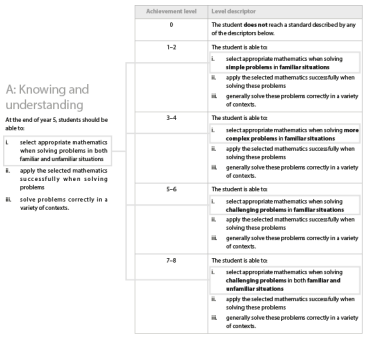
Assessed curriculum

Alignment of objectives and assessment criteria

In the MYP, assessment is closely aligned with the designed/planned and delivered curriculum. Each strand from MYP mathematics has a corresponding strand in the assessment criteria for this subject group. Figure 3 illustrates this alignment and the increasingly complex demands for student performance at higher achievement levels.



A: Knowing and understanding

At the end of year 5, students should be able to:

i. select appropriate mathematics when solving problems in both familiar and unfamiliar situations

ii. apply the selected mathematics successfully when solving problems

iii. solve problems correctly in a variety of contexts.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: i. select appropriate mathematics when solving **simple problems in familiar situations** ii. apply the selected mathematics successfully when solving these problems iii. generally solve these problems correctly in a variety of contexts.
3–4	The student is able to: i. select appropriate mathematics when solving **more complex problems in familiar situations** ii. apply the selected mathematics successfully when solving these problems iii. generally solve these problems correctly in a variety of contexts.
5–6	The student is able to: i. select appropriate mathematics when solving **challenging problems in familiar situations** ii. apply the selected mathematics successfully when solving these problems iii. generally solve these problems correctly in a variety of contexts.
7–8	The student is able to: i. select appropriate mathematics when solving **challenging problems in both familiar and unfamiliar situations** ii. apply the selected mathematics successfully when solving these problems iii. generally solve these problems correctly in a variety of contexts.

For further information please refer to *MYP: From principles into practice*, which can be found in the programme resource centre under **MYP resources**>**Learning and teaching** and to *Further guidance for developing MYP assessed curriculum* (April 2015, updated September 2016), which can be found under **MYP resources**>**Learning and teaching**.

Assessment criteria overview

Assessment for mathematics courses in all years of the programme is criterion-related, based on four equally weighted assessment criteria.

Criterion A	Knowing and understanding	**Maximum 8**
Criterion B	Investigating patterns	**Maximum 8**
Criterion C	Communicating	**Maximum 8**
Criterion D	Applying mathematics in real-life contexts	**Maximum 8**

Subject groups **must** assess **all** strands of **all** four assessment criteria **at least twice** in **each year** of the MYP.

In the MYP, subject-group objectives correspond to assessment criteria. Each criterion has eight possible achievement levels (1–8), divided into four bands that generally represent limited (1–2); adequate (3–4); substantial (5–6); and excellent (7–8) performance. Each band has its own unique descriptor that teachers use to make "best-fit" judgments about students' progress and achievement.

This guide provides the **required assessment criteria** for years 1, 3 and 5 of MYP mathematics. In response to national or local requirements, schools may add criteria and use additional models of assessment. Schools must use the appropriate assessment criteria, as published in this guide, to report students' final achievement in the programme.

Teachers clarify the expectations for each summative assessment task with direct reference to these assessment criteria. Task-specific clarifications should clearly explain what students are expected to know and do. They might be in the form of:

- a task-specific version of the required assessment criteria
- a face-to-face or virtual classroom discussion
- a detailed task sheet or assignment.

For further information please refer to *MYP: From principles into practice*, which can be found in the programme resource centre under **MYP resources**>**Learning and teaching**.

Mathematics assessment criteria: Year 1

Criterion A: Knowing and understanding

Maximum: 8

At the end of year 1, students should be able to:

- select appropriate mathematics when solving problems in both familiar and unfamiliar situations
- apply the selected mathematics successfully when solving problems
- solve problems correctly in a variety of contexts.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • select appropriate mathematics when solving **simple problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
3–4	The student is able to: • select appropriate mathematics when solving **more complex problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
5–6	The student is able to: • select appropriate mathematics when solving **challenging problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
7–8	The student is able to:

	• select appropriate mathematics when solving **challenging problems** in both **familiar and unfamiliar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.

