TIMSS ·USA·

8

RELEASED MATHEMATICS ITEMS

This book contains the released Trends in International Mathematics and Science Study (TIMSS) 2011 grade 8 mathematics assessment items. This is not a complete set of all TIMSS 2011 assessment items because some items are kept confidential so that they may be used in subsequent cycles of TIMSS to measure trends.

How Can This Set of Released Items Be Used?

In Teacher-designed Assessments. The items in this book present different ways of measuring students' understanding in various content and cognitive domains. A teacher may use these items to create an assessment according to the needs of the class after reviewing the items and selecting items of interest.

For Feedback on Student Understanding. Student responses can be scored according to the scoring information provided in the book. Items that coincide with concepts taught in class allow the teacher to gain feedback on the students' understanding of assessed concepts. For example, a teacher might decide to examine the incorrect or partially correct responses of the class. The teacher might use the items to identify particular difficulties or misconceptions experienced by individual students, which can serve as the basis for some remedial teaching or focused practice.

To Benchmark Student Performance. The teacher might also compare the percent of students in the class who responded correctly to an item with the percent of students who responded correctly to the same item in other education systems or in the United States.

This book contains TIMSS 2011 released items for grade 8. Each item appears on a single page, on which is provided information about the item's classification and about international student performance on the item. The items appear in the content domain order, as shown in the index on the next page.

Information about item classification

Take a look at the first item on page 1. Across the top are three boxes which identify the item's **content domain** (the subject matter in mathematics that the item assesses), its **main topic** (the specific topic assessed within that subject matter), and its **cognitive domain** (the cognitive or thinking process assessed). For this item, the content domain is number, the main topic is fractions and decimals, and the cognitive domain is applying.

Below the row of boxes and above a boxed-in area of the page is the **item label**. For this item, it is *Ann and Jenny divide 560 zeds*. Below the boxed-in area is the item number, which is more commonly used to identify each item than the item label. Within the boxed-in area is the item as it appeared in student test booklets.

Correct answers are shown beneath each item. The correct answer for multiple-choice items is simply a letter code. For example, in the item *M032094* on page 3, the letter code A is the correct answer. The correct answers for write-in or open-ended items are explained in a scoring guide. For example, the *Ann and Jenny divide 560 zeds* (page 1) provides an example of a scoring guide, indicating the general nature of correct and incorrect

responses. In some cases, partial credit may be awarded and these items will provide guidelines for fully correct, partially correct, and incorrect responses. Sample student responses are provided for some of the constructed-response items for each scoring category.

Information about international student performance

In the table along the right-hand side of the page are the **percent correct** statistics for the item. These consist of statistics on the percentage of students in each education system who could answer the question correctly. The lists of education systems are ordered in terms of this percentage. The international average is included as well.

To the right of some of the percent correct statistics are **special symbols** that indicate when an education system scored significantly higher or significantly lower than the international average. Thus, on the item *Ann and Jenny divide 560 zeds* as an example, an estimated 25 percent of U.S. students could correctly answer this item, a percentage that was not measurably different than the international average, after taking into account the standard of error associated with the percent correct statistic for the United States and for the international average.

TIMSS ·USA·

ITEM INDEX
Grade 8

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Applying

Ann and Jenny divide 560 zeds

Ann and Jenny divide 560 zeds between them. If Jenny gets $\frac{3}{8}$ of the money, how many zeds will Ann get?

Answer: _____

Item Number: M032064

SCORING

Correct Response

• 350

Incorrect Response

• 210

• 5/8

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	76 ⬡
Korea, Rep. of	67 ⬡
Hong Kong-CHN	61 ⬡
Chinese Taipei-CHN	60 ⬡
Finland	48 ⬡
Russian Federation	48 ⬡
Japan	45 ⬡
Israel	43 ⬡
Hungary	40 ⬡
Sweden	37 ⬡
England-GBR	34 ⬡
Australia	34 ⬡
Italy	34 ⬡
Lithuania	33 ⬡
Malaysia	32 ⬡
Norway	30
Kazakhstan	28
Turkey	28
New Zealand	28
International average	27
United States	**25**
Slovenia	25
Ukraine	24
Armenia	23 ⬢
Georgia	23 ⬢
Tunisia	21 ⬢
Romania	20 ⬢
United Arab Emirates	17 ⬢
Iran, Islamic Rep. of	17 ⬢
Macedonia, Rep. of	16 ⬢
Qatar	16 ⬢
Chile	14 ⬢
Thailand	13 ⬢
Palestinian Nat'l Auth.	12 ⬢
Lebanon	10 ⬢
Bahrain	10 ⬢
Indonesia	9 ⬢
Saudi Arabia	8 ⬢
Oman	7 ⬢
Jordan	7 ⬢
Morocco	6 ⬢
Syrian Arab Republic	6 ⬢
Ghana	3 ⬢

Benchmarking education system

Education system	Percent correct
Quebec-CAN	45 ⬡
North Carolina-USA	40 ⬡
Minnesota-USA	38 ⬡
Massachusetts-USA	36 ⬡
Ontario-CAN	31
Connecticut-USA	30
Colorado-USA	29
Alberta-CAN	29
Indiana-USA	28
Dubai-UAE	25
Florida-USA	23
California-USA	17 ⬢
Abu Dhabi-UAE	15 ⬢
Alabama-USA	14 ⬢

⬡ Percent higher than International average
⬢ Percent lower than International average

Ann and Jenny divide 560 zeds (continued)

M032064

Student Responses

Correct Response:

Answer: 350

Incorrect Response:

