Exhibit 3.13: Description of the TIMSS 2019 Advanced International Benchmark (625) of Mathematics Achievement

⬤ **Advanced** International Benchmark

625

Summary

Students can apply and reason in a variety of problem situations, solve linear equations, and make generalizations. They can solve a variety of fraction, proportion, and percent problems and justify their conclusions. They can understand linear functions and algebraic expressions. Students can use their knowledge of geometric figures to solve a wide range of problems involving angles, area, and surface area. They can calculate means and medians, and understand how changing data points can impact the mean. Students can interpret a wide variety of data displays to draw and justify conclusions, and solve multistep problems. They can solve problems involving expected values.

Students can solve a variety of fraction, proportion, and percent problems and justify their conclusions. They can reason with different representations of numbers in abstract and multistep problems.

Students can construct and solve linear equations in one or two variables. They can identify properties of linear functions from tables, graphs, and equations, including slopes and y-intercepts. Students can express generalizations either algebraically or in words, such as expressing the nth term in number patterns. They can simplify algebraic expressions.

Students can use their knowledge of geometric figures to solve a wide range of problems. They can solve a variety of problems about area and surface area, and use the Pythagorean theorem to find the side length of a triangle. Students can use their knowledge of the relationships between geometric figures, parallel lines, and angles to solve problems on the coordinate plane.

Students can calculate means and medians, and understand how changing data points can impact the mean. Students can interpret a wide variety of data displays to draw and justify conclusions, and solve multi-step problems. They can solve problems involving expected values.

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Country	Percent Full Credit	
Chinese Taipei	53 (2.0)	▲
Korea, Rep. of	52 (2.3)	▲
Japan	47 (2.1)	▲
2 Singapore	46 (2.1)	▲
Bahrain	30 (1.6)	▲
Cyprus	28 (2.3)	▲
2 Russian Federation	26 (2.5)	▲
† Hong Kong SAR	24 (2.8)	▲
Ireland	23 (2.1)	▲
Hungary	22 (1.9)	▲
3 Israel	22 (2.2)	
England	22 (2.8)	
Australia	21 (1.8)	
2 Kazakhstan	19 (1.9)	
International Average	**18 (0.3)**	
Turkey	18 (1.8)	
Iran, Islamic Rep. of	17 (1.9)	
† United States	17 (1.4)	
Romania	17 (1.8)	
† New Zealand	16 (1.1)	
Lithuania	16 (1.8)	
United Arab Emirates	14 (1.0)	▽
Portugal	14 (1.8)	▽
2 Sweden	13 (1.8)	▽
Finland	13 (1.4)	▽
† Norway (9)	10 (1.4)	▽
France	10 (1.4)	▽
2 Egypt	10 (1.3)	▽
Qatar	8 (1.4)	▽
Malaysia	8 (0.9)	▽
Italy	7 (1.2)	▽
Chile	6 (1.0)	▽
Jordan	6 (1.1)	▽
Kuwait	6 (1.3)	▽
Oman	6 (0.8)	▽
South Africa (9)	5 (0.5)	▽
Lebanon	5 (1.2)	▽
Morocco	4 (0.7)	▽
2 Saudi Arabia	4 (0.9)	▽
1 Georgia	- -	

Benchmarking Participants

Country	Percent Full Credit	
Moscow City, Russian Fed.	37 (2.9)	▲
2 Dubai, UAE	25 (2.2)	▲
Ontario, Canada	20 (2.4)	
‡ Quebec, Canada	18 (1.9)	
Western Cape, RSA (9)	12 (1.7)	▽
Abu Dhabi, UAE	10 (1.1)	▽
Gauteng, RSA (9)	7 (1.1)	▽

Content Domain: Number

Cognitive Domain: Reasoning

Description: Solves a multistep problem involving addition and subtraction of fractions

In the square below:

- The numbers in each row add to 1,
- The numbers in each column add to 1, and
- The numbers in both diagonals add to 1.

$\frac{8}{15}$		$\frac{2}{5}$
$\frac{1}{5}$	X	

What is the value of X?

