PISA 2022 Technical Report

17 Proficiency Scale Construction for the Core Domains

Introduction

This chapter discusses the methodology used to develop the PISA Mathematics reporting scales. These describe levels of proficiency in the domain and presents the outcomes of the development process for mathematics literacy, the major domain in the PISA 2022 assessment.

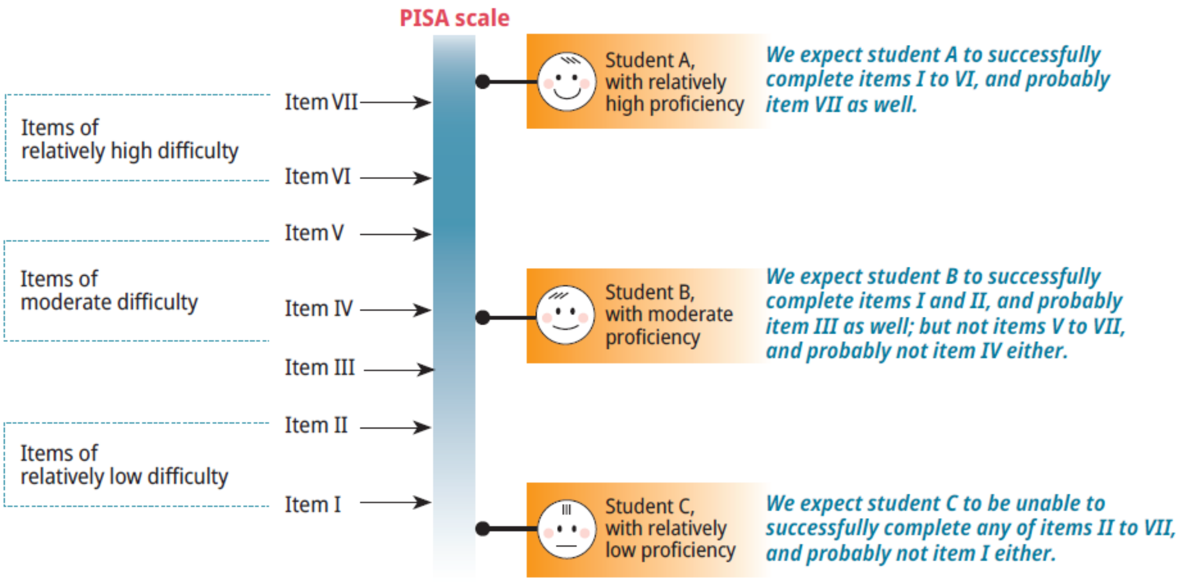
The reporting scales are called “proficiency scales” rather than “performance scales” because they describe what students *typically* know and can do at given levels of proficiency, rather than how individuals who were tested *actually* performed on a single test administration. This emphasis reflects the primary goal of PISA, which is to report general population-level results rather than the results for individual students. PISA uses samples of students and items to make estimates about populations. A sample of 15-year-old students is selected to represent all 15-year-olds in a country/economy and a sample of test items from a large pool is administered to each student. Results are then analysed using statistical models that estimate the likely proficiency of the population, based on this sampling.

The PISA test design makes it necessary to use techniques of modern item response modelling to both, estimate the ability of all students taking the PISA assessment and the statistical characteristics of all PISA items. These techniques are described in Chapter 11 [*Scaling PISA Data*].

The PISA data are collected using a rotated matrix test design in which students take different but overlapping sets of items. The mathematical model employed to analyse the PISA data is implemented through test analysis software that uses iterative procedures to simultaneously estimate the distribution of students along the proficiency dimension assessed by the test, as well as a mathematical function that describes the association of student proficiency and the likelihood of a correct response for each item on the test. The result of these procedures is a set of item parameters that represents, among other things, locations of the items on a proficiency continuum reflecting the domain being assessed. On that continuum, it is possible to estimate the distribution of groups of students, and thereby the average (location) and range (variability) of their skills and knowledge in this domain. This continuum represents the overall PISA scale in the relevant test domain, such as reading, mathematics, or science.

PISA assesses students and uses the outcomes of that assessment to produce estimates of students’ proficiency in relation to the skills and knowledge being assessed in each domain. The skills and knowledge of interest, as well as the kinds of tasks that represent those abilities, are described in the PISA frameworks (OECD, 2023[1]; 2023[2]; 2023[3]). For each domain, one or more scales are defined, each ranging from very low levels of proficiency to very high levels. Students whose ability estimate places them at a certain point on a PISA proficiency scale would be more likely to be able to successfully complete tasks at or below that point. Those students would be increasingly *more likely* to complete tasks located at progressively lower points on the scale, and increasingly *less likely* to complete tasks located at progressively higher points on the scale. Figure 17.1 depicts a simplified hypothetical proficiency scale, ranging from relatively low levels of proficiency at the bottom of the figure, to relatively high levels towards the top. Seven items of varying difficulty are placed along the scale, as are three students of varying ability. The relationship between the students and items at various levels is described in the figure.

Figure 17.1. Simplified relationship between items and students on a proficiency scale



In addition to defining the numerical range of the proficiency scale, it is also possible to define the scale by describing the competencies typical of students at particular points along the scale. The distribution of students along this proficiency scale is estimated, and locations of students can be derived from this distribution and their responses on the test. Those location estimates are then aggregated in various ways to generate and report useful information about the proficiency levels of 15-year-old students within and among participating countries/economies.

The development of a method for describing proficiency in PISA reading, mathematical and scientific literacy occurred in the lead-up to the reporting of outcomes of PISA 2000 and was revised in the lead-up to each of the subsequent surveys. The same basic methodology has again been used to develop proficiency descriptions for the core domains of PISA 2022, even though, like in the PISA 2015 and PISA 2018 cycles, a more general statistical model to describe the items was used in the scaling procedure compared to PISA cycles before 2015.

The proficiency descriptions that had been developed for the science domain in PISA 2015, for the reading domain in PISA 2018, and for financial literacy in 2012 were used again to report the results of PISA 2022. The proficiency descriptors for creative thinking, the innovative domain for PISA 2022, are entirely new and these are described in the next chapter of this Technical Report.

Reporting for mathematics, the major domain in PISA 2022, was linked back to the 2012 proficiency scale and was based on the detailed proficiency level descriptions developed in 2012, the last PISA cycle in which mathematics was the major domain. These proficiency level descriptors were revised based on PISA 2022 data in order to incorporate the new aspects of the mathematics framework and the performance of the new items, including the reasoning and interactive items.

The mathematics expert group (MEG) worked with the Core A contractor (ETS) to revise the sets of described proficiency scales and subscales for PISA mathematics. Similarly, the Creative Thinking Expert

Group (CTEG) worked with Core B3 contractor (ACT) to develop the described proficiency scale for that domain. More detail on the development of the Creative Thinking scale is given in Chapter 18.

Development of the PISA scales

The development of described proficiency scales for PISA has been carried out through a process that typically involves several tasks conducted by the expert groups and the item development team. The process of developing the described scales involved several iterations as the data were collected and analysed during PISA 2022. It should be noted that, as each PISA cycle builds upon the work implemented in previous cycles, the same tasks are not completed for every domain in every administration. The following description of the development process focuses on the development of described proficiency scales for mathematics.

