Exhibit 1.1.3: Summary of TIMSS 2023 International Benchmarks of Mathematics Achievement

Advanced International Benchmark

625 *Students can select and relate information to implement appropriate operations to solve problems.* They can interpret the results of computations given in problem contexts, formulate a variety of expressions and patterns, and relate fractions and decimals. They can estimate and relate measures, apply knowledge of two- and three-dimensional shapes, identify simple properties of lines and angles, and show a basic understanding of surface area and perimeter in simple shapes. Students can interpret data and make choices about data given in numerous contexts.

High International Benchmark

550 *Students relate concepts or representations in extended contexts.* They can apply knowledge of properties of whole numbers to justify a solution. They show an understanding of the number line, multiples, factors, rounding numbers, and operations with fractions and decimals. Students can resolve measurement tasks across numerous contexts. They can relate two-dimensional shapes to unfamiliar three-dimensional figures and demonstrate basic understanding of angles. Students can interpret features of data representations and represent data in a variety of graphs.

Intermediate International Benchmark

475 *Students demonstrate mathematical knowledge in simple situations and relate representations.* They can perform computations with three-digit whole numbers in a variety of situations. They can add and order simple decimals. Students can measure straight distances and describe three-dimensional shapes. They can use data from multiple sources to relate representations.

Low International Benchmark

400 *Students demonstrate basic mathematical understanding.* They can add and subtract whole numbers with up to three digits, multiply and divide single-digit whole numbers, and solve simple word problems. They can apply basic measurement ideas and properties of common geometric shapes. Students can read data from different representations and complete simple bar graphs.

Exhibit 1.1.5: Description of the TIMSS 2023 Low International Benchmark (400) of Mathematics Achievement

Low International Benchmark

400

Summary

Students demonstrate basic mathematical understanding. They can add and subtract whole numbers with up to three digits, multiply and divide single-digit whole numbers, and solve simple word problems. They can apply basic measurement ideas and properties of common geometric shapes. Students can read data from different representations and complete simple bar graphs.

Students recognize place value and can order six-digit numbers. They can add and subtract to complete simple number sentences or word problems. Students demonstrate basic understanding of multiplication with one-digit numbers by identifying missing values in number sentences or the next number in a counting sequence.

Students show some knowledge of measurement units and simple two-dimensional geometric shapes including symmetric shapes.

Students can read data from tables, bar graphs, and pictographs and complete the bars and labels of simple bar graphs.

Exhibit 1.1.6: Description of the TIMSS 2023 Intermediate International Benchmark (475) of Mathematics Achievement

Intermediate International Benchmark

475

Summary

Students demonstrate mathematical knowledge in simple situations and relate representations. They can perform computations with three-digit whole numbers in a variety of situations. They can add and order simple decimals. Students can measure straight distances and describe three-dimensional shapes. They can use data from multiple sources to relate representations.

Students can perform basic arithmetic with whole numbers up to 3 digits, including multiplication of 3-digit by 1-digit whole numbers, and division with a remainder. They can apply a simple multistep rule, solve word problems involving single-digit multiplication and comparison, and round whole numbers. Students can identify missing numbers or operations in number sentences with whole numbers and up to two operations. Students can represent a situation given in words as an expression or number sentence. Students can add and order numbers with one decimal place.

Students can measure lengths with an on-screen ruler. They can compare units of measure and relate metric prefixes to select appropriate measurements of mass and volume. They can relate three-dimensional shapes to their two-dimensional representations, including when given in an interactive model.

Students can read and interpret information in tally charts and line graphs. They can integrate multiple data sources to complete a two-way table. Students can relate data in a table to the corresponding pie chart representation. They can combine data with additional information to solve word problems.

Exhibit 1.1.6a: TIMSS 2023 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 1

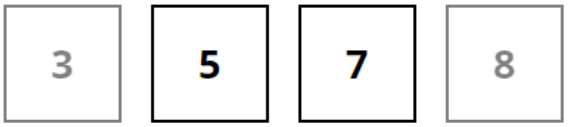
Content Domain: Number

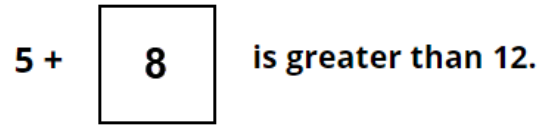
Cognitive Domain: Applying

Description: Identifies the missing number in two number sentences with inequalities

Make the number sentences true.

Drag one number card to each box.