Answer: $\frac{5}{8}$

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

4/100 plus 3/1000

$$\frac{4}{100} + \frac{3}{1000} =$$

A. 0.043

B. 0.1043

C. 0.403

D. 0.43

Item Number: M032094

Correct Response:	A

Overall Percent Correct

Education system	Percent correct
Singapore	92 ⬢
Korea, Rep. of	89 ⬢
Hong Kong-CHN	86 ⬢
Chinese Taipei-CHN	85 ⬢
Russian Federation	83 ⬢
Lebanon	81 ⬢
Japan	77 ⬢
Israel	77 ⬢
Italy	74 ⬢
Malaysia	73 ⬢
Slovenia	70 ⬢
Kazakhstan	69 ⬢
Lithuania	68 ⬢
Finland	68 ⬢
United Arab Emirates	68 ⬢
Tunisia	68 ⬢
Australia	68 ⬢
Sweden	67 ⬢
Armenia	66 ⬢
Ukraine	65
Hungary	63
United States	**63**
International average	62
Palestinian Nat'l Auth.	59
England-GBR	57 ⬢
Georgia	55 ⬢
Romania	54 ⬢
Thailand	54 ⬢
Macedonia, Rep. of	52 ⬢
Qatar	52 ⬢
New Zealand	51 ⬢
Iran, Islamic Rep. of	50 ⬢
Turkey	50 ⬢
Jordan	49 ⬢
Norway	49 ⬢
Morocco	49 ⬢
Saudi Arabia	49 ⬢
Bahrain	48 ⬢
Syrian Arab Republic	48 ⬢
Oman	47 ⬢
Indonesia	46 ⬢
Chile	41 ⬢
Ghana	34 ⬢

Benchmarking education system

North Carolina-USA	77 ⬢
Massachusetts-USA	76 ⬢
Minnesota-USA	72 ⬢
Dubai-UAE	71 ⬢
Quebec-CAN	71 ⬢
Connecticut-USA	70 ⬢
Indiana-USA	70 ⬢
Alberta-CAN	69 ⬢
Abu Dhabi-UAE	67
Ontario-CAN	65
Florida-USA	64
Colorado-USA	60
California-USA	58
Alabama-USA	45 ⬢

⬢ Percent higher than International average
⬢ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

Best estimate of (7.21x3.86)/10.09

Which of these is the BEST estimate of $\dfrac{7.21 \times 3.86}{10.09}$?

A. $\dfrac{7 \times 3}{10}$

B. $\dfrac{7 \times 4}{10}$

C. $\dfrac{7 \times 3}{11}$

D. $\dfrac{7 \times 4}{11}$

Item Number: M032166

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Singapore	92 ⌃
Hong Kong-CHN	90 ⌃
United States	**80 ⌃**
Russian Federation	79 ⌃
Finland	78 ⌃
Lithuania	77 ⌃
Japan	77 ⌃
Chinese Taipei-CHN	73 ⌃
Sweden	71 ⌃
Norway	71 ⌃
Korea, Rep. of	70 ⌃
Slovenia	69 ⌃
Ukraine	66 ⌃
Italy	66 ⌃
Australia	66 ⌃
England-GBR	65 ⌃
Hungary	64 ⌃
Israel	61 ⌃
Romania	58
International average	57
New Zealand	56
Malaysia	54
Macedonia, Rep. of	53
United Arab Emirates	52 ⌄
Armenia	52
Georgia	50 ⌄
Thailand	49 ⌄
Saudi Arabia	49 ⌄
Turkey	47 ⌄
Qatar	47 ⌄
Kazakhstan	46 ⌄
Lebanon	46 ⌄
Tunisia	45 ⌄
Bahrain	43 ⌄
Chile	43 ⌄
Palestinian Nat'l Auth.	42 ⌄
Iran, Islamic Rep. of	39 ⌄
Jordan	37 ⌄
Indonesia	36 ⌄
Oman	34 ⌄
Morocco	30 ⌄
Syrian Arab Republic	26 ⌄
Ghana	26 ⌄

Benchmarking education system	
Quebec-CAN	82 ⌃
Alberta-CAN	79 ⌃
Ontario-CAN	71 ⌃
Dubai-UAE	59
Abu Dhabi-UAE	48 ⌄
Minnesota-USA	89 ⌃
Connecticut-USA	87 ⌃
North Carolina-USA	86 ⌃
Massachusetts-USA	85 ⌃
Indiana-USA	85 ⌃
Florida-USA	81 ⌃
Colorado-USA	80 ⌃
California-USA	76 ⌃
Alabama-USA	70 ⌃

⌃ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Ratio, Proportion and Percent	Applying

The percentage of caps for sale

Color of Caps

The pie chart shows the percentage of caps for sale at a sporting goods store. If there are 200 caps, what is the total number of caps that are either white or green?

A.   55

B.   100

C.   110

D.   145

Item Number: M032595

Correct Response: **C**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	90 ⬟
Singapore	89 ⬟
Hong Kong-CHN	87 ⬟
Chinese Taipei-CHN	84 ⬟
Finland	80 ⬟
Japan	79 ⬟
Lithuania	66 ⬟
England-GBR	63 ⬟
Hungary	63 ⬟
Sweden	62 ⬟
Slovenia	61 ⬟
Italy	60 ⬟
United States	**59** ⬟
Israel	59 ⬟
Australia	58 ⬟
New Zealand	56 ⬟
Russian Federation	54 ⬟
Norway	54 ⬟
Turkey	53 ⬟
Ukraine	51
International average	49
Malaysia	46
Armenia	46
Chile	45
Kazakhstan	42 ⬢
Thailand	42 ⬢
Iran, Islamic Rep. of	40 ⬢
Qatar	38 ⬢
United Arab Emirates	38 ⬢
Romania	37 ⬢
Indonesia	36 ⬢
Saudi Arabia	34 ⬢
Bahrain	33 ⬢
Georgia	33 ⬢
Macedonia, Rep. of	32 ⬢
Lebanon	28 ⬢
Tunisia	28 ⬢
Syrian Arab Republic	25 ⬢
Oman	23 ⬢
Morocco	21 ⬢
Palestinian Nat'l Auth.	18 ⬢
Ghana	14 ⬢
Jordan	13 ⬢

Benchmarking education system

Massachusetts-USA	76 ⬟
Minnesota-USA	73 ⬟
Colorado-USA	67 ⬟
Alberta-CAN	67 ⬟
Quebec-CAN	67 ⬟
Indiana-USA	65 ⬟
Connecticut-USA	65 ⬟
North Carolina-USA	63 ⬟
Ontario-CAN	59 ⬟
Florida-USA	58 ⬟
California-USA	50
Dubai-UAE	42 ⬢
Alabama-USA	40
Abu Dhabi-UAE	39 ⬢

⬟ Percent higher than International average
⬢ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Whole Numbers	Knowing

36 as a product of prime factors

Which of these shows how 36 can be expressed as a product of prime factors?