Classification of items

As part of new item development for mathematics, test developers classified all items based on the specifications provided in the framework. Item classifications for the trend mathematics items were also revised to reflect the PISA 2022 assessment framework. All trend classifications were reviewed by the MEG and revised as needed.

Defining the overall proficiency scale

Using Main Survey data with preliminary student weights, the mathematics expert group met over several days and reviewed representative items, particularly those that were classified as representing the new reasoning process scale or having an interactive component (e.g., a spreadsheet or data simulator) and discussing key characteristics that differentiated performance along the proficiency scale. Following this meeting, the descriptors for each level in the overall proficiency scale were refined and finalised.

Identifying possible subscales

For each major domain assessed in PISA, reporting includes an overall proficiency scale based on the combined results for all items within that domain. In addition, the assessment framework may support subscales based on the various dimensions of the framework. Where subscales are included, they must arise clearly from the domain framework, be meaningful and potentially useful for feedback and reporting purposes and be defensible with respect to their measurement properties. Thus, the first stage in the process involves having the experts articulate possible reporting subscales based on the most recent framework.

In the case of mathematics, a single mathematical scale was developed for PISA 2000. With the additional data available in PISA 2003, when mathematics was the major test domain, subscales based on the four overarching subdomains – *space and shape, change and relationships, quantity* and *uncertainty* – were reported. In PISA 2006 and PISA 2009, when mathematics was again a minor domain, only a single scale was reported. For PISA 2012, the expert group carried out a comprehensive revision of the framework at the specific behest of the PISA Governing Board that indicated an interest in seeing mathematical process dimensions used as the primary basis for reporting in mathematics. As well as considering ways in which this could be done, the mathematics expert group also had to consider how the addition of the optional computer-based assessment component included in PISA 2012 could be incorporated into the reporting for the cycle. The outcome of these considerations was, first, a decision that the computer-based items would be used to expand the same mathematical literacy dimension that was expressed through the paper-based items. Second, the expert group recommended that three process-based subscales should be reported. These included: *formulating situations mathematically* (or “formulate”), *employing mathematical* *concepts, facts, and procedures* (or “employ”), and *interpreting, applying and evaluating mathematical outcomes* (or “interpret”). In addition, for continuity with the PISA 2003 reporting scales, the content-based scales including *space and shape, change and relationships, quantity*, and *uncertainty and data* (formerly just “uncertainty”), were also reported. For PISA 2015 and 2018, where mathematics was once more the minor domain, only a single scale representing overall proficiency in the mathematics domain was reported.

For the PISA 2022 cycle, the MEG decided that additional proficiency scales should be reported for the four mathematical processes (i.e., *mathematical reasoning; formulate; employ; and interpret*). Since the last three processes were part of the domain in previous cycles, proficiency scales already existed and just needed to be updated based on the new items classified to each process. However, mathematical reasoning was “new” this cycle as a separate process scale, so that a proficiency scale needed to be fully developed. As part of their work updating the mathematics framework, the MEG developed a range of actions that students would be expected to perform for each of the mathematical processes. These actions represented a hierarchy of “demands” that the items make of the students in order to solve a problem and were designed to span the proficiency scale. These lists of actions proved useful during the item development phase and when updating/writing the proficiency scales.

Scales in the minor domains

For science, the subscales selected for inclusion in the PISA 2006 database were the three competency-based subscales based on the scientific dimensions documented in the framework: *explaining phenomena scientifically, identifying scientific issues* and *using scientific evidence*. The 2015 expert group recommended reporting again on the three scientific competencies, as they were defined in the updated framework: *explain phenomena scientifically, evaluate and design scientific enquiry,* and *interpret data and evidence scientifically*. In addition, the expert group recommended that two knowledge subscales be reported: *content knowledg*e and *procedural/epistemic knowledge*. Procedural and epistemic knowledge were combined into a single reporting subscale due to a limited number of epistemic items in some of the administered forms. Finally, for continuity with previous reporting scales, three systems – *physical, living* and *Earth and space* – were recommended as a third reporting scale. For PISA 2018 and PISA 2022, only a single scale representing overall proficiency in the science domain is reported.

For reading, which was the major domain in PISA 2018, work on identifying possible subscales began with a review of the subscales used in PISA 2009, when reading was also a major domain. In PISA 2009, volume I of the *PISA 2009 Results* included an overall reading scale and descriptions of subscales that described the types of reading tasks or “cognitive aspects”: access and retrieve, integrate and interpret and reflect and evaluate and subscales based on the form of reading material: continuous texts and non-continuous texts (OECD, 2010[4]). For digital reading, a separate, single scale was developed based on the digital reading assessment items administered in 19 countries/economies in PISA 2009, as an international option (OECD, 2011[5]). In PISA 2012, when reading was a minor domain, a single print reading scale was reported, along with a single digital reading scale. For PISA 2018, the reading expert group decided the former distinction of “cognitive aspects” should be updated to “cognitive processes”. This terminology better connects the PISA 2018 assessment framework with the literature on reading psychology and better reflects the actual skills and proficiencies assessed. The subscales that correspond to the ways students interact and process text were updated to the following: locate information, understand, and evaluate and reflect. The former subscales that were based on the form of reading material are not included in PISA 2018. Instead, scales are included corresponding to using a single unit of text or multiple units of texts for answering the questions. For PISA 2022, only a single scale representing overall proficiency in reading was reported.

For creative thinking, the innovative domain in PISA 2022, a proficiency description on a single overall reporting scale was developed and is described in the next Chapter. The optional assessment of financial literacy used the same proficiency description from PISA 2015 and PISA 2018.

Defining the proficiency levels

The proficiency levels for each of the PISA domains were defined when each was first introduced as a major domain. The goal of that process was to decide how to divide up the proficiency continuum into levels that might be more interpretable. And, having defined those levels, decisions needed to be made about how to decide on the level to which a particular student should be assigned.

The relationship between the observed responses and student proficiency and item characteristics is probabilistic. That is, there is some probability that a particular student can correctly solve a particular item and each item can be differentially responsive to the proficiency being measured.

One of the basic tenets of the measurement of human skills or proficiencies is this: if a student's proficiency level exceeds the item's demands, the probability that the student can successfully complete that item is relatively high, and if the student's proficiency is lower than that required by the item, the probability of success for that student on that item is relatively low. The rate of change of the probability of success across the range of proficiency for each item is also affected by the sensitivity of the item to student proficiency.

This leads to the question as to the precise criterion that should be used to locate a student on the same scale as that on which the items are located. How can we assign a location that represents student proficiency in meaningful ways? When placing a student at a particular point on the scale, what probability of success should we deem sufficient in relation to items located at the same point on the scale? If a student were given a test comprising a large number of items, each with the same item characteristics, what proportion of those items would we expect the student to successfully complete? Or, thinking of it in another way, if a large number of students of equal ability were given a single test item with a specified item characteristic, about how many of those students would we expect to successfully complete the item?

The answers to these questions depend on assumptions about how items differ in their characteristics or how items function, as well as on what level of probability is deemed a *sufficient probability of success*. In order to define and report PISA outcomes in a consistent manner, an approach is needed to define performance levels and to associate students with those levels. The same basic methodology has again been used to develop proficiency descriptions for PISA 2022.