Criterion B: Investigating patterns

Maximum: 8

At the end of year 1, students should be able to:

- apply mathematical problem-solving techniques to recognize patterns
- describe patterns as relationships or general rules consistent with findings
- verify whether the pattern works for other examples.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • **apply**, **with teacher support**, mathematical problem-solving techniques to recognize **simple patterns** • **state** predictions consistent with simple patterns • *(not demonstrated at this level)*.
3–4	The student is able to: • **apply** mathematical problem-solving techniques to recognize **patterns** • **suggest** how these patterns work • *(not demonstrated at this level)*.
5–6	The student is able to: • **apply** mathematical problem-solving techniques to recognize **patterns** • **suggest relationships** or general rules consistent with findings • verify whether patterns work for **another example**.
7–8	The student is able to: •

	select and **apply** mathematical problem-solving techniques to recognize **correct patterns** • **describe patterns as relationships** or general rules consistent with **correct findings** • verify whether patterns work for **other examples**.

Note: A task that does not allow students to select a problem-solving technique is too guided and should result in students earning a maximum achievement level of 6 (for years 1 and 2).

Criterion C: Communicating

Maximum: 8

At the end of year 1, students should be able to:

- use appropriate mathematical language (notation, symbols and terminology) in both oral and written statements
- use appropriate forms of mathematical representation to present information
- *(not demonstrated at this level)*
- communicate coherent mathematical lines of reasoning
- organize information using a logical structure.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • use **limited** mathematical language • use **limited forms** of mathematical representation to present information • *(not demonstrated at this level)* • communicate through lines of reasoning that are **difficult to understand** • *(not demonstrated at this level)*.
3–4	The student is able to: • use **some appropriate** mathematical language • use **appropriate forms** of mathematical representation to present information **adequately** • *(not demonstrated at this level)* • communicate through lines of reasoning that are **able to be understood**, although these are **not always coherent** • **adequately organize** information using a logical structure.
5–6	The student is able to: • **usually** use **appropriate** mathematical language

	• **usually** use **appropriate forms** of mathematical representation to present information **correctly** • *(not demonstrated at this level)* • communicate through lines of reasoning that are **usually coherent** • **present** work that is **usually organized** using a logical structure.
7–8	The student is able to: • **consistently** use **appropriate** mathematical language • **consistently** use **appropriate forms** of mathematical representation to present information **correctly** • *(not demonstrated at this level)* • communicate **clearly** through **coherent** lines of reasoning • present work that is **consistently organized** using a logical structure.

Criterion D: Applying mathematics in real-life contexts

Maximum: 8

At the end of year 1, students should be able to:

- identify relevant elements of authentic real-life situations
- select appropriate mathematical strategies when solving authentic real-life situations
- apply the selected mathematical strategies successfully to reach a solution

- explain the degree of accuracy of a solution
- describe whether a solution makes sense in the context of the authentic real-life situation.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • identify **some** of the elements of the authentic real-life situation • *(not demonstrated at this level)* • apply mathematical strategies to **find a solution** to the authentic real-life situation, **with limited success** • *(not demonstrated at this level)* • *(not demonstrated at this level).*
3–4	The student is able to: • identify the **relevant** elements of the authentic real-life situation • *(not demonstrated at this level)* • apply mathematical strategies to **reach a solution** to the authentic real-life situation • *(not demonstrated at this level)* • **state**, **but not always correctly**, whether the solution makes sense in the context of the authentic real-life situation.
5–6	The student is able to: • identify the **relevant** elements of the authentic real-life situation •

	select **adequate** mathematical strategies to model the authentic real-life situation • apply the selected mathematical strategies to **reach a valid solution** to the authentic real-life situation • **describe** the degree of accuracy of the solution • **state correctly** whether the solution makes sense in the context of the authentic real-life situation.
7–8	The student is able to: • identify the **relevant** elements of the authentic real-life situation • select **adequate** mathematical strategies to model the authentic real-life situation • apply the selected mathematical strategies to **reach a correct solution** to the authentic real-life situation • **explain** the degree of accuracy of the solution • **describe correctly** whether the solution makes sense in the context of the authentic real-life situation.