A. 6×6

B. 4×9

C. $4 \times 3 \times 3$

D. $2 \times 2 \times 3 \times 3$

Item Number: M032626

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	90 △
Chinese Taipei-CHN	88 △
Singapore	79 △
Hong Kong-CHN	73 △
Hungary	69 △
Russian Federation	68 △
Italy	66 △
Thailand	65 △
United States	**64** △
Ukraine	59 △
Jordan	58 △
Palestinian Nat'l Auth.	56 △
Armenia	55 △
Turkey	53
Lebanon	52
Israel	52
England-GBR	51
United Arab Emirates	49
International average	49
Norway	49
Tunisia	49
Romania	49
Georgia	48
Qatar	46
Slovenia	45
Australia	45 ▽
New Zealand	43 ▽
Iran, Islamic Rep. of	43 ▽
Indonesia	43 ▽
Saudi Arabia	43 ▽
Ghana	43 ▽
Kazakhstan	41 ▽
Japan	37 ▽
Macedonia, Rep. of	37 ▽
Oman	35 ▽
Lithuania	35 ▽
Malaysia	34 ▽
Bahrain	32 ▽
Syrian Arab Republic	31 ▽
Sweden	29 ▽
Finland	29 ▽
Chile	29 ▽
Morocco	13 ▽
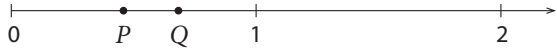
Benchmarking education system

Massachusetts-USA	81 △
Minnesota-USA	72 △
Indiana-USA	69 △
North Carolina-USA	69 △
California-USA	67 △
Colorado-USA	66 △
Dubai-UAE	60 △
Connecticut-USA	57 △
Florida-USA	54
Alabama-USA	51
Alberta-CAN	48
Ontario-CAN	45
Abu Dhabi-UAE	44
Quebec-CAN	44 ▽

△ Percent higher than International average
▽ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Reasoning
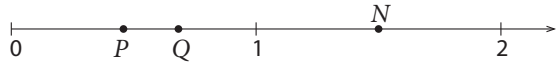
Location of N on number line
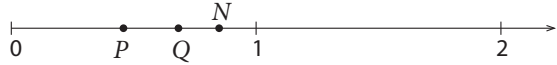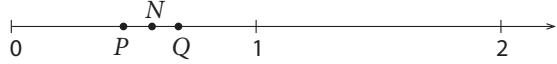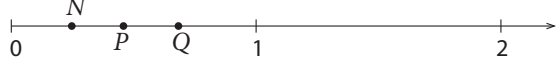
P and Q represent two fractions on the number line above.

$P \times Q = N$.

Which of these shows the location of N on the number line?

A.

B.

C.

D.

Item Number: M032662

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	53 ⬆
Hong Kong-CHN	47 ⬆
Singapore	45 ⬆
Korea, Rep. of	44 ⬆
Japan	43 ⬆
Russian Federation	31 ⬆
Sweden	30 ⬆
England-GBR	29 ⬆
Finland	29 ⬆
Palestinian Nat'l Auth.	28 ⬆
Israel	27 ⬆
Oman	26 ⬆
Syrian Arab Republic	25
Saudi Arabia	25
Jordan	24
Australia	23
Hungary	23
International average	23
United States	**22**
Qatar	22
Slovenia	21
Bahrain	21
New Zealand	19
Ukraine	19 ⬇
Lebanon	18 ⬇
Malaysia	18 ⬇
Lithuania	18 ⬇
Macedonia, Rep. of	17 ⬇
Iran, Islamic Rep. of	16 ⬇
Morocco	16 ⬇
Italy	16 ⬇
Norway	15 ⬇
Armenia	15 ⬇
United Arab Emirates	15 ⬇
Turkey	15 ⬇
Tunisia	14 ⬇
Kazakhstan	14 ⬇
Chile	14 ⬇
Georgia	13 ⬇
Ghana	13 ⬇
Romania	12 ⬇
Thailand	12 ⬇
Indonesia	10 ⬇

Benchmarking education system

	Percent correct
Massachusetts-USA	44 ⬆
Minnesota-USA	38 ⬆
North Carolina-USA	36 ⬆
Connecticut-USA	30 ⬆
Quebec-CAN	29 ⬆
Ontario-CAN	27 ⬆
Alberta-CAN	24
Colorado-USA	21
Florida-USA	20
California-USA	19
Indiana-USA	19
Abu Dhabi-UAE	16 ⬇
Dubai-UAE	14 ⬇
Alabama-USA	13 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

Write 3 5/6 in decimal form

Write $3\dfrac{5}{6}$ in decimal form, rounded to 2 decimal places.

Answer: _____

Item Number: M032725

SCORING

Correct Response

• 3.83

Incorrect Response

• 3.56

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	78 ⬆
Singapore	73 ⬆
Korea, Rep. of	65 ⬆
Chinese Taipei-CHN	61 ⬆
Japan	46 ⬆
Tunisia	41 ⬆
Russian Federation	39 ⬆
Kazakhstan	37 ⬆
Australia	31 ⬆
Slovenia	29
Hungary	29
Malaysia	29
Israel	29
United States	**29** ⬆
Italy	27
Armenia	27
Finland	25
Lithuania	25
International average	25
Sweden	25
England-GBR	24
United Arab Emirates	24
Ukraine	22
Macedonia, Rep. of	21
Norway	19 ⬇
Romania	19 ⬇
Morocco	18 ⬇
Georgia	18 ⬇
New Zealand	18 ⬇
Thailand	15 ⬇
Palestinian Nat'l Auth.	14 ⬇
Saudi Arabia	14 ⬇
Bahrain	13 ⬇
Qatar	12 ⬇
Indonesia	8 ⬇
Oman	8 ⬇
Ghana	6 ⬇
Chile	6 ⬇
Iran, Islamic Rep. of	5 ⬇
Jordan	5 ⬇
Syrian Arab Republic	4 ⬇
Lebanon	3 ⬇
Turkey	3 ⬇

Benchmarking education system

Minnesota-USA	42 ⬆
Massachusetts-USA	42 ⬆
Alberta-CAN	42 ⬆
North Carolina-USA	41 ⬆
Quebec-CAN	37 ⬆
Indiana-USA	35 ⬆
Florida-USA	35 ⬆
Connecticut-USA	34 ⬆
Ontario-CAN	31 ⬆
Dubai-UAE	26
Colorado-USA	23
Alabama-USA	22
Abu Dhabi-UAE	21
California-USA	20