Defining proficiency levels for PISA progressed in two broad phases. The first, which came after the development of the described scales, was based on a substantive analysis of PISA items in relation to the aspects that underpin each assessment domain. This produces descriptions of increasing proficiency that reflect observations of student performance and a detailed analysis of the cognitive demands of PISA assessment items. The second phase involves decisions about where to set cut-off points for levels and how to associate students with each level in order to lay out how a *sufficient probability of success* plays out in these levels. This is both a technical and a very practical matter of interpreting what it means to be at a level and has significant consequences for reporting national and international results.

Several principles were considered in developing and establishing a useful meaning of being at a level, and therefore for determining an approach to locating cut-off points between levels and associating students with them. For the levels to provide useful information to the PISA assessment stakeholders, it is important to develop a common understanding of what performance at each of those levels means.

First, it is important to understand that the skills measured in each PISA domain fall along a continuum: There are no natural breaking points to mark borderlines between stages along said continuum. Dividing the continuum into levels, though useful for communication about students' development, is essentially arbitrary. Like the definition of units on, for example, a scale of length, there is no fundamental difference between 1 metre and 1.5 metres – it is a matter of degree. It is useful, however, to define stages, or levels along the continua, because they enable us to communicate about the proficiency of students in terms other than continuous numbers. This is a rather common concept, an approach we all know from categorising clothing and portions by size (i.e., small, medium, large, extra-large, etc.).

The approach adopted since PISA 2000 was that it would only be useful to regard students as having attained a particular level if this would mean that we can have certain expectations about what these students are capable of, in general, when they are said to be at that level. It was thus decided that this expectation would have to mean, at a minimum, that students at a particular level would be more likely than not to successfully complete tasks at that level. By implication, it must be expected that they would succeed on at least half of the items on a test composed of items uniformly spread across that level. This definition of being "at a level" is useful in helping to interpret the proficiency of students at different points across the proficiency range defined at each level.

For example, the expectation is that students located at the bottom border of a level would complete at least 50% of items correctly on a test set at the level, while students at the middle and top of each level would be expected to achieve a higher success rate. At the top border of a level would be the students who would be likely to solve a high proportion of the tasks at that level. But, being at the top border of that level, they would also be at the bottom border of the next highest level where, according to the reasoning here, they should have at least a 50% likelihood of solving any tasks defined to be at that higher level.

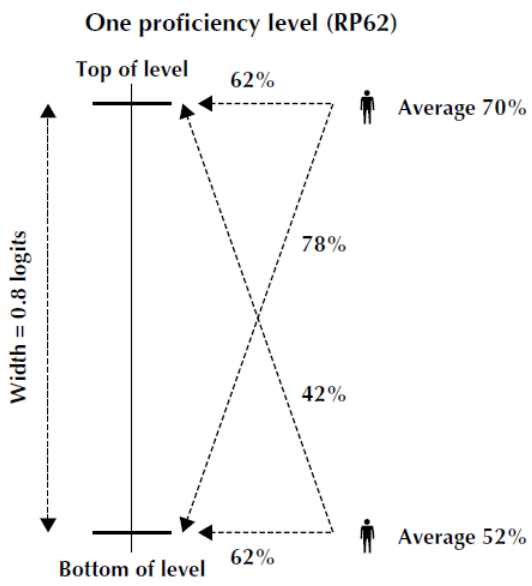
Furthermore, the meaning of being at a level for a given scale should be more or less consistent for each level and, indeed, also for scales from the different domains. In other words, to the extent possible within the substantively based definition and description of levels, cut-off points should create levels of more or less constant range. Some small variation may be appropriate, but for interpretation and definition of cut-off points and levels to be consistent, the levels have to be about equally broad within each scale. The exception would be the highest and lowest proficiency levels, which are unbounded.

Thus, a consistent approach should be taken to defining levels for the different scales. Their range may not be exactly the same for the proficiency scales in different assessment domains, but the same kind of interpretation should be possible for each scale that is developed. This approach links the following three variables:

- the expected success of a student at a particular level on a test containing items at that level (proposed to be set at a minimum that is near 50% for the student at the bottom of the level and greater for students who are higher in the level)
- the width of the levels in that scale (determined largely by substantive considerations of the cognitive demands of items at the level and data related to student performance on the items)
- the probability that a student in the middle of a level would correctly answer an item of average difficulty for that level (in fact, the probability that a student at any particular level would get an item at the same level correct), sometimes referred to as the "RP value" for the scale, where "RP" indicates "response probability".

Figure 17.2 summarises the relationship among these three mathematically linked variables under a particular scenario. The vertical line represents a segment of the proficiency scale, with marks delineating the "top of level" and "bottom of level" for any level one might want to consider, with a width of 0.8 logits between the boundaries of the level (noting that this width can vary somewhat for different assessment domains). The RP62 indicates that students will be located on the scale at a point that gives them a 62% chance of getting a typical item at that same level correct. The student represented near the top of the level shown has a 62% chance of getting an item correct that is located at the top of the level, and similarly the student represented at the bottom of the level has the same chance of correctly answering a question at the bottom of the level. A student at the bottom of the level will have an average score of about 52% correct on a set of items spread uniformly across the level. Of course, that student will have a higher likelihood (62%) of getting an item at the bottom of the level correct, and a lower likelihood (about 42%) of getting an item at the top of the level correct. A student at the top of the level will have an average score of about 70% correct on a set of items spread uniformly across the level. That student will have a higher likelihood (about 78%) of getting a typical item at the bottom of the level correct and a lower likelihood (62%) of getting an item at the top of the level correct.

Figure 17.2. Calculating the RP values used to define PISA proficiency levels



In PISA we have implemented the following solution: Start with the range of described abilities for each bounded level in each scale (the desired band breadth); then determine the highest possible RP value that will be common across domains potentially having bands of slightly differing breadth that would give effect to the broad interpretation of the meaning of being at a level (an expectation of correctly responding to a minimum of 50% of the items in a test comprising items spread uniformly across that level). The value RP = 0.62 is a probability value that satisfied the logistic equations for typical items in that level through which the scaling model is defined, subject to the two constraints mentioned earlier (a width per level of about 0.8 logits and the expectation that a student would get at least half of the items correct on a hypothetical test composed of items spread evenly across the level). In fact, RP=0.62 satisfied the requirements for any scales having band widths up to about 0.97 logits.

The highest and lowest levels are unbounded. For a certain high point on the scale and below a certain low point, the proficiency descriptions could, arguably, cease to be applicable. At the high end of the scale, this is not such a problem since extremely proficient students could reasonably be assumed to be capable of at least the achievements described for the highest level. At the other end of the scale, however, the same argument does not hold. A lower limit therefore needs to be determined for the lowest described level, below which no meaningful description of proficiency is possible. It was proposed that the floor of the lowest described level be set so that it was the same range as the other described levels. Student performance below this level is lower than that which PISA can reliably assess and, more importantly, describe.

Reporting PISA results for Mathematics

In this section, the ways in which levels of mathematics are defined, described and reported will be discussed. This will be illustrated using a subset of released new mathematics items from PISA 2022.