Mathematics assessment criteria: Year 3

Criterion A: Knowing and understanding

Maximum: 8

At the end of year 3, students should be able to:

- select appropriate mathematics when solving problems in both familiar and unfamiliar situations
- apply the selected mathematics successfully when solving problems
- solve problems correctly in a variety of contexts.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • select appropriate mathematics when solving **simple problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
3–4	The student is able to: • select appropriate mathematics when solving **more complex problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
5–6	The student is able to: • select appropriate mathematics when solving **challenging problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
7–8	The student is able to:

	• select appropriate mathematics when solving **challenging problems** in both **familiar and unfamiliar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.

Criterion B: Investigating patterns

Maximum: 8

At the end of year 3, students should be able to:

- select and apply mathematical problem-solving techniques to discover complex patterns
- describe patterns as relationships and/or general rules consistent with findings
- verify and justify relationships and/or general rules.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • **apply**, **with teacher support**, mathematical problem-solving techniques to discover **simple patterns** • **state predictions** consistent with patterns • *(not demonstrated at this level)*.
3–4	The student is able to: • **apply** mathematical problem-solving techniques to discover **simple patterns** • **suggest relationships** and/or general rules consistent with **findings** • *(not demonstrated at this level)*.
5–6	The student is able to: • **select** and **apply** mathematical problem-solving techniques to discover **complex patterns** • **describe patterns** as relationships and/or general rules consistent with **findings** • **verify** these relationships and/or general rules.
7–8	The student is able to: •

	select and **apply** mathematical problem-solving techniques to discover **complex patterns** • **describe patterns** as relationships and/or general rules consistent with **correct findings** • **verify** and **justify** these relationships and/or general rules.

Note: A task that does not allow students to select a problem-solving technique is too guided and should result in students earning a maximum achievement level of 4 (year 3 and higher). However, teachers should give enough direction to ensure that all students can begin the investigation.
For year 3 and higher, a student who describes a general rule consistent with incorrect findings will be able to achieve a maximum achievement level of 6, provided that the rule is of an equivalent level of complexity.

Criterion C: Communicating

Maximum: 8

At the end of year 3, students should be able to:

- use appropriate mathematical language (notation, symbols and terminology) in both oral and written explanations
- use appropriate forms of mathematical representation to present information
- move between different forms of mathematical representation
- communicate complete and coherent mathematical lines of reasoning
- organize information using a logical structure.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • use **limited** mathematical language • use **limited forms** of mathematical representation to present information • *(not demonstrated at this level)* • communicate through lines of reasoning that are **difficult to interpret** • *(not demonstrated at this level)*.
3–4	The student is able to: • use **some appropriate** mathematical language • use **appropriate forms** of mathematical representation to present information **adequately** • *(not demonstrated at this level)* • communicate through lines of reasoning that are **able to be understood**, although these are **not always clear** • **adequately organize** information using a logical structure.
5–6	The student is able to: • **usually** use **appropriate** mathematical language

	• **usually** use **appropriate forms** of mathematical representation to present information **correctly** • move between different forms of mathematical representation **with some success** • communicate through lines of reasoning that are clear although **not always coherent or complete** • present work that is **usually organized** using a logical structure.
7–8	The student is able to: • **consistently** use **appropriate** mathematical language • use **appropriate forms** of mathematical representation to **consistently** present information **correctly** • move **effectively** between different forms of mathematical representation • communicate through lines of reasoning that are **complete and coherent** • present work that is **consistently organized** using a logical structure.

Criterion D: Applying mathematics in real-life contexts

Maximum: 8

At the end of year 3, students should be able to:

- identify relevant elements of authentic real-life situations
- select appropriate mathematical strategies when solving authentic real-life situations
- apply the selected mathematical strategies successfully to reach a solution
- explain the degree of accuracy of a solution
- explain whether a solution makes sense in the context of the authentic real-life situation.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • identify **some** of the elements of the authentic real-life situation • *(not demonstrated at this level)* • apply mathematical strategies to **find a solution** to the authentic real-life situation, **with limited success** • *(not demonstrated at this level)* • *(not demonstrated at this level).*
3–4	The student is able to: • identify the **relevant** elements of the authentic real-life situation • select, **with some success**, **adequate** mathematical strategies to model the authentic real-life situation • apply mathematical strategies to **reach a solution** to the authentic real-life situation • *(not demonstrated at this level)* • **describe** whether the solution makes sense in the context of the authentic real-life situation.
5–6	The student is able to: •

	identify the **relevant** elements of the authentic real-life situation • select **adequate** mathematical strategies to model the authentic real-life situation • apply the selected mathematical strategies to **reach a valid solution** to the authentic real-life situation • **describe** the degree of accuracy of the solution • **discuss** whether the solution makes sense in the context of the authentic real-life situation.
7–8	The student is able to: • identify the **relevant** elements of the authentic real-life situation • select **appropriate** mathematical strategies to model the authentic real-life situation • apply the selected mathematical strategies to **reach a correct solution** • **explain** the degree of accuracy of the solution • **explain** whether the solution makes sense in the context of the authentic real-life situation.

