

Each project should be assessed against the following seven criteria.

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|-------------|-----------------------------|
| Criterion A | Introduction |
| Criterion B | Information/measurement |
| Criterion C | Mathematical processes |
| Criterion D | Interpretation of results |
| Criterion E | Validity |
| Criterion F | Structure and communication |
| Criterion G | Notation and terminology |

The descriptions of the achievement levels for each of these seven assessment criteria follow and it is important to note that each achievement level represents the **minimum** requirement for that level to be awarded. The final mark for each project is obtained by adding together the achievement levels awarded for each criterion A–G.

The maximum possible mark is 20.

Applying the assessment criteria

The method of assessment used is criterion referenced, not norm referenced. That is, the method of assessing each project judges students by their performance in relation to identified assessment criteria and not in relation to the work of other students.

Each project submitted for mathematical studies SL is assessed against the seven criteria A to G. For each assessment criterion, different levels of achievement are described that concentrate on positive achievement. The description of each achievement level represents the minimum requirement for that level to be achieved.

The aim is to find, for each criterion, the level descriptor that conveys most adequately the achievement levels attained by the student.

The teacher should read the description of each achievement level, starting with level 0, until one is reached that describes a level of achievement that has **not** been reached. The level of achievement gained by the student is therefore the preceding one, and it is this that should be recorded.

For example, when considering successive achievement levels for a particular criterion, if the description for level 3 does not apply, then level 2 should be recorded.

For each criterion, whole numbers only may be recorded; fractions and decimals are not acceptable.

The highest achievement levels do not imply faultless performance, and teachers should not hesitate to use the extremes, including 0, if they are appropriate descriptions of the work being assessed.

The whole range of achievement levels should be awarded as appropriate. For a particular piece of work, a student who attains a certain achievement level in relation to one criterion may not necessarily attain similar achievement levels in relation to the other criteria.

Teachers should not assume that the overall assessment of the students produces any particular distribution of scores.

It is expected that the assessment criteria be available to students at all times. Descriptors of the achievement levels for each assessment criterion are given in the tables in the following section. Within the tables, for each achievement level, there is a link to a project within this teacher support material that achieved that level for that particular criterion.

Students should be made aware that they will not receive a grade for mathematical studies SL if they have not submitted a project.

Achievement levels

Criterion A: Introduction

In this context, the word “task” is defined as “what the student is going to do”; the word “plan” is defined as “how the student is going to do it”. A statement of the task should appear at the beginning of each project. It is expected that each project has a clear title.

| Achievement level | Descriptor |
|-------------------|--|
| 0 | The project does not contain a clear statement of the task. <i>There is no evidence in the project of any statement of what the student is going to do or has done.</i> |
| 1 | The project contains a clear statement of the task. <i>For this level to be achieved, the task should be stated explicitly.</i> |
| 2 | The project contains a title, a clear statement of the task and a description of the plan. <i>The plan need not be highly detailed, but must describe how the task will be performed. If the project does not have a title, this achievement level cannot be awarded.</i> |
| 3 | The project contains a title, a clear statement of the task and a detailed plan that is followed. <i>The plan should specify what techniques are to be used at each stage and the purpose behind them, thus lending focus to the task.</i> |

Criterion B: Information/measurement

In this context, generated measurements include those that have been generated by computer, by observation, by prediction from a mathematical model or by experiment. Mathematical information includes geometrical figures and data that are collected empirically or assembled from outside sources. This list is not exhaustive and mathematical information does not solely imply data for statistical analysis. If a questionnaire or survey is used then a copy of this along with the raw data must be included.

| Achievement level | Descriptor |
|-------------------|--|
| 0 | The project does not contain any relevant information collected or relevant measurements generated. <i>No attempt has been made to collect any relevant information or to generate any relevant measurements.</i> |
| 1 | The project contains relevant information collected or relevant generated measurements. <i>This achievement level can be awarded even if a fundamental flaw exists in the instrument used to collect the information, for example, a faulty questionnaire or an interview conducted in an invalid way.</i> |
| 2 | The relevant information collected, or set of measurements generated, is organized in a form appropriate for analysis or is sufficient in both quality and quantity. <i>A satisfactory attempt has been made to structure the information/measurements ready for the process of analysis, or the information/measurement collection process has been thoroughly described and the quantity of information justified. The raw data must be included for this achievement level to be awarded.</i> |
| 3 | The relevant information collected, or set of measurements generated, is organized in a form appropriate for analysis and is sufficient in both quality and quantity. <i>The information/measurements have been properly structured ready for analysis and the information/measurement collection process has been thoroughly described and the quantity of information justified. If the information/measurements are too sparse or too simple, this achievement level cannot be awarded. If the information/measurements are from a secondary source, then there must be evidence of sampling if appropriate. All sampling processes should be completely described.</i> |

Criterion C: Mathematical processes

When presenting diagrams, students are expected to use rulers where necessary and not merely sketch. A freehand sketch would not be considered a correct mathematical process. When technology is used, the student would be expected to show a clear understanding of the mathematical processes used. All graphs must contain all relevant information. The teacher is responsible for determining the accuracy of the mathematics used and must indicate any errors on the final project. If a project contains no simple mathematical processes, then the first two further processes are assessed as simple.