⬆ Percent higher than International average
⬇ Percent lower than International average

Write 3 5/6 in decimal form (continued)

M032725

Student Responses

Correct Response:

Answer: _____3.83_____

Incorrect Response:

Answer: _____3.333_____

Content Domain	Main Topic	Cognitive Domain
NUMBER	Whole Numbers	Reasoning

Numbers to get greatest results

Place the four digits 3, 5, 7, and 9 into the boxes below in the positions that would give the greatest result when the two numbers are multiplied.

$$\begin{array}{r}\square\ \square \\ \times\ \square\ \square \\ \hline \end{array}$$

Item Number: M042002

SCORING

Correct Response

• 93 x 75 OR 75 x 93

Incorrect Response

• 95 x 73 OR 73 x 95

• 97 x 53 OR 53 x 97

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	63 ⬆
Singapore	55 ⬆
Japan	51 ⬆
Chinese Taipei-CHN	50 ⬆
Norway	47 ⬆
Israel	46 ⬆
Korea, Rep. of	42 ⬆
New Zealand	41 ⬆
England-GBR	41 ⬆
United States	**38** ⬆
Russian Federation	37 ⬆
Sweden	36 ⬆
Slovenia	36 ⬆
Hungary	35 ⬆
Australia	34 ⬆
Finland	32
Italy	31
Kazakhstan	29
International average	28
Malaysia	25
Lithuania	25
Macedonia, Rep. of	24
Ukraine	23 ⬇
Tunisia	22 ⬇
Iran, Islamic Rep. of	22 ⬇
Armenia	21 ⬇
United Arab Emirates	21 ⬇
Turkey	20 ⬇
Thailand	20 ⬇
Palestinian Nat'l Auth.	19 ⬇
Syrian Arab Republic	19 ⬇
Saudi Arabia	19 ⬇
Qatar	18 ⬇
Jordan	18 ⬇
Romania	17 ⬇
Georgia	17 ⬇
Lebanon	15 ⬇
Morocco	13 ⬇
Chile	13 ⬇
Oman	13 ⬇
Bahrain	12 ⬇
Indonesia	10 ⬇
Ghana	2 ⬇

Benchmarking education system	
Quebec-CAN	51 ⬆
Massachusetts-USA	48 ⬆
Minnesota-USA	47 ⬆
Ontario-CAN	47 ⬆
North Carolina-USA	45 ⬆
Alberta-CAN	42 ⬆
Connecticut-USA	39 ⬆
Indiana-USA	38 ⬆
Florida-USA	35 ⬆
Colorado-USA	34
California-USA	33
Alabama-USA	27
Dubai-UAE	24
Abu Dhabi-UAE	23 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Numbers to get greatest results (continued)
M042002

Student Responses

Correct Response:

$$
\begin{array}{r}
^{4}\;\boxed{7}\;\boxed{5} \\
\times\; \boxed{9}\;\boxed{3} \\
\hline
2\,2\,5 \\
6\,7\,5 \\
\hline
6\,9\,7\,5
\end{array}
$$

Incorrect Response:

$$
\begin{array}{r}
\boxed{9}\;\boxed{7} \\
\times\; \boxed{5}\;\boxed{3} \\
\hline
5\,1\,4\,1
\end{array}
$$

Content Domain	Main Topic	Cognitive Domain
NUMBER	Whole Numbers	Applying

Express 256 X 4,096 as power of 4

Look at this table:

4^1	4^2	4^3	4^4	4^5	4^6
4	16	64	256	1,024	4,096

Use the table to express the value of $256 \times 4{,}096$ as a power of 4.

A. 4^{10}

B. 4^{16}

C. 4^{20}

D. 4^{24}

Item Number: M042016

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	74 ⬆
Lebanon	73 ⬆
Russian Federation	72 ⬆
Korea, Rep. of	70 ⬆
Singapore	70 ⬆
Chinese Taipei-CHN	69 ⬆
Italy	67 ⬆
United States	**63** ⬆
Ukraine	63 ⬆
United Arab Emirates	62 ⬆
Israel	59 ⬆
Lithuania	57 ⬆
Kazakhstan	57 ⬆
Slovenia	55
Hungary	53
Armenia	53
Qatar	52
Finland	51
International average	51
Romania	49
England-GBR	48
Macedonia, Rep. of	48
Australia	47
Saudi Arabia	46 ⬇
Japan	46 ⬇
Iran, Islamic Rep. of	45 ⬇
New Zealand	45 ⬇
Jordan	45 ⬇
Thailand	45 ⬇
Turkey	44 ⬇
Malaysia	43 ⬇
Georgia	42 ⬇
Chile	42 ⬇
Palestinian Nat'l Auth.	42 ⬇
Tunisia	41 ⬇
Oman	41 ⬇
Sweden	39 ⬇
Syrian Arab Republic	39 ⬇
Morocco	39 ⬇
Indonesia	39 ⬇
Bahrain	37 ⬇
Norway	32 ⬇
Ghana	28 ⬇

Benchmarking education system

North Carolina-USA	70 ⬆
Massachusetts-USA	69 ⬆
California-USA	66 ⬆
Florida-USA	66 ⬆
Minnesota-USA	65 ⬆
Dubai-UAE	64 ⬆
Abu Dhabi-UAE	63 ⬆
Indiana-USA	61 ⬆
Ontario-CAN	59 ⬆
Quebec-CAN	56 ⬆
Connecticut-USA	54
Alabama-USA	53
Colorado-USA	52
Alberta-CAN	43 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

What is K on a number line
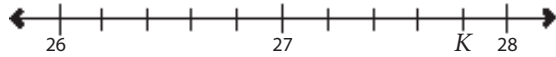
Which number does *K* represent on this number line?

