Exhibit 3.12: Description of the TIMSS 2019 High International Benchmark (550) of Mathematics Achievement

High International Benchmark

550

Summary

Students can apply their understanding and knowledge in a variety of relatively complex situations. They can solve problems with fractions, decimals, ratios, and proportions. Students at this level show basic procedural knowledge related to algebraic expressions and equations. They can solve a variety of problems with angles, including problems involving triangles, parallel lines, rectangles, and congruent and similar figures. Students can interpret data in a variety of graphs and solve simple problems involving outcomes and probabilities.

Students can solve problems with fractions, decimals, ratios, and proportions.

Students at this level show basic procedural knowledge related to algebraic expressions. They can simplify expressions with integers. They can evaluate a variety of expressions and formulas, including those with exponents. They can identify algebraic expressions that represent real world situations. Students can identify the solutions of linear equations, a pair of simultaneous linear equations in two variables, and identify the values that satisfy two inequalities. They can determine a specific term of a numerical or geometric pattern.

Students can solve a variety of problems with angles, including problems involving triangles, parallel lines, rectangles, and congruent and similar figures. They can identify points in the Cartesian plane to draw lines and shapes. They can visualize rectangular solids.

Students can interpret data from pie charts, line graphs, and bar graphs to solve problems and provide explanations. They can calculate means. They can solve simple problems involving outcomes and probabilities.

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Exhibit 3.12.1: High International Benchmark of Mathematics Achievement – Example Item 1

Country	Percent Correct	
[2] Singapore	87 (1.4)	▲
Japan	82 (1.6)	▲
Korea, Rep. of	81 (1.9)	▲
Chinese Taipei	80 (1.7)	▲
[†] Hong Kong SAR	72 (2.1)	▲
[3] Israel	70 (2.0)	▲
Ireland	68 (2.3)	▲
England	67 (2.4)	▲
Australia	67 (2.0)	▲
Hungary	66 (2.1)	▲
Lithuania	61 (2.1)	▲
[†] United States	61 (1.7)	▲
[2] Russian Federation	60 (2.5)	▲
[†] New Zealand	57 (2.2)	
International Average	**54 (0.3)**	
[2] Kazakhstan	54 (2.5)	
Qatar	53 (2.2)	
Finland	52 (2.0)	
[†] Norway (9)	52 (2.3)	
Cyprus	52 (2.4)	
United Arab Emirates	52 (1.1)	
Romania	52 (2.3)	
Iran, Islamic Rep. of	51 (2.1)	
[1] Georgia	51 (2.8)	
[2] Sweden	50 (2.6)	
Malaysia	49 (1.9)	▽
France	49 (2.3)	▽
Chile	47 (3.3)	▽
Bahrain	46 (2.1)	▽
Italy	46 (2.5)	▽
Jordan	43 (2.1)	▽
[2] Egypt	43 (1.9)	▽
Portugal	43 (2.3)	▽
Kuwait	40 (2.3)	▽
[2] Saudi Arabia	40 (1.9)	▽
South Africa (9)	38 (1.3)	▽
Turkey	35 (1.9)	▽
Morocco	33 (1.4)	▽
Oman	33 (1.8)	▽
Lebanon	29 (2.1)	▽

Benchmarking Participants

Moscow City, Russian Fed.	67 (2.3)	▲
[2] Dubai, UAE	66 (2.1)	▲
Ontario, Canada	63 (2.3)	▲
Western Cape, RSA (9)	49 (2.2)	▽
Abu Dhabi, UAE	46 (1.8)	▽
[‡] Quebec, Canada	43 (2.4)	▽
Gauteng, RSA (9)	41 (1.7)	▽

Content Domain: Number
Cognitive Domain: Applying
Description: In a word problem dividing a quantity by a given ratio, determines the quantity of one of the parts

A piece of string was 45 cm long. Then, it was divided into two pieces in a ratio of 4:5.

What is the length of the shorter piece of string in cm?

A. 5
B. 20
C. 25
D. 36

▲ Percent significantly higher than international average
▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

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Exhibit 3.12.2: High International Benchmark of Mathematics Achievement – Example Item 2

Country	Percent Full Credit	
[2] Singapore	73 (2.1)	▲
Chinese Taipei	66 (2.0)	▲
[†] Hong Kong SAR	66 (2.3)	▲
[2] Russian Federation	60 (2.6)	▲
Korea, Rep. of	55 (2.3)	▲
Ireland	48 (2.4)	▲
Lithuania	48 (2.4)	▲
[2] Kazakhstan	47 (2.7)	▲
[3] Israel	46 (2.4)	▲
Japan	44 (1.9)	▲
[†] United States	43 (2.3)	▲
Hungary	43 (2.5)	▲
Romania	41 (2.3)	▲
England	40 (2.9)	
Cyprus	39 (1.9)	▲
Australia	37 (2.1)	
United Arab Emirates	36 (1.2)	
International Average	**35 (0.3)**	
Italy	35 (2.7)	
[1] Georgia	34 (2.6)	
Portugal	34 (2.3)	
Turkey	32 (2.2)	
Bahrain	31 (1.7)	
Oman	28 (1.7)	▽
Qatar	28 (2.1)	▽
Lebanon	27 (2.0)	▽
[2] Egypt	27 (2.0)	▽
Finland	25 (1.8)	▽
France	23 (2.0)	▽
[†] Norway (9)	23 (1.9)	▽
Iran, Islamic Rep. of	22 (1.5)	▽
[2] Sweden	22 (2.0)	▽
Malaysia	22 (1.5)	▽
Jordan	21 (1.8)	▽
[†] New Zealand	19 (1.5)	▽
South Africa (9)	17 (1.1)	▽
[2] Saudi Arabia	15 (1.6)	▽
Chile	14 (1.5)	▽
Kuwait	12 (1.8)	▽
Morocco	6 (1.0)	▽

