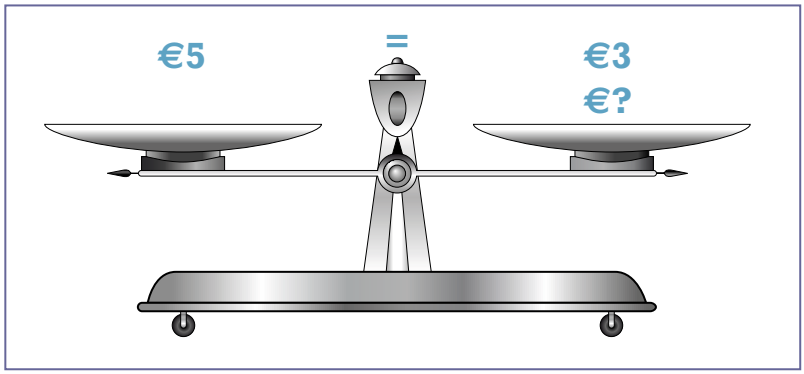
Answer:

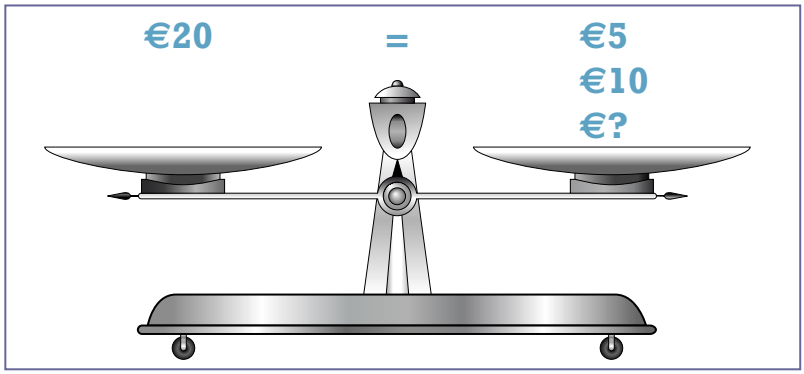
Exemplar 6: **Mathematics**

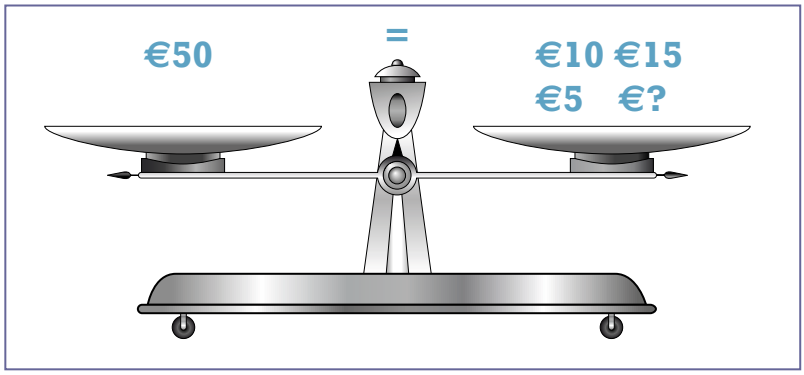
Worksheet G

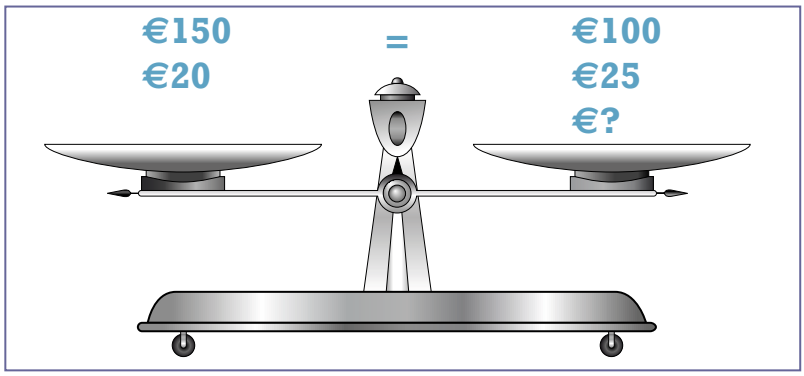
Balancing

How much would have to be added to the weighing scales each time so that it would be balanced?









Exemplar 6: **Mathematics**

Worksheet H

Balancing a cashbook (i)

Write the balancing figure in the box in each of these cashbooks.

Debit		**Credit**	
Earnings	€25	Magazine	€3
		Make Up	€12
		Balance	€

Debit		**Credit**	
Present	€50	DVD	€28
		Sweets	€3
		Book	€8
		Balance	€

Debit		**Credit**	
Wages	€350	Groceries	€70
		Petrol	€30
		Mobile Phone Bill	€60
		Shoes	€65
		Balance	€

Debit		**Credit**	
Wages	€350	Dentist	€40
Lotto	€10	Groceries	€80
		Cinema	€40
		Balance	€

Exemplar 6: **Mathematics**

Balancing a cashbook (ii)

Write the total figures in the boxes in each of these cashbooks.

Debit		**Credit**	
Earnings	€25	Magazine	€3
		Make Up	€12
		Balance	€12
	€		€

Debit		**Credit**	
Present	€50	DVD	€28
		Sweets	€3
		Book	€8
		Balance	€11
	€		€

Debit		**Credit**	
Wages	€350	Groceries	€70
		Petrol	€30
		Mobile Phone Bill	€60
		Shoes	€65
		Balance	€125
	€		€

Debit		**Credit**	
Wages	€500	Dentist	€40
Lotto	€10	Groceries	€80
		Cinema	€44
		Balance	€346
	€		€

Exemplar 6: **Mathematics**

Balancing a cashbook (iii)

Fill in the boxes to show the amount the person has left in each of these cashbooks.

Debit		**Credit**	
Earnings	€25	Magazine	€3
		Make Up	€12
		Balance	€12
	€25		€25
Balance	€		

Debit		**Credit**	
Present	€50	DVD	€28
		Sweets	€3
		Book	€8
		Balance	€11
	€50		€50
Balance	€		

Debit		**Credit**	
Wages	€350	Groceries	€70
		Petrol	€30
		Mobile Phone Bill	€60
		Shoes	€65
		Balance	€125
	€350		€350
Balance	€		

Debit		**Credit**	
Wages	€500	Dentist	€40
Lotto	€10	Groceries	€80
		Cinema	€44
		Balance	€346
	€510		€510
Balance	€		

Exemplar 6: **Mathematics**

Game 1

Tossing the Coin game
Two large two-sided discs made from cardboard or laminated paper are required by each pair or group of students.

Disc 1: 'In' printed on one side and 'Debit' printed on the other

Disc 2: 'Out' printed on one side and 'Credit' on the other

One person tosses a coin (disc) and when the student sees the side that is facing upwards he or she must guess the word on the other side.

Note: A score may be kept in this game in order to ascertain a winner. Alternatively, each student may be required to continue guessing on each toss until they have made five correct guesses.

Exemplar 7: **Mathematics**

Syllabus topic: Statistics | Collect, display and interpret

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Data Strand unit: representing and interpreting data	**Statistics** 1. Collecting and recording data. Tabulating data. Drawing and interpreting bar-charts, pie-charts and trend graphs. 2. Discrete array expressed as a frequency table.	Sets, relations and charts: draw a bar chart/ trend graph, complete a frequency table, work out the mode and mean

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to twelve class periods.

Potential areas of difficulty

- → Understanding concepts (such as mean, mode)
- → Transferring learning to real life (interpreting graphs, understanding survey data)
- → Spatial awareness (difficulty with drawing graphs)
- → Language (understanding and formulating answers to questions asked about graphs)

Strategies used in this exemplar

- Using students' personal experiences
- Using appropriate ICT resources
- Using cross-curricular approaches
- Encouraging students to use relevant mathematical language situating mathematics in real- life contexts
- Adapting the requirements of the task

Resources

- A selection of newspapers and magazines, posters, coloured pens and pencils, rulers, graph paper
- Appropriate ICT facilities (for example, a spreadsheet package)
- The classroom may need to be rearranged to facilitate group work.
- Students may need some input (on oral communication skills) and practice on presenting a project to the class if they have not done this before.

Exemplar 7: **Mathematics**

Suggested outcomes

As a result of engaging in these activities students should be enabled to

1. recognise bar, trend, and pie charts
2. collect and record simple data gathered from their classmates
3. show simple data on a frequency table
4. represent simple data on bar/trend chart and
   - draw simple conclusions from the data
   - identify the mode (most frequent item)
   - calculate the mean (average) from simple data
5. communicate their work to classmates
6. use ICT to draw charts.

Supporting activities

1. Students gather and discuss magazine and newspaper cuttings of charts and data. Refer to the bar-chart for 'ask the audience' results in Who Wants To Be a Millionaire.
2. Under the guidance of the teacher the students each produce a tally chart for the class showing how students travel to school, for example:

Travel by	Tally chart	Number of students
Bus	𝍸 ||	**7**
Car	𝍸	**5**
Walk	𝍸 𝍸	**10**
Bicycle	𝍸 |||	**8**

3. This leads to a frequency table as follows:

Transport	Bus	Car	Walk	Bicycle
No. of students	**7**	**5**	**10**	**8**

4. Students then draw a bar chart and a trend graph to represent the information
5. Questions will assist students to draw conclusions (for example, Which method of travel is most/least popular? Why might this be? How many more students walk than come by car?). Note: Mean (average) does not apply to this example.
6. After working through the above example students can undertake a statistics project as outlined in the Planning for Statistics sheet on pages 94 to 96.

Assessment strategies

1. Students complete a simple questionnaire or worksheet after the initial activities, but before starting the project. The teacher observes whether they
   - recognise various kinds of charts
   - know how to record data using a tally chart
   - know how to use a frequency table to record data
   - can construct and use various kinds of charts know how to calculate mean and mode.
2. The teacher can use the feedback from these assessments to assist in guiding students towards suitable tasks during the project (reinforcement, gaining of new skills, etc.).
3. As the project proceeds, the teacher can assess further, by observation, the student's ability to collect, record, and tabulate data, to choose and draw charts, and to communicate the work.

These outcomes may be assessed by methods suggested following the description of the activities below.

Cross-curricular links: These skills can be reinforced if similar concepts in geography (data representation and interpretation) and CSPE (Action project) are treated at the same time.

Exemplar 7: **Mathematics**

Activity 6

Planning for a Statistics Project

The Project Planning Sheet and Six Steps in Project Work sheets outlined in the JCSP student profile system handbook offer a useful outline for students working on projects, and can be adapted specifically for use with mathematics. A suggested adaptation for both sheets is outlined below.

Statistics Project Planning Sheet

Name of Student _____

Date _____

Title and Description of Project

The title of my project is _____

I will gather information from my class about _____

I will display the information using _____

Other information _____

What I will learn from this project:

During my work on this project I will learn how to _____

_____

_____

_____

_____

_____

Exemplar 7: **Mathematics**

Activities	Names of people responsible
Deciding how to gather information from the class	Whole group
Design a way to gather the survey information	
Carrying out the survey	
Making a table to show the information gathered	
Draw a bar chart to show the information	
Draw a trend graph to show the information	
Find the mean and mode from the information	
Write down some conclusions that can be made from the information gathered	
Display the work on a poster	
Discuss what was learned from doing the project	Whole group
Present the work to the class – who explains what?	

Further Notes on a Statistics Project

When students are deciding on a topic on which to gather data from classmates the teacher could provide a list of possible topics to choose from, for example

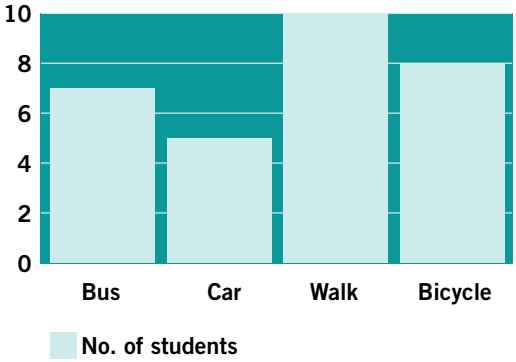
- favourite foods
- shoe sizes
- bed times
- heights of mountains
- favourite film stars
- favourite pop stars or groups
- pets
- birthdays
- area of hands
- temperatures
- traffic count
- frequency of occurrence of letters of the alphabet on a page of a book (why does e have the shortest symbol in Morse code?).

Exemplar 7: **Mathematics**

Students should decide on a suitable way to record the data (information) and test that it works by surveying their own group (for example, tally charts, frequency table, pictorial representation). A simple spreadsheet package can be used for drawing graphs on the computer. Students enter the data in the form of a frequency table.

