An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

# Resource Booklet

# Mathematics

# Cluster Workshop

# 2018-19

Ionad Oideachais Mhuineacháin

AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

# Contents

# Junior Cycle Terminology

| | |
|---|---|
| **Specification** | A subject or short course specification details the intended learning outcomes, and how they can be achieved and demonstrated. The specification outlines how the learning in any subject or short course is linked to particular statements of learning and key skills. |
| **Learning Outcome** | Learning outcomes are statements in curriculum specifications to describe the knowledge, understanding, skills and values students should be able to demonstrate after a period of learning |
| **Learning Intention** | A learning intention for a lesson or series of lessons is a statement, created by the teacher, which describes clearly what the teacher wants the students to know, understand and be able to do as a result of the learning and teaching activities. |
| **Success Criteria** | Success criteria are linked to learning intentions. They are developed by the teacher and/or the student and describe what success looks like. They help the teacher and student to make judgements about the quality of student learning. |
| **Contextual Strand** | The four contextual strands are; Number, Geometry and Trigonometry, Algebra and Functions, and Statistics and Probability. |
| **Unifying Strand** | The unifying strand permeates all of the contextual strands and is composed of the six elements of the specification. There is no specific content linked to this strand; rather, its learning outcomes underpin the rest of the specification. Each learning outcome in this strand is applicable to all of the activities and content of the other four strands |
| **Action Verb** | Each action verb is described in terms of what the learner should be able to do once they have achieved the learning outcome. |
| **L2LP** | Level 2 Learning Programmes are designed for a very specific group of students with general learning disabilities in the higher functioning moderate and low functioning mild categories. Level 2 Learning Programmes are based around Priority Learning Units (PLUs). |
| **Priority Learning Unit (PLU)** | The PLUs focus on developing the basic social, pre-vocational and life skills of the students involved. There are five Level 2 PLUs; Communicating and Literacy, Numeracy, Personal Care, Living in a Community and Preparing for Work. |
| **Summative Assessment** | Assessment is summative when it is used to evaluate student learning at the end of the instructional process or of a period of learning. The purpose is to summarise the students' achievements and to determine whether and to what degree the students have demonstrated understanding of that learning by comparing it against agreed success criteria or features of quality. |
| **Formative Assessment** | The Junior Cycle will be underpinned by the further integration of formative assessment as a normal part of teaching and learning in classrooms. Formative assessment involves teachers and students reflecting on how learning is progressing and deciding next steps to ensure successful outcomes. A vital part of formative assessment is the feedback that teachers provide to their students. Through a range of assessment activities, the teacher helps the student to identify what has been achieved and where there is room for further learning and development. To facilitate the type of learning envisaged above, the role of the teacher and the dynamics of the teacher-student relationship will evolve. Teachers will place a greater emphasis on integrating assessment into their teaching, so they can better monitor students' |

| | |
|---|---|
| | progress in learning and identify how they can support students to reflect on and critically analyse their own learning. |
| **Classroom-Based Assessment (CBA)** | Classroom-Based Assessments in subjects and short courses provide students with opportunities to demonstrate their understanding and skills in ways not possible in a formal examination. Classroom-Based Assessments, facilitated by the classroom teacher, are undertaken by students in a defined time period, within class contact time and to a national timetable. |
| **Subject Learning and Assessment Review (SLAR) meeting** | Following the completion of a Classroom-Based Assessment, teachers will engage in review meetings, where they will share and discuss samples of their assessments of student work and build common understanding about the quality of student learning. |
| **Assessment Task** | The Assessment Task is a written task completed by students during class time and is sent to the State Examinations Commission for marking. The Assessment Task is specified by the NCCA and is related to the learning outcomes of the second Classroom-Based Assessment. The Guidelines for the Classroom-Based Assessments and Assessment Task for each subject will provide all the necessary details. |
| **Junior Cycle Profile of Achievement (JCPA)** | The JCPA is the award that students will receive at the end of their junior cycle. The award will reward achievement across all areas of learning and assessment including ongoing, formative assessment; Classroom-Based Assessments; and SEC grades, which include results from the final examinations and the Assessment Tasks. |
| **Features of Quality** | Features of quality are the statements in the short course/subject specifications that support teachers in making judgements about the quality of student work for the purpose of awarding achievement grades for certification. As success criteria are closely linked to learning intentions and based on the day-to-day processes in the classroom, student learning will gradually come to reflect the requirements set out in the features of quality which are used for certification purposes. |
| **On Balance Judgement** | When using the Features of Quality to assess the level of student achievement in a Classroom-Based Assessment, teachers use 'on-balance' judgement. The teacher should read the Features of Quality (starting with *Yet to meet expectations*) until they reach a descriptor that best describes the work being assessed. Where it is not clearly evident which quality descriptor should apply, teachers must come to a judgment based on the evidence from the student's work, to select the descriptor that best matches the student's work overall. This 'best fit' approach allows teachers to select the descriptor that 'on balance' describes the work being assessed. |