Building an item map for mathematics

The data from the PISA mathematics assessment were analysed to estimate a set of item characteristics for the 234 items included in the Main Survey. During the process of item development, each item was classified to reflect the content area and mathematical process it required. Following data analysis, the items were associated with their difficulty. Table 17.1 shows an item map, which includes information for a set of new mathematics units released after the PISA 2022 Main Survey. Each row in Table 17.1 represents a level on the mathematics proficiency scale. The selected items have been ordered according to their difficulty, with the most difficult at the top, and the least difficult at the bottom of the table. The difficulty estimate for each item expressed in the reporting scale is given in the rightmost column. For items with a partial-credit response category, the item is listed twice to show the level for a full-credit response and the level for a partial-credit response. Partial-credit responses are listed in italicised font. Note that four new mathematics units were also released after the Field Trial, but those units are not included here because there were no estimates of item difficulty.

Defining levels of mathematical literacy

The reporting approach used by the OECD has been defined in previous PISA cycles and is based on the definition of a number of levels of proficiency. Descriptions were developed to characterise typical student performance at each level. The levels were used to summarise the performance of students, to compare performances across subgroups of students, and to compare average performances among groups of students, in particular among the students from different participating countries/economies. A similar approach has been used here to analyse and report PISA 2022 assessment outcomes for mathematics.

Since the PISA 2000 assessment, results have been reported on a scale with a mean of 500 and a standard deviation of 100. The metric has been set using the participating OECD countries at the time when the subject was the major domain for the first time. In PISA 2012, the last time mathematics was the major domain, the scale consisted of Levels 1 through 6. Starting with the PISA for Development (PISA-D) assessment, Level 1 on the mathematics scale was split into Levels 1c, 1b, and 1a, with Level 1a corresponding to what had previously just been Level 1. This was done to further describe what students at the lower levels of proficiency can do. The level definitions on the PISA mathematical literacy scale are given in Table 17.2.

Information about the items in each level is used to develop summary descriptions of the kinds of mathematical skills and abilities associated with different levels of proficiency. These summary descriptions can then be used to encapsulate typical mathematical proficiency of students associated with each level. As a set, they describe a progression in mathematical ability.

For PISA 2022, there was already a set of proficiency level descriptors upon which to build. The new items that were developed for PISA 2022 were considered in relation to the existing level descriptions. Table 17.3 presents the updated description for the overall mathematical literacy scale. Table 17.4, Table 17.5, and Table 17.6 present updated descriptions for each process (i.e., Formulate, Employ, and Interpret, respectively) that was part of the mathematical problem-solving model also used in PISA 2012. Table 17.7 presents a description of the mathematical reasoning process, which for PISA 2022 was treated as separate process.

Table 17.8, Table 17.9, Table 17.10, and Table 17.11 present updated descriptions for each content that was part of the mathematics assessment in PISA 2022.

Cutpoints defining proficiency levels for Reading, Science and Financial Literacy in PISA 2022

Table 17.12, Table 17.13, and Table 17.14 present the cut points used to assign items and students to a proficiency level for the minor domains of reading and science, as well as for the financial literacy domain. As with the mathematics cut points, values in the table are the lower bound for the corresponding level. For example, in the reading scale, Level 6 begins with 698.32. Level 5 begins with 625.61 and ends just below 698.32, where Level 6 begins. Below Level 1c are those with values lower than 189.33. In other words, those reaching a level are those with a score or difficulty at or above the given cut point. This same interpretation applies to all proficiency scales used in PISA.

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Chapter 17 tables

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Table 17.1. A map for released mathematics items

Level	Cut point	Item	Item Difficulty
6	669.30	Forested Area (CMA161Q03) – Full Credit Forested Area (CMA161Q04) Points (CMA156Q01) – Full Credit	840 739 672
5	606.99	Forested Area (CMA161Q02) *Points (CMA156Q01) – Partial Credit* Forested Area (CMA161Q01) – Full Credit Triangular Pattern (CMA150Q03) – Full Credit *Forested Area (CMA161Q03) – Partial Credit*	647 *642* 636 620 *617*
4	544.68	*Forested Area (CMA161Q01) – Partial Credit* *Triangular Pattern (CMA150Q03) – Partial Credit*	*575* *545*
3	482.38	Solar System (CMA123Q01) – Full Credit (*Partial Credit*)	514 (*503*)
2	420.07	Triangular Pattern (CMA150Q02) Solar System (CMA123Q02)	448 430
1a	357.77	Triangular Pattern (CMA150Q01)	411
1b	295.47	There were no released items at this level	
1c	233.17	There were no released items at this level	

Table 17.2. Mathematical literacy performance band definitions on the PISA scale

Level	Score points on the PISA Scale
6	At or above 669.30
5	At or above 606.99 but less than 669.30
4	At or above 544.68 but less than 606.99
3	At or above 482.38 but less than 544.68
2	At or above 420.07 but less than 482.38
1a	At or above 357.77 but less than 420.07
1b	At or above 295.47 but less than 357.77

Level	Score points on the PISA Scale
1c	At or above 233.17 but less than 295.47

Table 17.3. Summary descriptions of the proficiency levels on the Mathematical Literacy scale

Level	What students can typically do
6	At Level 6, students can work through abstract problems and demonstrate creativity and flexible thinking to develop solutions. For example, they can recognise when a procedure that is not specified in a task can be applied in a non-standard context or when demonstrating a deeper understanding of a mathematical concept is necessary as part of a justification. They can link different information sources and representations, including effectively using simulations or spreadsheets as part of their solution. Students at this level are capable of critical thinking and have a mastery of symbolic and formal mathematical operations and relationships that they use to clearly communicate their reasoning. They can reflect on the appropriateness of their actions with respect to their solution and the original situation.
5	At Level 5, students can develop and work with models for complex situations, identifying or imposing constraints, and specifying assumptions. They can apply systematic, well-planned problem-solving strategies for dealing with more challenging tasks, such as deciding how to develop an experiment, designing an optimal procedure, or working with more complex visualisations that are not given in the task. Students demonstrate an increased ability to solve problems whose solutions often require incorporating mathematical knowledge that is not explicitly stated in the task. Students at this level reflect on their work and consider mathematical results with respect to the real-world context.
4	At Level 4, students can work effectively with explicit models for complex concrete situations, sometimes involving two variables, as well as demonstrate an ability to work with undefined models that they derive using a more sophisticated computational-thinking approach. Students at this level begin to engage with aspects of critical thinking, such as evaluating the reasonableness of a result by making qualitative judgements when computations are not possible from the given information. They can select and integrate different representations of information, including symbolic or graphical, linking them directly to aspects of real-world situations. At this level, students can also construct and communicate explanations and arguments based on their interpretations, reasoning, and methodology.
3	At Level 3, students can devise solution strategies, including strategies that require sequential decision-making or flexibility in understanding of familiar concepts. At this level, students begin using computational-thinking skills to develop their solution strategy. They are able to solve tasks that require performing several different but routine calculations that are not all clearly defined in the problem statement. They can use spatial visualisation as part of a solution strategy or determine how to use a simulation to gather data appropriate for the task. Students at this level can interpret and use representations based on different information sources and reason directly from them, including conditional decision-making using a two-way table. They typically show some ability to handle percentages, fractions and decimal numbers, and to work with proportional relationships.
2	At Level 2, students can recognise situations where they need to design simple strategies to solve problems, including running straightforward simulations involving one variable as part of their solution strategy. They can extract relevant information from one or more sources that use slightly more complex modes of representation, such as two-way tables, charts, or two-dimensional representations of three-dimensional objects. Students at this level demonstrate a basic understanding of functional relationships and can solve problems involving simple ratios. They are capable of making literal interpretations of results.
1a	At Level 1a, students can answer questions involving simple contexts where all information needed is present, and the questions are clearly defined. Information may be presented in a variety of simple formats and students may need to work with two sources simultaneously to extract relevant information. They are able to carry out simple, routine procedures according to direct instructions in explicit situations, which may sometimes require multiple iterations of a routine procedure to solve a problem. They can perform actions that are obvious or that require very minimal synthesis of information, but in all instances the actions follow clearly from the given stimuli. Students at this level can employ basic algorithms, formulae, procedures, or conventions to solve problems that most often involve whole numbers.
1b	At Level 1b, students can respond to questions involving easy to understand contexts where all information needed is clearly given in a simple representation (i.e., tabular or graphic) and, as necessary, recognise when some information is extraneous and can be ignored with respect to the specific question being asked. They are able to perform simple calculations with whole numbers, which follow from clearly prescribed instructions, defined in short, syntactically simple text.
1c	At Level 1c, students can respond to questions involving easy to understand contexts where all relevant information is clearly given in a simple, familiar format (for example, a small table or picture) and defined in a very short, syntactically simple text. They are able to follow a clear instruction describing a single step or operation.