Mathematics assessment criteria: Year 5

Criterion A: Knowing and understanding

Maximum: 8

At the end of year 5, students should be able to:

- select appropriate mathematics when solving problems in both familiar and unfamiliar situations
- apply the selected mathematics successfully when solving problems
- solve problems correctly in a variety of contexts.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • select appropriate mathematics when solving **simple problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
3–4	The student is able to: • select appropriate mathematics when solving **more complex problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
5–6	The student is able to: • select appropriate mathematics when solving **challenging problems** in **familiar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.
7–8	The student is able to:

	• select appropriate mathematics when solving **challenging problems** in both **familiar and unfamiliar situations** • apply the selected mathematics successfully when solving these problems • generally solve these problems correctly in a variety of contexts.

Criterion B: Investigating patterns

Maximum: 8

At the end of year 5, students should be able to:

- select and apply mathematical problem-solving techniques to discover complex patterns
- describe patterns as general rules consistent with findings
- prove, or verify and justify, general rules.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • **apply**, **with teacher support**, mathematical problem-solving techniques to discover **simple patterns** • **state predictions** consistent with patterns • *(not demonstrated at this level)*.
3–4	The student is able to: • **apply** mathematical problem-solving techniques to discover **simple patterns** • **suggest general rules** consistent with **findings** • *(not demonstrated at this level)*.
5–6	The student is able to: • **select** and **apply** mathematical problem-solving techniques to discover **complex patterns** • **describe patterns** as general rules consistent with **findings** • **verify** the validity of these general rules.
7–8	The student is able to: •

	select and **apply** mathematical problem-solving techniques to discover **complex patterns** • **describe patterns** as general rules consistent with **correct findings** • **prove**, or **verify** and **justify**, these general rules.

Note: A task that does not allow students to select a problem-solving technique is too guided and should result in students earning a maximum achievement level of 4 in year 5. However, teachers should give enough direction to ensure that all students can begin the investigation. For year 5, a student who describes a general rule consistent with incorrect findings will be able to achieve a maximum achievement level of 6, provided that the rule is of an equivalent level of complexity.
Examples could include the following non-exhaustive list:
Simple patterns: linear and quadratic in the form ax^2 or ax^2+c
Complex patterns: quadratic, cubic, quartic, exponential or rational in the form $\frac{f(x)}{g(x)}$
where $f(x)$ and $g(x)$ may be linear or quadratic or exponential.

Criterion C: Communicating

Maximum: 8

At the end of year 5, students should be able to:

- use appropriate mathematical language (notation, symbols and terminology) in both oral and written explanations
- use appropriate forms of mathematical representation to present information
- move between different forms of mathematical representation

- communicate complete, coherent and concise mathematical lines of reasoning
- organize information using a logical structure.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • use **limited** mathematical language • use **limited forms** of mathematical representation to present information • *(not demonstrated at this level)* • communicate through lines of reasoning that are **difficult to interpret** • *(not demonstrated at this level)*.
3–4	The student is able to: • use **some appropriate** mathematical language • use **appropriate forms** of mathematical representation to present information **adequately** • *(not demonstrated at this level)* • communicate through lines of reasoning that are **complete** • **adequately organize** information using a logical structure.
5–6	The student is able to: • **usually** use **appropriate** mathematical language •

	usually use **appropriate forms** of mathematical representation to present information **correctly** • **usually** move between different forms of mathematical representation • communicate through lines of reasoning that are **complete and coherent** • **present** work that is **usually organized** using a logical structure.
7–8	The student is able to: • **consistently** use **appropriate** mathematical language • use **appropriate forms** of mathematical representation to **consistently** present information **correctly** • move **effectively** between different forms of mathematical representation • communicate through lines of reasoning that are **complete, coherent and concise** • **present** work that is **consistently organized** using a logical structure.

