Misc. Additional Guidance



# Assessment objectives

Problem-solving is central to learning mathematics and involves the acquisition of mathematical skills and concepts in a wide range of situations, including non-routine, open-ended and real-world problems. Having followed a DP mathematics HL course, students will be expected to demonstrate the following.

1. **Knowledge and understanding**: recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of familiar and unfamiliar contexts.
2. **Problem-solving**: recall, select and use their knowledge of mathematical skills, results and models in both real and abstract contexts to solve problems.
3. **Communication and interpretation**: transform common realistic contexts into mathematics; comment on the context; sketch or draw mathematical diagrams, graphs or constructions both on paper and using technology; record methods, solutions and conclusions using standardized notation.
4. **Technology**: use technology, accurately, appropriately and efficiently both to explore new ideas and to solve problems.
5. **Reasoning**: construct mathematical arguments through use of precise statements, logical deduction and inference, and by the manipulation of mathematical expressions.
6. **Inquiry approaches**: investigate unfamiliar situations, both abstract and real-world, involving organizing and analysing information, making conjectures, drawing conclusions and testing their validity.

# Developing the exploration

Although the exploration is likely to be written in the second year of the course, students should be made familiar with the concept of the exploration at a very early stage. The specific planning and timing of the exploration will vary from school to school.

The following are suggestions that could be adopted at the different stages of the exploration.

## Before students start the exploration

- Give out the criteria and stimuli early in the course and familiarize students with aims 6–9.
- Give notice of a time frame for doing the exploration.
- Encourage students to keep a record of ideas during the course (journal, notebook, blog).
- Encourage students to look for ideas everywhere (for example, reading mathematical material), and give access to such material (for example, TV, internet, other courses).
- Point out opportunities for exploring mathematics in everyday syllabus work.
- Give students opportunities to practise mathematical writing.
- Familiarize students with available technology.

## At the beginning of the exploration

- Look at examples from the TSM or other students' work.
- Brainstorm and/or use mind-mapping activities.
- Encourage the sharing of ideas.
- Ensure that students have a clear written focus before starting to write the exploration.

## While students are doing the exploration

- Encourage self-assessment.
- Provide opportunities for discussion and questions.
- Provide appropriate feedback on the draft.

## After students have submitted the exploration

- Ensure that internal standardization between teachers takes place, including between mathematics SL and mathematics HL teachers.
- Discuss with students the strengths and weaknesses of their exploration.

# Planning

1. Ensure that students have time to explore the mathematics.
2. Give a realistic deadline for submission of a draft of the written exploration.
3. Give a realistic deadline for feedback to the students.
4. Give a realistic deadline for final submission.
5. Be aware of students' mathematical experience in relation to the exploration at the time of doing the exploration and record this.

## Long-term planning

The aim of long-term planning is to put the exploration into perspective in relation to the whole course. It should take into account:

- the sequencing of teaching units over the duration of the course
- those topics that are more applicable to the exploration
- appropriate places where the skills and strategies of the exploration can be introduced
- opportunities for students to record and develop ideas relevant to the exploration, for example, journals or blogs
- the resources available
- the role, if any, that the exploration will play in terms of school assessment
- timetabling exploration deadlines into the school calendar.

## Short-term planning

The aim of short-term planning is to provide a framework for the exploration so that students gain the maximum benefit from the experience.

It is expected that teachers will give help and guidance to the students while they are doing the exploration. Ten hours of class time should be allocated to management of the exploration work. Some of this time can be taken up with individual or group activities, where students learn some of the skills associated with exploration work. It is expected that students will spend additional time working on their explorations outside class time. Teachers should briefly discuss the exploration early during the course, so that students are aware of what is required and that this is an essential part of the course.

### A possible time frame for the exploration

It is envisaged that 10 hours of class time and approximately 10 hours outside class be spent on the exploration.

#### Choosing a focus/topic: 2 weeks

Class time: 2–3 hours

This will involve introductory lesson(s) leading to each student having a focused aim to their exploration. The purpose and scope of the exploration should be explained. In doing this, teachers could demonstrate in various ways how a stimulus will be used. The list below shows the wide range of stimuli that are suitable as starting points to generate an idea as a focus for the exploration.