| Achievement level | Descriptor |
|-------------------|--|
| 0 | The project does not contain any mathematical processes. <i>For example, where the processes have been copied from a book, with no attempt being made to use any collected/generated information. Projects consisting of only historical accounts will achieve this level.</i> |
| 1 | At least two simple mathematical processes have been carried out. <i>Simple processes are considered to be those that a mathematical studies SL student could carry out easily, for example, percentages, areas of plane shapes, graphs, trigonometry, bar charts, pie charts, mean and standard deviation, substitution into formulae and any calculations and/or graphs using technology only.</i> |
| 2 | At least two simple mathematical processes have been carried out correctly. <i>A small number of isolated mistakes should not disqualify a student from achieving this level. If there is incorrect use of formulae, or consistent mistakes in using data, this level cannot be awarded.</i> |
| 3 | At least two simple mathematical processes have been carried out correctly. All processes used are relevant. <i>The simple mathematical processes must be relevant to the stated aim of the project.</i> |
| 4 | The simple relevant mathematical processes have been carried out correctly. In addition, at least one relevant further process has been carried out. <i>Examples of further processes are differential calculus, mathematical modelling, optimization, analysis of exponential functions, statistical tests and distributions, compound probability. For this level to be achieved, it is not required that the calculations of the further process be without error. At least one further process must be calculated showing full working.</i> |
| 5 | The simple relevant mathematical processes have been carried out correctly. In addition, at least one relevant further process has been carried out. All processes, both simple and further, that have been carried out are without error. <i>If the measurements, information or data are limited in scope, then this achievement level cannot be awarded.</i> |

Criterion D: Interpretation of results

Use of the terms “interpretation” and “conclusion” refers very specifically to statements about what the mathematics used tells us after it has been used to process the original information or data. Discussion of limitations and validity of the processes is assessed elsewhere.

| Achievement level | Descriptor |
|-------------------|---|
| 0 | The project does not contain any interpretations or conclusions. <i>For the student to be awarded this level, there must be no evidence of interpretation or conclusions anywhere in the project, or a completely false interpretation is given without reference to any of the results obtained.</i> |
| 1 | The project contains at least one interpretation or conclusion. <i>Only minimal evidence of interpretations or conclusions is required for this level. This level can be achieved by recognizing the need to interpret the results and attempting to do so, but reaching only false or contradictory conclusions.</i> |
| 2 | The project contains interpretations and/or conclusions that are consistent with the mathematical processes used. <i>A “follow through” procedure should be used and, consequently, it is irrelevant here whether the processes are either correct or appropriate; the only requirement is consistency.</i> |
| 3 | The project contains a meaningful discussion of interpretations and conclusions that are consistent with the mathematical processes used. <i>To achieve this level, the student would be expected to produce a discussion of the results obtained and the conclusions drawn based on the level of understanding reasonably to be expected from a student of mathematical studies SL. This may lead to a discussion of underlying reasons for results obtained. If the project is a very simple one, with few opportunities for substantial interpretation, this achievement level cannot be awarded.</i> |

Criterion E: Validity

Validity addresses whether appropriate techniques were used to collect information, whether appropriate mathematics was used to deal with this information, and whether the mathematics used has any limitations in its applicability within the project. Any limitations or qualifications of the conclusions and interpretations should also be judged within this criterion. The considerations here are independent of whether the particular interpretations and conclusions reached are correct or adequate.

| Achievement level | Descriptor |
|-------------------|--|
| 0 | There is no awareness shown that validity plays a part in the project. |
| 1 | There is an indication, with reasons, if and where validity plays a part in the project. <i>There is discussion of the validity of the techniques used or recognition of any limitations that might apply. A simple statement such as "I should have used more information/measurements" is not sufficient to achieve this level. If the student considers that validity is not an issue, this must be fully justified.</i> |

Criterion F: Structure and communication

The term "structure" should be taken primarily as referring to the organization of the information, calculations and interpretations in such a way as to present the project as a logical sequence of thought and activities starting with the task and the plan, and finishing with the conclusions and limitations.

Communication is not enhanced by a large number of repetitive procedures. All graphs must be fully labelled and have an appropriate scale.

It is not expected that spelling, grammar and syntax are perfect, and these features are not judged in assigning a level for this criterion. Nevertheless, teachers are strongly encouraged to correct and assist students with the linguistic aspects of their work. Projects that are very poor linguistically are less likely to excel in the areas that are important in this criterion. Projects that do not reflect the significant time commitment required will not score highly on this assessment criterion.

| Achievement level | Descriptor |
|-------------------|--|
| 0 | No attempt has been made to structure the project. <i>It is not expected that many students will be awarded this level.</i> |
| 1 | Some attempt has been made to structure the project. <i>Partially complete and very simple projects would only achieve this level.</i> |
| 2 | The project has been structured in a logical manner so that it is easily followed. <i>There must be a logical development to the project. The project must reflect the appropriate commitment for this achievement level to be awarded.</i> |
| 3 | The project has been well structured in accordance with the stated plan and is communicated in a coherent manner. <i>To achieve this level, the project would be expected to read well, and contain footnotes and a bibliography, as appropriate. The project must be focused and contain only relevant discussions.</i> |

Criterion G: Notation and terminology

This criterion refers to the use of correct terminology and mathematical notation. The use of calculator or spreadsheet notation is not acceptable.

| Achievement level | Descriptor |
|-------------------|---|
| 0 | The project does not contain correct mathematical notation or terminology. <i>It is not expected that many students will be awarded this level.</i> |
| 1 | The project contains some correct mathematical notation or terminology. |
| 2 | The project contains correct mathematical notation and terminology throughout. <i>Variables should be explicitly defined. An isolated slip in notation need not preclude a student from achieving this level. If it is a simple project requiring little or no notation and/or terminology, this achievement level cannot be awarded.</i> |