Criterion D: Applying mathematics in real-life contexts

Maximum: 8

At the end of year 5, students should be able to:

- identify relevant elements of authentic real-life situations
- select appropriate mathematical strategies when solving authentic real-life situations

- apply the selected mathematical strategies successfully to reach a solution
- justify the degree of accuracy of a solution
- justify whether a solution makes sense in the context of the authentic real-life situation.

Achievement level	Level descriptor
0	The student **does not** reach a standard described by any of the descriptors below.
1–2	The student is able to: • identify **some** of the elements of the authentic real-life situation • *(not demonstrated at this level)* • apply mathematical strategies to **find a solution** to the authentic real-life situation, **with limited success** • *(not demonstrated at this level)* • *(not demonstrated at this level).*
3–4	The student is able to: • identify the **relevant** elements of the authentic real-life situation • select, **with some success**, **adequate** mathematical strategies to model the authentic real-life situation • apply mathematical strategies to **reach a solution** to the authentic real-life situation • *(not demonstrated at this level)* • **discuss** whether the solution makes sense in the context of the authentic real-life situation.
5–6	The student is able to: •

	identify the **relevant** elements of the authentic real-life situation • select **adequate** mathematical strategies to model the authentic real-life situation • apply the selected mathematical strategies to **reach a valid solution** to the authentic real-life situation • **explain** the degree of accuracy of the solution • **explain** whether the solution makes sense in the context of the authentic real-life situation.
7–8	The student is able to: • identify the **relevant** elements of the authentic real-life situation • select **appropriate** mathematical strategies to model the authentic real-life situation • apply the selected mathematical strategies to **reach a correct solution** to the authentic real-life situation • **justify** the degree of accuracy of the solution • **justify** whether the solution makes sense in the context of the authentic real-life situation.

MYP eAssessment

Students seeking **IB MYP course results** for MYP mathematics courses complete an on-screen examination in which they can demonstrate their achievement of subject-group objectives. Successful results can contribute to students' attainment of the **IB MYP certificate**.

For mathematics, optional on-screen examinations are written with the expectation that students have completed the mathematics framework for standard or extended mathematics. This verification of learning assures accurate and consistently applied standards.

Mathematics examination blueprint

MYP on-screen examinations are constructed as a series of tasks that sample, simulate or replicate internal assessment practices. The assessments follow an agreed structure that provides a clear framework for developing each examination. The distribution of marks within each eAssessment may vary by no more than three marks from those displayed in the blueprint.

As part of an ethical assessment model, these assessment blueprints ensure consistency and transparency, and they guarantee a balanced approach in measuring students' achievement with respect to MYP objectives. MYP on-screen examination blueprints document the close connection of large-scale assessment with subject-group objectives, classroom learning engagements and the programme's rigorous internal assessment requirements.

These blueprints enable teachers and students to review the nature and purpose of MYP eAssessment. They provide an important resource for helping students to prepare for on-screen examinations, focusing attention on subject-group criteria and assessment strategies in each subject group.

Overview

The following table illustrates how on-screen examinations in mathematics assessment are structured.

Task	Marks	Main criteria assessed	Criterion marks
Knowing and understanding	31–35*	A	25
		C	6–10*
Applying mathematics in real-life contexts	31–35*	D	25
		C	6–10*
Investigating patterns	31–35	B	25
		C	6–10
	100		

*Note that criterion C is assessed equally across all tasks to mark a total of 25 marks.

Examination sources, tools and tasks

Sources

A variety of sources will feature in each assessment and could include the following.

- Animations
- Data tables
- Graphs
- Simulations
- Static images
- Videos

Tools

A variety of response tools will be available to students including but not limited to an on-screen calculator, a measuring tool, drawing canvasses, a mathematics canvas, a graph plotter and a table drawing tool.

Tasks

Knowing and understanding

The first task assesses students' knowledge and understanding of mathematics, but marks may be awarded against the other criteria when appropriate to the skills used in answering a question. For example, a question assessing knowledge and understanding may also require students to move between different forms of mathematical representation.

Applying mathematics in real-life contexts

The second task assesses students' ability to apply mathematics in a real-life context, which is typically connected to the global context for the session. Students may be required to produce pieces of extended writing to evaluate and justify the validity of mathematics models.