Table 17.4. Summary descriptions of the proficiency levels on the Formulating situations mathematically scale

Level	What students can typically do
6	Students at Level 6 can typically apply a wide variety of mathematical content knowledge to transform and represent information from a broad variety of contexts into a mathematical form amenable to analysis. At this level, students can formulate and solve complex real-world problems involving significant modelling steps and extended calculations, such as applying their geometric knowledge to irregular shapes, inferring relevant parameters of a large data set, or analysing an experiment to recognise the mathematical relationship between

Level	What students can typically do
	objects. Students at level 6 are able to identify the relationship between the key components of a problem and to develop algebraic formulations that accurately represent them.
5	At level 5, students show an ability to use their understanding across a range of mathematical areas to transform information or data from a problem context into mathematical form, sometimes involving two or more variables. They are able to recognise a situation where statistical counting techniques can be applied or formulate inequalities based on given conditions. Students are able to manipulate relatively large data sets by determining appropriate mathematical operations to perform using a spreadsheet tool. They are able to analyse more complex geometric figures, for example, by recognising the relationship between the properties of a compound figure and the properties of individual shapes that comprise the compound figure. Students at this level can formulate a process to solve a problem where some of the information used is given as a range instead of a single value or when information is not given explicitly in the task.
4	At Level 4, students are able to solve complex problems in a variety of contexts that may require designing a sequence of steps to reach the solution. They also recognise when a single process, repeated iteratively, can lead to the solution. Students are able to run simulations to identify the underlying relationship between two or more variables. They can determine probabilities from data presented in two-way tables. Students at this level can also formulate linear algebraic expressions of relatively simple contexts involving one constraint, recognise an application of a known procedure from a data table and use that procedure to determine missing values, or formulate a method to compare information, such as the prices of several sale items. They can work with more complex geometric models of practical situations which contain all the relevant information needed for formulating the solution.
3	At Level 3, students can identify and extract information from a variety of sources, including text, geometric models, tables, and diagrams, where all necessary information is provided. They can identify basic mathematical concepts relevant for the model or identify how to transform information given in a diagram to data that can be input into a simulation. Students at this level are able to solve problems by recognising situations in which quantities are related proportionally or by performing a computation using a percentage in real-life contexts such as medical testing or ticket sales. They are able to solve simple multi-step problems where the sequence of steps needs to be determined, and each step requires translating some of the given information into a form that can be operated on mathematically.
2	At this level, students can understand clearly formulated instructions and information about simple processes and tasks in order to express them in a mathematical form. They can determine a rule used in a simple pattern, and then use that rule to extend the pattern to the next term. They are able to use information presented in tables or diagrams to identify or build a simple model of a practical situation. For example, they can revise a given formula to determine the number of seats in any row of a theatre. Students at this level are able to translate descriptions of situations to be operated on mathematically that first require identifying information relevant to the particular task. At this level, students begin to formulate situations involving non-integer quantities, provided all necessary information is given in the task.
1a	At this level, students can recognise an explicit model of a contextual situation from a list or translate a short verbal description so that it can be operated on using basic mathematical tools. Students at this level are able to work with simple models involving one operation and at most two variables. For example, they can select the appropriate model that represents the total number of items that can be produced based on a production rate. Students at this level are capable of formulating situations that involve whole numbers and where all relevant information is given.
1b	*There were no items to describe this level on the scale.*
1c	*There were no items to describe this level on the scale.*

Table 17.5. Summary descriptions of the proficiency levels on the Employing mathematical concepts, facts, and procedures scale

Level	What students can typically do
6	Students at Level 6 are typically able to employ a strong repertoire of knowledge and procedural skills in a wide range of mathematical areas. They can solve problems involving several stages or a problem that does not have a well-defined solution method, such as computing the area of an irregularly shaped figure. They demonstrate an understanding of statistical data, and can apply that understanding, for example, to determine the probability of different events. Students at this level can observe regularities in information and use that to determine algorithms to apply to a situation. At Level 6, students' work is consistently precise and reflects a strong ability to work with different data formats and representations.
5	Students at Level 5 can employ a broader range of knowledge and skills to solve problems. They can sensibly link information in graphical and diagrammatic formats to textual information. Students can reason proportionally to find a unit rate or understand and apply the meaning of a concept to extract relevant information from a table to solve a problem. At this level, they can devise a strategy to extrapolate from a sample or to determine which of two savings options would be better in a situation involving variously priced items. Students demonstrate the ability to solve problems that require converting between units or working with constraints and can provide mathematical or conceptual arguments to support their results. They also demonstrate proficiency working with percentages and ratios.
4	At Level 4, students show an understanding of the context and can recognise efficient strategies for solving problems. For example, they can typically identify relevant data and information from contextual material and use it to perform such tasks as, calculating distances from a map, analysing a model based on percentages, or comparing the results from two different formulae to compute the same measure. They are able to determine how a rating system was used to support a claim or evaluate several construction designs to rank order them based on a given criterion. At this level, students can estimate values from a graph and use them to solve a problem or analyse statements relating quantities expressed in different numerical formats. They demonstrate an ability to work with ratios or problems that require a series of steps be performed in a specific order.

