Mathematics assessment criteria

Please note that the assessment criteria in this guide are for first use in final assessment in 2012.

The following assessment criteria have been established by the IB for mathematics in the MYP. All final assessment in the final year of the MYP must be based on these assessment criteria even if schools are not registering students for IB-validated grades and certification.

<table>
<thead>
<tr>
<th>Criterion A</th>
<th>Knowledge and understanding</th>
<th>Maximum 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criterion B</td>
<td>Investigating patterns</td>
<td>Maximum 8</td>
</tr>
<tr>
<td>Criterion C</td>
<td>Communication in mathematics</td>
<td>Maximum 6</td>
</tr>
<tr>
<td>Criterion D</td>
<td>Reflection in mathematics</td>
<td>Maximum 6</td>
</tr>
</tbody>
</table>

For each assessment criterion, a number of band descriptors are defined. These describe a range of achievement levels with the lowest represented as 0. The criteria are not equally weighted.

The descriptors concentrate on positive achievement, although failure to achieve may be included in the description for the lower levels.
Criterion A: Knowledge and understanding

Maximum: 8
Knowledge and understanding are fundamental to studying mathematics and form the base from which to explore concepts and develop skills. This criterion expects students to use their knowledge and to demonstrate their understanding of the concepts and skills of the prescribed framework in order to make deductions and solve problems.

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

- know and demonstrate understanding of the concepts from the five branches of mathematics (number, algebra, geometry and trigonometry, statistics and probability, and discrete mathematics)
- use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations, including those in real-life contexts
- select and apply general rules correctly to make deductions and solve problems, including those in real-life contexts.

Assessment tasks for this criterion are likely to be classroom tests, examinations, real-life problems and investigations that may have a variety of solutions.

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Level descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The student does not reach a standard described by any of the descriptors below.</td>
</tr>
<tr>
<td>1–2</td>
<td>The student generally makes appropriate deductions when solving simple problems in familiar contexts.</td>
</tr>
<tr>
<td>3–4</td>
<td>The student generally makes appropriate deductions when solving more complex problems in familiar contexts.</td>
</tr>
<tr>
<td>5–6</td>
<td>The student generally makes appropriate deductions when solving challenging problems in a variety of familiar contexts.</td>
</tr>
<tr>
<td>7–8</td>
<td>The student consistently makes appropriate deductions when solving challenging problems in a variety of contexts including unfamiliar situations.</td>
</tr>
</tbody>
</table>

Notes

- **Unfamiliar situation**: challenging questions or instructions set in a new context in which students are required to apply knowledge and/or skills they have been taught.
- **Deduction**: reasoning from the general to the particular/specific to reach a conclusion from the information given.
- **Context**: the situation and the parameters given to a problem.
Criterion B: Investigating patterns

Maximum: 8

Through the use of mathematical investigations, students are given the opportunity to apply mathematical knowledge and problem-solving techniques to investigate a problem, generate and/or analyse information, find relationships and patterns, describe these mathematically as general rules, and justify or prove them.

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

- select and apply appropriate inquiry and mathematical problem-solving techniques
- recognize patterns
- describe patterns as relationships or general rules
- draw conclusions consistent with findings
- justify or prove mathematical relationships and general rules.

Assessment tasks for this criterion should be mathematical investigations of some complexity, as appropriate to the level of MYP mathematics. Tasks should allow students to choose their own mathematical techniques to investigate problems, and to reason from the specific to the general. Assessment tasks could have a variety of solutions and may be set in real-life contexts. Teachers should clearly state whether the student has to provide a justification or a proof.

Teachers should include a good balance between tasks done under test conditions and tasks done at home in order to ensure the development of independent mathematical thinking.