Investigating patterns

Investigative skills in mathematics will be assessed in the final task. The abstract questions in this task will contain a greater degree of scaffolding than would be appropriate in the classroom to allow students of different abilities to access the task.

Conventions for on-screen examinations in MYP mathematics

Standardized symbols, notation and terminology for mathematics

MYP eAssessments use the standards adopted by the IB from a system of notation based on ISO 80000 (International Organization for Standardization, 2009). Students are expected to recognize this notation in mathematics, and teachers should introduce this notation as a regular part of MYP courses in these subject groups as appropriate.

For on-screen examinations, symbols, units and equations—where appropriate—are provided on a toolbar to ensure consistent usage and authentic age-appropriate mathematical communication. If

an examination question requires additional symbols or notations, they will be defined and explained within the context of the relevant task.

Candidates must always use correct mathematical notation, not calculator notation. Candidates should be familiar with scientific notation, also referred to as standard form as follows.

$a \times 10^k$ where $1 \leq a \leq 10$ and $k \in Z$

Answers will require an appropriate use of significant figures or decimal places based on the demands of the question. Unless otherwise indicated, final answers are to be given correct to three significant figures. Estimation is to be completed by rounding; truncation will not be rewarded.

Correct use of subscript and superscript is expected in all relevant mathematical contexts.

Where specific currency symbols are required, they will be provided as a button on the toolbar.

The following list does not constitute additional curriculum specifications beyond the MYP mathematics framework published in this guide. Rather, the symbols below depict the universe of mathematical symbols that could be used in relevant questions and the symbols that will be available for students to use in their responses. They provide a common shared communication convention for MYP eAssessment.

Symbol	Meaning
$\mathbb{N}$	The set of positive integers and zero, $\{0, \quad 1, \quad 2, \quad 3 \quad ...\}$
$\mathbb{Z}$	The set of integers, $\{0, \quad \pm 1, \quad \pm 2, \quad \pm 3 \quad ...\}$
Θ	The set of rational numbers
$\mathbb{P}$	The set of real numbers
$+$	Plus
$-$	Minus
$\pm$	Plus or minus
$a \times b$	a multiplied by/times b Note: also accepted $a \cdot b$ (half-high dot) ab Not accepted: $a \quad b$
a b a/b	Divided by Note: also accepted $a \times b^{-1}$
$=$	Is equal to
$\neq$	Is not equal to
$\equiv$	Is identical to

$\approx$	Is approximately equal to
$\sim$	Is proportional to
$<$	Less than
$\leq$	Less than or equal to
$>$	Greater than
$\geq$	Greater than or equal to
∞	Infinity
$0.\dot{8}\dot{1}$	Recurring decimal, where the dot appears over the first and last repeating numeral
$\sphericalangle ABC$	Angle at vertex B in the triangle ABC Note: the angle is not oriented, it holds that $\sphericalangle ABC = \sphericalangle CBA$
$\overline{AB}$	Line segment from A to B
$\overrightarrow{AB}$	Vector from A to B
$\mathbf{a}$	Vector a Note: An arrow above the letter symbol can be used instead of bold face type to indicate a vector $(\vec{a})$
$\mathbf{a} \cdot \mathbf{b}$	Dot product of a and b Note: Must be in bold to distinguish from simple multiplication
Σ	

	Sigma, sum of
$\sum_{i=1}^{n} a_i$	$a_1 + a_2 + \ldots + a_n$ sum of a_1, a_2, ..., a_n
a^p	a to the power of p Note: use of calculator terminology ∧ will not be accepted
$\sqrt{a}$	Square root Note: $a^{1/2}$ will also be accepted
$\sqrt[n]{a}$	n_{th} root of a Note: If the symbol acts on a composite expression, parentheses or brackets must be used to avoid ambiguity Also accepted $a^{1/n}$
$\overline{X}$	Mean value of *x*
σ	Standard deviation
$\lvert a \rvert$	Absolute value of a Also: vector magnitude
$f, \quad g, \quad h \quad \ldots$	Functions, models, for example, $f(x) =$ Note: $y =$ also accepted where not dictated by stimulus or question
$f^{-1}, \quad g^{-1}$	Inverse functions
$g \circ f$	Composite function Note: $(g \circ f)(x) = g(f(x))$