$X = \dfrac{5}{15}$

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

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Exhibit 3.13.2: Advanced International Benchmark of Mathematics Achievement – Example Item 2

Country	Percent Full Credit	
[2] Singapore	74 (2.1)	▲
Chinese Taipei	66 (1.8)	▲
[†] Hong Kong SAR	61 (2.4)	▲
Korea, Rep. of	59 (2.8)	▲
[3] Israel	46 (2.7)	▲
Japan	42 (2.1)	▲
Cyprus	41 (2.3)	▲
[2] Russian Federation	40 (3.0)	▲
Romania	36 (2.8)	▲
Lithuania	34 (2.4)	▲
[2] Sweden	34 (2.2)	▲
Hungary	33 (2.6)	▲
[2] Kazakhstan	30 (2.2)	
Australia	29 (1.8)	
International Average	**26 (0.3)**	
[1] Georgia	26 (2.7)	
United Arab Emirates	25 (0.9)	
Bahrain	25 (1.7)	
[†] United States	24 (1.8)	
Turkey	23 (2.1)	
Ireland	23 (1.7)	
England	22 (2.5)	
Finland	21 (1.7)	▽
[†] Norway (9)	18 (1.7)	▽
Portugal	18 (1.8)	▽
[†] New Zealand	17 (1.4)	▽
[2] Egypt	17 (1.9)	▽
Iran, Islamic Rep. of	16 (1.9)	▽
Oman	15 (1.2)	▽
Italy	15 (1.9)	▽
France	14 (1.8)	▽
Lebanon	14 (1.9)	▽
Jordan	13 (1.3)	▽
Malaysia	12 (0.9)	▽
Qatar	12 (1.5)	▽
Kuwait	8 (1.7)	▽
Morocco	6 (1.1)	▽
Chile	5 (1.0)	▽
South Africa (9)	5 (0.5)	▽
[2] Saudi Arabia	3 (0.6)	▽

Benchmarking Participants

Country	Percent Full Credit	
Moscow City, Russian Fed.	51 (2.5)	▲
[‡] Quebec, Canada	46 (3.2)	▲
[2] Dubai, UAE	40 (1.9)	▲
Ontario, Canada	26 (2.4)	
Abu Dhabi, UAE	15 (1.2)	▽
Western Cape, RSA (9)	13 (1.9)	▽
Gauteng, RSA (9)	7 (1.2)	▽

Content Domain: Algebra

Cognitive Domain: Applying

Description: Constructs a linear equation for the perimeter of a triangle and solves for the length of one side

The perimeter of triangle *ABC* is 21 cm.

What is the value of x?

$x =$ [2.5] cm

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.

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Exhibit 3.13.3: Advanced International Benchmark of Mathematics Achievement – Example Item 3

Country	Percent Correct	
Japan	77 (1.7)	▲
Korea, Rep. of	77 (1.8)	▲
² Singapore	76 (1.9)	▲
Chinese Taipei	64 (2.1)	▲
† Hong Kong SAR	56 (2.7)	▲
² Russian Federation	34 (2.4)	▲
Hungary	32 (2.1)	▲
² Kazakhstan	32 (2.6)	▲
Romania	29 (2.5)	
Lithuania	28 (2.1)	
† Norway (9)	28 (2.3)	
Australia	28 (1.6)	
England	26 (2.3)	
International Average	**26 (0.3)**	
Cyprus	26 (2.0)	
Portugal	26 (2.4)	
Bahrain	25 (1.3)	
Italy	25 (2.1)	
Finland	23 (1.7)	▽
Ireland	22 (2.0)	▽
³ Israel	21 (1.9)	▽
† New Zealand	20 (1.9)	▽
Iran, Islamic Rep. of	20 (2.0)	▽
² Sweden	20 (2.0)	▽
Turkey	19 (1.7)	▽
United Arab Emirates	17 (0.8)	▽
Morocco	17 (1.4)	▽
Malaysia	16 (1.4)	▽
Lebanon	16 (1.6)	▽
France	16 (1.6)	▽
† United States	15 (1.4)	▽
Chile	14 (1.0)	▽
¹ Georgia	13 (2.2)	▽
² Egypt	13 (1.4)	▽
Qatar	13 (1.5)	▽
Oman	12 (1.0)	▽
² Saudi Arabia	11 (1.4)	▽
Jordan	11 (1.3)	▽
Kuwait	7 (1.5)	▽
South Africa (9)	6 (0.5)	▽
Benchmarking Participants		
Moscow City, Russian Fed.	41 (2.0)	▲
‡ Quebec, Canada	39 (2.8)	▲
² Dubai, UAE	27 (2.0)	
Ontario, Canada	25 (2.9)	
Abu Dhabi, UAE	13 (1.0)	▽
Western Cape, RSA (9)	9 (1.2)	▽
Gauteng, RSA (9)	8 (1.1)	▽