# Map of the Website


Key Documents


News/Events


CPD Workshops


Planning


Assessment


Resources

**Framework**
**Maths Specification**
**Maths Info Leaflet**
**Assessment Guidelines**

**Latest News**
**Twitter Feed**
**Newsletter Issue 1**

**Presentation 2017/18**
**Resource booklet**
**Quadrilateral learning experience**
**9 pin Geoboard**
**Elective Workshops - Webinar**
**Triangle Card Sort Task**

**Linking Junior Cycle Mathematics with L2LPs**
**Quick Reference Guide – Links Between Primary and Post Primary**
**Primary Mathematics Curriculum**
**Professional Time in Mathematics**
**Mathematics Specification**
**Suggested Planning Templates – Units of Learning**

**Assessment in Junior Cycle Mathematics PowToon**
**Formative Assessment in Mathematics – Quick Reference Guide**

**Learning Outcomes Poster**
**Editable Learning outcomes document**
**Action Verb Poster**
**Unifying Strand Poster**
**Introducing the Mathematics Specification PowToon**
**Assessment in Junior Cycle Mathematics PowToon**
**Formative Assessment in Mathematics – Quick Reference Guide**

# What are your hopes for the day?

# Reflecting on Teaching and Learning Practices

Take some time to consider whether you **always**, **sometimes** or **never** use the pedagogical approaches below

| In my classroom …. |  Always |  Sometimes |  Never |
|---|---|---|---|
| I establish students' current level of understanding and prior knowledge at the start of a new unit of learning. | | | |
| I give my students a written test at the end of a topic. | | | |
| I share learning intentions with my students. | | | |
| I use a variety of strategies to gather feedback from students. | | | |
| I adapt my teaching according to student responses. | | | |
| I ensure my students know what successful learning looks like. | | | |
| I use a range of questioning strategies. | | | |
| I provide students with the opportunity to pose questions. | | | |
| Lessons are designed to encourage students to communicate mathematically. | | | |
| I enable students to reflect on their learning. | | | |
| Students are aware of their progression within a unit of learning. | | | |
| I provide opportunities for students to assess their own progress. | | | |

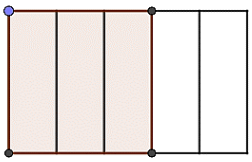
# Effective Questioning for Deeper Learning

Open questions promote deeper engagement with learning

Closed questions generally allow for a single response

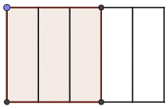
| Closed question | Possible Open question |
|---|---|
| Calculate the perimeter of a rectangle with length 6 units and breadth 5 units? | If a rectangle has a perimeter of 22 units, what are its possible dimensions? |
| Calculate $\frac{3}{4}+\frac{3}{12}$ | Give an example of two fractions that add to 1. |
| Round 5.7347 correct to one decimal place | A number has been rounded to 5.7<br>What might the original number have been? |