A. 27.4

B. 27.8

C. 27.9

D. 28.2

Item Number: M042024

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Singapore	94 ⬢
Japan	93 ⬢
Hong Kong-CHN	92 ⬢
Korea, Rep. of	90 ⬢
Chinese Taipei-CHN	86 ⬢
England-GBR	82 ⬢
Sweden	79 ⬢
Finland	79 ⬢
Slovenia	74 ⬢
Hungary	73 ⬢
Lithuania	73 ⬢
Australia	73 ⬢
New Zealand	72 ⬢
Russian Federation	68 ⬢
Norway	67 ⬢
United States	**65 ⬢**
Israel	61 ⬢
Malaysia	61 ⬢
Italy	59 ⬢
Ukraine	58
International average	54
Thailand	48 ▼
Chile	45 ▼
Kazakhstan	44 ▼
United Arab Emirates	43 ▼
Lebanon	41 ▼
Macedonia, Rep. of	40 ▼
Qatar	39 ▼
Romania	38 ▼
Georgia	38 ▼
Turkey	37 ▼
Tunisia	37 ▼
Bahrain	36 ▼
Armenia	36 ▼
Saudi Arabia	33 ▼
Palestinian Nat'l Auth.	32 ▼
Morocco	31 ▼
Jordan	31 ▼
Syrian Arab Republic	29 ▼
Indonesia	29 ▼
Oman	25 ▼
Iran, Islamic Rep. of	22 ▼
Ghana	19 ▼

Benchmarking education system	
Massachusetts-USA	82 ⬢
Quebec-CAN	81 ⬢
Minnesota-USA	81 ⬢
North Carolina-USA	75 ⬢
Connecticut-USA	75 ⬢
Indiana-USA	73 ⬢
Alberta-CAN	69 ⬢
Ontario-CAN	68 ⬢
Colorado-USA	66 ⬢
California-USA	66 ⬢
Florida-USA	60
Dubai-UAE	52
Abu Dhabi-UAE	44 ▼
Alabama-USA	44 ▼

⬢ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Applying

Equivalent expression

The fractions $\dfrac{4}{14}$ and $\dfrac{\square}{21}$ are equivalent.

What is the value of $\square$?

A. 6

B. 7

C. 11

D. 14

Item Number: M042031

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	88 ⬠
Singapore	83 ⬠
Chinese Taipei-CHN	82 ⬠
Hong Kong-CHN	78 ⬠
Japan	66 ⬠
Israel	63 ⬠
Russian Federation	62 ⬠
Slovenia	56 ⬠
United States	**55** ⬠
Finland	55 ⬠
United Arab Emirates	54 ⬠
Lithuania	54
Saudi Arabia	54
Armenia	53
Kazakhstan	53
Sweden	52
Romania	51
Lebanon	51
International average	50
Malaysia	49
Hungary	49
Italy	48
Chile	47
Macedonia, Rep. of	45
Australia	45 ▼
Ukraine	44 ▼
England-GBR	43 ▼
Qatar	43 ▼
Palestinian Nat'l Auth.	43 ▼
Syrian Arab Republic	42 ▼
Tunisia	42 ▼
Bahrain	42 ▼
New Zealand	41 ▼
Norway	40 ▼
Turkey	40 ▼
Georgia	39 ▼
Oman	39 ▼
Thailand	38 ▼
Iran, Islamic Rep. of	35 ▼
Jordan	34 ▼
Morocco	34 ▼
Ghana	32 ▼
Indonesia	31 ▼

Benchmarking education system

North Carolina-USA	79 ⬠
Quebec-CAN	74 ⬠
Minnesota-USA	71 ⬠
Massachusetts-USA	68 ⬠
Florida-USA	59 ⬠
Connecticut-USA	57 ⬠
Colorado-USA	56
Indiana-USA	54
Dubai-UAE	54 ⬠
Ontario-CAN	54 ⬠
Alberta-CAN	53
California-USA	49
Abu Dhabi-UAE	46
Alabama-USA	43

⬠ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

Equivalent fraction for 0.125

Which fraction is equivalent to 0.125?

A. $\dfrac{125}{100}$

B. $\dfrac{125}{1,000}$

C. $\dfrac{125}{10,000}$

D. $\dfrac{125}{100,000}$

Item Number: M042032

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	97 ⬠
Singapore	93 ⬠
Chinese Taipei-CHN	91 ⬠
Lebanon	89 ⬠
Hong Kong-CHN	87 ⬠
Russian Federation	86 ⬠
Slovenia	80 ⬠
Japan	80 ⬠
Kazakhstan	79 ⬠
Finland	78 ⬠
United States	**76** ⬠
Tunisia	75 ⬠
Lithuania	75 ⬠
Hungary	74 ⬠
Malaysia	73
Italy	73
Sweden	73 ⬠
Armenia	72
Israel	72
Ukraine	70
International average	70
Palestinian Nat'l Auth.	67
United Arab Emirates	67
Morocco	67
Australia	67
Romania	66
Jordan	66
Saudi Arabia	65 ⬇
Georgia	64 ⬇
Thailand	64 ⬇
England-GBR	62 ⬇
Macedonia, Rep. of	62 ⬇
Bahrain	61 ⬇
Qatar	59 ⬇
Turkey	59 ⬇
Iran, Islamic Rep. of	58 ⬇
New Zealand	58 ⬇
Norway	58 ⬇
Syrian Arab Republic	56 ⬇
Chile	54 ⬇
Oman	54 ⬇
Indonesia	53 ⬇
Ghana	46 ⬇

Benchmarking education system

North Carolina-USA	85 ⬠
Massachusetts-USA	84 ⬠
Indiana-USA	83 ⬠
Quebec-CAN	82 ⬠
Minnesota-USA	81 ⬠
Connecticut-USA	80 ⬠
Alberta-CAN	78 ⬠
Florida-USA	76
California-USA	73
Ontario-CAN	73
Colorado-USA	71
Dubai-UAE	69
Abu Dhabi-UAE	67
Alabama-USA	66

⬠ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Applying

Length of the original pipe

A workman cut off $\frac{1}{5}$ of a pipe. The piece he cut off was 3 meters long.

How many meters long was the original pipe?