Benchmarking Participants

Country	Percent Full Credit	
Moscow City, Russian Fed.	73 (2.1)	▲
[2] Dubai, UAE	52 (2.5)	▲
[‡] Quebec, Canada	44 (3.1)	▲
Ontario, Canada	44 (3.2)	▲
Western Cape, RSA (9)	28 (2.5)	▽
Abu Dhabi, UAE	28 (1.3)	▽
Gauteng, RSA (9)	20 (2.0)	▽

Content Domain: Algebra

Cognitive Domain: Applying

Description: Solves a word problem involving evaluating a formula with exponents

The stopping distance (*d*) meters depends on the speed (*v*) meters per second of the car when the brakes are applied. A formula for calculating this distance is:

$$d = \frac{2v + v^2}{20}$$

What is the stopping distance when $v = 20$?

$d = $ [22] m

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
( ) Standard errors appear in parentheses. Because of rounding some results may appear inconsistent.

SOURCE: IEA's Trends in International Mathematics and Science Study - TIMSS 2019
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Exhibit 3.12.3: High International Benchmark of Mathematics Achievement – Example Item 3

Country	Percent Full Credit	
Japan	79 (1.7)	▲
2 Singapore	70 (1.7)	▲
† Hong Kong SAR	66 (2.5)	▲
Korea, Rep. of	64 (2.5)	▲
Italy	59 (2.7)	▲
Lithuania	58 (2.6)	▲
Hungary	57 (2.4)	▲
Chinese Taipei	53 (2.2)	▲
2 Russian Federation	52 (2.5)	▲
† United States	51 (2.3)	▲
3 Israel	49 (2.2)	▲
England	48 (2.5)	▲
Portugal	48 (2.7)	▲
Turkey	47 (2.0)	▲
Finland	44 (2.0)	
Malaysia	42 (1.9)	
France	42 (2.0)	
International Average	**41 (0.3)**	
† Norway (9)	41 (2.5)	
Bahrain	40 (2.0)	
Cyprus	40 (2.2)	
2 Kazakhstan	39 (2.3)	
Chile	39 (2.2)	
Romania	39 (2.4)	
United Arab Emirates	38 (1.1)	▽
2 Sweden	38 (2.5)	
Ireland	35 (2.2)	▽
Qatar	33 (2.1)	▽
Iran, Islamic Rep. of	32 (2.0)	▽
Oman	28 (1.8)	▽
Australia	28 (1.7)	▽
1 Georgia	27 (2.3)	▽
Jordan	27 (2.1)	▽
Kuwait	26 (2.1)	▽
2 Egypt	23 (1.8)	▽
Morocco	22 (1.4)	▽
† New Zealand	21 (1.4)	▽
South Africa (9)	21 (0.9)	▽
Lebanon	20 (2.1)	▽
2 Saudi Arabia	10 (1.2)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	64 (1.9)	▲
Ontario, Canada	60 (2.9)	▲
2 Dubai, UAE	49 (2.9)	▲
‡ Quebec, Canada	46 (3.0)	
Abu Dhabi, UAE	35 (1.5)	▽
Western Cape, RSA (9)	27 (1.9)	▽
Gauteng, RSA (9)	27 (1.7)	▽

Content Domain: Geometry

Cognitive Domain: Reasoning

Description: Compares properties of two open cylinders made by rolling the same rectangle in different directions

Soh and Ben have identical rectangular pieces of paper. They use different ways to roll their papers into cylinders so that the opposite sides of the paper touch as shown below.

Soh's Method   **Ben's Method**

Compare the properties of the two cylinders.
Use the drop-down menus.

Height
Soh's cylinder   [> ▼]   Ben's cylinder

Diameter
Soh's cylinder   [< ▼]   Ben's cylinder

Surface Area (with open ends)
Soh's cylinder   [= ▼]   Ben's cylinder

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
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Exhibit 3.12.4: High International Benchmark of Mathematics Achievement – Example Item 4
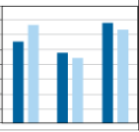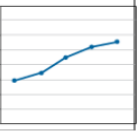
Content Domain: Data and Probability
Cognitive Domain: Applying
Description: Identifies an appropriate graph for three different types of data