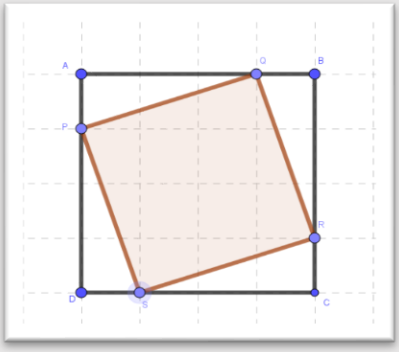
Convert the closed question to an open question or vice versa.

| Closed question | Open question |
|---|---|
| 1. What proportion of the shape below is shaded?  | |
| 2. Find the point of intersection of $y = 2x + 1$ and $y = x + 3$ | |
| 3. | Create a list of four numbers whose mean is 5. |
| 4. | Give me an example where multiplying two numbers gives an answer that is smaller than either. |

# Other Questioning Strategies

## In as many ways as possible…

| | |
|---|---|
| 1. What proportion of the shape below is shaded?  | **Shade $\frac{3}{5}$ of a rectangle in as many ways as possible.** |



www.projectmaths.ie

## Always, sometimes, never…

When you multiply two numbers together the answer is bigger.
Always, sometimes, never?

x + y = xy
always, sometimes, never?

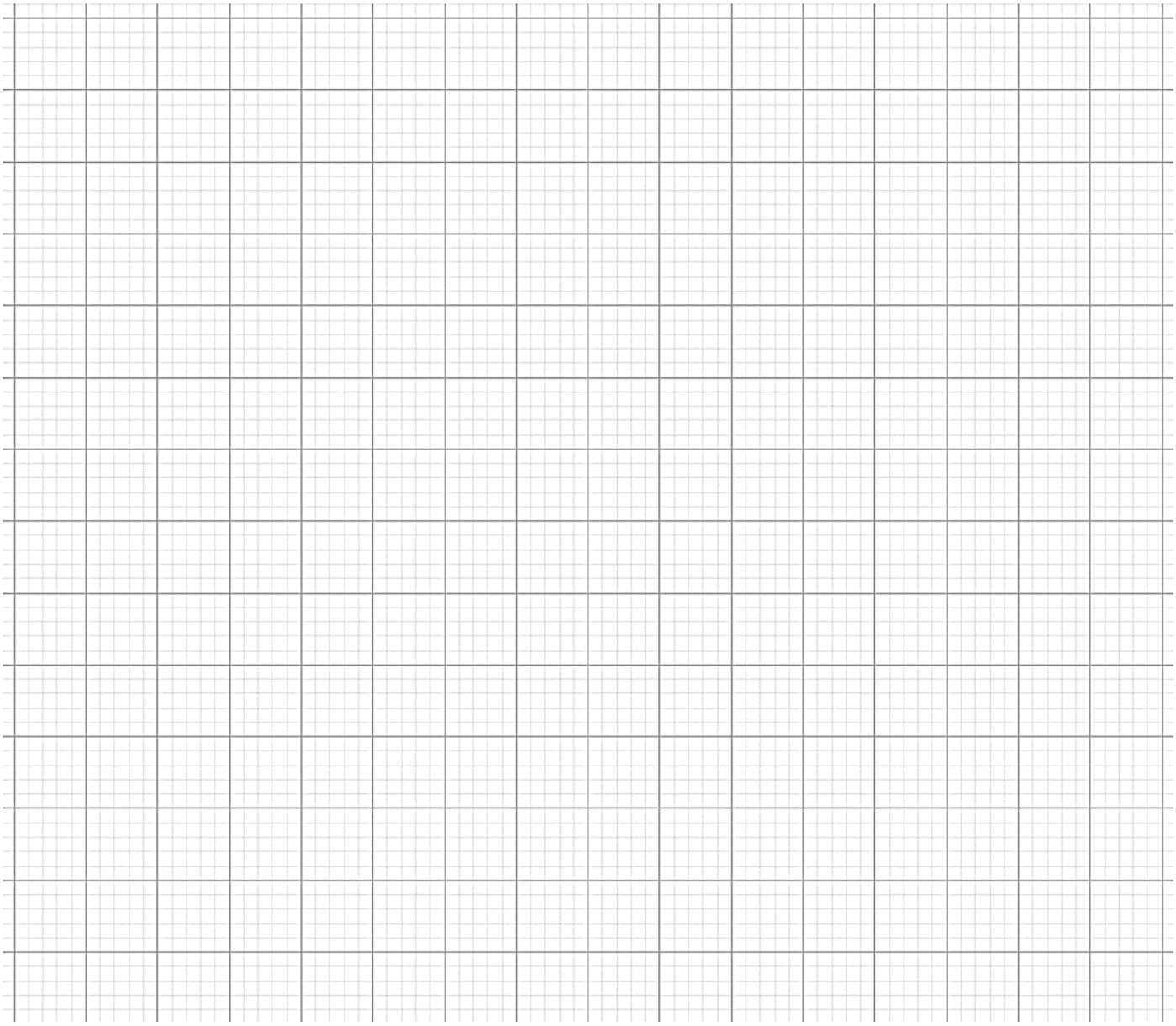
If you add the same number to the numerator and denominator of a fraction, the fraction gets bigger in value.