A.   8 m

B. 12 m

C. 15 m

D. 18 m

Item Number: M042041

Correct Response:	**C**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	96 ⬆
Japan	94 ⬆
Chinese Taipei-CHN	92 ⬆
Singapore	92 ⬆
Finland	90 ⬆
Hong Kong-CHN	90 ⬆
Sweden	89 ⬆
Italy	88 ⬆
Russian Federation	85 ⬆
Norway	84 ⬆
Slovenia	81 ⬆
Lithuania	81 ⬆
Israel	80 ⬆
Australia	79 ⬆
England-GBR	79 ⬆
New Zealand	79 ⬆
United States	**73** ⬆
Iran, Islamic Rep. of	72
Kazakhstan	72
Ukraine	71
Turkey	71
Hungary	71
International average	70
Armenia	69
Thailand	64 ⬇
Malaysia	63 ⬇
Macedonia, Rep. of	63 ⬇
Tunisia	60 ⬇
United Arab Emirates	60 ⬇
Romania	59 ⬇
Palestinian Nat'l Auth.	58 ⬇
Chile	58 ⬇
Georgia	58 ⬇
Indonesia	56 ⬇
Jordan	53 ⬇
Bahrain	53 ⬇
Qatar	52 ⬇
Lebanon	52 ⬇
Ghana	51 ⬇
Syrian Arab Republic	51 ⬇
Oman	49 ⬇
Saudi Arabia	44 ⬇
Morocco	43 ⬇

Benchmarking education system

Massachusetts-USA	88 ⬆
Quebec-CAN	88 ⬆
Alberta-CAN	85 ⬆
Minnesota-USA	84 ⬆
North Carolina-USA	82 ⬆
Ontario-CAN	80 ⬆
Connecticut-USA	79 ⬆
Colorado-USA	77 ⬆
Indiana-USA	76 ⬆
California-USA	70
Florida-USA	69
Dubai-UAE	68
Alabama-USA	60 ⬇
Abu Dhabi-UAE	55 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Ratio, Proportion and Percent	Knowing

Complete the missing boxes

Peter, James, and Andrew each had 20 tries at throwing balls into a basket.

Complete the missing boxes below.

Name	Number of Successful Shots	Percentage of Successful Shots
Peter	10 out of 20	50 %
James	15 out of 20	☐
Andrew	☐ out of 20	80%

Item Number: M042059

SCORING

Correct Response

• 75 and 16, both correct

Partially Correct Response

• Only 75 correct

• Only 16 correct

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct	
Singapore	89	⬡
Korea, Rep. of	76	⬡
Hong Kong-CHN	76	⬡
Chinese Taipei-CHN	69	⬡
Japan	57	⬡
Israel	57	⬡
Russian Federation	55	⬡
United States	**54**	⬡
Australia	53	⬡
Lithuania	53	⬡
Sweden	51	⬡
Finland	50	⬡
Slovenia	49	⬡
England-GBR	48	⬡
New Zealand	46	⬡
Hungary	46	⬡
Italy	46	⬡
Norway	42	
Malaysia	42	
International average	37	
United Arab Emirates	37	
Kazakhstan	36	
Lebanon	35	
Armenia	34	
Turkey	33	⬢
Ukraine	33	
Romania	26	⬢
Chile	26	⬢
Qatar	24	⬢
Macedonia, Rep. of	22	⬢
Bahrain	22	⬢
Iran, Islamic Rep. of	22	⬢
Indonesia	20	⬢
Georgia	20	⬢
Tunisia	19	⬢
Thailand	18	⬢
Palestinian Nat'l Auth.	18	⬢
Syrian Arab Republic	17	⬢
Saudi Arabia	12	⬢
Morocco	11	⬢
Jordan	11	⬢
Oman	10	⬢
Ghana	8	⬢

Benchmarking education system		
Quebec-CAN	81	⬡
Massachusetts-USA	79	⬡
Minnesota-USA	77	⬡
Alberta-CAN	75	⬡
Ontario-CAN	68	⬡
North Carolina-USA	62	⬡
Connecticut-USA	59	⬡
Indiana-USA	59	⬡
Florida-USA	58	⬡
Colorado-USA	51	⬡
Dubai-UAE	46	⬡
California-USA	41	
Abu Dhabi-UAE	34	
Alabama-USA	31	

⬡ Percent higher than International average
⬢ Percent lower than International average

Complete the missing boxes (continued)
M042059

Student Responses

Correct Response:

Name	Number of Successful Shots	Percentage of Successful Shots
Peter	10 out of 20	50 %
James	15 out of 20	75%
Andrew	16 out of 20	80%

Partially Correct Response:

Name	Number of Successful Shots	Percentage of Successful Shots
Peter	10 out of 20	50 %
James	15 out of 20	75%
Andrew	17 out of 20	80%

Incorrect Response:

Name	Number of Successful Shots	Percentage of Successful Shots
Peter	10 out of 20	50 %
James	15 out of 20	60%
Andrew	17 out of 20	80%

Content Domain	Main Topic	Cognitive Domain
NUMBER	Integers	Reasoning

Next line in the pattern

Here is a pattern:

$3 - 3 = 0$

$3 - 2 = 1$

$3 - 1 = 2$

$3 - 0 = 3$

What will the next line in the pattern be?

Answer: _____

Item Number: M042186

SCORING

Correct Response

• $3 - (-1) = 4$ or $3 + 1 = 4$

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	80 ⌃
Hong Kong-CHN	80 ⌃
Chinese Taipei-CHN	79 ⌃
Korea, Rep. of	74 ⌃
Japan	70 ⌃
Israel	67 ⌃
Russian Federation	61 ⌃
United States	**58 ⌃**
Armenia	58 ⌃
Australia	57 ⌃
England-GBR	57 ⌃
Hungary	52 ⌃
Slovenia	51 ⌃
New Zealand	50 ⌃
United Arab Emirates	49 ⌃
Finland	49 ⌃
Lithuania	48 ⌃
Romania	45
International average	42
Italy	42
Kazakhstan	42
Bahrain	41
Ukraine	40
Macedonia, Rep. of	40
Jordan	39
Norway	39
Sweden	34 ⌄
Malaysia	33 ⌄
Turkey	33 ⌄
Qatar	30 ⌄
Georgia	27 ⌄
Oman	27 ⌄
Lebanon	27 ⌄
Iran, Islamic Rep. of	24 ⌄
Thailand	24 ⌄
Chile	21 ⌄
Palestinian Nat'l Auth.	21 ⌄
Saudi Arabia	21 ⌄
Tunisia	17 ⌄
Syrian Arab Republic	16 ⌄
Ghana	14 ⌄
Morocco	12 ⌄
Indonesia	4 ⌄

Benchmarking education system

Minnesota-USA	74 ⌃
Massachusetts-USA	72 ⌃
North Carolina-USA	69 ⌃
Quebec-CAN	65 ⌃
Indiana-USA	64 ⌃
Florida-USA	62 ⌃
California-USA	59 ⌃
Ontario-CAN	58 ⌃
Alberta-CAN	57 ⌃
Connecticut-USA	55 ⌃
Colorado-USA	55 ⌃
Dubai-UAE	54 ⌃
Abu Dhabi-UAE	47 ⌃
Alabama-USA	42

⌃ Percent higher than International average
⌄ Percent lower than International average

Next line in the pattern (continued)

M042186

Student Responses

Correct Response:

$$3-(-1)=4$$

Incorrect Response:

$$4-4=0$$

Content Domain	Main Topic	Cognitive Domain
NUMBER	Whole Numbers	Applying

Packing eggs into boxes

Kim is packing eggs into boxes.