It could also be useful to look at an example of one or more stimuli and discuss with students how this could lead to a focus for a mathematical exploration. An example of a "mind map" starting from the stimulus "water" is included below to exemplify how this process could develop.

Examples of explorations from the TSM and other sources could be looked at to demonstrate to students what is expected of them.

At the end of this period, each student should have decided on a focus for the exploration and have a preliminary plan of how to approach it. This could involve describing the aims in class and inviting discussion and comment from fellow students.

**Draft exploration: 3 weeks**

Class time: 4–5 hours

Class time could be used for writing the exploration (though it is envisaged that students will also spend time outside lessons researching and writing their exploration and preparing a draft to submit). Discussion among their peers and with the teacher is encouraged, but it is essential that the written draft exploration submitted is the student's own work and they should be prepared to explain any aspects of their work. Teachers may also utilize this time to review and comment on drafts.

**Teacher to review and comment on drafts: 4–8 weeks**

Class time: 1–2 hours

This draft should be reviewed by the teacher and comments made on the strengths and weaknesses of the work. This first draft must not be heavily annotated or edited by the teacher, but is an opportunity for students to receive further guidance on the exploration. This time could be used by students to consider and possibly discuss the implications of this draft.

**Final writing: 2 weeks**

Class time: 1–2 hours

The student will now have a short period in which to finalize the exploration based on the draft and the advice given. During this time, the student can discuss their work with the teacher, but the final document **must** be exclusively their own work. It is after this stage that the work will be marked by the teacher.

**Stimuli**

Students sometimes find it difficult to know where to start with a task as open-ended as this. While it is hoped that students will appreciate the richness of opportunities for mathematical exploration, it may sometimes be useful to provide a stimulus as a means of helping them to get started on their explorations.

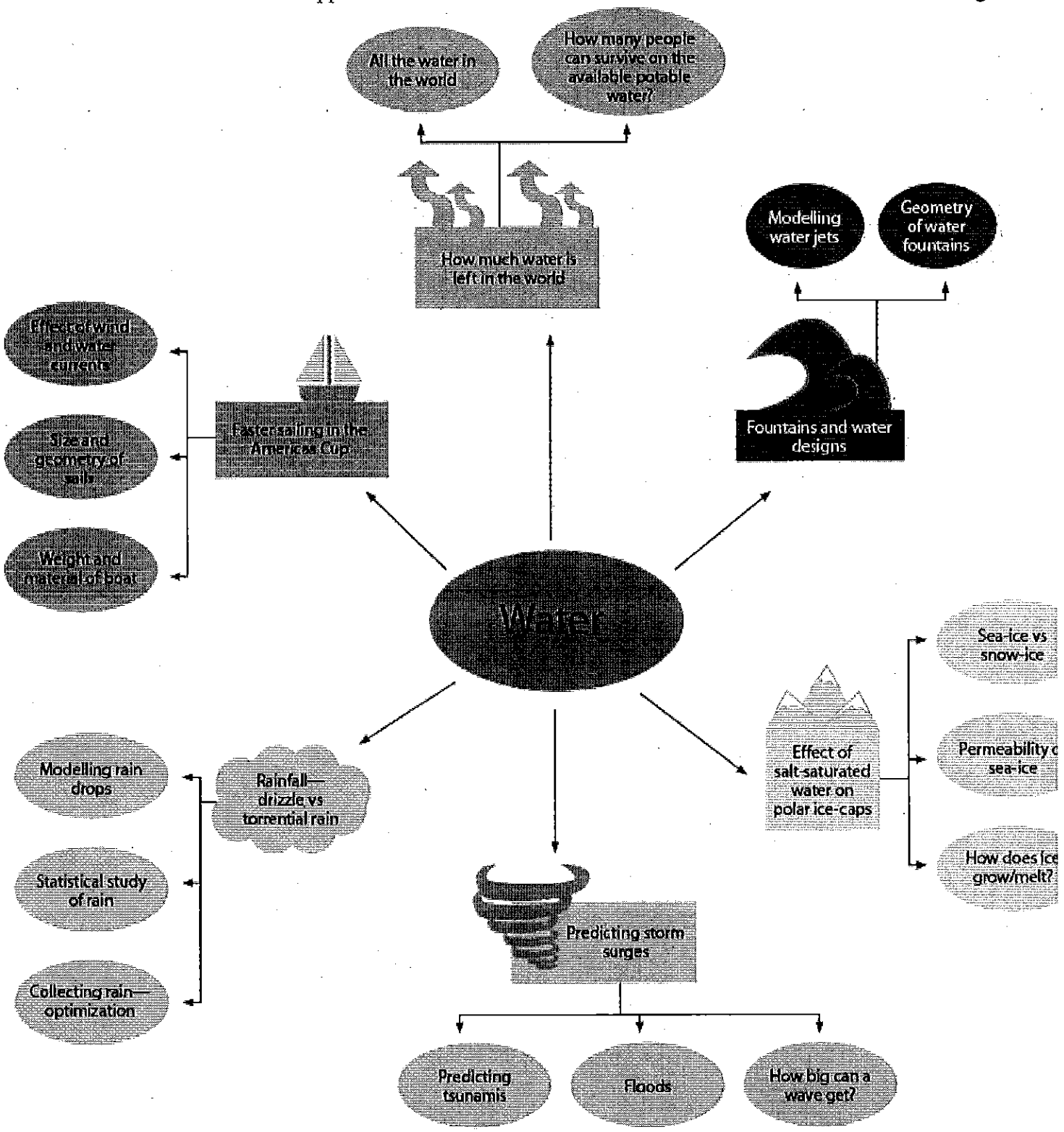
Possible stimuli that could be given to the students include:

| | | | |
|---|---|---|---|
| sport | archaeology | computers | algorithms |

| | | | |
|---|---|---|---|
| cell phones | music | sine | musical harmony |
| motion | e | electricity | water |
| space | orbits | food | volcanoes |
| diet | Euler | games | symmetry |
| architecture | codes | the internet | communication |
| tiling | population | agriculture | viruses |
| health | dance | play | pi ($\pi$) |
| geography | biology | business | economics |
| physics | chemistry | information technology in a global society | psychology |

**A possible mind map for the stimulus "water"**

During introductory discussions about the exploration, the use of brainstorming sessions can be useful to generate ideas. In particular, the use of a mind map has been shown to be useful in helping students to generate thoughts on this. The mind map below illustrates how, starting with the stimulus "water", some possible foci for a mathematical exploration could be generated.


All the water in the world
How many people can survive on the available potable water?
How much water is left in the world
Modelling water jets
Geometry of water fountains
Fountains and water designs
Effect of wind and water currents
Size and geometry of sails
Weight and material of boat
Faster sailing in the America's Cup
Water
Sea-ice vs snow-ice
Permeability of sea-ice
How does ice grow/melt?
Effect of salt-saturated water on polar ice-caps
Modelling rain drops
Statistical study of rain
Collecting rain—optimization
Rainfall—drizzle vs torrential rain
Predicting storm surges
Predicting tsunamis
Floods
How big can a wave get?

## Assessment criteria

Each exploration should be assessed against the following five criteria.

| | |
|---|---|
| **Criterion A** | Communication |
| **Criterion B** | Mathematical presentation |
| **Criterion C** | Personal engagement |
| **Criterion D** | Reflection |
| **Criterion E** | Use of mathematics |

The descriptions of the achievement levels for each of these five 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 exploration is obtained by adding together the achievement levels awarded for each criterion A–E. It should be noted that the descriptors for criterion E are different for mathematics SL and mathematics HL.

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 exploration judges students by their performance in relation to identified assessment criteria and not in relation to the work of other students.

Each exploration submitted for mathematics SL or mathematics HL is assessed against the five criteria A to E. 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 level attained by the student.

Teachers 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.

A student who attains a high level of achievement in relation to one criterion will not necessarily attain high levels of achievement in relation to the other criteria. Similarly, a student who attains a low level of achievement for one criterion will

not necessarily attain low achievement levels for the other criteria. Teachers should not assume that the overall assessment of the students will produce any particular distribution of marks.