Always, sometimes, never?

# Natural Numbers

**‘Natural numbers can be expressed as the sum of consecutive positive whole numbers’**

**Is this statement *always, sometimes or never* true?**



# Effective Questioning – Comments and Suggestions

**Effective questioning is designed to:**

- Identify the existing level of student understanding/knowledge/skill
- Extend and deepen student learning
- Inform future planning

**We can make our questions more effective by:**

- Preparing key questions
- Planning the sequencing in which questions are asked
- Asking fewer, but more open questions
- Using incorrect answers to identify and address misconceptions
- Asking questions that require students to defend their reasoning

**Some classroom strategies:**

- Think, pair, share
- Increase wait time to five seconds
- No hands up
- Instead of 'any questions?' try 'ask me two questions'
- Reduce scaffolding
- The student as problem poser

**Further thoughts or comments:**

Adapted from:

# Toolkit for Mathematical Investigations

| | |
|---|---|
| Define a problem | What do I want to know? What do I already know? Form a conjecture, specialise/reduce, restrict/extend, stress / ignore |
| Translate | Tools, Concrete Materials, Tables, Pattern Identification, Diagrams, Formulae, Check for hidden assumptions |
| Engage and Solve | Spatial/Graphical Reasoning, List, Draw, Work backwards, Eliminate, Sort, Classify, Estimate, Compare, Organise, Vary, Try extreme cases, Work systematically |
| Interpret | Summarise, Explain, Justify, Reason, Generalise, Prove, Judge the Validity, Convince, Predict, Draw conclusions, Mathematical Solutions, Real-World Solutions. |

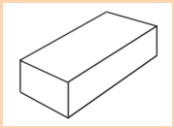
It is not intended to present the stages as a rigid and linear process. For some problems it may not be possible to simply move through them consecutively to produce an answer. It may be the case that students move backwards and forwards between the stages and the activities may be revisited at different times as students complete the investigation.

Assessment Guidelines P. 16

# Tasks for Discussion

Represent a linear equation whose solution is $x = 5$

For which cuboids do all faces have the same perimeter?