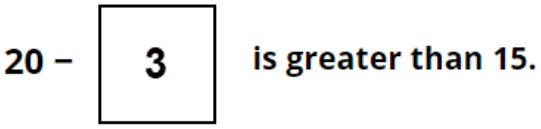


Exhibit 1.1.6b: TIMSS 2023 Intermediate International Benchmark (475) of Mathematics Achievement – Example Item 2

Content Domain: Data

Cognitive Domain: Applying

Description: Determines one or two out of three missing values in a table given conditions for the data (1 of 2 points)

Students in a class made three different origami animals using blue, red, and yellow paper. The table shows the number of animals that were made with each color paper.

Animal	Color Paper		
	Blue	Red	Yellow
 Tortoise	8	4	3
 Giraffe	3	2	10
 Fish	10	6	

Complete the table by solving this puzzle:

- There are the same number of blue fish as yellow giraffes.
- There are the same number of red fish as the other two red animals combined.
- There are 24 yellow animals in all.

The answer shown illustrates one type of response that would receive partial credit (1 of 2 points)

Exhibit 1.1.7: Description of the TIMSS 2023 High International Benchmark (550) of Mathematics Achievement

High International Benchmark

550

Summary

Students relate concepts or representations in extended contexts. They can apply knowledge of properties of whole numbers to justify a solution. They show an understanding of the number line, multiples, factors, rounding numbers, and operations with fractions and decimals. Students can resolve measurement tasks across numerous contexts. They can relate two-dimensional shapes to unfamiliar three-dimensional figures and demonstrate basic understanding of angles. Students can interpret features of data representations and represent data in a variety of graphs.

Students can multiply and divide 3-digit by 1-digit numbers and perform addition with more than two terms with up to 4-digit numbers and subtraction with up to 4 digits, including regrouping. Students can label different number line representations, including those involving place values and distances. They can integrate different number properties to support a conclusion, including identifying even and odd numbers, factors, and multiples. Students can identify, describe, and apply patterns and rules given in words or visual representations. They can represent situations with expressions involving several operations. Students can subtract one-place decimals and add two-place decimals.

Students can relate measures in a variety of contexts, including estimating full lengths given partial lengths, using non-standard units, and converting minutes to hours. They can classify and compare a variety of shapes and angles based on their properties. They can identify two-dimensional views that represent unfamiliar three-dimensional shapes and parallel lines on a grid and demonstrate some understanding of rotational symmetry.

Students can solve problems by interpreting data presented in tables, pictographs, and line and bar graphs. They can interpret the scale of graphs and use given information to complete pictographs, line graphs, and bar graphs.

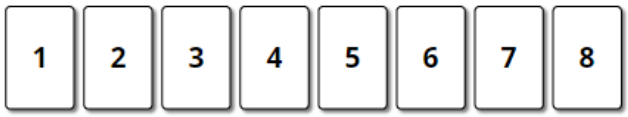
Exhibit 1.1.7a: TIMSS 2023 High International Benchmark (550) of Mathematics Achievement – Example Item 1

Content Domain: Number

Cognitive Domain: Reasoning

Description: Solves a problem set in a novel situation involving addition and comparison of whole numbers and justifies the solution

Mark and Keith are playing a game that uses these 8 cards.



They put the cards facedown so the numbers do not show. Then each player picks 2 cards. The player with the larger sum is the winner.

Mark picks the **8** card and the **2** card. The sum is 10.

Keith first picks the **4** card.

Can Keith win the game?

(Click one box.)

- [x] Yes
- [ ] No

Explain your answer.

he could pick 7 or 8

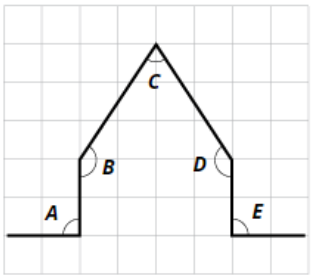
The answer shown illustrates one type of response that would receive full credit.
Other types of correct responses are possible as defined by the item's unique scoring guide.

Exhibit 1.1.7b: TIMSS 2023 High International Benchmark (550) of Mathematics Achievement – Example Item 2

Content Domain: Measurement and Geometry

Cognitive Domain: Knowing

Description: Classifies angle types in a figure



Identify the type of each angle in the diagram. Record your answers in the table.

Angle *A* is already done for you.

	Right angle	Smaller than a right angle	Larger than a right angle
A	☑	☐	☐
B	☐	☐	☑
C	☐	☑	☐
D	☐	☐	☑
E	☑	☐	☐

Exhibit 1.1.8: Description of the TIMSS 2023 Advanced International Benchmark (625) of Mathematics Achievement

Advanced International Benchmark

625

Summary

Students can select and relate information to implement appropriate operations to solve problems. They can interpret the results of computations given in problem contexts, formulate a variety of expressions and patterns, and relate fractions and decimals. They can estimate and relate measures, apply knowledge of two- and three-dimensional shapes, identify simple properties of lines and angles, and show a basic understanding of surface area and perimeter in simple shapes. Students can interpret data and make choices about data given in numerous contexts.