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 an exploration within this TSM that achieved that level for that particular criterion.

**Students should be made aware that they will not receive a grade for mathematics SL or mathematics HL if they have not submitted an exploration.**

## Achievement levels

### Criterion A: Communication

This criterion assesses the organization and coherence of the exploration. A well-organized exploration contains 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.<br>**Example 1 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=3.html)** |
| 3 | The exploration is coherent and well organized.<br>**Example 8 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=10.html)** |
| 4 | The exploration is coherent, well organized, concise and complete.<br>**Example 9 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=11.html)** |

### 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.<br>**Example 4 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=6.html)** |
| 2 | The mathematical presentation is mostly appropriate.<br>**Example 9 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=11.html)** |
| 3 | The mathematical presentation is appropriate throughout.<br>**Example 1 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=3.html)** |

**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.<br>**Example 3 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=5.html)** |
| 2 | There is evidence of some personal engagement.<br>**Example 5 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=7.html)** |
| 3 | There is evidence of significant personal engagement. |

| | |
|---|---|
| | Example 7 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=9.html) |
| 4 | There is abundant evidence of outstanding personal engagement.<br>Example 6 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=8.html) |

**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.<br>Example 5 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=7.html) |
| 2 | There is evidence of meaningful reflection.<br>Example 8 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=10.html) |
| 3 | There is substantial evidence of critical reflection.<br>Example 6 (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=8.html) |

**Criterion E: Use of mathematics**

The achievement levels and descriptors for criterion E are different for mathematics SL and mathematics HL.

**SL only**

This criterion assesses to what extent 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.*

*A piece of 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.*

| Achievement level | Descriptor |
|---|---|

| | |
|---|---|
| 0 | The exploration does not reach the standard described by the descriptors below.<br><br>**Example 3** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=5.html) |
| 1 | Some relevant mathematics is used. |
| 2 | Some relevant mathematics is used. Limited understanding is demonstrated. |
| 3 | Relevant mathematics commensurate with the level of the course is used. Limited understanding is demonstrated.<br><br>**Example 4** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=6.html) |
| 4 | Relevant mathematics commensurate with the level of the course is used. The mathematics explored is partially correct. Some knowledge and understanding are demonstrated.<br><br>**Example 9** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=11.html) |
| 5 | Relevant mathematics commensurate with the level of the course is used. The mathematics explored is mostly correct. Good knowledge and understanding are demonstrated.<br><br>**Example 8** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=10.html) |
| 6 | Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct. Thorough knowledge and understanding are demonstrated.<br><br>**Example 2** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=4.html) |

**HL only**

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.<br><br>**Example 3** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=5.html) |
| 1 | Some relevant mathematics is used. Limited understanding is demonstrated.<br><br>**Example 4** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=6.html) |
| 2 | Some relevant mathematics is used. The mathematics explored is partially correct. Some knowledge and understanding are demonstrated.<br><br>**Example 5** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=7.html) |
| 3 | Relevant mathematics commensurate with the level of the course is used. The mathematics explored is correct. Good knowledge and understanding are demonstrated.<br><br>**Example 6** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=8.html) |
| 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.<br><br>**Example 1** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=3.html) |
| 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.<br><br>**Example 7** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=9.html) |
| 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.<br><br>**Example 2** (tsm.xql@doc=d_5_matsl_tsm_1205_1_e&part=2&chapter=4.html) |

# Frequently asked questions

**What is the difference between a mathematical exploration and an extended essay in mathematics?**

The criteria are completely different. It is intended that the exploration is to be a much less extensive piece of work than a mathematics extended essay. The intention is for students to "explore" an idea rather than have to do the formal research demanded in an extended essay.

**How long should it be?**

It is difficult to be prescriptive about mathematical writing. However, the *Mathematics SL guide* and the *Mathematics HL guide* state that 6–12 pages should be appropriate. A common failing of mathematical writing is excessive repetition, and this should be avoided, as such explorations will be penalized for lack of conciseness. However, it is recognized that some explorations will require the use of several diagrams, which may extend them beyond the page limit.

**How long should it take?**

It is difficult to give a single answer. However, the guideline of 10 hours class time with approximately the same amount of time outside class should suffice for students to develop their ideas and complete the exploration.