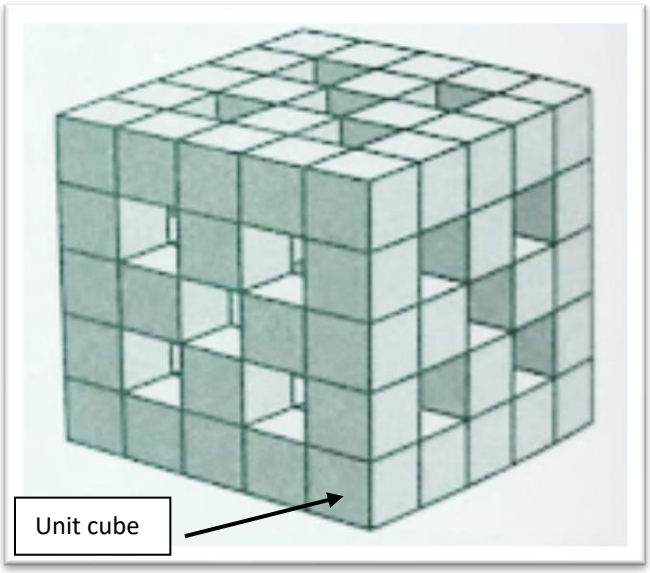


Given any rectangle, there is another rectangle with the same perimeter but smaller area

What 2D shapes can be created by slicing through a cube?

If I cut a piece off of a shape it reduces the area and the perimeter. Discuss

If the sum of two numbers is fixed, then their product is a maximum when they are equal




# Rowing Video

## What questions do you want answers to?

## Classroom Based Assessment 1

| Classroom-Based Assessments | Format | Student preparation | Completed |
|---|---|---|---|
| **Mathematical investigation** | A report may be presented in a wide range of formats | A student will, over a three-week period, follow the problem-solving cycle to investigate a mathematical problem.<br><br>**Problem-solving cycle:** define a problem; decompose it into manageable parts and/or simplify it using appropriate assumptions; translate the problem to mathematics if necessary; engage with the problem and solve it if possible; interpret any findings in the context of the original problem. | Towards the end of Year Two |

# Features of Quality CBA 1

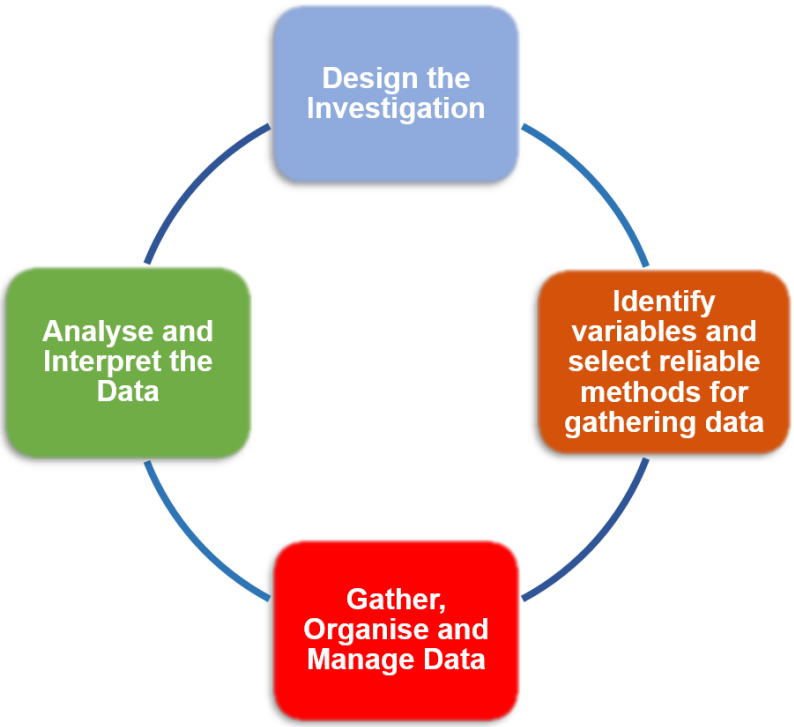
| Features of Quality for the Mathematical Investigation | |
|---|---|
| **Exceptional** | |
| **Defining the Problem Statement** | • Poses a concise problem statement and clarifies and simplifies the problem by making justified assumptions, where appropriate |
| **Finding a strategy or translating the problem to mathematics** | • Develops an efficient justified strategy and evaluates progress towards a solution, conjectures relationship between variables where appropriate |
| **Engaging with the mathematics to solve the problem** | • Mathematical procedures are followed with a high level of precision, and a justified answer is achieved; solution/observations are generalised and extended to other situations where appropriate |
| **Interpreting and reporting** | • Deductive arguments used and precise mathematical language and symbolic notation used to consolidate mathematical thinking and justify decisions and solutions; strengths and/ or weaknesses in the mathematical representation/solution strategy are identified |
| **Above expectations** | |
| **Defining the Problem Statement** | • Poses a problem statement and clarifies/simplifies the problem by making assumptions, where appropriate |
| **Finding a strategy or translating the problem to mathematics** | • Justifies the use of a suitable strategy to engage with the problem and identifies any relevant variables |
| **Engaging with the mathematics to solve the problem** | • Suitable mathematical procedures are followed, and accurate mathematical language, symbolic notation and visual representations are used; attempts are made to generalise patterns in the solution/observation |
| **Interpreting and reporting** | • Checks reasonableness of solution and revisits assumptions/ strategy to iterate the process, if necessary, uses formal mathematical language to communicate ideas and identifies what worked well and what could be improved |