Level	What students can typically do
3	Students at Level 3 demonstrate more flexibility in devising and implementing solution strategies for problems that can be solved in a variety of ways. They are able to solve problems where the information given in the task must first be analysed to determine which of a given set of processes should be implemented, such as determining a fine for exceeding a speed limit based on different driving speeds or a model for computing charges for water-usage. At this level, students are able to use the basic properties of angles to solve a geometric problem or are able to translate between graphical and tabular representations of the same data. Students show an ability to approximate a final solution from interim results or to recognise how a given constraint affects the conclusion. They can work with percentages, fractions, decimal numbers, proportional relationships, and simple non-linear contexts.
2	Students at Level 2 show an ability to work with given models in flexible ways, such as identifying the relevant information to input or manipulating information to make it amenable to use in the model (including models with multiple inputs or tasks that require using a calculator tool specific to the context). They are also able to determine the input when given the output. Students can apply familiar geometric concepts to analyse a spatial pattern. At this level, students show an understanding of place value in decimal numbers and can use that understanding to compare numbers presented in a familiar context. They can apply a known procedure that first requires understanding a data table to extract the necessary information. Students are able to solve simple problems using proportional reasoning and work with ratios.
1a	Students at Level 1a can solve well-defined problems that require minimal decisions. For example, they can make direct inferences from textual information that points to an obvious strategy to solve a given problem, particularly where the mathematical procedures are one- or two-step arithmetic operations with whole numbers or require application of a familiar procedure. Students are able to extract information presented in a variety of formats, such as advertisements, simple pie charts, diagrams, or tables, which contain all the needed information to solve a problem. At this level, students can compute simple percentages, recognise when quantities are related proportionally, find the total area of a standard region, or determine a cost saving.
1b	At Level 1b, students can employ straightforward, one-step procedures that are clearly defined in the task, and where all information is presented in simple tabular format. For example, they are able to determine the winner of a tournament given the criterion for winning or locate information in a table based on a set of conditions.
1c	*There were no items to describe this level on the scale.*

Table 17.6. Summary descriptions of the proficiency levels on the Interpreting, applying and evaluating mathematical outcomes scale

Level	What students can typically do
6	At Level 6, students are able to link multiple complex mathematical representations in an analytical way to identify and extract data and information that enables conceptual and contextual questions to be answered. Students at this level demonstrate creativity in order to evaluate claims or interpret solutions to problems that require greater insight to solve, such as using a simulation to determine a design that satisfies several conditions. They are able to interpret data sets with multiple variables that typically require having to perform two or more operations before being able to evaluate a set of given claims related to the data set. Students can recognise different possible subdivisions of an irregular shape based on interpreting a list of geometric properties of the irregular shape. At this level, students can readily interpret or evaluate percentages, frequency distributions, and statistical measures, such as means and medians, in a variety of contexts.
5	At Level 5, students demonstrate the ability to interpret complex situations that require analyses of the underlying mathematics and can apply their understanding of mathematical concepts to real-world situations to make judgements on the reasonableness of claims or results. For example, students can explain why a possible mathematical model does not fit the real-world context. They can interpret experimental results and devise a method for comparing and ranking the results based on a given criterion. At this level, students can evaluate statistical statements based on means or product ratings presented in multiple formats, or they can manipulate a data set so that the presentation facilitates interpretation of the provided information.
4	At Level 4, students are able to interpret and evaluate situations or outcomes that typically involve satisfying multiple conditions, in a range of real-world contexts. They are able to interpret simple statistical or probabilistic statements from data presented in tables or charts in such contexts as fitness levels or genetics. Students at this level are able to interpret experimental results to infer a relationship between two variables in order to evaluate a claim or explain how the computational result of an experiment relates to a given set of specifications. They can determine if a solution is compatible with a particular context or recognise how different adjustments to an algorithm affect the results. At this level, students also are able to approach problems where their interpretation of the given information or model can influence the solution strategy they choose for the task.
3	Students at Level 3 show an ability to reflect on an outcome, or the process used to reach an outcome, in more complex contexts. For example, they can interpret an algebraic model of a design plan to determine what quantity a variable in the model represents or manipulate a set of data using a spreadsheet tool to analyse claims related to energy usage or changes in population data. Students are able to use simulation results to determine a relationship between two contextual variables or explain if a conjecture about a simple algorithm is true. Students demonstrate spatial reasoning by translating between two- and three-dimensional representations of solids or by understanding how properties of geometric figures are related. At this level, students can analyse relatively unfamiliar data presentations to support their conclusions or interpret solutions of non-integer values or ratios with respect to real-world contexts.
2	At Level 2, students can link conceptual and contextual elements of the problem to the mathematics in order to solve problems in a variety of real-world contexts where the information is presented clearly. Students are able to evaluate outcomes, often without having to perform calculations, such as determining the angle measures of an object based on interpreting a description of its properties. They can interpret

Level	What students can typically do
	context-specific language into simple mathematical relationships, sometimes involving one or two constraints, or understand how relationships presented in graphical formats relate to the context, such as a graph of distance versus time. At this level, students can run simulations and interpret the results with respect to the conditions of the task involving one variable.
1a	At Level 1a, students are able to locate and utilise information in order to make sense of the context. They can interpret information that requires relating two simple data sources, such as tables. For example, they can relate information in one table showing how points are awarded to another table of match outcomes to solve a problem in a familiar context or to understand how data from one source is represented in another source. Students at this level can also recognise when some of the given information can be ignored with respect to the specific task.
1b	At Level 1b, students are able to interpret contextual information presented in one of a variety of formats, such as two-way tables or work schedules. They demonstrate an ability to process the information given basic constraints imposed by the task, such as determining which rule from a table to apply or when to plan an event.
1c	Students at Level 1c can interpret information from real-world contexts presented in simple diagrams or tables and then use that information to solve well-defined problems involving a single operation with whole numbers or straightforward comparisons.

Table 17.7. Summary descriptions of the proficiency levels on the Mathematical reasoning scale

Level	What students can typically do
6	At Level 6, students use deductive and inductive reasoning to devise strategies to solve real-world problems that require inference and creativity to recognise the mathematical nature of the task. Tasks at this level are often presented abstractly and require reasoning to recognise how the context-specific language can be transformed into known mathematical concepts or procedures, which underlies making the mathematical context suitable for analysis. Students can solve problems that require visualising a nonstandard geometric model not explicitly shown or described in the task or that require a solid understanding of known algorithms. For example, they can transform given information to construct a visual model to represent a situation or they can use the definition of a procedure for computing a statistical measure to justify if a mathematical result is possible without having numerical values to manipulate. At this level, they use reasoning to critique the limits of a model, such as identifying if a model can or cannot be used in a particular situation, which is necessary for being able to interpret/evaluate the mathematical outcome in context. Students also use reasoning to construct mathematical arguments based on logic and contradictions, such as justifying if a conclusion can be made from a given data set or developing a counterexample in response to a claim.
5	At Level 5, students can recognise structure in problem situations that can be solved using an algorithmic approach. Students use computational thinking to design an optimal procedure, such as programming a sequence of commands, and then reflect on the solution to determine if it meets the given constraints. They can analyse situations and recognise how a known procedure or set of procedures can be applied as a way to justify, for example, if an object can fit into a particular space or if a plan for a geometric design is possible. At this level, they can determine how to develop an experiment and run simulations to collect data necessary for evaluating a context. Students can identify a counterexample or analyse a rule used in a pattern as a way to support a mathematical argument. Students also use reasoning to develop solution strategies by identifying which elements of a model vary and which are invariant.
4	At Level 4, students demonstrate reasoning ability by reflecting on solutions to explain mathematical concepts in real-world contexts. They can evaluate the reasonableness of a claim and provide mathematical justifications to either support or refute the claim, such as recognising how to apply a common procedure in a novel context or determining how to interpret data or information presented in articles, tables, or phone apps. At this level, students can use their understanding of arithmetic and algebraic properties to analyse how manipulating the variables in a model or the steps in a procedure will help explain the real-world results, or they can develop a model to derive a relationship between the variables used in an equation. Students can identify more complex geometric relationships from images of shapes or descriptions of their properties. They are able to reason inductively from sample results to inform decision making or reason about the likelihood of various outcomes related to a probability context.
3	At Level 3, students can apply reasoning by utilising definitions and making judgements necessary for transforming conceptual and contextual situations into mathematical problems. Students at this level can evaluate a claim based on devising simple strategies to connect the underlying mathematics with the context. They are able to solve problems that require making minimal assumptions, such as recognising the relative size of a region from a diagram or comparing graphs of population data. Students can reason about properties in a description of a geometric model to determine a simple algebraic relationship. At this level, they can also apply reasoning to solve problems involving familiar concepts presented in nonstandard ways, such as race results or statistical measures represented graphically on a coordinate plane.
2	At Level 2, students are able to use reasoning to infer relationships between conceptual and contextual elements in a problem or to devise a straight-forward strategy for evaluating a claim. For example, they can order objects by recognising how the size of various objects relates to distance traveled or how to use given assumptions to compare two rate plans with varying prices. Students at this level can also use spatial reasoning, when provided with a model or diagram, to recognise an alternate representation of an image or to analyse simple geometric properties of the model.
1a	At Level 1a, students use reasoning to draw conclusions based on their understanding of simple mathematical concepts, such as evaluating the likelihood of an outcome in a familiar probability context.
1b	*There were no items to describe this level on the scale.*
1c	*There were no items to describe this level on the scale.*