**Does the exploration need a title?**

It is good practice to have a title for all pieces of work. If the exploration is based on a stimulus, it is recommended that the title not just be the stimulus. Rather, the title should give a better indication of where the stimulus has taken the student. For example, rather than have the title "water", the title could be "Water—predicting storm surges".

**Can students in the same school/class use the same title for the exploration?**

Yes, but the explorations must be different, based on the avenues followed by each student. As noted above, the title should give an idea of what the exploration is about. Group work is not allowed.

**Can students in the same school/class use the same stimulus?**

Yes, this is permissible. However, the stimuli are intended to be broad themes around which a variety of foci could develop. It is therefore expected that, even if students use the same stimuli, the resulting explorations will be very different.

**Can SL and HL students use the same stimulus?**

Yes, there is no reason to restrict any stimulus to a particular level, although the assessment of criterion E will be different.

**Do teachers have to use stimuli?**

No, but it may sometimes be useful to provide a stimulus as a means of helping students to get started on their exploration.

**Can teachers choose their own stimuli?**

If a teacher decides to use stimuli, they are free to choose their own or to choose one from the TSM list. Indeed, the suggested stimuli are intended merely to illustrate the wide-ranging potential for exploring mathematics.

**How many explorations should be done by a student during the course?**

The exploration is a significant piece of work and, as such, the advice would be that there is no necessity to undertake more than one during the course. However, in line with the "Approaches to the teaching and learning of mathematics

SL/HL" section of the two guides, students should be given many opportunities to use modelling and investigative techniques to develop the sorts of skills necessary to perform well in the exploration.

**If a student does more than one exploration, how will the teacher choose which one to submit?**

This will be a matter for the school to decide. As long as one exploration is submitted that is the student's own work, how this is chosen is not prescribed by the IB.

**Should the scope and sequence of the SL/HL course be influenced by the exploration?**

Ideally, it should not be. It is intended that the exploration should be a natural opportunity to develop ideas that students have become familiar with as a part of the course. However, if it is felt that particular skills are likely to be needed in order for students to undertake the exploration successfully, then a teacher or school may wish to consider this when deciding on the teaching sequence.

**How much help can a teacher give the student in finding a topic/focus for their exploration?**

The role of the teacher here is to provide advice to the student on choosing the topic, and there is no set limit to the amount of help a teacher can give in this respect. However, if the student has little or no input into the decision about which focus to choose, then it is unlikely that he or she will be able to explore the ideas successfully in order to generate a good exploration.

**How much help can the teacher give to the student with the mathematical content of the exploration?**

If a student needs help with the revision of a particular topic because they are having some problems using this in their exploration, then it is permissible (indeed, this is good practice) for the teacher to give this help. However, this must be done in such a way that is not directly connected with the exploration.

**When is a good time in the course to introduce the exploration?**

It is a good idea to mention it as early as possible, so that students are aware of the requirements, and to make reference to it during the early part of the course. Certain topics may lend themselves more easily to exploration work, and teachers should try to make suggestions about this when appropriate. Ideally, the work on the exploration should start before the end of the first year.

**What should the target audience be for a student when writing the exploration?**

The exploration should be accessible to fellow students.

**Can the students use mathematics other than that they have done in class?**

Yes, but this must be clearly explained and referenced, and teacher comments should clarify this.

**Can students use mathematics that is outside the syllabus?**

Yes, as long as the mathematics used is relevant. However, this is not necessary to obtain full marks.

**What happened to investigation and modelling in the curriculum?**

The section in the guides on "Approaches to the teaching and learning of mathematics SL/HL" shows that investigation and modelling are still regarded as essential skills in mathematics SL and mathematics HL. Use of such pedagogical techniques are good practice in reinforcing students' understanding, and this will be assessed in examination questions. However, it is likely that some good explorations will also involve the use of investigation and/or modelling.

**What is the difference between criterion A (communication) and criterion B (mathematical presentation)?**

Communication is focusing on the overall organization and coherence of the exploration, whereas mathematical presentation focuses on the appropriateness of the mathematics. An exploration that is logically set out in terms of its overall structure could score well in criterion A despite using inappropriate mathematics. Conversely, an exploration that uses appropriate diagrams and technology to develop the ideas could score well in criterion B but poorly in criterion A because it lacked a clear aim or conclusion, for example.