| In line with expectations | |
|---|---|
| **Defining the Problem Statement** | • With limited guidance poses a problem statement, breaks the problem down into manageable steps and simplifies the problem by making assumptions, if appropriate |
| **Finding a strategy or translating the problem to mathematics** | • Chooses an appropriate strategy to engage with the problem |
| **Engaging with the mathematics to solve the problem** | • Records observations/data systematically and follows suitable mathematical procedures with minor errors; graphs and/or diagrams/words are used to provide insights into the problem and/or solution |
| **Interpreting and reporting** | • Assesses the reasonableness of the solution and makes a concrete connection to the original question, uses everyday familiar language to communicate ideas |
| **Yet to meet expectations** | |
| **Defining the Problem Statement** | • Uses a given problem statement and with guidance breaks the problem down into steps |
| **Finding a strategy or translating the problem to mathematics** | • Uses a given strategy |
| **Engaging with the mathematics to solve the problem** | • Records observations/data and follows some basic mathematical procedures |
| **Interpreting and reporting** | • Comments on any solution |

# Classroom Based Assessment 2

| Classroom-Based Assessments | Format | Student preparation | Completed |
|---|---|---|---|
| **Statistical Investigation** | A report may be presented in a wide range of formats | A student will, over a three-week period follow the Statistical enquiry cycle.<br>**Statistical enquiry cycle:** formulate a question; plan and collect unbiased, representative data; organise and manage the data; explore and analyse the data using appropriate displays and numerical summaries and answer the original question giving reasons based on the analysis section. | Year Three |

## Statistical Enquiry Cycle



# Features of Quality CBA 2

| Features of Quality for the Statistical Investigation | |
|---|---|
| **Exceptional** | |
| **Designing the investigation** | • Poses a question that anticipates variability and seeks generalisation, study design will produce as far as practical reliable and valid results by taking into account variability and confounding variables |
| **Identifying the variables of interest** | • Describes relationship between the variables and describes considerations related to reliability and fairness |
| **Organising and managing the data** | • Use distributions to analyse the data and justifies measures of centre used to describe the data |
| **Analysing and interpreting data summaries** | • Interprets the data in relation to the original question; conclusion displays understanding of the limitations of generalising to the population and considers the need to reformulate the original question in light of the findings |
| **Above expectations** | |
| **Designing the investigation** | • Poses a question that anticipates variability and seeks generalisation; data collection plan shows awareness of how variability affects the validity and reliability of the findings |
| **Identifying the variables of interest** | • Chosen measuring strategy will provide valid and reliable data |
| **Organising and managing the data** | • Uses appropriate data displays and describes the data in terms of measures of centre and spread |
| **Analysing and interpreting data summaries** | • Reports the findings and the conclusion refers to the original question and attempts to look beyond the data |