Each box holds 6 eggs.

She has 94 eggs.

What is the smallest number of boxes she needs to pack all the eggs?

Answer: _____ boxes

Item Number: M052061

SCORING

Correct Response

• 16

Incorrect Response

• 15 OR 15.6 OR 15.67 OR 15.7 OR 15 $^2/_3$

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	89 ⬦
Chinese Taipei-CHN	86 ⬦
Japan	75 ⬦
Korea, Rep. of	74 ⬦
Finland	66 ⬦
Singapore	64 ⬦
Lithuania	62 ⬦
England-GBR	61 ⬦
Sweden	58 ⬦
Hungary	58 ⬦
United States	**56** ⬦
Norway	56 ⬦
Slovenia	54 ⬦
Russian Federation	54 ⬦
Kazakhstan	54 ⬦
Australia	53 ⬦
Ukraine	46
New Zealand	46 ⬦
Israel	45
International average	41
Armenia	39
Georgia	37
Italy	35 ⬇
Romania	33 ⬇
Thailand	33 ⬇
United Arab Emirates	32 ⬇
Turkey	31 ⬇
Malaysia	29 ⬇
Chile	29 ⬇
Macedonia, Rep. of	27 ⬇
Lebanon	24 ⬇
Bahrain	23 ⬇
Tunisia	23 ⬇
Qatar	22 ⬇
Iran, Islamic Rep. of	22 ⬇
Indonesia	21 ⬇
Saudi Arabia	21 ⬇
Jordan	17 ⬇
Morocco	15 ⬇
Palestinian Nat'l Auth.	14 ⬇
Oman	14 ⬇
Syrian Arab Republic	13 ⬇
Ghana	12 ⬇

Benchmarking education system

Minnesota-USA	76 ⬦
Massachusetts-USA	76 ⬦
Indiana-USA	72 ⬦
Quebec-CAN	72 ⬦
North Carolina-USA	69 ⬦
Colorado-USA	63 ⬦
Florida-USA	62 ⬦
Ontario-CAN	61 ⬦
Alberta-CAN	59 ⬦
Connecticut-USA	58 ⬦
Alabama-USA	48 ⬦
California-USA	38
Dubai-UAE	35 ⬇
Abu Dhabi-UAE	32 ⬇

⬦ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

Which number sentence is true

Which of these number sentences is true?

A. $\dfrac{3}{10}$ of 50 = 50% of 3

B. 3% of 50 = 6% of 100

C. 50 ÷ 30 = 30 ÷ 50

D. $\dfrac{3}{10} \times 50 = \dfrac{5}{10} \times 30$

Item Number: M052214

Correct Response:	D

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	74 ⬢
Korea, Rep. of	68 ⬢
Singapore	67 ⬢
Hong Kong-CHN	63 ⬢
Russian Federation	58 ⬢
Hungary	53 ⬢
Japan	52 ⬢
Armenia	51 ⬢
Malaysia	50 ⬢
Lebanon	47 ⬢
Israel	46 ⬢
Ghana	44
Lithuania	43
Romania	43
Kazakhstan	43
Indonesia	41
International average	41
Turkey	40
Georgia	40
United Arab Emirates	40
Iran, Islamic Rep. of	39
Ukraine	38
Thailand	38
Palestinian Nat'l Auth.	38
Qatar	37
Italy	36
Australia	36 ⬢
United States	**36** ⬢
Morocco	34 ⬢
Oman	34 ⬢
Jordan	34 ⬢
Tunisia	33 ⬢
England-GBR	33 ⬢
Macedonia, Rep. of	32 ⬢
Finland	32 ⬢
Saudi Arabia	31 ⬢
Bahrain	31 ⬢
Slovenia	31 ⬢
Syrian Arab Republic	27 ⬢
New Zealand	27 ⬢
Chile	25 ⬢
Sweden	24 ⬢
Norway	23 ⬢

Benchmarking education system

North Carolina-USA	56 ⬢
Massachusetts-USA	46
Dubai-UAE	44
Minnesota-USA	43
Indiana-USA	41
Florida-USA	40
Quebec-CAN	39
Abu Dhabi-UAE	37
California-USA	34 ⬢
Connecticut-USA	33 ⬢
Alberta-CAN	32 ⬢
Ontario-CAN	29 ⬢
Alabama-USA	29 ⬢
Colorado-USA	25 ⬢

⬢ Percent higher than International average
⬢ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

Select the decimal equal to 3/5

Which number is equal to $\dfrac{3}{5}$?

A.　　0.8

B.　　0.6

C.　　0.53

D.　　0.35

Item Number: M052216

Correct Response:	**B**

Overall Percent Correct

Education system	Percent correct
Singapore	96 ⌃
Korea, Rep. of	96 ⌃
Lebanon	93 ⌃
Hong Kong-CHN	89 ⌃
Chinese Taipei-CHN	89 ⌃
Japan	86 ⌃
Russian Federation	84 ⌃
Sweden	83 ⌃
United States	**83** ⌃
Kazakhstan	82 ⌃
Armenia	80 ⌃
United Arab Emirates	77 ⌃
Tunisia	75 ⌃
Lithuania	74 ⌃
Israel	74 ⌃
Italy	72
Saudi Arabia	72
Morocco	71
Slovenia	71
Australia	70
Finland	69
Qatar	69
Romania	69
International average	68
Ukraine	68
Hungary	67
Palestinian Nat'l Auth.	66
Macedonia, Rep. of	65
Malaysia	65
Georgia	65
Norway	63
Oman	60 ⌄
England-GBR	59 ⌄
New Zealand	56 ⌄
Bahrain	54 ⌄
Syrian Arab Republic	52 ⌄
Indonesia	50 ⌄
Thailand	50 ⌄
Jordan	49 ⌄
Turkey	48 ⌄
Chile	39 ⌄
Ghana	39 ⌄
Iran, Islamic Rep. of	38 ⌄