Table 17.8. Summary descriptions of the proficiency levels on the mathematical content subscale: Change and relationships

Level	What students can typically do
6	At Level 6, students use significant insight, abstract reasoning and argumentation skills and technical knowledge and conventions to solve problems involving relationships among variables and to generalise mathematical solutions to complex real-world problems. They are able to create and use an algebraic model of a functional relationship incorporating multiple quantities. They apply deep geometrical insight to work with complex patterns. And they are typically able to use complex proportional reasoning, and complex calculations with percentage to explore quantitative relationships and change.
5	At Level 5, students solve problems by using algebraic and other formal mathematical models, including in scientific contexts. They are typically able to use complex and multi-step problem-solving skills, and to reflect on and communicate reasoning and arguments, for example in evaluating and using a formula to predict the quantitative effect of change in one variable on another. They are able to use complex proportional reasoning, for example to work with rates, and they are generally able to work competently with formulae and with expressions including inequalities.
4	Students at Level 4 are typically able to understand and work with multiple representations, including algebraic models of real-world situations. They can reason about simple functional relationships between variables, going beyond individual data points to identifying simple underlying patterns. They typically employ some flexibility in interpretation and reasoning about functional relationships (for example in exploring distance-time-speed relationships) and are able to modify a functional model or graph to fit a specified change to the situation; and they are able to communicate the resulting explanations and arguments.
3	At Level 3, students can typically solve problems that involve working with information from two related representations (text, graph, table, formulae), requiring some interpretation, and using reasoning in familiar contexts. They show some ability to communicate their arguments. Students at this level can typically make a straight-forward modification to a given functional model to fit a new situation; and they use a range of calculation procedures to solve problems, including ordering data, time difference calculations, substitution of values into a formula, or linear interpolation.
2	Students at Level 2 are typically able to locate relevant information on a relationship from data provided in a table or graph and make direct comparisons, for example to match given graphs to a specified change process. They can reason about the basic meaning of simple relationships expressed in text or numeric form by linking text with a single representation of a relationship (graph, table, simple formula), and can correctly substitute numbers into simple formulae, sometimes expressed in words. At this level, student can use interpretation and reasoning skills in a straight-forward context involving linked quantities.
1a	Students at Level 1a are typically able to evaluate single given statements about a relationship expressed clearly and directly in a formula, table, or graph. Their ability to reason about relationships, and change in those relationships, is limited to simple expressions and to those located in familiar situations, such as contexts involving unit rates. They may apply simple calculations needed to solve problems related to clearly expressed relationships.
1b	*There were no items in the PISA 2022 Mathematics assessment to describe this level on the scale.*
1c	*There were no items in the PISA 2022 Mathematics assessment to describe this level on the scale.*

Table 17.9. Summary descriptions of the proficiency levels on the mathematical content subscale: Quantity

Level	What students can typically do
6	At Level 6 and above, students conceptualise and work with models of complex quantitative processes and relationships; devise strategies for solving problems; formulate conclusions, arguments and precise explanations; interpret and understand complex information, and link multiple complex information sources; interpret graphical information and apply reasoning to identify, model and apply a numeric pattern. They are able to analyse and evaluate interpretive statements based on data provided; work with formal and symbolic expressions; plan and implement sequential calculations in complex and unfamiliar contexts, including working with large numbers, for example to perform a sequence of currency conversions, entering values correctly and rounding results. Students at this level work accurately with decimal fractions; they use advanced reasoning concerning proportions, geometric representations of quantities, combinatorics and integer number relationships; and they interpret and understand formal expressions of relationships among numbers, including in a scientific context.
5	At Level 5, students are able to formulate comparison models and compare outcomes to determine best price; interpret complex information about real-world situations (including graphs, drawings and complex tables, for example two graphs using different scales); they are able to generate data for two variables and evaluate propositions about the relationship between them. Students are able to communicate reasoning and argument; recognise the significance of numbers to draw inferences; provide a written argument evaluating a proposition based on data provided. They can make an estimation using daily life knowledge; calculate relative and/or absolute change; calculate an average; calculate relative and/or absolute difference, including percentage difference, given raw difference data; and they can convert units (for example calculations involving areas in different units).
4	At Level 4, students are typically able to interpret complex instructions and situations; relate text-based numerical information to a graphic representation; identify and use quantitative information from multiple sources; deduce system rules from unfamiliar representations; formulate a simple numeric model; set up comparison models; and explain their results. They are typically able to carry out accurate and more complex or repeated calculations, such as adding 13 given times in hour/minute format; carry out time calculations using given data

Level	What students can typically do
	on distance and speed of a journey; perform simple division of large multiples in context; carry out calculations involving a sequence of steps and accurately apply a given numeric algorithm involving a number of steps. Students at this level can perform calculations involving proportional reasoning, divisibility or percentages in simple models of complex situations.
3	At Level 3, students typically use basic problem-solving processes, including devising a simple strategy to test scenarios, understand and work with given constraints, use trial and error, and use simple reasoning in familiar contexts. At this level students typically can interpret a text description of a sequential calculation process, and correctly implement the process; identify and extract data presented directly in textual explanations of unfamiliar data; interpret text and diagrams describing a simple pattern; perform calculations including working with large numbers, calculations with speed and time, conversion of units (for example from an annual rate to a daily rate). They understand place value involving mixed 2- and 3-decimal values and including working with prices; and are typically able to order a small series of (4) decimal values; calculate percentages of up to 3-digit numbers; and apply calculation rules given in natural language.
2	At Level 2, students can typically interpret simple tables to identify and extract relevant quantitative information; interpret a simple quantitative model (such as a proportional relationship) and apply it using basic arithmetic calculations. They are able to identify the links between relevant textual information and tabular data to solve word problems; interpret and apply simple models involving quantitative relationships; identify the simple calculation required to solve a straight-forward problem; carry out simple calculations involving the basic arithmetic operations, as well as ordering 2- and 3-digit whole numbers and decimal numbers with one or two decimal places, and calculate percentages.
1a	At Level 1a, students are typically able to solve basic problems in which relevant information is explicitly presented, and the situation is straightforward and limited in scope. They are able to handle situations where the required computational activity is obvious and the mathematical task is basic, such as performing one or two simple arithmetic operations with whole numbers or percentages. Students at this level can manipulate quantitative information to make it amenable to computational analysis, such as determining the total number of points earned by teams given a record of their wins and losses.
1b	At Level 1b, students can solve straight-forward problems that require single arithmetic operations with whole numbers or retrieving numerical information from a table or chart. For example, students can total the columns of a simple table and compare the results, or they can read and interpret a simple table of monetary amounts or a work schedule to satisfy a situation with a single constraint.
1c	*There were no items in the PISA 2022 Mathematics assessment to describe this level on the scale.*

