Criterion A: Communication

This criterion assesses the organization and coherence of the exploration. A well-organized exploration includes an introduction, has a rationale (which includes explaining why this topic was chosen), describes the aim of the exploration and has a conclusion. A coherent exploration is logically developed and easy to follow.

Graphs, tables and diagrams should accompany the work in the appropriate place and not be attached as appendices to the document.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	The exploration has some coherence.
2	The exploration has some coherence and shows some organization.
3	The exploration is coherent and well organized.
4	The exploration is coherent, well organized, concise and complete.

Your exploration

To get a good mark for Criterion A: Communication

✓ A well organised exploration should have
- An **introduction** in which you should discuss the context of the exploration
- A **rationale** which should include an explanation of why you chose this topic
- A description of the **aim** of the exploration which should be clearly identifiable
- A **conclusion**.

✓ A coherent exploration is logically developed and easy to follow.

✓ Your exploration should "read well".

✓ Any graphs, tables and diagrams that you use should accompany the work in the appropriate place and not be attached as appendices to the document.

✓ A concise exploration is one that focuses on the aim and avoids irrelevancies.

✓ A complete exploration is one in which all steps are clearly explained without detracting from its conciseness.

✓ It is essential that references are cited where appropriate, i.e.,
- Your exploration should contain footnotes as appropriate. For example, if you are using a quote from a publication, a formula from a mathematics book, etc, put the source of the quote in a footnote.
- Your exploration should contain a bibliography as appropriate. This can be in an appendix at the end. List any books you use, any websites you consult, etc.

ж Further Guidance ж

- A **complete** exploration will have all steps clearly explained, and will meet its aim.

- **Organization** refers to the overall structure or framework, including the introduction, body, conclusion etc.

- **A coherent** exploration displays a logical development and is not difficult to follow ('reads well').

- **A concise** exploration remains focused on the overall aim and avoids irrelevant material.

- Key ideas and concepts need to be clearly explained.

- Graphs, tables and diagrams should be embedded in the text where most appropriate and <u>not</u> be put in an appendix at the end of the document.

- The use of technology is not required but strongly encouraged where appropriate.

- It is absolutely critical that the use of a source is cited (footnoted) at the location where it is used.

- Your bibliography must list all sources (books, websites, etc) you consulted when writing your Exploration.

Criterion B: Mathematical presentation

This criterion assesses to what extent the student is able to:

- use appropriate mathematical language (notation, symbols, terminology)
- define key terms, where required
- use multiple forms of mathematical representation, such as formulae, diagrams, tables, charts, graphs and models, where appropriate.

Students are expected to use mathematical language when communicating mathematical ideas, reasoning and findings.

Students are encouraged to choose and use appropriate ICT tools such as graphic display calculators, screenshots, graphing, spreadsheets, databases, drawing and word-processing software, as appropriate, to enhance mathematical communication.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	There is some appropriate mathematical presentation.
2	The mathematical presentation is mostly appropriate.
3	The mathematical presentation is appropriate throughout.

Your exploration

To get a good mark for Criterion B: Mathematical presentation

✓ You are expected to use correct mathematical notation and terminology when communicating mathematical ideas, reasoning and findings.

✓ You are encouraged to choose and use appropriate ICT tools such as graphic display calculators, mathematical software, spreadsheets, databases, drawing and word-processing software, as appropriate, to enhance mathematical communication.

✓ You should define key terms, where required.

✓ You should express your results to an appropriate degree of accuracy, when applicable.

✓ You should always include scales and labels if you use a graph. Tables should have appropriate headings.

✓ Variables should be explicitly defined.

✓ Do not use calculator or computer notation. For example, use 2^x and not 2^x; use × not *; use 0.028 and not 2.8E-2.

ж Further Guidance ж

▪ You are expected to use mathematical language (notation, symbols & terminology) when communicating mathematical ideas, reasoning and findings.

▪ You should use appropriate technology such as graphic display calculators; and software such as equation editors, spreadsheets, dynamic geometry, computer algebra, drawing and word-processing software along with other mathematical software to enhance the presentation of mathematics in your Exploration.

▪ The meaning of key terms should clear and any variables or parameters should be explicitly defined.

▪ All graphs, tables & diagrams should be clearly labeled – and include captions where appropriate.

▪ Do <u>not</u> use calculator or computer notation unless it is software generated and cannot be changed.

Criterion C: Personal engagement

This criterion assesses the extent to which the student engages with the exploration and makes it their own. Personal engagement may be recognized in different attributes and skills. These include thinking independently and/or creatively, addressing personal interest and presenting mathematical ideas in their own way.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	There is evidence of limited or superficial personal engagement.
2	There is evidence of some personal engagement.
3	There is evidence of significant personal engagement.
4	There is abundant evidence of outstanding personal engagement.

Your exploration

To get a good mark for Criterion C: Personal engagement

✓ You should choose a topic for your exploration that you are interested in as it will be easier to display personal engagement.