Students then use various options to choose which kind of chart they would like to use, for example:

How we travel to school



Students may need some assistance in drawing conclusions from their data. A list of questions could be provided to help them.

Note: The above series of activities is based on groups of students working on a statistics project. Activities can be differentiated through extra guidance by the teacher and with students choosing to complete various tasks within the group.

Exemplar 7: **Mathematics**

Assessment strategy 6

Sample assessment instrument for statistics project presentations (peer, teacher, and self-assessment)
Students and teacher each have a sheet like the one below with headings suggesting various criteria on which students presenting projects can be assessed. Each student is also invited to make a statement of self-evaluation under these headings. Marks (e.g. out of 20) could be assigned under each heading, or students could be asked to note one strength of the presentation and one area that could be improved. It is important that feedback is of a positive nature.

Group Number	Explanation of how the survey was completed (why a certain topic was chosen, how data was gathered, etc.)	Explanation of charts (why a certain kind of chart was chosen, how it was drawn, use of ICT, etc.)	Layout and presentation of project (colour, legibility, use of headings, etc.)	Ability to draw conclusions from the data and express them	What the group learned from doing the project (how to work as a group, how to do a survey, how to draw conclusions from the information, etc.)

Sample assessment scheme for statistics project
Students are given a copy of the assessment table before starting the project, and the allocation of marks is clearly outlined. This enables students to ensure that all of the headings are covered in their final presentation. The table is then completed by the teacher who fills in a mark based on the assessment criteria outlined on the following pages and, if appropriate, a comment. Alternatively, the teacher can consult with the group of students and agree a mark based on the assessment criteria.

Written Presentation (10 marks)

Format, layout, neatness, legibility	0-5 marks
Use and quality of illustrative material (pictures)	0-5 marks

Content (30 marks)

Introduction (reason for choice of topic)	0-3 marks
Collecting and recording data	0-4 marks
Organisation of data using a suitable table	0-4 marks
Use of charts (with and without ICTs)	0-10 marks
Use of statistical calculations (mean, mode)	0-5 marks
Statement of conclusions based on data	0-4 marks

Oral Presentation (10 marks)

Oral skills (speaks clearly, expresses in own words, addresses whole class)	0-3 marks
Understanding of material	0-4 marks
What was learned from doing the project	0-3 marks

Exemplar 7: **Mathematics**

Criterion- referenced assessment

The following criteria are suggestions to assist the teacher in the assignment of marks under the headings given in the table on page 145.

Written Presentation (10 marks)

Format, layout, neatness, legibility

Mark (5)	Criteria
0-1	Little effort made to organise material, which is difficult to follow.
2-3	Some effort made to present material in a suitable format.
4-5	A high standard of written presentation with well organised material was evident.

Use and quality of illustrative material (pictures)

Mark (5)	Criteria
0-1	Little or no use was made of appropriate illustrative material.
2-3	Basic use was made of illustrative material.
4-5	Illustrative material used is of high quality and very relevant.

Content (30 marks)

Introduction

Mark (3)	Criteria
0-1	Little or no effort was made to introduce the project.
2-3	The introduction clearly outlines the content of the project.

Collecting and recording data

Mark (4)	Criteria
0-1	Data are not organised into a table.
2-3	A table is used but could be more suitable.
4	Data are organised into a suitable table.

Organisation of data using a suitable table

Mark (4)	Criteria
0-1	There is little or no explanation of methods of data collection and recording.
2-3	Demonstrates some knowledge of appropriate methods of data
4	Demonstrates knowledge of appropriate methods of data collection and recording and gives reasons for selection of particular methods.

Exemplar 7: **Mathematics**

Use of charts (with and without ICT)

Mark (10)	Criteria
0-2	Few or poorly produced/explained charts are used.
3-5	Some charts are used, but more variety and explanation are needed.
6-8	Good standard of charts
9-10	Very high standard of charts

Use of statistical calculations (Mean, Mode)

Mark (5)	Criteria
0-1	Little or no calculations are shown.
2-3	Some calculations are shown.
4-5	Shows a clear understanding of statistical calculations.

Statement of conclusions based on data

Mark (4)	Criteria
0-1	Makes little or no attempt to state conclusion.
2-3	Some attempt is made to state conclusions.
4	Makes clear and relevant conclusions.

Oral Presentation (10 marks)

Oral skills (speaks clearly, addresses whole class)

Mark (3)	Criteria
0-1	Needs to speak more clearly and address the class.
2-3	Communicates with the whole class about the project.

Understanding of material

Mark (4)	Criteria
0-1	No real understanding of the material is shown.
2-3	Can explain his/her own section of the project.
4	Talks confidently about the project material.

What was learned from doing the project

Mark (3)	Criteria
0-1	No statement is made on what was learned.
2-3	Communicates what was learned from the project.

Exemplar 8: **Mathematics**

Syllabus topic: Algebra | Algebra Activity

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Algebra Strand units: Variables, Equations	Algebra: Meaning of variable, constant, term, expression, coefficient. Evaluation of expressions.	Not applicable

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to fifteen class periods.

Potential areas of difficulty

- → Short term memory (remembering algebraic procedures)
- → Understanding concepts and abstractions (What is an unknown? What is a variable?)
- → Transferring learning to real life (using problem-solving skills in everyday life)
- → Poor vocabulary/language (problems with understanding algebraic terms)

Strategies used in this exemplar

- Group discussion of ideas linked to students experience
- Using concrete materials
- Using games to reinforce concepts, operations, and problem-solving skills
- Encouraging students to use relevant mathematical language
- Visual representation of algebra (using counters, straws, etc.)

Resources

- Snooker balls or different coloured disks (Activity 2)
- Materials such as straws, Plasticine, and counters used to make patterns (Activity 3A)
- Students should be encouraged to record their observations in some way.
- All activities can be run as a whole class activity or in small groups.
- This exemplar makes use of some of the lesson ideas outlined in the *Junior Certificate Guidelines for Teachers: Mathematics.* Asterisks are used to mark sections of the extract that contain material not relevant to the Junior Certificate foundation level course. Teachers may find it useful to use and adapt other lesson ideas from those guidelines.
- Algebra is a theoretical topic and may prove particularly difficult for some students with mild general learning difficulties. Teachers are encouraged to choose the learning outcomes, learning activities, and assessment strategies that best suit the needs of their students.

Exemplar 8: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. understand that algebra involves using letters to represent things – understand that a variable is something that can take different values 2. recognise and describe a pattern using a sequence of numbers – use basic mathematical language to describe a pattern or rule 3. record number pairs appropriately 4. carry out simple calculations in their heads – orally solve simple verbal first degree equations in one variable 5. demonstrate some simple problem-solving skills.	1. Use the Group discussion on algebra activity on page 102 to encourage students to think of – real-life situations when a letter or a symbol is used for short to represent something – real-life situations where a quantity varies. 2 Use Snookered! on pages &3.104-106 to introduce the students to the use of letters to represent numbers and to the evaluation of simple expressions. Note that a similar activity could be developed with scrabble letters. 3. Spot the pattern (See page 112.) 4. Guess my rule (see page 114.) This activity is based on the activity outlined in the *Junior Certificate Guidelines for Teachers: Mathematics,* Algebra lesson idea 3. 5. Think of a number (see page 117.)	1. Observe whether students can – give a simple verbal explanation of what algebra is? – give examples of a variable? 2. Have completed the worksheets in the Snookered! activity and in pairs corrected the work. 3. Observe whether students can – participate in the discussion outlined in this activity? – describe what they are doing? – state which quantities are variables? – Observe how much direction students need. 4. Observe whether students can use appropriate language to describe the emerging pattern or the rule. – Oral calculations quiz: The teacher goes around the class asking for answers to simple calculations (for example, 5 added to 2 gives? 10 minus 4 is? Double 3 to get?). The teacher should try to use a range of different terms for the same concept (subtract, minus, take away, less, etc.). 5. After activity 5 students can do the worksheet or role play (See page 117.).

Exemplar 8: **Mathematics**

Activity 1

Group discussion on algebra

A. For short

Hold a group discussion on real-life situations where a letter or a symbol is used to represent something. Some examples are included in the table below. Students may need hints from the teacher such as 'think of clothes sizes'.

Letter or symbol	Stands for
€	euro
c	cent
p	pence
£	pound

Letter or symbol	Stands for
s	small
m	medium
l	large
p	page

Letter or symbol	Stands for
l	litre
m	metre
g	gram

Explain that algebra uses letters to represent things. Certain things can be written in a much shorter way in algebra than in English. Encourage students to think of a shorter way to write each of the following: Apple, Banana, Coffee, Yoghurt, Pear.

Ask students to write a shorter version of the following shopping list:

3 apples, 5 bananas, 1 jar of coffee, 4 yoghurts, 2 pears.

Exemplar 8: **Mathematics**

B.Things that vary

Hold a group discussion on real-life situations where things (numerical quantities) vary. Some examples are given in the table below. Students may need some examples to get them started. Encourage discussion. For example, Why does it vary? What approximate values might it take, etc.

Shopping bill
Cost of a pack of crisps
Cost of a litre of petrol
The amount of money you have in your pocket
Your shoe size
Your age
The mark you get in different mathematics tests
Time you spend asleep each night
The amount of rain that falls each day
The temperature

Explain that in algebra we are usually dealing with things that vary.These are called variables. For example, if we are measuring the temperature (T for short), it will probably be different today than it will be tomorrow.

Exemplar 8: **Mathematics**

Activity 2

Snookered!
The activity described here is reproduced from *Algebra lesson idea 1* from the *Junior Certificate Guidelines for Teachers: Mathematics.*

Title: Snooker balls and variables!

Topic: Algebra

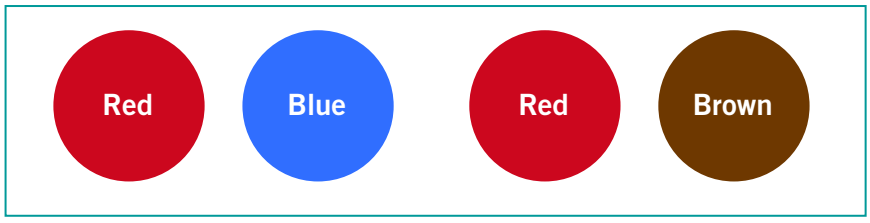
Aims:
1. To introduce students to the use of variables using a snooker analogy
2. To give the students confidence in using variables—algebra is not just for the good classes

Resources

- A set of snooker balls or different coloured discs or coloured circles drawn on the overhead or blackboard
- A large sheet showing the values of the different coloured balls in snooker
- Pre-prepared worksheets

Method

1. Initiate an opening discussion about snooker.
2. Get the students to give the value of different snooker balls. Use a large sheet showing the values of different coloured balls in snooker as an aid.
3. Write up a pretend break on the board as follows:



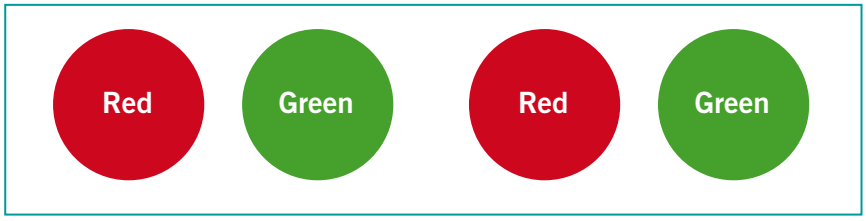
Ask students to work out the value of the break score. More examples can be done and the scores found.

4. Students can be given a prepared worksheet (number 1) to complete using similar examples which can be corrected immediately.

Exemplar 8: **Mathematics**

5. The next step is to ask students to write out the pretend break in words.

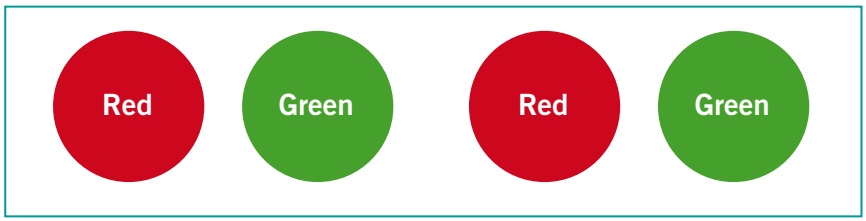
   The teacher should write clearly what each letter stands for:
   R = Red G = Green U = Blue K = Black N = Brown



   Students are asked: How many of each colour are there?
   Answer: 2 red and 2 green (answer to be given in this way).