Table 17.10. Summary descriptions of the proficiency levels on the mathematical content subscale: Space and shape

Level	What students can typically do
6	At Level 6, students are able to solve complex problems involving multiple representations or calculations; identify, extract, and link relevant information, for example by extracting relevant dimensions from a diagram or map and using scale to calculate an area or distance; they use spatial reasoning, significant insight and reflection, for example by interpreting text and related contextual material to formulate a useful geometric model and applying it taking into account contextual constraints; they are able to recall and apply relevant procedural knowledge from their mathematical knowledge base such as in circle geometry, trigonometry, Pythagoras's rule, or area and volume formulae to solve problems; and they are typically able to generalise results and findings, communicate solutions and provide justifications and argumentation.
5	At Level 5, students are typically able to solve problems that require appropriate assumptions to be made, or that involve reasoning from assumptions provided and taking into account explicitly stated constraints, for example in exploring and analysing the layout of a room and the furniture it contains. They solve problems using theorems or procedural knowledge such as symmetry properties, or similar triangle properties or formulas including those for calculating area, perimeter or volume of familiar shapes; they use well-developed spatial reasoning, argument and insight to infer relevant conclusions and to interpret and link different representations, for example to identify a direction or location on a map from textual information.
4	Students at Level 4 typically solve problems by using basic mathematical knowledge such as angle and side-length relationships in triangles, and doing so in a way that involves multistep, visual and spatial reasoning, and argumentation in unfamiliar contexts; they are able to link and integrate different representations, for example to analyse the structure of a three dimensional object based on two different perspectives of it; and typically they can compare objects using geometric properties.
3	At Level 3, students are able to solve problems that involve elementary visual and spatial reasoning in familiar contexts, such as calculating a distance or a direction from a map or a GPS device; they are typically able to link different representations of familiar objects or to appreciate properties of objects under some simple specified transformation; and at this level students can devise simple strategies and apply basic properties of triangles and circles, and can use appropriate supporting calculation techniques such as scale conversions needed to analyse distances on a map.
2	At Level 2, students are typically able to solve problems involving a single familiar geometric representation (for example, a diagram or other graphic) by comprehending and drawing conclusions in relation to clearly presented basic geometric properties and associated constraints. They can also evaluate and compare spatial characteristics of familiar objects in a situation where given constraints apply (such as comparing the height or circumference of two cylinders having the same surface area; or deciding whether a given shape can be dissected to produce another specified shape).
1a	Students at Level 1a can typically recognise and solve simple problems in a familiar context using pictures or drawings of familiar geometric objects and applying basic spatial skills such as recognising elementary symmetry properties, or comparing lengths or angle sizes, or using procedures such as dissection of shapes.

Level	What students can typically do
1b	*There were no items in the PISA 2022 Mathematics assessment to describe this level on the scale.*
1c	*There were no items in the PISA 2022 Mathematics assessment to describe this level on the scale.*

Table 17.11. Summary descriptions of the proficiency levels on the mathematical content subscale: Uncertainty and data

Level	What students can typically do
6	At Level 6, students are able to interpret, evaluate and critically reflect on a range of complex statistical or probabilistic data, information and situations to analyse problems. Students at this level bring insight and sustained reasoning across several problem elements; they understand the connections between data and the situations they represent and are able to make use of those connections to explore problem situations fully; they bring appropriate calculation techniques to bear to explore data or to solve probability problems; and they can produce and communicate conclusions, reasoning and explanations.
5	At Level 5, students are typically able to interpret and analyse a range of statistical or probabilistic data, information and situations to solve problems in complex contexts that require linking of different problem components. They can use proportional reasoning effectively to link sample data to the population they represent, can appropriately interpret data series over time and are systematic in their use and exploration of data. Students at this level can use statistical and probabilistic concepts and knowledge to reflect, draw inferences and produce and communicate results.
4	Students at Level 4 are typically able to activate and employ a range of data representations and statistical or probabilistic processes to interpret data, information and situations to solve problems. They can work effectively with constraints, such as statistical conditions that might apply in a sampling experiment, and they can interpret and actively translate between two related data representations (such as a graph and a data table). Students at this level can perform statistical and probabilistic reasoning to make contextual conclusions.
3	At Level 3, students are typically able to interpret and work with data and statistical information from a single representation that may include multiple data sources, such as a graph representing several variables, or from two simple related data representations such as a simple data table and graph. They are able to work with and interpret descriptive statistical, probabilistic concepts and conventions in contexts such as coin tossing or lotteries and make conclusions from data, such as calculating or using simple measures of centre and spread. Students at this level can perform basic statistical and probabilistic reasoning in simple contexts.
2	Students at Level 2 are typically able to identify, extract and comprehend statistical data presented in a simple and familiar form such as a simple table, a bar graph or pie chart; they can identify, understand and use basic descriptive statistical and probabilistic concepts in familiar contexts, such as tossing coins or rolling dice. At this level students can interpret data in simple representations, and apply suitable calculation procedures that connect given data to the problem context represented.
1a	At Level 1a, students can typically read and extract data from charts or two-way tables, and recognise how these data relate to the context. Students at this level can also use basic concepts of randomness to identify misconceptions in familiar experimental contexts, such as flipping a coin.
1b	Students at Level 1b, can typically read information presented in a well-labelled table to locate and extract specific data values while ignoring distracting information.
1c	*There were no items in the PISA 2022 Mathematics assessment to describe this level on the scale.*

Table 17.12. Cutpoints for the Reading Scale

Cut point	Level Name
698.32	Level 6
625.61	Level 5
552.89	Level 4
480.18	Level 3
407.47	Level 2
334.75	Level 1a
262.04	Level 1b
189.33	Level 1c

Table 17.13. Cutpoints for the Science Literacy Scale

Cut point	Level Name
707.93	Level 6
633.33	Level 5

558.73	Level 4
484.14	Level 3
409.54	Level 2
334.94	Level 1a
260.54	Level 1b[1]

Note: 1. Level 1b bandwidth is slightly narrower than others.

Table 17.14. Cut points for the Financial Literacy Scale

Cut point	Level Name
624.63	Level 5
549.86	Level 4
475.10	Level 3
400.33	Level 2
325.57	Level 1