| In line with expectations | |
|---|---|
| **Designing the investigation** | • Poses a question that anticipates variability and plans to collect/source the type of data appropriate for the question posed |
| **Identifying the variables of interest** | • Identifies variables and develops a measuring strategy for measuring the dependent and independent variable |
| **Organising and managing the data** | • Displays data in a way that allows patterns to be identified, identifies patterns and describes the data in terms of those patterns |
| **Analysing and interpreting data summaries** | • Makes a concrete connection to the original question of the investigation but does not look beyond the data |
| **Yet to meet expectations** | |
| **Designing the investigation** | • Makes a concrete connection to the original question of the investigation but does not look beyond the data |
| **Identifying the variables of interest** | • Gathers and displays data |
| **Organising and managing the data** | • Makes statements about the data displayed |
| **Analysing and interpreting data summaries** | • No concrete connection back to the original question |

# Assessment Task

The Assessment Task is a written task completed by students during class time. It is not marked by the class teacher but is sent to the State Examinations Commission for marking as part of the state-certified examination in Mathematics. The Assessment Task is specified by the NCCA and is related to the learning outcomes on which the second Classroom-Based Assessment is based. In the case of mathematics, this is the Statistical Investigation. The details of the of the Assessment Task are outlined in the table below:

| Format | Student preparation | Completed |
|---|---|---|
| Students complete a specified written task which is sent to the SEC for marking. | The Assessment Task will link to the Statistical Investigation. | Following completion of the second Classroom Based Assessment in Year Three. |

The Assessment Task will be allocated 10% of the marks used to determine the grade. The Assessment Task is directly related to the nature and focus of the second Classroom-Based Assessment the Statistical Investigation, which is *to pose a question, gather and analyse data and interpret it in the context of the original question*. The knowledge and skills developed by students during this Classroom-Based Assessment emerge from their growing awareness of *statistical inquiry*.

The Assessment Task will comprise of **some or all** of the following:

- Engagement with a short stimulus in written, audio, audio-visual or multi-modal format in preparation for the written task
- A written task that tests the students in their capacity to reflect on the skills they have developed

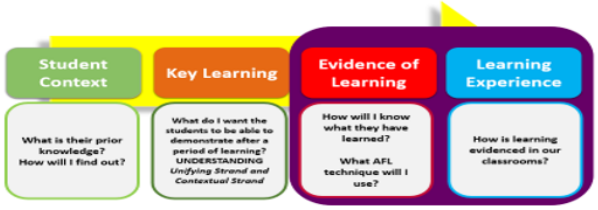
The Assessment Task is offered at a Common Level and the questions posed will take into account the broad cohort of students taking the assessment. Including the experience of the stimulus material, the Assessment Task takes approximately a double class period or two single class periods (i.e. a minimum of 80 minutes) to complete. The student response is written into a pro-forma booklet and the school forwards the completed student booklets for the Assessment Task in accordance with arrangements set out by the SEC.

Schools will have some flexibility in choosing the 2 class periods for completion, with a window of one week being identified during which the Assessment Task must be undertaken by students.

Where a student is absent for the completion of all or part of the Assessment Task, schools should make local arrangements in the school to allow the student to complete the task as close as possible to the timeframe scheduled for completion.

Examples of Assessment Tasks and guidelines on how to organise and manage the Assessment Task, across two class periods, will be available at www.curriculumonline.ie and in the *Assessment Toolkit* in Autumn 2019.

# Planning Template – Essential Components

| | |
|---|---|
| **Theme** Decide on a Theme to connect learning outcomes within and between strands | **Teacher Notes**<br><br>These notes are filled in throughout the process of learning, teaching and assessment to inform the teacher on the progress of the unit of learning |
| **Unit of Learning** | |
| **Student Context** Year Group, special considerations, what is their prior knowledge? | |
| **Learning Outcomes** Create a sub-group of learning outcomes for the unit | |
| **Key Learning** What the students should understand<br><br>Student's understanding is developed incrementally over the three years of junior cycle | |
| **Ongoing Assessment** Formative & summative | **Reflection**<br>On completion of a unit of learning these insights will inform future planning for teaching and learning. What went well? What would I change for the next time I teach this unit? Did my method(s) of assessment measure what I wanted? |
| **Learning Experiences**<br>  | |