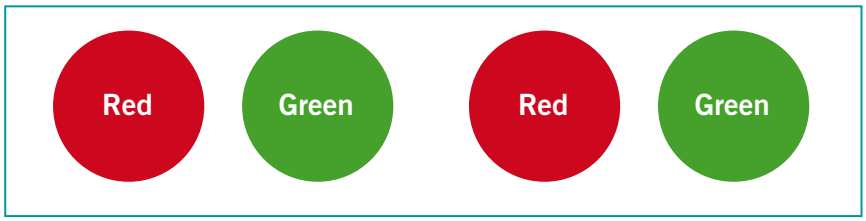
6. Students are then given another worksheet (number 2) with similar examples to complete.

7. When the second worksheet is corrected an identical worksheet (number 3) is given out. On this occasion students are asked to write the answer as follows:



   Answer: 2R + 2G

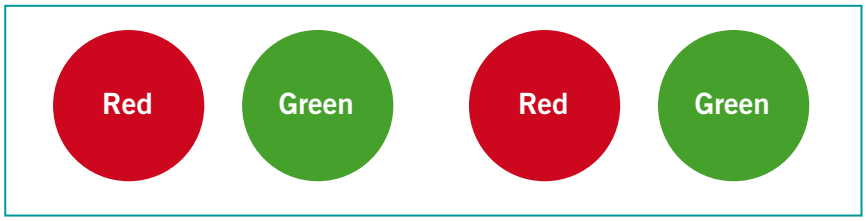
8. The same worksheet (number 4) is again given to the students. Now, students are asked to substitute the value of each snooker ball and arrive at the total break:



   Answer: 1 + 3 + 1 + 3 = 8
   Example: 2R + 2G = 8

Exemplar 8: **Mathematics**

9. A similar worksheet (number 5) is given to students to complete. On this occasion the variable expression is given under each example and students are asked to substitute the correct value and arrive at the score break. The teacher shows an example first:



Answer: 2R + 2G = 2(1) + 2(3) = 2 + 6 = 8

The students are now substituting values for variables.

The students can then progress to using x and y or other letters. It is possible for the teacher to combine the last two worksheets into one if so desired.

Notes

- Classroom management implications: Worksheets can be done individually or in pairs.
- Strictly speaking, the letters in the above analogy stand for objects and not variables per se. However, practising teachers of mathematics have found the lesson idea effective when dealing with students who find algebra difficult.

Exemplar 8: **Mathematics**

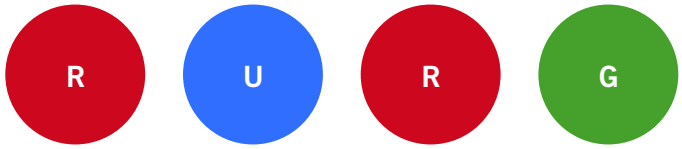
Worksheet 1

Snooker: work out that break!

R = Red Y = Yellow G = Green U = Blue K = Black N = Brown P = Pink

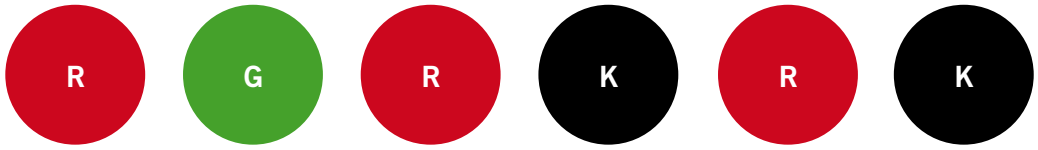
Work out the scores for each of the breaks below:

1.



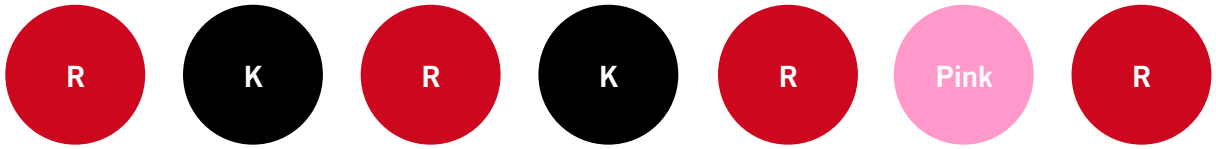
Break = _____

2.



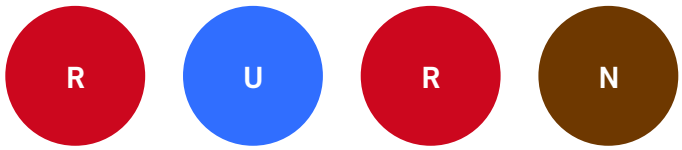
Break = _____

3.



Break = _____

3.



Break = _____

Exemplar 8: **Mathematics**

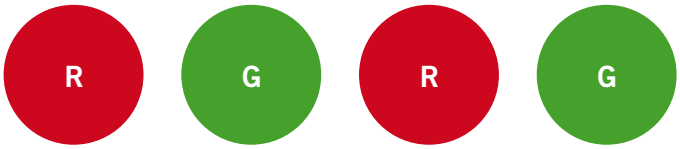
Worksheet 2

Snooker: breaks and words!

R = Red Y = Yellow G = Green U = Blue K = Black N = Brown P = Pink

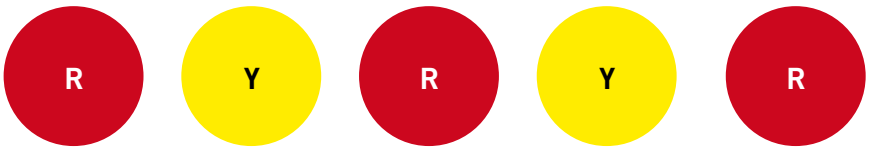
How many of each colour are in the following breaks?

1.



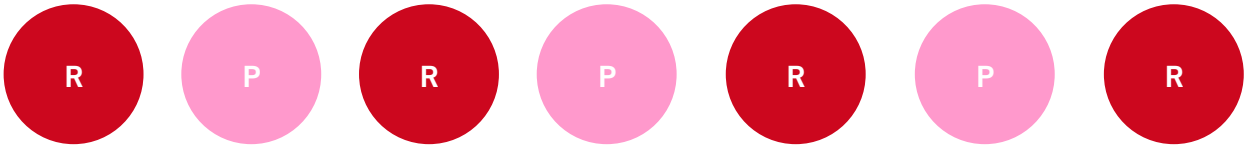
Total =

2.



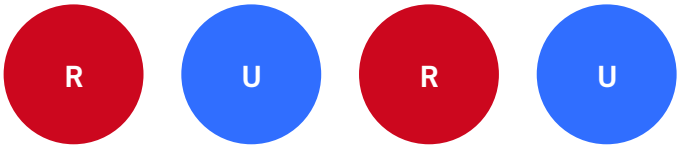
Total =

3.



Total =

4.



Total =

Exemplar 8: **Mathematics**

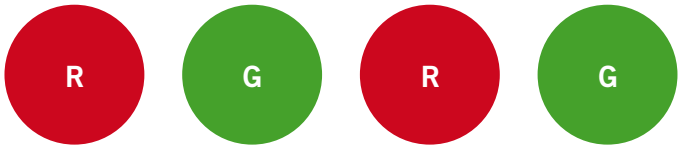
Worksheet 3

Snooker: breaks and letters!

R = Red Y = Yellow G = Green U = Blue K = Black N = Brown P = Pink

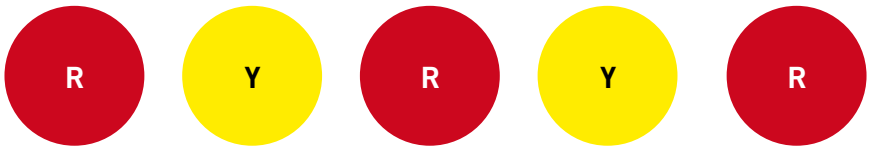
How many of each letter are in the following breaks?

1.



Total =

2.

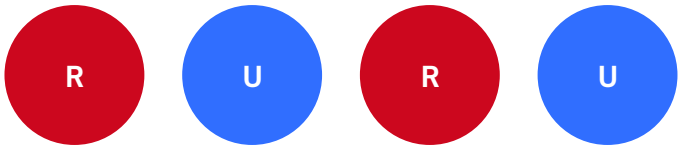


Total =

3.

Total =

4.



Total =

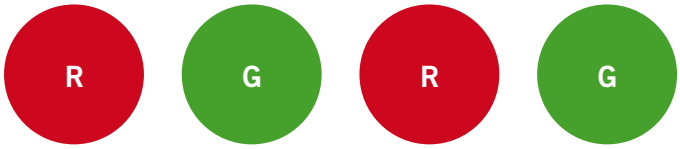
Exemplar 8: **Mathematics**

Worksheet 4

Snooker: letters and addition!

R = Red Y = Yellow G = Green U = Blue K = Black N = Brown P = Pink

Work out the scores for each of the following

1. 

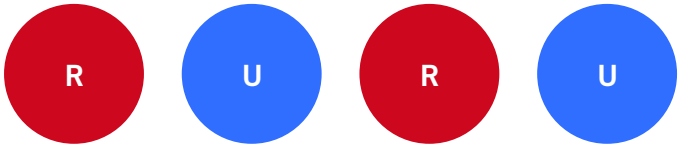
Example 2R + 2G = ____

1. 

Total = ____

1. 

Total = ____

1. 

Total = ____

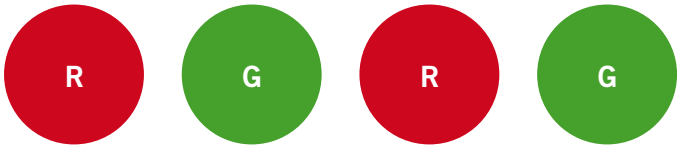
Exemplar 8: **Mathematics**

Worksheet 5

Snooker: letters and substitution!

R = Red Y = Yellow G = Green U = Blue K = Black N = Brown P = Pink

Work out the scores for each of the following

1. 

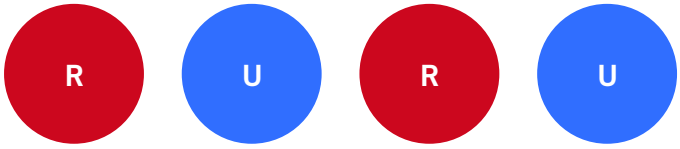
Example 2R + 2G = 2( ) + 2( ) =

2. 

3R + 2Y = 3( ) + 2( ) =

3. 

4R + 3P = 2( ) + 2( ) =

4. 

2R + 2U = 2( ) + 2( ) =

Exemplar 8: **Mathematics**

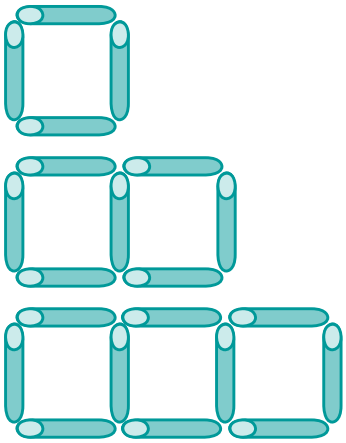
Activity 3

Spot the pattern

Students take 4 straws and arrange them in a square as shown below. Students continue to add straws in order to make more squares. Is there a pattern to the number of straws needed to make a certain number of squares?

2 squares are made from ___ straws

3 squares are made from ___ straws



Students can be encouraged to find a suitable way to record the information. One possible example is the table shown below:

Number of straws	Number of squares
4	1
7	2
10	3

This activity could lead to a discussion instigated by questions such as:

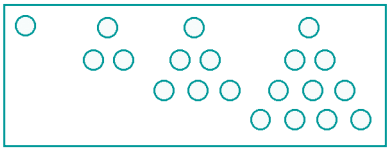
- How many straws would you need to make 5 squares?
- How many straws would you need to make 8 square?
- How many straws would you need to make 10 squares?
- Is there a way to find out these answers without having to make all of the squares?
- Is there a pattern to the list of numbers of straws needed: 4,7,10,…? (add 3)
- How could we describe this pattern (starting at 4, go up in threes; treble the number of squares and add one to get the number of straws needed.)?
- Can we write this in mathematical terms? (for example, number of squares = $3 \times 3 + 1 = 10$).
- What changes or varies with each pattern of squares? (The variables are number of squares and number of straws.)