Content Domain: Geometry
Cognitive Domain: Reasoning
Description: Uses properties of supplementary angles to solve for an angle
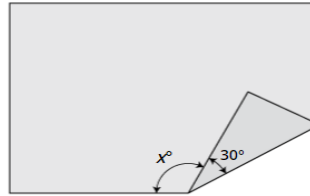
A rectangular piece of paper is folded at one corner, as shown above. What is the value of x?

Answer: 120

▲ 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 3.13.4: Advanced International Benchmark of Mathematics Achievement – Example Item 4

Country	Percent Correct	
Korea, Rep. of	71 (1.9)	▲
Japan	70 (1.9)	▲
Chinese Taipei	69 (1.8)	▲
[2] Singapore	66 (2.1)	▲
† Hong Kong SAR	64 (2.4)	▲
† Norway (9)	52 (2.6)	▲
[3] Israel	47 (2.3)	▲
Finland	47 (2.0)	▲
[2] Sweden	47 (2.4)	▲
Lithuania	46 (2.7)	▲
[2] Russian Federation	44 (3.1)	▲
Australia	43 (1.9)	▲
Ireland	42 (2.4)	▲
† United States	41 (1.6)	▲
Hungary	38 (2.7)	
France	38 (2.1)	
Portugal	37 (2.4)	
Turkey	37 (2.1)	
Italy	37 (2.1)	
International Average	**36 (0.3)**	
Cyprus	36 (2.1)	
† New Zealand	35 (1.8)	
England	35 (2.6)	
[2] Kazakhstan	32 (2.1)	▽
United Arab Emirates	30 (1.0)	▽
Bahrain	28 (2.0)	▽
Chile	27 (2.6)	▽
Malaysia	26 (1.4)	▽
Qatar	25 (2.1)	▽
Iran, Islamic Rep. of	24 (2.0)	▽
[1] Georgia	24 (2.3)	▽
Romania	23 (2.1)	▽
Morocco	21 (1.3)	▽
[2] Egypt	20 (1.6)	▽
Oman	20 (1.3)	▽
Kuwait	19 (1.9)	▽
[2] Saudi Arabia	18 (1.2)	▽
Jordan	17 (1.8)	▽
Lebanon	11 (1.5)	▽
South Africa (9)	10 (0.7)	▽

Benchmarking Participants

Moscow City, Russian Fed.	53 (2.3)	▲
‡ Quebec, Canada	51 (2.6)	▲
[2] Dubai, UAE	40 (2.3)	
Ontario, Canada	39 (2.6)	
Abu Dhabi, UAE	25 (1.5)	▽
Western Cape, RSA (9)	18 (1.6)	▽
Gauteng, RSA (9)	13 (1.2)	▽

Content Domain: Data and Probability
Cognitive Domain: Applying
Description: Determines the change in a mean given changes in individual scores

A relay team for a 400 m race has 4 runners. They took 12 seconds, 13 seconds, 11 seconds, and 13 seconds, respectively, to complete their legs of the race.

In the next race, 2 of the runners each improved their times by 2 seconds, and the other 2 had the same times as before. By how many seconds did the team's mean running time improve?

A 0 sec.
B 1 sec.
C 2 sec.
D 4 sec.

▲ 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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