Country	Percent Full Credit	
Japan	83 (1.2)	▲
2 Singapore	76 (1.8)	▲
Chinese Taipei	68 (1.8)	▲
Korea, Rep. of	67 (2.2)	▲
Ireland	64 (2.2)	▲
Australia	64 (2.1)	▲
Portugal	63 (2.8)	▲
England	61 (2.7)	▲
† Hong Kong SAR	61 (2.5)	▲
Hungary	58 (2.6)	▲
Lithuania	58 (2.2)	▲
† Norway (9)	58 (2.8)	▲
Turkey	58 (1.9)	▲
France	54 (2.3)	▲
Finland	54 (2.0)	▲
2 Russian Federation	54 (2.9)	▲
† New Zealand	53 (2.4)	▲
† United States	53 (2.2)	▲
3 Israel	52 (2.0)	▲
Italy	51 (2.5)	
Cyprus	50 (2.6)	
International Average	**47 (0.3)**	
Bahrain	45 (1.8)	
2 Sweden	45 (2.3)	
Malaysia	43 (1.8)	▽
United Arab Emirates	40 (0.9)	▽
Romania	38 (2.5)	▽
Chile	37 (2.2)	▽
Oman	37 (2.0)	▽
Qatar	34 (2.5)	▽
Kuwait	33 (2.8)	▽
2 Kazakhstan	31 (2.0)	▽
2 Saudi Arabia	29 (2.0)	▽
Jordan	26 (2.2)	▽
South Africa (9)	25 (1.1)	▽
Iran, Islamic Rep. of	25 (1.9)	▽
Lebanon	22 (2.1)	▽
Morocco	21 (1.3)	▽
1 Georgia	20 (1.8)	▽
2 Egypt	18 (1.4)	▽

Benchmarking Participants

Country	Percent Full Credit	
Moscow City, Russian Fed.	69 (2.5)	▲
Ontario, Canada	66 (2.3)	▲
‡ Quebec, Canada	65 (2.5)	▲
2 Dubai, UAE	59 (1.8)	▲
Western Cape, RSA (9)	39 (2.0)	▽
Gauteng, RSA (9)	33 (1.6)	▽
Abu Dhabi, UAE	31 (1.4)	▽

Lee wants to make three graphs to show information about his town. The titles of his graphs are shown in the table below.

Which type of graph is best for each?

Drag one type of graph to each title.

The answer shown illustrates the type of response that would receive full credit (1 point).

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
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Exhibit 3.12.5: High International Benchmark of Mathematics Achievement – Example Item 5

Country	Percent Correct	
Korea, Rep. of	70 (2.0)	▲
[2] Singapore	69 (1.9)	▲
Japan	65 (1.8)	▲
Chinese Taipei	63 (2.1)	▲
Ireland	57 (2.4)	▲
Australia	56 (2.0)	▲
Turkey	55 (2.2)	▲
Bahrain	52 (2.1)	▲
[†] United States	52 (2.2)	▲
England	50 (2.2)	▲
[†] Hong Kong SAR	49 (2.9)	▲
Finland	49 (2.1)	▲
Italy	48 (2.5)	▲
[†] New Zealand	48 (2.3)	▲
[†] Norway (9)	48 (2.8)	
Lithuania	46 (2.7)	
[3] Israel	46 (2.7)	
Iran, Islamic Rep. of	45 (2.8)	
International Average	**43 (0.4)**	
Hungary	43 (2.3)	
[2] Russian Federation	42 (2.6)	
[2] Sweden	42 (2.7)	
Cyprus	41 (2.4)	
Portugal	41 (2.6)	
[2] Kazakhstan	39 (2.7)	
France	38 (2.4)	▽
United Arab Emirates	38 (1.0)	▽
Chile	36 (1.9)	▽
Malaysia	35 (1.4)	▽
Jordan	34 (2.0)	▽
Oman	34 (1.6)	▽
Qatar	32 (2.3)	▽
Romania	30 (2.4)	▽
Kuwait	30 (2.0)	▽
[2] Egypt	27 (1.8)	▽
[2] Saudi Arabia	27 (1.9)	▽
[1] Georgia	27 (2.2)	▽
Morocco	26 (1.8)	▽
South Africa (9)	25 (1.2)	▽
Lebanon	22 (1.8)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	53 (2.3)	▲
Ontario, Canada	50 (3.0)	▲
[‡] Quebec, Canada	50 (2.4)	▲
[2] Dubai, UAE	48 (2.1)	▲
Western Cape, RSA (9)	35 (1.9)	▽
Abu Dhabi, UAE	34 (1.5)	▽
Gauteng, RSA (9)	28 (1.5)	▽

Content Domain: Data and Probability
Cognitive Domain: Applying
Description: Estimates the number of objects in a given probability sample

A bag contains 24 marbles, some white and some black.

A marble is chosen at random, its color is noted, and the marble is placed back into the bag. This is done 120 times, and a white marble appears 70 times.

How many white marbles are likely to be in the bag?

Ⓐ 7

Ⓑ 10

Ⓒ 12

Ⓓ 14

▲ Percent significantly higher than international average

▽ Percent significantly lower than international average

See Appendix B.7 for population coverage notes 1, 2, and 3. See Appendix B.10 for sampling guidelines and sampling participation notes †, ‡, and ≡.
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