e	Base of natural logarithm
$\log_2(x)$	Logarithm to the base 2 of argument x
$\ln(x)$	Natural logarithm of x
π	Pi, ratio of the circumference of a circle to its diameter
$\sin(x)$ $\cos(x)$ $\tan(x)$ $\sin^{-1}(x)$ $\cos^{-1}(x)$ $\tan^{-1}(x)$	Sine of x, cosine of x, tangent of x Inverse functions of above Note: arcsin, and so on, will be accepted but not provided on the calculator or toolbar
∈	Is an element of
∉	Is not an element of
∅	The empty (null) set
$n(A)$	The number of elements in the finite set A
Y	The universal set
∪	Union
∩	Intersection
⊂	Is a proper subset of
⊆	Is a subset of
A'	

	The complement of the set A

Table 7 *Standardized symbols*

Mathematics subject-specific grade descriptors

Subject-specific grade descriptors serve as an important reference in the assessment process. Through careful analysis of subject-group criteria and the general grade descriptors, they have been written to capture and describe in a single descriptor the performance of students at each grade for each MYP subject group.

For on-screen examination subjects, teachers are required to submit predicted grades. When considering predicted grades, teachers should consider their own assessment of students during MYP year 4 and the first part of MYP year 5 and, allowing for subsequent academic development, are asked to predict the outcome of eAssessment for their students with reference to the subject-specific grade descriptors. This prediction helps the IB to check the alignment between teachers' expectations and the IB's assessment outcome and, as such, forms an essential strategy for ensuring reliable results.

Subject-specific grade descriptors are also the main reference used to select grade boundaries for each discipline in each assessment session. During this process, the grade award team compares student performance against descriptors of achievement at grades 2 and 3; 3 and 4; and 6 and 7 (other boundaries are set at equal intervals between these key transitions). The grade award process is able to compensate for variations in challenge between examinations and in standards applied to marking (both between subjects and for a particular subject across sessions) by setting boundaries for each discipline and examination session, with reference to real student work.

Subject-specific grade descriptors tie eAssessment to criterion-related assessment and to MYP assessment criteria and level descriptors, which put the programme's criterion-related assessment philosophy into practice.

Grade	Descriptor
1	Produces work of a very limited quality. Conveys many significant misunderstandings or lacks understanding of most concepts and contexts. Very rarely demonstrates evidence of mathematical thinking. Very inflexible, rarely shows evidence of knowledge or skills.
2	Produces mathematical work of limited quality. Communicates limited understanding of some concepts and contexts. Demonstrates limited evidence of mathematical thinking. Limited evidence of transfer of mathematical knowledge and application of skills.
3	Produces mathematical work of an acceptable quality. Communicates basic understanding of many concepts and contexts with occasional evidence of appropriate application of mathematical techniques and terminology, with occasional significant misunderstandings or gaps. Begins to demonstrate some analytical thinking when problem-solving and investigating. Begins to transfer mathematical knowledge and apply skills, requiring support even in familiar classroom situations.
4	Produces good-quality mathematical work. Communicates basic understanding of most concepts and contexts with evidence of appropriate application of mathematical techniques and terminology, with few misunderstandings and minor gaps. Often

	demonstrates analytical thinking when problem-solving and investigating. Transfers some mathematical knowledge and applies skills in familiar classroom situations, but requires support in unfamiliar situations.
5	Produces generally high-quality mathematical work. Communicates good understanding of concepts and contexts demonstrating proficient application of mathematical techniques and terminology. Demonstrates analytical thinking and logical processes, sometimes with sophistication, when problem-solving and investigating. Usually transfers mathematical knowledge and applies skills, with some independence, in familiar classroom and real-world situations.
6	Produces high-quality, occasionally insightful mathematical work. Communicates extensive understanding of concepts and contexts demonstrating proficient application of mathematical techniques and terminology. Demonstrates analytical thinking and logical processes, frequently with sophistication when problem-solving and investigating. Transfers mathematical knowledge and applies skills, often with independence, in a variety of familiar and unfamiliar classroom and real-world situations.
7	Produces high-quality work that frequently uses mathematics insightfully. Communicates comprehensive, nuanced understanding

	of concepts and contexts demonstrating proficient application of mathematical techniques and terminology. Consistently demonstrates sophisticated analytical thinking and logical processes when problem-solving and investigating. Frequently transfers mathematical knowledge and applies skills, with independence and expertise, in a variety of complex classroom and real-world situations.