**Can a student submit one of the old portfolios?**

The portfolio tasks were written for completely different criteria and are therefore unsuitable to be submitted as explorations.

**Does the exploration have to be word processed or handwritten?**

It can be in either form as long as it is clearly legible.

**What is personal engagement?**

The exploration is intended to be an opportunity for students to use mathematics to develop an area of interest to them rather than merely to solve a problem set by someone else. Criterion C (personal engagement) will be looking at how well the student is able to demonstrate that he or she has "made the exploration their own" and expressed ideas in an individual way.

**What is the difference between precise and correct?**

As outlined in criterion E (use of mathematics), "precise" mathematics requires absolute accuracy with appropriate use of notation. "Correct" mathematics may contain the occasional error as long as it does not seriously interfere with the flow of the work or give rise to conclusions or answers that are clearly wrong.

**What is a complete exploration?**

In a complete exploration, all steps are clearly explained without detracting from its conciseness.

**Is there any way to deal with students who do little or no work on the exploration?**

The obvious case to present to any student who is hesitant to make progress with the exploration work is to emphasize the possible impact on the final assessment, with the exploration making up 20% of their final mark. If a student is reluctant to do any work at all, then perhaps a meeting of student, parents or guardians, the teacher and the Diploma Programme coordinator is advisable. At such a meeting, it would be appropriate to review the consequences of not submitting an exploration. Students should be made aware that they will not receive a grade for mathematics SL or mathematics HL if they have not submitted an exploration.

It may also be helpful to develop a school or departmental policy for explorations, so that guidelines, due dates, expectations, consequences and so on are made clear to both students and parents early in the course.

**How can the teacher best monitor the work of students?**

Having a schedule of dates will help. It is also important that the teacher takes the time to review the work of students in class. Developing a checklist of tasks and allowing for brief comment might help to keep open communication channels between students and the teacher.

**Can you recommend a target date for completion of the exploration?**

This will, of course, vary from school to school depending upon several factors, not to mention other deadlines set within the Diploma Programme (for example, guided coursework, extended essays, laboratory reports). Teachers should also

allow themselves plenty of time for the assessment process. The IB's deadline for samples of student work for moderation is in April for a May examination session or in October for a November examination session. Therefore, it is not unreasonable for teachers to collect final explorations six to eight weeks prior to this deadline.

**Some teachers need further guidance on how to apply the exploration assessment criteria. Is guidance available?**

In addition to this teacher support material, teachers should attend a workshop for mathematics SL or mathematics HL as appropriate before it is time to assess the explorations of their students. The Diploma Programme coordinator has information about workshops, but details can also be found on the IB public website (**http://www.ibo.org** (http://www.ibo.org)).

If possible, teachers should also try to get help from within their own department or school in assessing the explorations of their students.

**How will teachers know if their assessment is satisfactory or appropriate?**

Following an examination session, each school is provided with feedback. This will normally provide comments on the contents of the explorations, interpretation of assessment criteria, and clerical and/or procedural matters.

**If a school has a large number of students (or several classes) doing the exploration, must only one teacher mark all the explorations?**

The exploration should be marked by the teacher who has taught the student. However, teachers should be aware that moderation is applied to a school rather than to individual teachers. It is, therefore, of the utmost importance that teachers collaborate and agree on their marking standards. Guidance is available in the *Handbook of procedures for the Diploma Programme*. It is essential that internal standardization between teachers takes place, including between mathematics SL and mathematics HL teachers.

**Where can teachers receive more advice on the exploration?**

Teachers should be aware that all questions on the exploration can be posted in the mathematics forums on the online curriculum centre (OCC), and advice will then be offered by experienced teachers and the online faculty member. The OCC also has many resources that have been posted by experienced teachers in the Resources section, and these may provide a useful starting point for new teachers. However, it is important to understand that all opinions expressed by users of the OCC are expressed strictly in their individual capacities, and not as representatives of the IB.