Exemplar 8: **Mathematics**

Extension activities

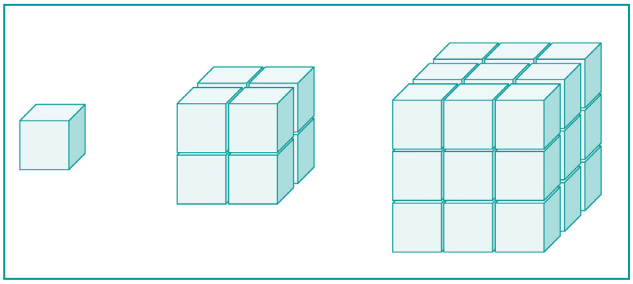
The following diagrams suggest other patterns of shapes that could lead to similar discussion:

Counters shaped as equilateral triangles:



Number of rows of counters (x)	1	2	3	4	5
Number of counters (y)	1	3	6	10	15

Cubes made from plasticine:



Number of cubes across a row (x)	1	2	3	4	5
Number of cubes in block (y)	1	8	27	64	125

Exemplar 8: **Mathematics**

Activity 4

Guess my rule

The activity described here is based on Algebra lesson idea 3 from the *Junior Certificate Guidelines for Teachers: Mathematics*. The lesson idea is also reproduced below in full for information, although some of the concepts included are not appropriate for students studying the foundation level course. Comparing this original lesson idea with the modified exemplar shows how an idea can be modified to suit students with a mild general learning disability.

- Simplified example for 'Guess my rule'
- The teacher thinks of the rule 'add 5'.
- The student says the number 2.
- The teacher applies the rule and says 7.
- The student records 2 7 (or 2,7 or other suitable notation).
- Another student says the number 5.
- The teacher applies the rule and says 10.
- The student records 5 10.
- The student guesses rule correctly as 'add on 5'.
- This student now makes up a new rule and the game continues.

The kind of rules used can include 'add a number', 'subtract a number', 'multiply a number', or a combination of these. It may be advisable to begin with a selection of different addition rules before progressing to the other operations.

Exemplar 8: **Mathematics**

Algebra lesson idea 3

Title: 'Guess my rule'

Topic: Elementary algebra

Aim: To develop the concept of a variable

Method

1. The teacher thinks of a simple (verbal) rule such as 'double and add 1', and challenges the students to guess what this rule is. The teacher asks the students to put forward numbers between, say, 0 and 20.

A student then provides a number.

The teacher gives the result of applying the rule and this cycle is repeated several times.

At any stage a student may offer a guess as to what the rule is. If the guess is wrong the student may not guess again (or put forward another number) during this game. Eventually (hopefully) the students guess the rule. The teacher spends some time checking to see that all students understand and can apply the rule.

Note

At this stage symbols should be avoided and the rule formulated in words (unless the students themselves suggest some symbolic representation).

2. The game is played again, using a different rule (perhaps formulated by, or with input from, the student who identified the rule correctly in the first game). If the students have not already seen the need to record number pairs systematically the teacher suggests the strategy and an appropriate format is agreed.

3. The students form small groups and play the game. The one who guesses the rule formulates the next rule. The teacher arbitrates where necessary and checks that the rules are being applied correctly. The students have to write the rules in their own words and explain them to the teacher when she/he visits the group.

4. For homework, students are asked to try out the game at home, and to report any interesting incidents the next day. On this day the teacher asks for feedback, asking, for instance, if anyone suggested a 'short cut', but not yet introducing symbolic notation unless the students suggest it.

Exemplar 8: **Mathematics**

Classroom management implications

Ideally, it is helpful if the students are used to working in groups, and to negotiating and sorting out problems themselves before appealing to the teacher as 'referee'.

Note

1. The game can be played with various types of rule for some time. Eventually, when the students are tired of writing the rules in English, symbolic notation can be introduced in stages, for example

$2 \times$ number $+ 1$
and after a while
$2 \times N + 1$

(or using some symbol of the students' choice in place of N, but eventually introducing a letter to stand for 'any number'). The multiplication sign should be retained for some time (as in the Primary School Curriculum).

2. This introduces the idea of a variable (which can take many values) rather than an unknown (which has a specific value, for example as in 'x + 7 = 10'). Starting with a variable may help to avoid problems, which can arise, for example, with the similar game 'my number plus 7 is 10, what is my number?' This can lead eventually to protests of the form 'but yesterday we decided x was 6 …'

3. The game can be used also to introduce the idea of a function.

Exemplar 8: **Mathematics**

Activity 5

Think of a number

This activity is an introduction to solving simple equations. Students must understand that each basic operation has an inverse or an opposite. For example:

- Adding and subtracting are opposites.
- Multiplying and dividing are opposites.

The teacher and student activities are outlined in the examples below:

Example 1

Teacher: I am thinking of a number. When I add 4 to it I get 9. What was my number?

Student: Your number was 5.

Teacher: Why?

Student: 9 take away 4 gives 5.

Example 2

Teacher: Think of a number and write it down secretly.

Student: (Thinks of 4 and writes it down.)

Teacher: In your head, add the number you wrote down to itself (or double the number).

Student: (Thinks of 8.)

Teacher: Add 5 to this number.

Student: (Thinks of 13.)

Teacher: Tell me your answer.

Student: The answer is 13.

Teacher: By my powers of deduction I can tell you that the original number you thought of was (Thinks: 13 - 5 = 8; 8 ÷2 = 4.) four.

The steps from start to finish can be as simple or as complicated as is appropriate for the students.

The example above could be represented by the equation:

$2x + 5 = 13$

Students can then take it in turns to act as the leader.

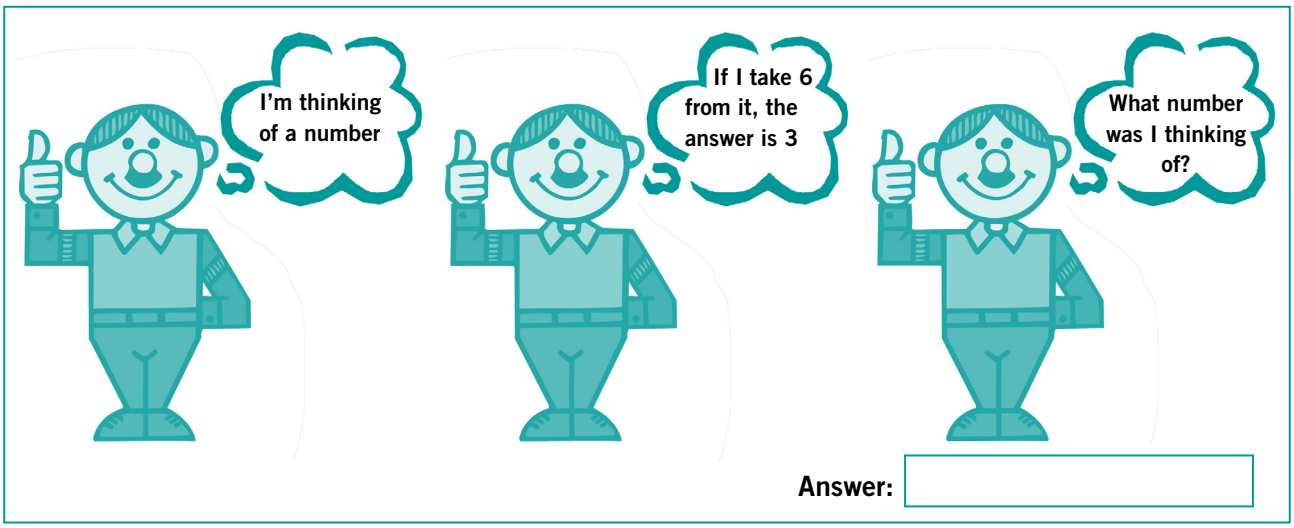
Assessment Note: Students can use the following worksheet in twos, with one role-playing the cartoon character in the worksheet and the other trying to guess the rule. Students then switch roles. In this way students are assessing each other's ability to make and guess a rule. In such an activity students should be encouraged to describe how they worked out the initial number.

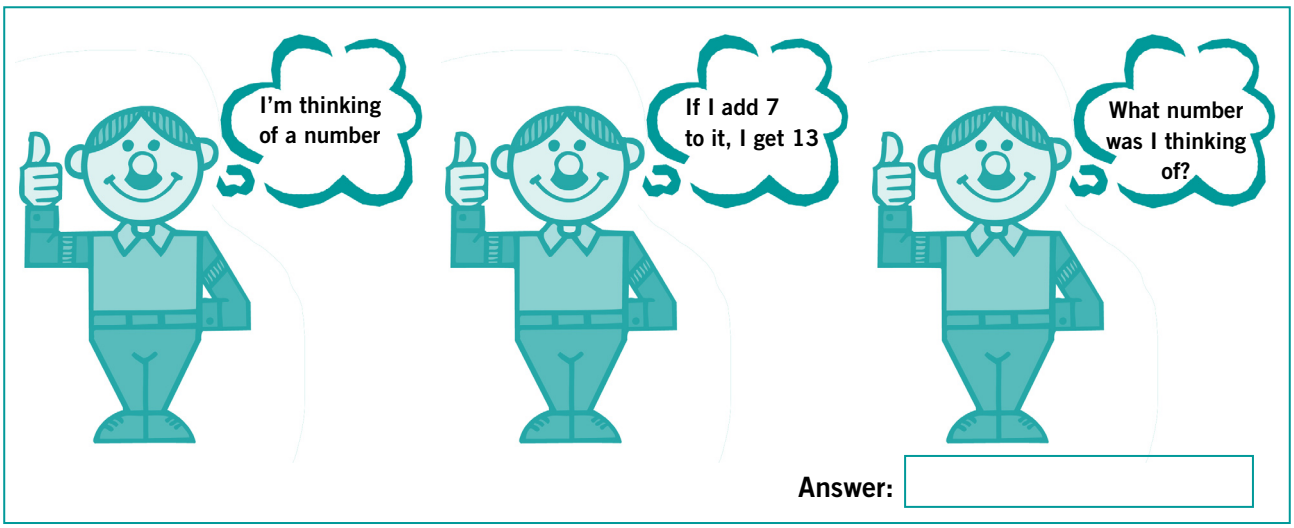
Exemplar 8: **Mathematics**

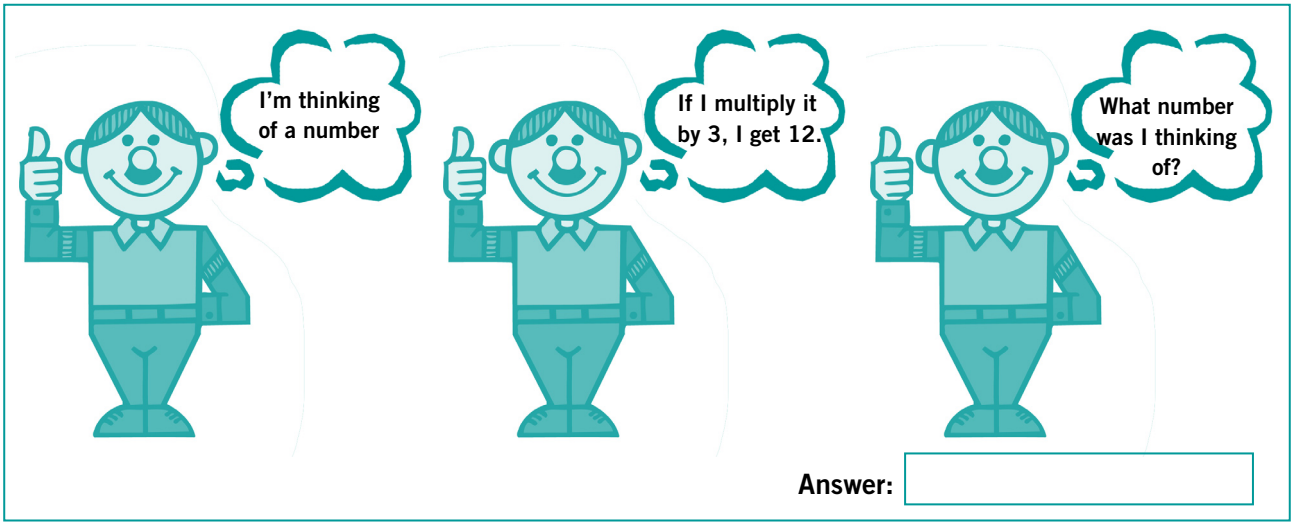
Assessment strategy 7

'Think of a number' worksheet

Students are encouraged to describe how they worked out the missing number.







Exemplar 9: **Mathematics**

Syllabus topic: Functions and Graphs | Plotting Points

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Data Strand unit: Representing and interpreting data	Functions and graphs: Concept of a function	Graphs, Constructions and transformations

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to six class periods.