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Level descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The student does not reach a standard described by any of the descriptors below.</td>
</tr>
<tr>
<td>1–2</td>
<td>The student applies, with some guidance, mathematical problem-solving techniques to recognize simple patterns.</td>
</tr>
<tr>
<td>3–4</td>
<td>The student applies mathematical problem-solving techniques to recognize patterns, and suggests relationships or general rules.</td>
</tr>
<tr>
<td>5–6</td>
<td>The student selects and applies mathematical problem-solving techniques to recognize patterns, describes them as relationships or general rules, and draws conclusions consistent with findings.</td>
</tr>
<tr>
<td>7–8</td>
<td>The student selects and applies mathematical problem-solving techniques to recognize patterns, describes them as relationships or general rules, draws the correct conclusions consistent with the correct findings, and provides justifications or a proof.</td>
</tr>
</tbody>
</table>

Notes

- **Pattern**: the underlining order, regularity or predictability between the elements of a mathematical system. To identify pattern is to begin to understand how mathematics applies to the world in which we live. The repetitive features of patterns can be identified and described as relationships or generalized rules.
- **Justification**: give valid reasons or evidence to support the conclusion and explain why the rule works.
• **Proof**: a mathematical demonstration of the truth of the relationship or general rule.

• A student who describes a general rule consistent with incorrect findings will still be able to achieve in the 5–6 band, provided that the rule is of an equivalent level of complexity.

• Clear guidance should be incorporated in the teachers’ task to ensure all students receive the same guidance and understand the basic requirements of the task.
Criterion C: Communication in mathematics

Maximum: 6

Students are expected to use mathematical language appropriately when communicating mathematical ideas, reasoning and findings—both orally and in writing.

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

- use appropriate mathematical language in both oral and written explanations
- use different forms of mathematical representation
- communicate a complete and coherent mathematical line of reasoning using different forms of representation when investigating problems.

Students are encouraged to choose and use ICT tools as appropriate and, where available, to enhance communication of their mathematical ideas. Some of the possible ICT tools used in mathematics include spreadsheets, graph plotter software, dynamic geometry software, computer algebra systems, mathematics content-specific software, graphic display calculators (GDC), word processing, desktop publishing, graphic organizers and screenshots.

Assessment tasks for this criterion are likely to be real-life problems, tests, examinations and investigations.

Tests and examinations that are to be assessed against criterion C must be designed to allow students to show complete lines of reasoning using mathematical language.

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Level descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The student does not reach a standard described by any of the descriptors below.</td>
</tr>
<tr>
<td>1–2</td>
<td>The student shows basic use of mathematical language and/or forms of mathematical representation. The lines of reasoning are difficult to follow.</td>
</tr>
<tr>
<td>3–4</td>
<td>The student shows sufficient use of mathematical language and forms of mathematical representation. The lines of reasoning are clear though not always logical or complete. The student moves between different forms of representation with some success.</td>
</tr>
<tr>
<td>5–6</td>
<td>The student shows good use of mathematical language and forms of mathematical representation. The lines of reasoning are concise, logical and complete. The student moves effectively between different forms of representation.</td>
</tr>
</tbody>
</table>

Notes

- **Mathematical language**: the use of notation, symbols, terminology and verbal explanations.
- **Forms of mathematical representation**: refers to formulae, diagrams, tables, charts, graphs and models used to represent mathematical information.
Criterion D: Reflection in mathematics

Maximum: 6

MYP mathematics encourages students to reflect upon their findings and problem-solving processes.

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

- explain whether his or her results make sense in the context of the problem
- explain the importance of his or her findings in connection to real life where appropriate
- justify the degree of accuracy of his or her results where appropriate
- suggest improvements to the method when necessary.

Assessment tasks are most likely to be mathematical investigations or real-life problems. Generally these types of tasks will provide students with opportunities to use mathematical concepts and skills to solve problems in real-life contexts.

<table>
<thead>
<tr>
<th>Achievement level</th>
<th>Level descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>The student does not reach a standard described by any of the descriptors below.</td>
</tr>
</tbody>
</table>
| 1–2               | The student attempts to explain whether his or her results make sense in the context of the problem.  
The student attempts to describe the importance of his or her findings in connection to real life where appropriate. |
| 3–4               | The student correctly but briefly explains whether his or her results make sense in the context of the problem.  
The student describes the importance of his or her findings in connection to real life where appropriate.  
The student attempts to justify the degree of accuracy of his or her results where appropriate. |
| 5–6               | The student critically explains whether his or her results make sense in the context of the problem.  
The student provides a detailed explanation of the importance of his or her findings in connection to real life where appropriate.  
The student justifies the degree of accuracy of his or her results where appropriate.  
The student suggests improvements to his or her method where appropriate. |

Notes

- **Explain**: give a detailed account including reasons or causes.
- **Describe**: give a detailed account.