# Suggested Planning Template 1

| Theme | Teacher Notes |
|---|---|
| Unit of Learning | |
| Student Context | |
| Learning Outcomes | |
| Key Learning | |
| Ongoing Assessment | Reflection |
| Learning Experiences | |

# Suggested Planning Template 2

**Unit Theme** _____ **Duration** _____

**Student Context** _____

**Learning Outcomes**

**Key Learning for this Unit**

**Contextual Strand**

**Teacher Notes**

**Ongoing Assessment**

**Unifying Strand**

**Learning Experiences**

**Wellbeing Indicators**

**SSE Focus**

**Reflection on Unit**

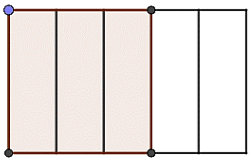
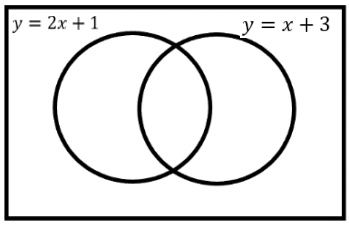
# Frequently Asked Questions

There is a frequently asked questions document on conducting Classroom Based Assessments and SLAR meetings available at:

https://www.jct.ie/maths/departmental_planning

or use the QR code opposite to take you to the document.

# Effective Questioning for Deeper Learning-Suggestions

| Closed question | Open questions |
|---|---|
| 1. What proportion of the shape below is shaded?  | **Shade $\frac{3}{5}$ of a rectangle in as many ways as possible.** |
| 2. Find the point of intersection of $y = 2x + 1$ and $y = x + 3$ | **Place at least one set of coordinates in each part of the Venn Diagram**   |
| 3. **Calculate the mean of 2, 6, 8 and 4?** | Create a list of four numbers whose mean is 5. |
| 4. **Calculate $12 \times 0.5$** | Give me an example where multiplying two numbers gives an answer that is smaller than either. |

# Notes

An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

**Contact details:**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For any queries, please contact us on one of the following:

Follow us on Twitter @JCTMaths

@JCforTeachers

Email: info@jct.ie

Phone number: 047 74008

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More information and resources available on our website: www.jct.ie/maths

To sign up for our mailing list follow the QR code

## Unifying Strand

**Element: Building blocks**

*Students should be able to:*

U.1 recall and demonstrate understanding of the fundamental concepts and procedures that underpin each strand

U.2 apply the procedures associated with each strand accurately, effectively, and appropriately

U.3 recognise that equality is a relationship in which two mathematical expressions have the same value

**Element: Representation**

*Students should be able to:*

U.4 represent a mathematical situation in a variety of different ways, including: numerically, algebraically, graphically, physically, in words; and to interpret, analyse, and compare such representations

**Element: Connections**

*Students should be able to:*

U.5 make connections within and between strands

U.6 make connections between mathematics and the real world

**Element: Problem solving**

*Students should be able to:*

U.7 make sense of a given problem, and if necessary mathematise a situation

U.8 apply their knowledge and skills to solve a problem, including decomposing it into manageable parts and/or simplifying it using appropriate assumptions

U.9 interpret their solution to a problem in terms of the original question

U.10 evaluate different possible solutions to a problem, including evaluating the reasonableness of the solutions, and exploring possible improvements and/or limitations of the solutions (if any)

**Element: Generalisation and proof**

*Students should be able to:*

U.11 generate general mathematical statements or conjectures based on specific instances

U.12 generate and evaluate mathematical arguments and proofs

**Element: Communication**

*Students should be able to:*

U.13 communicate mathematics effectively: justify their reasoning, interpret their results, explain their conclusions, and use the language and notation of mathematics to express mathematical ideas precisely