Potential areas of difficulty

- Students may experience: difficulty in perceptual skills, visual, tactile, and auditory perception
- Short term memory (remembering to plot the horizontal co-ordinate before the vertical co-ordinate)
- Understanding concepts and abstractions (What is a point?)
- Vocabulary/language (understanding mathematical instructions to plot points)

Strategies used in this exemplar

- Using concrete materials
- Using games to reinforce concepts and operations
- Using cross-curricular approaches
- Plotting points that form names and shapes that are familiar to students

Resources

- A range of draughts or chess boards or equivalent 8 × 8 grids, draughts pieces or other counters
- A scrabble board with raised edges (may also be useful and may suit students with a visual impairment)
- OHP
- A spreadsheet program can also be used for this activity
- Some aspects of the topic Relations, functions and graphs are theoretical and may prove particularly difficult for some students with mild general learning disabilities. Teachers are encouraged to choose the learning outcomes, learning activities, and assessment strategies that best suit the needs of their students.

Exemplar 9: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. state some situations when you need to give your position to someone 2. understand that graphing involves horizontal and vertical positioning 3. read co-ordinates of points from a basic square grid 4. place a counter on the correct square of a basic square grid given its co-ordinates 5. place several counters on a grid given a list of co-ordinates and recognise and name the shape produced 6. place a shape of counters on a grid and make a list of the co-ordinates.	1. Students engage in a structured discussion and other activities on the purposes of using graphs and co-ordinates to give your position, and on the merits of graphs over tables. 2. Students complete the *Graphing the classroom* activity. 3. Using a draughts or chess board tape letters along the horizontal and numbers along the vertical of a grid. The teacher has an overhead projector grid prepared with a number of counters placed. The teacher leads the students in naming the positions of various counters (for example, A2, F5). 4. Students work in pairs. One student places a counter on the grid and the other names its position. 5. Students work in pairs. One student gives the co-ordinates for a counter and the other places the counter in the correct position. 6. The teacher puts a list of co-ordinates on the board or overhead projector. Students are challenged to make the shape/letter/number using counters on their grid. 7. Students work in pairs. One student makes a shape with the counters on the grid and records the co-ordinates in secret. The other student is then given the list of co-ordinates and the empty grid and tries to replicate the shape.	1. Observe whether students can state two situations when it is important to know your position. 2. Observe whether students, starting from an agreed initial position, can pace out a given number of horizontal and vertical steps to get to a particular place in the classroom (for example take 4 horizontal steps and 3 vertical steps. Where are you?). 3. Students work in pairs as in activities 4 and 5. Observe whether students keep a record of how many correct answers their partner gives. 4. After the activity each student notes any difficulties they had with certain co-ordinates (for example switching letters and numbers, misreading the grid). 5. Students complete the worksheet on page 125 and compare their results in pairs to find their errors. The teacher observes students as they work to see if they have progressed beyond the difficulties expressed in assessment strategy 4.

Cross-curricular links: These skills can be reinforced if grid references in geography are treated at the same time.
Possible extension activities are suggested.

Exemplar 9: **Mathematics**

Activity 1

Let's talk about graphs and co-ordinates

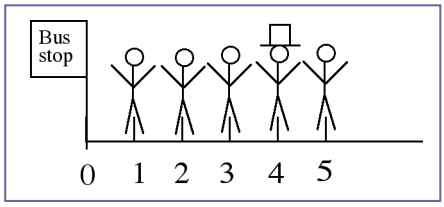
Structured Discussion

The teacher initiates a structured discussion about the purposes of using co-ordinates and graphs. Some possible questions to initiate the discussion might include the following.

- How are cinema and theatre seats laid out? Why is a letter and a number (for example, D7) commonly used? Why not just a number?
- Have you ever heard anyone in a film say, 'What are your co-ordinates?' What does this mean? (Where are you? What is your position? Where are you on the map?, etc.)
- In *Star Trek* before they get beamed up they sometimes say, 'Lock onto my co-ordinates'. What does this mean?
- A boat at sea is in trouble because of a storm. They radio for help. A search-and-rescue helicopter is sent out to find the boat. What information must the boat owner give on the radio to help the helicopter crew to find the boat? (Latitude and longitude, distance from land, compass direction travelled from land, etc.)
- Has anyone played the game *Battleships?* How do you tell your opponent where you are bombing? (Give a letter for horizontal position and a number for vertical position, for example D3).
- Links to geography, for example map references, can be noted.
- When might we use graphs? (to show unemployment figures over time, to show attendance at school, how the weight and height of a child on a graph can show if the child is getting enough nourishment). Graphs from magazines and newspapers may be a useful resource.

Why two co-ordinates?

Students are shown the diagram below on the board or on the OHP and asked to describe the position of the person queuing at the bus stop who is wearing the hat. Most will answer '4'. Other similar examples of when a single number can give someone's position can be examined such as a person in a lift, a name on a roll book, a house on a street.



Referring back to the discussion on finding your seat in a cinema, remind the students that two pieces of information are needed to find a position. Now set up the classroom seats in a grid. Give each row a letter (say A to D) and number the seats in each row (say 1 to 5). The teacher calls out a student's name and a seat position (say B3). The student must find the correct seat and sit down. Different students now select a student and a seat position and the activity continues until everyone is seated.

Other examples of situations like this can be discussed. Students should understand that when something is on a grid (in two dimensions) we need two pieces of information to fix its position. Usually (although this is not the case in the cinema) the first number (or letter) tells you the position across (horizontally) and the second number tells you the position up (vertically).

Exemplar 9: **Mathematics**

Graphs or tables?

The teacher distributes a handout with a table of figures on it to one half of the class, and a handout with a graph on it to the other half. (See sample table and graph below.) In pairs, students try to interpret the table or graph. Students are not told initially that the table and graph represent the same information. The teacher encourages the students to comment on how easy the graph and table are to interpret. Simple questions can be put to the students to see whether those with the table or graph can find the answers more quickly.

Sample questions

- Describe the growth of the plant? (going up gradually)
- How high did the plant grow? (2cm)
- What was the biggest increase in the growth of the plant? (0.5cm between days 4 and 6)
- Were there any days that the plant had not grown at all? How do you know?

During the discussion the following points may be raised.

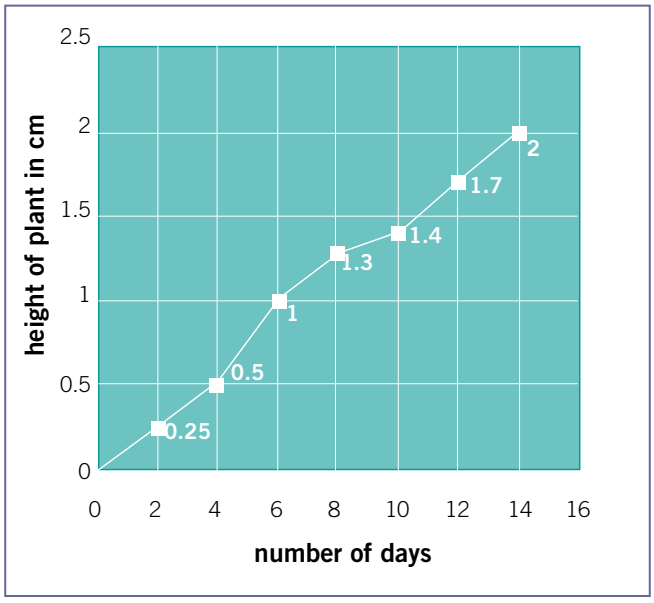
- Graphs are easier than tables to take in at a glance.
- On a graph you can look for peaks and slopes and bends more easily than on a table.

Keywords

Keywords and phrases relevant to this topic should be introduced to the discussion or the follow-up activities as appropriate. Suitable words and phrases include *graph, graph paper, horizontal, vertical, axis, grid, couples, position, co-ordinates, point, name a point, plot, trend, increase, decrease, 'graph rainfall against time'.*

Growth of Plant

What can you tell from the following graph?



What can you tell from the following table?

Number of days after planting	0	2	4	6	8	10	12	14
Height of plant in cm	0	0.25	0.5	1	1.3	1.4	1.7	2

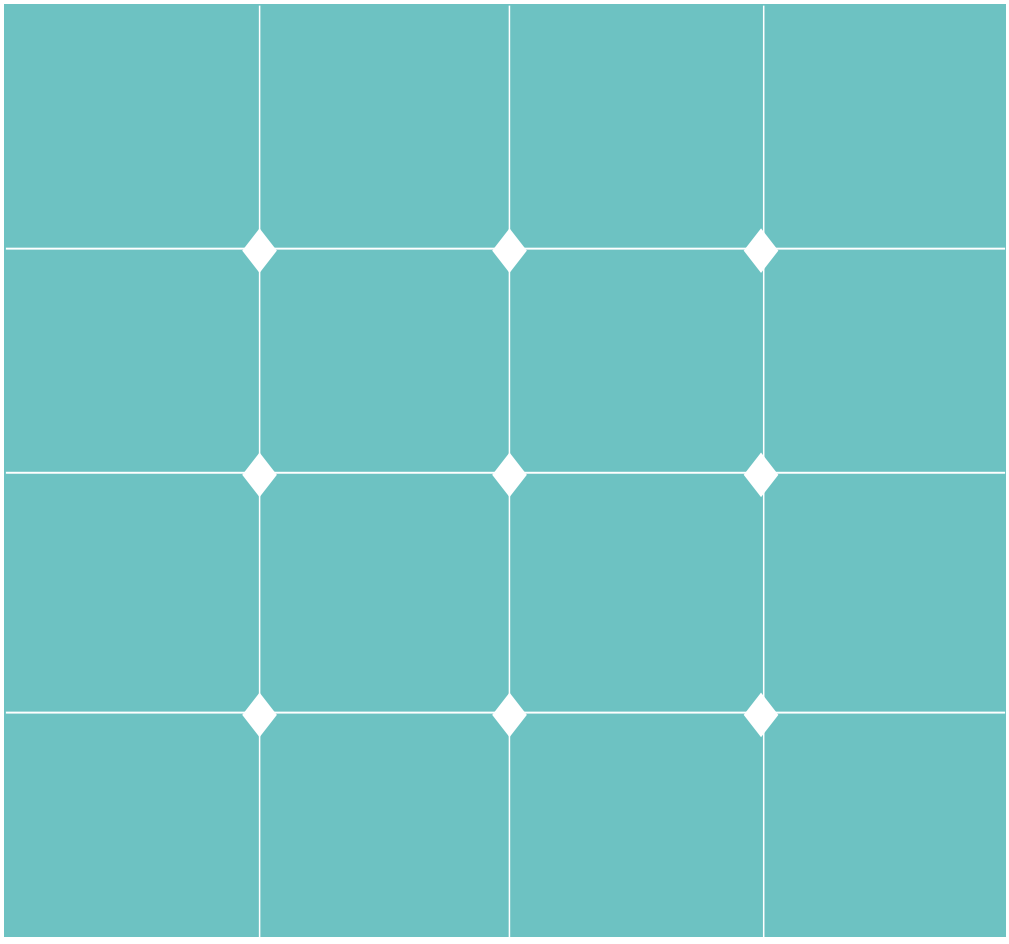
Exemplar 9: **Mathematics**

Activity 2

Graphing the classroom

All students are given a copy of a grid map of the classroom and several pictures representing items or people in the classroom. The class first discusses where to place the door so that they all have the same orientation. Then the students cut out each of the pictures below and stick them onto the correct position on the grid map of the classroom. Follow-up discussion can bring out ideas such as horizontal position and vertical position.

Classroom map



The Door

My desk

My friend's desk

The board

The cupboard

The bookshelves

Exemplar 9: **Mathematics**

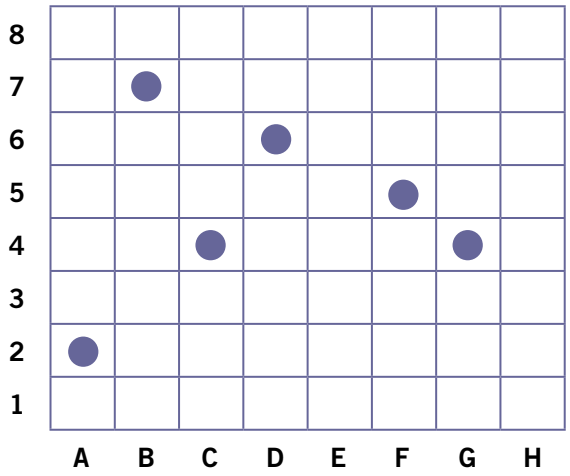
Activities 3, 4, 5, 6, and 7

Placing counters on a grid

Resources

A selection of draughts or chess boards, ideally one for every two students, with letters taped along the horizontal and numbers along the vertical of the grid as shown in figure 1 below.

The co-ordinates of the points on the grid in figure 1 are: A2, B7, C4, D6, F5, G4



Exemplar 9: **Mathematics**

Assessment strategy 5

Plot the co-ordinates worksheet

Put counters on the following co-ordinates. What letter is produced?

B2, B3, B4, B5, B6, B7, C6, D5, E4, F3, G2, G3, G4, G5, G6, G7.