✓ You can demonstrate personal engagement by using some of the following different attributes and skills.
- Thinking and working independently
- Thinking creatively
- Addressing your personal interests
- Presenting mathematical ideas in your own way
- Asking questions, making conjectures and investigating mathematical ideas
- Looking for and creating mathematical models for real-world situations
- Considering historical and global perspectives
- Exploring unfamiliar mathematics.

ж Further Guidance ж

▪ It is important to choose a topic in which you are genuinely interested.

▪ If it is necessary to include mathematical work from a source such as a textbook in your Exploration then you should endeavor to insert your own comments and description of the work as much as possible.

▪ Ways to show personal engagement include: investigating your own questions & conjectures; making up your own examples; presenting ideas & results in your own words; creating your own models or functions.

Criterion D: Reflection

This criterion assesses how the student reviews, analyses and evaluates the exploration. Although reflection may be seen in the conclusion to the exploration, it may also be found throughout the exploration.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	There is evidence of limited or superficial reflection.
2	There is evidence of meaningful reflection.
3	There is substantial evidence of critical reflection.

Your exploration

To get a good mark for Criterion D: Reflection

✓ Although reflection may be seen in the conclusion to the exploration, it may also be found throughout the exploration.

✓ You can show reflection in your exploration by
- Discussing the implications of your results
- Considering the significance of your findings and results
- Stating possible limitations and/or extensions to your results
- Making links to different fields and/or areas of mathematics.

ж Further Guidance ж

▪ Simply describing results represents **limited or superficial reflection**. To achieve a score higher than 1 you will need to provide deeper and more sophisticated consideration of methods and results.

▪ Ways of showing **meaningful reflection** include: linking results to the aim of your Exploration; commenting on what you have learned; considering limitations; or comparing different mathematical approaches.

▪ Ways of showing **critical reflection** include: considering implications of results; discussing strengths and weaknesses of methods; considering different perspectives; making links between different areas of math.

▪ **Substantial evidence** is likely to mean that reflection is present throughout the exploration.

Criterion E: Use of mathematics

This criterion assesses to what extent and how well students use mathematics in the exploration.

Students are expected to produce work that is commensurate with the level of the course. The mathematics explored should either be part of the syllabus, or at a similar level or beyond. It should not be completely based on mathematics listed in the prior learning. If the level of mathematics is not commensurate with the level of the course, a maximum of two marks can be awarded for this criterion.

The mathematics can be regarded as correct even if there are occasional minor errors as long as they do not detract from the flow of the mathematics or lead to an unreasonable outcome.

Sophistication in mathematics may include understanding and use of challenging mathematical concepts, looking at a problem from different perspectives and seeing underlying structures to link different areas of mathematics.

Rigour involves clarity of logic and language when making mathematical arguments and calculations.

Precise mathematics is error-free and uses an appropriate level of accuracy at all times.

Achievement level	Descriptor
0	The exploration does not reach the standard described by the descriptors below.
1	Some relevant mathematics is used. Limited understanding is demonstrated.
2	Some relevant mathematics is used. The mathematics explored is partially correct. Some knowledge and understanding are demonstrated.
3	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct. Good knowledge and understanding are demonstrated.
4	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct and reflects the sophistication expected. Good knowledge and understanding are demonstrated.
5	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct and reflects the sophistication and rigour expected. Thorough knowledge and understanding are demonstrated.
6	Relevant mathematics commensurate with the level of the course is used. The mathematics explored is precise and reflects the sophistication and rigour expected. Thorough knowledge and understanding are demonstrated.

Your exploration

To get a good mark for Criterion E: Use of mathematics

✓ You are expected to produce work that is commensurate with the level of the course you are studying. The mathematics you explore should either be part of the syllabus, or at a similar level (or beyond).

✓ You should ensure that the mathematics involved is not completely based on mathematics listed in the prior learning.

✓ **If the level of mathematics is not commensurate with the level of the course you can only get a maximum of two marks for this criterion.**

✓ You need to demonstrate within your exploration that you fully understand the mathematics used.

✓ You can demonstrate sophistication of mathematics in your exploration by
  ● Showing that you understand and can use challenging mathematical concepts
  ● Showing that you can extend the applications of mathematics beyond that which you learned in the classroom
  ● Looking at a problem from different mathematical perspectives
  ● Identifying underlying structures to link different areas of mathematics.

✓ Rigor involves clarity of logic and language when making mathematical arguments and calculations.

✓ Precise mathematics is error-free and uses an appropriate level of accuracy at all times.

ж Further Guidance ж

▪ It is critical that you clearly demonstrate that you understand the mathematical concepts and methods that you write about in your Exploration.

▪ **Sophistication in mathematics** may include understanding & use of challenging math concepts, looking at a problem from different perspectives and seeing underlying structures to link different areas of mathematics.

▪ **Rigour** involves clarity of logic and language when making mathematical arguments and calculations.

▪ **Precise mathematics** is error-free and uses an appropriate level of accuracy at all times.