Students can integrate several number properties to solve multistep word problems involving whole numbers. They can interpret division results, including those with a remainder, to give the appropriate answer based on the problem context. Students can solve simple equations involving an unknown and formulate expressions and number sentences. They can apply a multiplication rule to find a number in a sequence. They can use an interactive table of values to determine and describe rules involving addition, multiplication, or multiples. Students can represent a simple fraction as a portion of a whole and make multiple comparisons, including comparing one-place decimals with two-place decimals.

Students can estimate quantities between graded intervals, including with a ruler. They can relate measures and constraints to solve multistep problems, such as interpreting a balanced scale to determine an unknown weight and relating duration with time. They can determine the area of a triangle or square using unit squares, draw a rectangle on a grid given its perimeter, and find missing lengths. Students can draw parallel or perpendicular lines on a grid and identify the properties of an angle in a closed shape. They can identify properties of simple polygons, draw a polygon to meet given requirements, and relate triangles to the composition of an irregular shape. Students can identify the number and shape of faces comprising a non-rectangular three-dimensional shape.

Students can represent data on a line graph and determine the best display for a given dataset. They can interpret data to determine what questions can be answered from data in a table, complete a table from listed observations, and solve multistep problems.

Exhibit 1.1.8a: TIMSS 2023 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 1

Content Domain: Measurement and Geometry

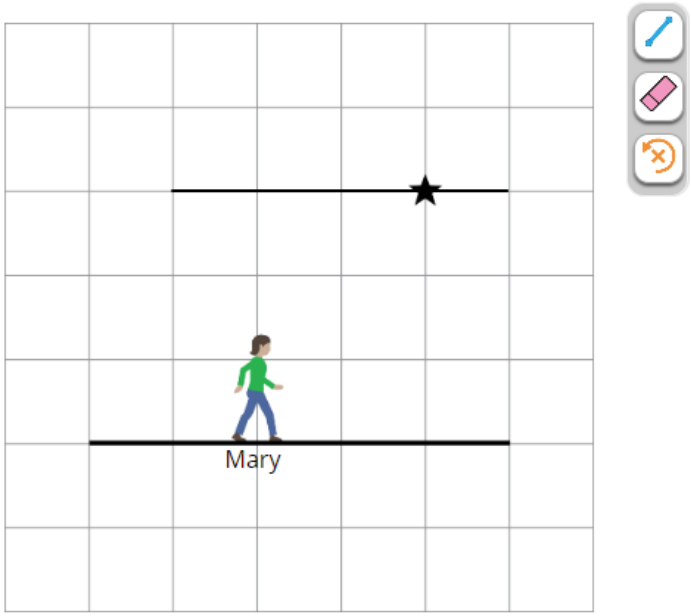
Cognitive Domain: Applying

Description: Draws a line on a square grid that is parallel to a given line and passes through a specified point

Mary is walking along a path in the park.

There is another path in the park that is **parallel** to Mary's path and goes through the ★ .

Draw the other path.



The answer shown illustrates one type of response that would receive full credit.
Other types of correct responses are possible as defined by the item's unique scoring guide.

Exhibit 1.1.8b: TIMSS 2023 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 2

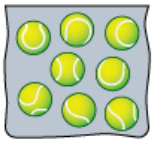
Content Domain: Number

Cognitive Domain: Applying

Description: Identifies an expression with division and addition that represents a situation

A sports coach needs to put 40 tennis balls and 10 soccer balls into bags.

Each bag can hold **either** 8 tennis balls **or** 2 soccer balls.



or

How can the sports coach calculate the total number of bags he will need?

A $40 + (10 \div 2)$

B $(40 \div 2) + (10 \div 8)$

C $(40 + 8) \div (10 + 2)$

D $(40 \div 8) + (10 \div 2)$

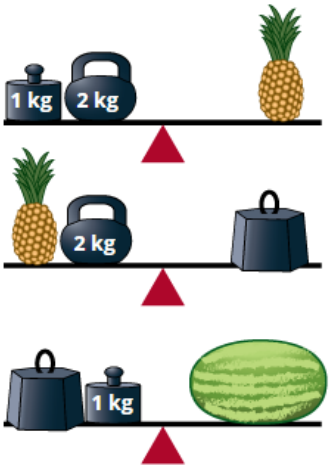
Exhibit 1.1.8c: TIMSS 2023 Advanced International Benchmark (625) of Mathematics Achievement – Example Item 3

Content Domain: Measurement and Geometry

Cognitive Domain: Reasoning

Description: Determines the weight of an object given a series of three balanced scales

On each scale the objects on the left weigh the same as the objects on the right.



How much does the  weigh?

A 3 kg

B 4 kg

C 5 kg

D 6 kg