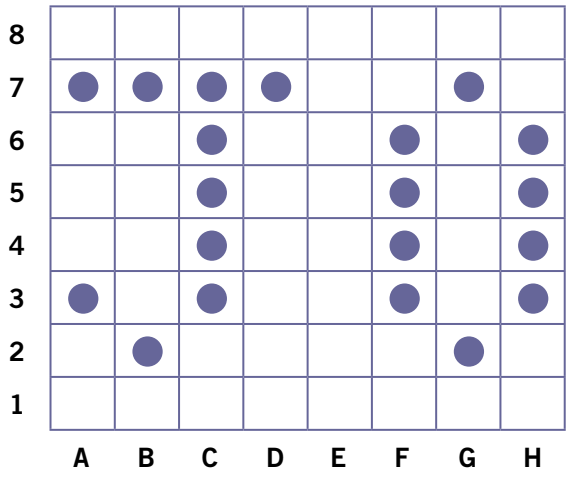
My name is Joseph. I have put my age into co-ordinates for you to plot. What age am I?

A6, B1, B2, B3, B4, B5, B6, B7, D1, E1, F1, F2, F3, F4, E4, F5, F6, F7, E7, D7.

My name is Marie. My favourite shape is the shape of my favourite toy on windy days. The coordinates for this shape are: B5, C6, C4, D3, D7, E2, E8, F3, F7, G4, G6, H5.

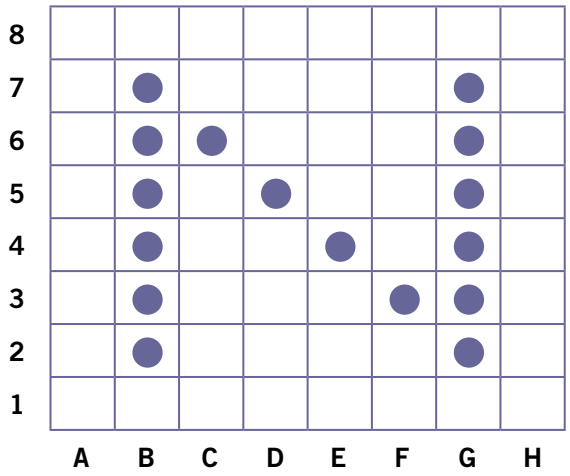
What is my favourite shape? What is my favourite toy?

My name is Jo. List the co-ordinates needed to spell out my name as shown in the grid below:

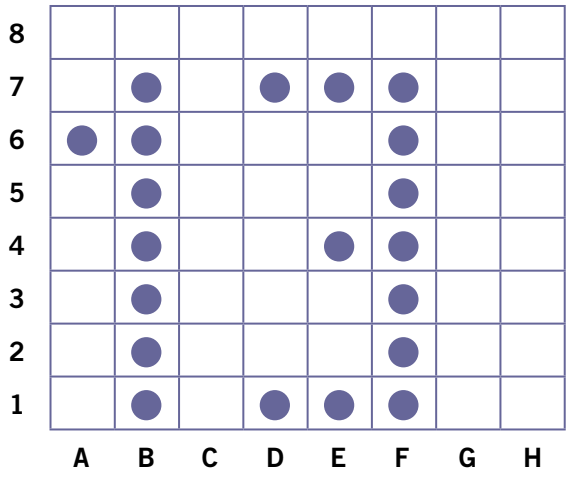


Exemplar 9: **Mathematics**

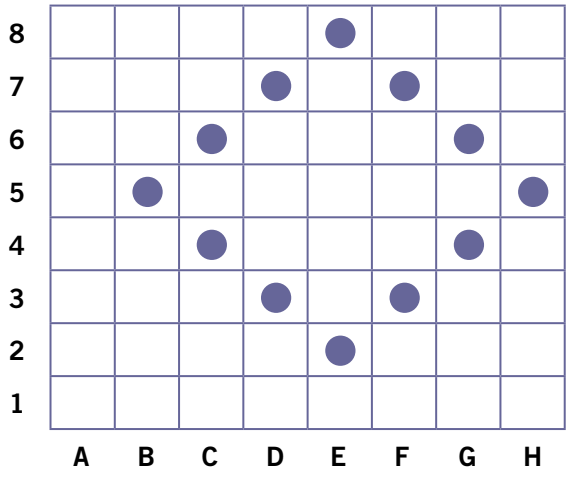
Solutions



The letter N



I am 13 years old



My favourite shape is a diamond (or a rhombus) and my favourite toy is a kite

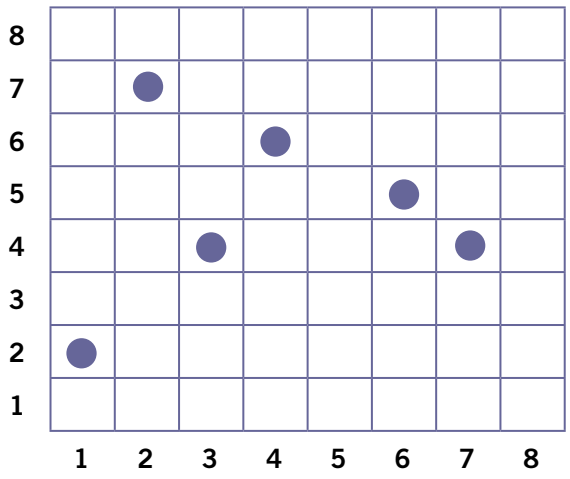
The co-ordinates needed to spell out JO are:
A7, B7, C7, D7, C6, C5, C4, C3, B2, A3, F6, F5, F4, F3, G2, H3, H4, H5, H6, G7.

Exemplar 9: **Mathematics**

Possible extension activities

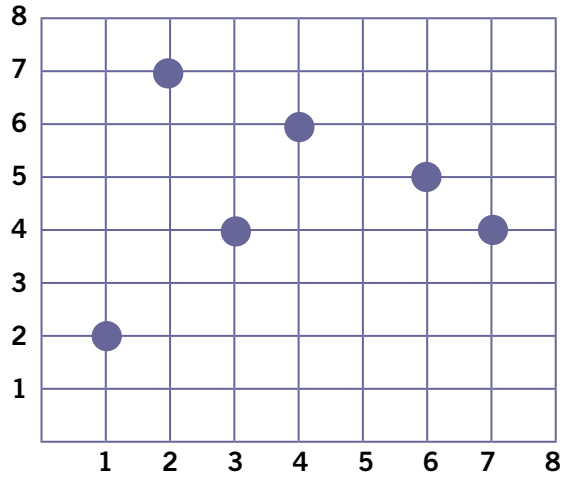
(a) Replace the letters on the horizontal line with the numbers as shown in figure 2 below and repeat a selection of the above activities.

The co-ordinates of the points on the grid in figure 2 are: 1,2; 2,7; 3,4; 4,6; 6,5; 7,4



(b) Replace the numbering of the grid spaces with numbering of the grid lines as shown in figure 3 below.

The co-ordinates of the points on the grid in figure 3 are: (1,2); (2,7); (3,4); (4,6); (6,5); (7,4)



(c) The hit and miss activity in geometry lesson idea 13 on page 71 of the *Junior Certificate Guidelines for Teachers: Mathematics,* can be used.

(d) Students can learn to draw their own co-ordinate grid and can practise similar activities to those outlined above.

Exemplar 10: **Mathematics**

Syllabus topic: Geometry | What kind of triangle is it?

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Shape and Space Strand units: 2-D shapes, Lines and angles	Geometry: Synthetic geometry: Triangle (scalene, isosceles, equilateral), rectangle, square, circle	Maths: Perimeter, Area and Volume.

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to four class periods.

Potential areas of difficulty

- Understanding concepts (isosceles triangle)
- Transferring learning to real-life (seeing common geometrical shapes in the environment, comparing and contrasting shapes)
- Spatial awareness (drawing triangles)
- Language (understanding keywords such as scalene, equilateral)
- Confusion with signs and symbols (marking angles and sides in a triangle as equal)

Strategies used in this exemplar

- Using concrete materials
- Adapting the materials given to a group
- Adapting the responses required
- Identification and specific targeting of mathematical language
- Using cross-curricular approaches

Resources

- Worksheet, cut-out version of worksheet, rulers, protractors, set squares, string, paper, transparent paper
- This exemplar makes use of some of the lesson ideas outlined in the *Junior Certificate Guidelines for Teachers: Mathematics.* Teachers may find it useful to use and adapt other lesson ideas from these guidelines.
- Some aspects of geometry are theoretical and may prove particularly difficult for some students with mild general learning disabilities. Teachers are encouraged to choose the learning outcomes, learning activities, and assessment strategies that best suit the needs of their students. The activities presented in this exemplar illustrate how an activity can be modified to suit students with special needs.

Exemplar 10: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. identify simple geometrical shapes in their environment 2. use and understand some geometrical words and symbols 3. compare the lengths of sides in a triangle 4. compare the measures of angles in a triangle 5. recognise a right angle 6. use mathematical equipment (ruler, protractor, set square) more accurately) 7. describe a triangle in terms of the number of equal sides and equal angles (for example, this triangle has 2 equal sides and 2 equal angles) 8. state whether a triangle is scalene, isosceles, equilateral, or right-angled, and give reasons.	**1. Spot the shape** This activity involves students finding items in the classroom or the school that match given shapes. **2. Let's talk about shapes** This activity encourages the students to use and understand some geometrical terms by making a pictorial and symbolic dictionary. **3. What kind of triangle is it?** This activity is based on *Geometry lesson idea 1* on page 58 of the *Junior Certificate Guidelines for Teachers: Mathematics.* ***Differentiation:*** Suggestions for differentiating activity 3 are given.	1. Observe whether students can give two examples of things shaped like given shapes (for example triangle, square, rectangle, parallelogram, quadrilateral). 2. Observe as, in pairs, one student says a word from the geometrical dictionary and challenges the other student to draw the relevant diagram. If the student draws the incorrect diagram the first student explains the word to him/her. This continues. 3. Assess students' progress by observing their record of work on the triangles worksheet. • Can the student recognise when sides of a triangle are the same length? • Can the student recognise when angles of a triangle are the same measure? • Can the student recognise a right angle? • How accurate is the students in using mathematics equipment? • Can the student state correctly which triangles have equal sides and angles? • Does the student understand the meaning of the terms scalene, isosceles, equilateral, right angle

Cross-curricular links: These skills can be reinforced if similar concepts in Technical Graphics and Materials Technology (Wood) are treated at the same time.

Exemplar 10: **Mathematics**

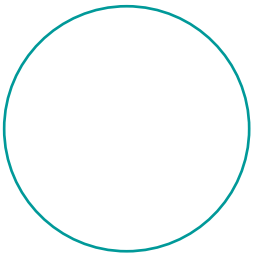
Activity 1

Spot the shape

Students work in small groups. Each group is given a card to complete as shown in the examples below. The objective is to record as many different items they can see in the classroom (or around the school) that are the same shape as the one on their sheet.

Group 1: Your shape is a CIRCLE.

List all of the things you can see that are shaped like a circle.

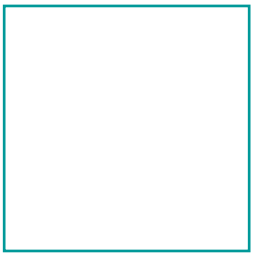


Group 2: Your shape is a RECTANGLE.

List all of the things you can see that are shaped like a rectangle.

Group 3: Your shape is a SQUARE.

List all of the things you can see that are shaped like a square.



Exemplar 10: **Mathematics**

Activity 2

Let's talk about shapes

Further discussion can take place after the hunt for shapes as to reasons why certain things are certain shapes, for example:

- Manhole covers and bath-plugs are usually circular, so that the lid cannot fall into the hole.
- Wheels are round, so that they make a ride smooth.
- Drain-pipes are rounded, or cylindrical, so that things cannot get stuck in corners.
- Books are usually rectangular.
- Packets of food are usually rectangular, for ease of storage.
- Bricks are usually rectangular, so that they can be easily built on top of each other.

Keywords

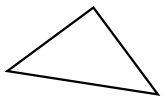
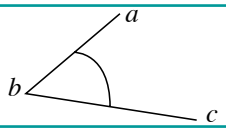
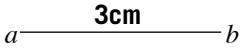
Students need to be familiar with appropriate geometrical key words and symbols.

Geometrical words include *line, angle, shape, triangle, scalene, isosceles, equilateral, quadrilateral, parallelogram, rectangle, square, length, measure, equal, same, different.*

Students also need to be able to name and use geometrical instruments, including ruler, compass, set squares, protractor.

Making a dictionary

Students are guided in the making of a dictionary as they come across geometrical words. Some sample entries are shown in the table below. Students are encouraged to suggest entries for the dictionary.

Word	Diagram	Symbol	Explanation
Triangle			A shape with 3 sides
Isosceles triangle			A triangle with two equal sides and two equal angles
Angle		$\angle abc$	The space or corner formed when two lines meet
Length of a line		$\lvert ab \rvert$ = 3cm	How long a line is

Exemplar 10: **Mathematics**

Activity 3

What kind of triangle is it?

This is based on *Geometry lesson idea 1* on page 58 of the *Junior Certificate Guidelines for Teachers: Mathematics.* The lesson idea is reproduced below in full for information. Comparing this original lesson idea with the modified exemplar shows how an idea can be modified to suit students with a mild general learning disabilities.

Geometry lesson idea 1

Title: Different types of triangle

Topic: Triangles

Aim: 1. That students will be able to recognise various types of triangles.
2. That students will be provided with concrete experiences dealing with triangles.

Resources

The worksheet with various types of triangles is on the next page.

Method

The students are introduced to a series of triangles on a worksheet, an example of which is presented on page 133. The triangles comprise a mixture of isosceles, right-angled, scalene, and equilateral triangles. The students' task is to determine the lengths of the sides, the magnitudes of the angles and consequently the type of each triangle presented. The results can be presented in tabular form, as shown.

Classroom Management Implications

Students can work individually on the above exercise but should then be encouraged to share and discuss their results with their peers as the exercise goes on.

Note

The worksheet below was constructed using a standard word processing package that incorporated a basic set of drawing tools.

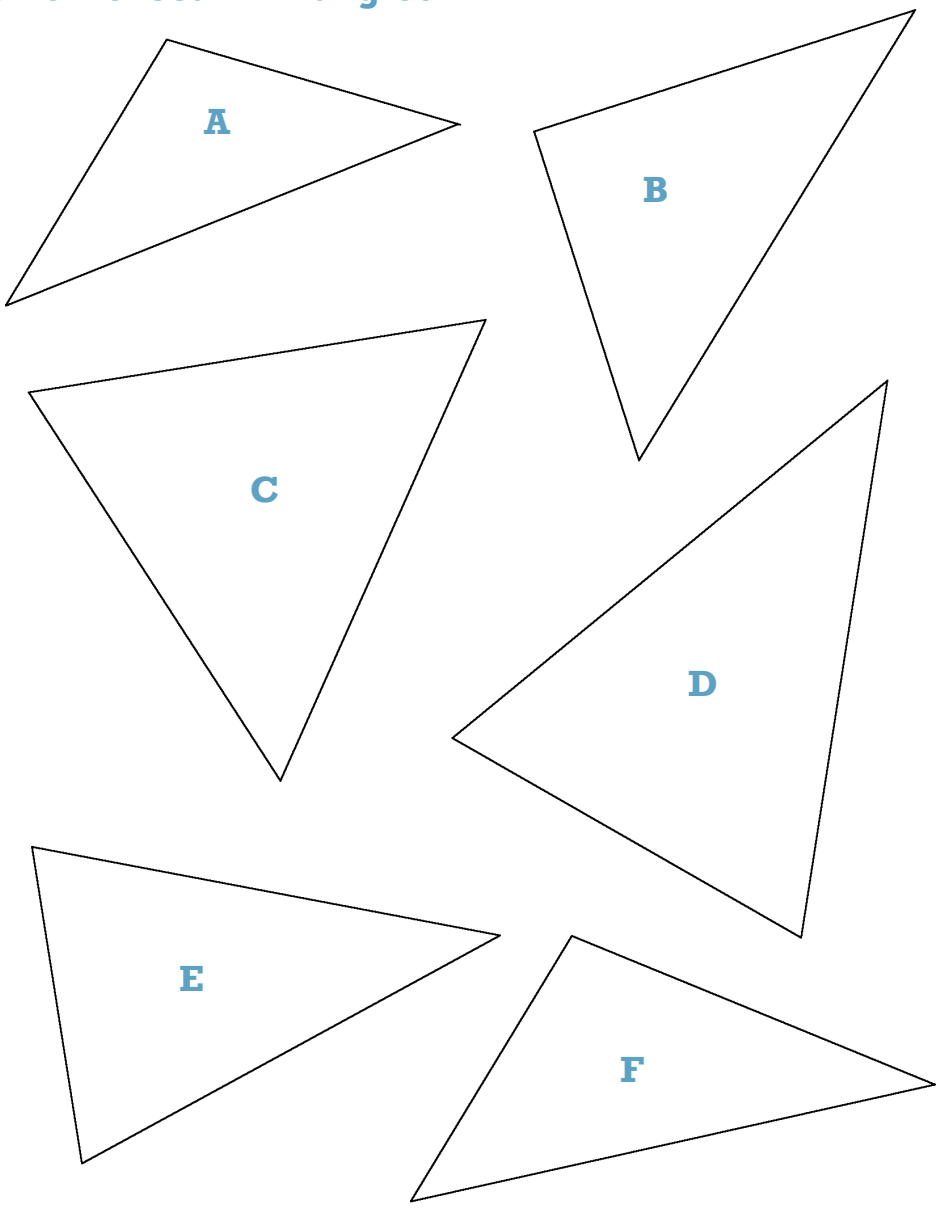
Teachers familiar with dynamic geometry software will know that such packages can be used to prepare these worksheets also. An additional advantage is that they can also provide a teacher's master copy with a printout of the lengths of sides and angles in the given triangles.

Familiarity with isosceles (from *isos,* equal and *skelos,* a leg) and equilateral triangles can be further enhanced if students use cut-out triangles from the same sheet. The sides of each triangle can be compared by folding along a suitable axis.

The Irish phrases used to describe these different types of triangles can give an insight into their properties. Thus, for example, 'triantán comhchosach' (equal legs) describes the isosceles triangle, while 'triantán comhshleasach' (equal sides) describes the equilateral triangle.

Exemplar 10: **Mathematics**

Student Worksheet — Triangles



Triangle	Angle 1	Angle 2	Angle 3	Side 1	Side 2	Side 3	Equilateral	Isosceles	Right-Angled	Scalene
A										
B										
C										
D										
E										
F										

Exemplar 10: **Mathematics**

Differentiating geometry activities

Some of the skills required by the above activity include the ability to

- measure the length of a line with a ruler
- measure an angle with a protractor
- compare measurements
- use knowledge of geometrical terms to name triangles correctly.

However, some students may have difficulties with some of these skills. For example, a student who has difficulty using a ruler accurately can still compare the lengths of the sides of a triangle with the aid of a piece of string or a strip of paper.

The measure of angles in a triangle can be measured and compared with the aid of

- a protractor
- a set square (for right angles)
- a piece of transparent paper (tracing an angle to see if it fits into any of the other two angles)
- cut-out versions of the triangles on the worksheet (rotating the triangle around to see which angles fit into each other, or tearing off one corner and compare it to others).

In this way students may learn to recognise the various kinds of triangles without getting an exact measurement for lengths of sides or measure of angles. Some students may also be able to apply certain terms to the triangles.

For students that have difficulties with language, the table of triangles could be adapted to have headings: *no sides the same* instead of *scalene, 2 sides the same* instead of *isosceles, and all sides the same* instead of *equilateral.*

In this way students can experience an activity without necessarily being able to achieve all of the learning outcomes.

Exemplar 11: **Mathematics**

Syllabus topic: The business of living

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Measures Strand units: Money	The Business of Living: Personal income and expenditure	Personal Finance: Manage personal finances in the areas of income, expenditure and budgeting

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to four class periods.

Potential areas of difficulty

- Language: understanding terms
- Understanding concepts – income and expenditure
- Transfer to real life
- Using charts appropriately
- Taking roles

Strategies used in this exemplar

- Language development (business terms, such as household, income, expenditure, budget, consumer, cash flow)
- Matching sources of income and expenditure
- Setting up a system of barter (exchange) using school and personal objects
- Role-playing consumers and retailers using play money and household objects
- Measuring and recording income and expenditure in charts (in tabular form)
- Measuring and recording using a spreadsheet
- Discussing choice, opportunity, cost, impulse buying, and planning
- Investigating applications of planned spending and planned savings
- Setting priorities in expenditure

Resources

- Magazines, toys, games, cards
- Monopoly/play money
- Items of household consumer goods
- Computer with spreadsheet

Exemplar 11: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of these activities students should be enabled to 1. identify sources of income 2. identify expenditure on household goods 3. classify household expenditure and calculate lists.	1. Teacher-led class discussion 2. Playing different roles in a retail outlet 3A. Students construct a chart of important items for a household 3B. Students calculate cost of needs/bills in a household for a week 3C. Students prepare a chart to illustrate a budget	Teacher observation of students 1. discussing and describing where people source income and spend cash 2. setting up a retail outlet to sell goods carrying out the transaction of exchanging cash for household goods including – recording the cash received by the retail outlet – explaining to classmates why cash was spent on the items chosen, and each retailer explaining his/her pay slip – completing a record of money spent 3. constructing a chart of the expenditure of a household – preparing a plan (budget) matching income and expenditure (on paper or on a spreadsheet)

Exemplar 11: **Mathematics**

Activity 1

Students, using magazine and newspaper advertisements, discuss income from different sources, such as pocket money, employment, social welfare.

Activity 2

Divide the students into two groups: retailers and consumers. Distribute monopoly/play money to the groups. Construct a retail outlet (a table filled with consumer goods and standard household goods) with prices attached to the items. Students barter for goods or exchange play money for goods and keep records of the transactions.

Introduce the concept of income for work by providing pay slips for retailers.

Exchange/barter role playing
Two students begin the process of negotiating a fair exchange. Two more students take up positions between these and negotiate a different exchange.

Through this exercise the student comes to understand that exchange may differ depending on how a person values an item.

Retailer/consumer role playing
The terms employer/retailer/employee and consumer are introduced.

A retail outlet is set up displaying household goods with prices attached. Students could set their own prices for products displayed. When play money has been distributed two students are allocated more than the others. When transactions take place each student is asked to record what they bought and the price of same. Choices made are compared.

Through this exercise the students come to understand that items for a household may be seen as more or less important depending on how a person values them. The students with more play money allocated to them display their purchases and costs. The remaining money is counted and compared with what they received. This demonstrates the concept of choice.

Exemplar 11: **Mathematics**

Activity 3A

Students construct a chart of important items for a household, classifying them under very important and less important.

Prepare a wall chart classifying household expenditure, use calculators/computer spreadsheet for calculations.

The terms savings/spending/planning/budget are introduced. A class chart is prepared outlining and classifying various items purchased. The concept of fixed/regular bills (ESB, rent, heating, running a car) are introduced to illustrate other expenditure.

Students are then helped to design the costs of running a household. These costs are listed very important/ important. Calculators are used to add up the cost of these items. A computer spreadsheet is set up to record the transactions of the household.

Through this exercise the students come to understand that households differ but that each needs to plan spending. A quiz can be prepared setting priorites for different households (ordinary households/footballers/ movie stars).

The students should discuss why planning a budget is useful for any household.

This demonstrates the concept of planning expenditure to cover priority items.

Activity 3B

Students discuss the needs/bills of a household and calculate the cost of these needs for a week.

Activity 3C

A pie chart of household expenditure
The classified household expenditure is graphed in a pie chart. This looks at the costs in terms of necessity and discretionary income, and illustrates priorities in a household.

Exemplar 12: **Mathematics**

Syllabus topic: Number Systems, Applied arithmetic and measure Home Economics: Food Studies/Culinary Skills	Design and make a pizza

Primary School Curriculum (5th and 6th classes)	Junior Certificate (Ordinary level)	Junior Certificate School Programme
Mathematics Strand: Number Strand units: Fractions Strand: Measures Strand units: Weight, Time, Money **SPHE** Strand: Myself Strand unit: Taking care of my body *Health and well being* *Food and nutrition*	Mathematics: Number systems Applied arithmetic and measure Home economics: Food Studies / Culinary skills:	Food Studies and Culinary Skills

Time scale: The full range of learning and assessment activities presented in this exemplar may take up to eight class periods.

Potential areas of difficulty

- Short term memory (remembering recipe amounts and stages)
- Short attention span and lack of concentration (difficulty sticking to the task and following the recipe through the different stages)
- Understanding concepts (difficulty with weighing and measuring, costing and comparing costs)
- Spatial awareness (difficulty with organising workspace and finding things as they are needed)
- Transferring learning to real-life (difficulty transferring knowledge gained in mathematics about how to measure and calculate)
- Relating skills and concepts to those already learned
- Poor vocabulary/language (difficulty in following recipes as they are traditionally written, difficulty with the language used to evaluate products)
- Visual sequencing (difficulty with copying from the board)

Exemplar 12: **Mathematics**

Strategies used in this exemplar

- Using a flow chart instead of traditional style recipes
- Using a map for setting up the unit-part of the preparation class
- Using visual clues where appropriate
- Breaking the task into stages
- Encouraging students to reward themselves with a visual ticking system as they complete each stage
- Referring back to skills and knowledge previously learned, for example scone making
- Encouraging students to use the relevant terminology
- Using a simple worksheet with a strong visual component for evaluation
- Using cross-curricular links to mathematics

Resources

- Ingredients and equipment for making pizzas
- A selection of different convenience pizzas, for example French bread pizzas, individual pizzas, frozen pizzas, and deli pizzas
- Stickers, for example *happy faces,* to mark off stages as completed
- Activity sheets
- Outcomes, activities and assessment strategies which have a direct mathematical application are marked with an asterisk.

Exemplar 12: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
As a result of engaging in these activities students should be enabled to 1. record the prices of a variety of pizzas and ingredients for making the pizza 2. calculate the cost of the fresh pizza and compare it to the cost of a convenience pizza 3. understand what a pizza is and how it is made 4. recall the healthy eating guidelines and foods from the four food groups and relate these to the chosen pizza 5. weigh and measure the ingredients required 6. set up equipment on the allocated workspace 7. draw up a time plan and follow this during the cookery class 8. set the oven to the required temperature 9. divide the pizza into eight equal parts 10. evaluate the pizza in relation to the others in the class and in relation to a convenience pizza.	1. *Let's go Shopping:* Students visit the supermarket to research the different pizzas on the market and to research the costs of pizzas and ingredients. (Activity Sheet 1) – *What is a pizza?* Students identify the different parts of the pizza, base, sauce and toppings. – *Design and make a pizza:* Recap on healthy eating guidelines and the four food groups. Students are guided through the design process to design their own pizza. 2. *Flowchart :* The teacher and students complete a flow chart for the cookery class, including times. (Activity Sheet 2) 3. *Equipment list and unit map:* Recap on weighing and measuring. (Activity Sheet 3) 4. *Cookery class:* Students follow time plans to make the pizza. The teacher demonstrates each stage to reinforce skills. Students tick the smiley face on their flow charts to indicate the completion of each stage.	1&2. The teacher observes students recording the prices of two different brands of each product, selecting the best value in each case. 3&4. The teacher observes students writing four points to show they know what a pizza is and to illustrate how the four food groups can be included. 5. The teacher observes students completing the process of 'designing' their own pizzas (working in pairs). 6. Teacher observes the student performing the following: – weighing and measuring ingredients – setting up equipment on the allocated workspace – following flowchart and time-plan – food preparation skills – setting oven to correct temperature – dividing the pizza into eight equal parts.

Exemplar 12: **Mathematics**

Suggested outcomes	Supporting activities	Assessment strategies
	5. Students divide the pizza into eight equal portions and discuss how many portions would make ½, ¼, ¾, etc. 6. At the end of the cookery class students carry out a brief evaluation of the finished pizzas. During the next class a more detailed evaluation can be carried out. The teacher could cook a convenience pizza to allow students to compare these with their fresh pizza. (Activity Sheet 4).	7. Evaluation Sheet: Students calculate the cost of the pizza and compare it to the cost of a convenience pizza. The student is asked to give his or her own pizza marks out of ten and give reasons why marks are being deducted.

Exemplar 12: **Mathematics**

Activity 1

Let's go shopping
Some preparation work will have to be done before the supermarket visit.

Students might draw a plan of the supermarket and mark on it where to look for the different items.

Data can be gathered on the visit to the supermarket. Students can work in pairs.

The task can be divided up among students. For example, each pair of student could be assigned two or three ingredients to research and one convenience pizza. Results can then be compiled back in the classroom.

Having the calculations done in a mathematics class can encourage cross-curricular links with mathematics.

Let's go shopping

Pricing ingredients for my pizza

PRODUCT	BRAND NAME	PRICE	WEIGHT	PRICE PER 25g (Or each)
Self-raising flour				
Milk				
Olive oil				
Onion				
Can of tomatoes				
Tomato puree				
Mozzarella cheese				
Pepperoni				
Can of pineapple				
Green pepper				

Exemplar 12: **Mathematics**

Let's go shopping

Convenience pizzas

1. Make a list of all the different types of convenience pizzas you can think of in column 1 of the table below.

PIZZA TYPE	BRAND NAME	PRICE	WEIGHT	PRICE PER 100g
For example, French bread pizza				

Best value pizza

Which pizza is the best value for money?

Give two reasons why

1.

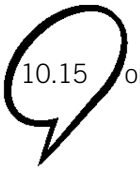
2.

Exemplar 12: **Mathematics**

Activity 2

Making my pizza (flowchart)

The flow chart can be worked on during a preparation class and further information can be filled in as required. The different stages of the flow chart should have enough space to add further notes.

The callouts 

on the left side of the sheet are for the time plan.

The teacher and students can spend time working out the time plan during the preparation class.

The smiley faces  on the right side of the page are for students to to tick as they complete each stage.

Exemplar 12: **Mathematics**

Making my pizza

Starting time: _____

SET UP UNIT
USE UNIT MAP

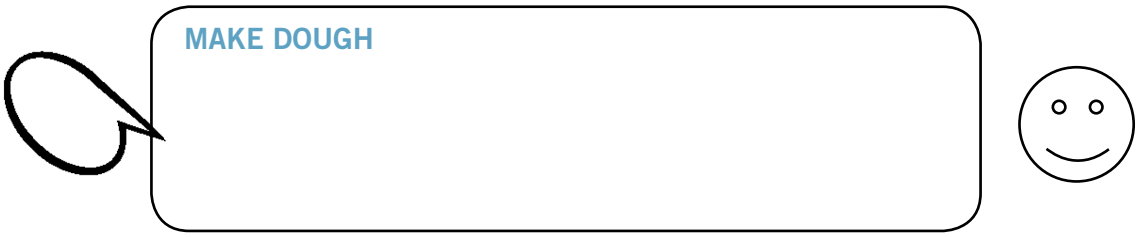
SET OVEN
200^{0}C
GAS 6

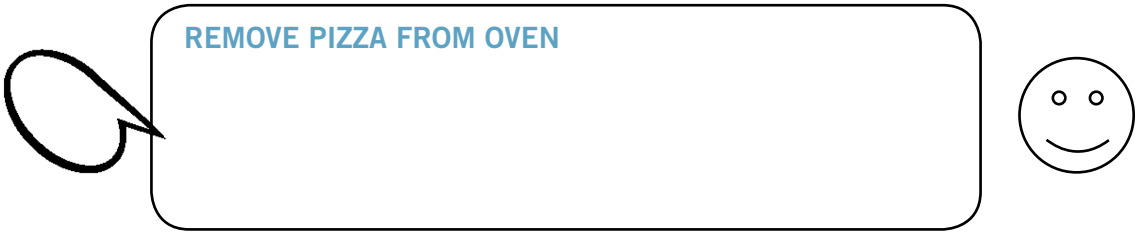
PREPARE INGREDIENTS
FOR SAUCE

PREPARE TOPPINGS

MAKE SAUCE

Exemplar 12: **Mathematics**





Finish time: _____

Exemplar 12: **Mathematics**

Activity 3

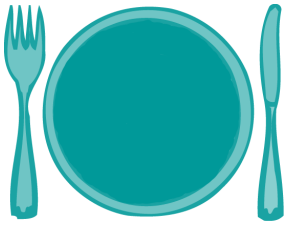
Equipment list and unit map

The unit map will help the student to set up the unit correctly before they start the class. It will benefit students who have spatial awareness difficulties if it is used constantly.

The map given includes only the basics. It can be completed during the preparation class.

Students would benefit from some revision of weighing and measuring during the preparation class.

Equipment list and unit map



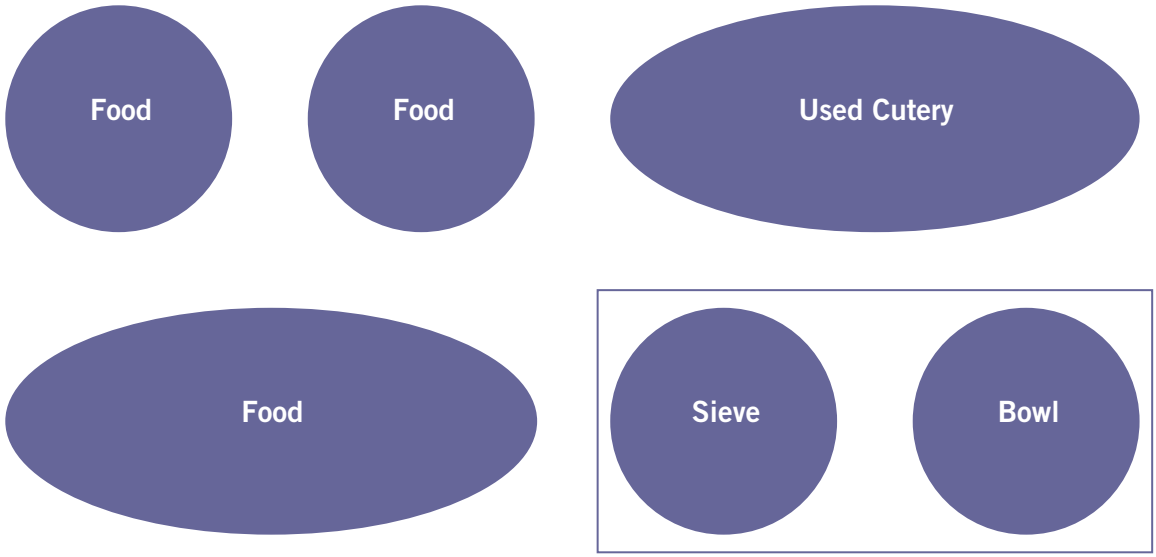
Class: _____

Make a list of all the equipment you will need for your cookery class in Column 1 and then tick it off in Column 2 as you collect it.

Equipment	Tick

Exemplar 12: **Mathematics**

Unit map



Activity 6

Evaluation - Pizzas

The Pizza I made – Cost

Ingredients	Weight	Cost

Total cost: _____

Cost per portion: _____

Marks out of 10: _____

Convenience Pizza – Cost

Brand name of Pizza	Weight	Cost

Total cost: _____

Cost per portion: _____

Marks out of 10: _____

Exemplar 12: **Mathematics**

Give reasons why you deducted marks in each case.

Appendix 1

Real-world mathematics

The tables presented below offer suggestions for linking some aspects of mathematics to the world of the student. Table 1 gives a real-world situation and suggests a variety of mathematical entry points that relate to it. Table 2 takes a mathematical concept and suggests where it can be found in real-world situations. The tables are included here to suggest possible starting points in the mathematics classroom. They are by no means all-inclusive.

Table 1

Situation	Mathematical entry points
Railway, bus station, or airport	Timetables Ticket fares Shapes (in the station, on the train/bus) Geometry (parallel lines, right angles)
Road transport	Planning a journey (time, distance, speed) Maps (distance, scale)
Post office	Price of stamps Weight of parcel/envelope Area of envelope required to hold a card Interest on savings
Garden	Planning and pricing the design of a garden (length, area, money) Buying garden equipment (use of brochures to compare prices)
Pets	Buying food Vet charges Distance walked with dog Length and width of kennel/hutch Volume of water in bowl How often to change the water How often to feed the pet
Weather	Charting rainfall, hours of sunshine, wind speed
Car park	Graphing the number of cars against time Cost Area of ordinary car-park space, of invalid space, of parent-and-child space, of car park
Cooking	Recipes Planning a dinner Weighing Costing Temperature Cooking time
DIY	Measuring (length, perimeter, area) Costing the decoration of a room Pricing tools
Mobile phones	Which company offers the best value? How much call credit left, how many calls/texts can be made for this amount? At what time is it cheaper to make calls or send texts?
Shopping	Money Special offers Price per weight/volume VAT

Table 2

Concept	Links to the world around us
Number	Patterns on floor or ceiling tiles The calendar Booking/finding seats in a cinema/theatre
Shape	Wall and floor patterns Straight lines, right angles in the classroom Symmetry in a butterfly, in our bodies (sort of) Various boxes, cans, bottles from the supermarket Why is a manhole cover or bath-plug round?
Time	Timetables Journeys by walking, cycling, car, bus, train, aeroplane Times we do things in school or at home Graphs of time spent watching TV, sleeping
Measure	Old units of measure based on the body (for example, the use of 'hands' to measure the height of a horse) Estimating and measuring length for DIY tasks Distance on maps, heights of mountains Capacity of various tins, cans, cartons Weight of items, of persons