Benchmarking education system

North Carolina-USA	94 ⌃
Florida-USA	91 ⌃
Minnesota-USA	90 ⌃
Massachusetts-USA	89 ⌃
Quebec-CAN	87 ⌃
Indiana-USA	86 ⌃
Connecticut-USA	84 ⌃
Alberta-CAN	83 ⌃
Colorado-USA	80 ⌃
Dubai-UAE	77 ⌃
California-USA	77 ⌃
Abu Dhabi-UAE	74 ⌃
Ontario-CAN	73 ⌃
Alabama-USA	72

⌃ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Applying

Method for subtracting fractions

Which shows a correct method for finding $\dfrac{1}{3} - \dfrac{1}{4}$?

A. $\dfrac{1 - 1}{4 - 3}$

B. $\dfrac{1}{4 - 3}$

C. $\dfrac{3 - 4}{3 \times 4}$

D. $\dfrac{4 - 3}{3 \times 4}$

Item Number: M052228

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	86 ⬦
Singapore	83 ⬦
Chinese Taipei-CHN	82 ⬦
Hong Kong-CHN	77 ⬦
Japan	65 ⬦
Russian Federation	63 ⬦
Armenia	56 ⬦
Italy	51 ⬦
Kazakhstan	50 ⬦
Lebanon	49 ⬦
Malaysia	46 ⬦
Israel	45 ⬦
Ukraine	41
United Arab Emirates	38
Turkey	37
International average	37
Romania	36
Palestinian Nat'l Auth.	35
Australia	34
Jordan	33
Hungary	33
Georgia	33
Slovenia	30 ⬇
Thailand	29 ⬇
United States	**29** ⬇
Lithuania	28 ⬇
England-GBR	28 ⬇
Saudi Arabia	28 ⬇
Iran, Islamic Rep. of	27 ⬇
New Zealand	26 ⬇
Macedonia, Rep. of	25 ⬇
Oman	24 ⬇
Qatar	24 ⬇
Bahrain	24 ⬇
Indonesia	21 ⬇
Tunisia	21 ⬇
Morocco	21 ⬇
Ghana	19 ⬇
Norway	19 ⬇
Syrian Arab Republic	18 ⬇
Finland	16 ⬇
Sweden	14 ⬇
Chile	12 ⬇

Benchmarking education system

Massachusetts-USA	44
Dubai-UAE	43 ⬦
Abu Dhabi-UAE	40
California-USA	38
Minnesota-USA	35
North Carolina-USA	35
Colorado-USA	34
Quebec-CAN	33 ⬇
Ontario-CAN	33 ⬇
Connecticut-USA	31
Florida-USA	29 ⬇
Indiana-USA	29 ⬇
Alberta-CAN	28 ⬇
Alabama-USA	21 ⬇

⬦ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Fractions and Decimals	Knowing

Add 42.65 to 5.748

42.65 + 5.748 =

Answer: _____

Item Number: M052231

SCORING

Correct Response

- 48.398

Incorrect Response

- 10,013 with decimal point inserted anywhere or without decimal

- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct	
Singapore	94	⬆
Malaysia	91	⬆
Hong Kong-CHN	91	⬆
Kazakhstan	90	⬆
Lithuania	90	⬆
Russian Federation	90	⬆
Chinese Taipei-CHN	89	⬆
United States	**89**	⬆
Hungary	88	⬆
Italy	88	⬆
Korea, Rep. of	87	⬆
Slovenia	85	⬆
Armenia	84	⬆
Tunisia	82	⬆
Israel	82	⬆
Australia	82	⬆
Norway	81	⬆
Lebanon	81	⬆
Japan	81	⬆
Ukraine	80	⬆
United Arab Emirates	79	⬆
Sweden	79	⬆
England-GBR	79	⬆
Finland	79	⬆
International average	72	
Morocco	72	
Qatar	72	
New Zealand	70	
Romania	69	
Saudi Arabia	65	⬇
Macedonia, Rep. of	65	⬇
Georgia	64	⬇
Thailand	64	⬇
Chile	58	⬇
Indonesia	57	⬇
Palestinian Nat'l Auth.	56	⬇
Oman	49	⬇
Turkey	48	⬇
Bahrain	43	⬇
Iran, Islamic Rep. of	42	⬇
Jordan	36	⬇
Ghana	36	⬇
Syrian Arab Republic	31	⬇

Benchmarking education system

Massachusetts-USA	95	⬆
Minnesota-USA	93	⬆
Florida-USA	93	⬆
Alabama-USA	92	⬆
Connecticut-USA	91	⬆
Indiana-USA	90	⬆
North Carolina-USA	90	⬆
Quebec-CAN	90	⬆
California-USA	89	⬆
Alberta-CAN	86	⬆
Ontario-CAN	85	⬆
Colorado-USA	82	⬆
Abu Dhabi-UAE	81	⬆
Dubai-UAE	80	⬆

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
NUMBER	Algebraic Expressions	Applying

Sum of 3 consecutive whole numbers

What is the sum of the three consecutive whole numbers with $2n$ as the middle number?

A. $6n + 3$

B. $6n$

C. $6n - 1$

D. $6n - 3$

Item Number: M032047

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	78 ⬗
Chinese Taipei-CHN	76 ⬗
Finland	70 ⬗
Hong Kong-CHN	69 ⬗
Japan	68 ⬗
Singapore	64 ⬗
Lithuania	63 ⬗
Romania	62 ⬗
Israel	57 ⬗
Kazakhstan	57 ⬗
Italy	56 ⬗
Lebanon	56
Hungary	56
Morocco	55 ⬗
Syrian Arab Republic	55
Georgia	54
Russian Federation	53
Tunisia	52
Palestinian Nat'l Auth.	52
International average	52
Thailand	52
Armenia	51
Turkey	51
Ukraine	49
Iran, Islamic Rep. of	49
Macedonia, Rep. of	48
Jordan	48 ⬗
Ghana	47 ⬗
England-GBR	46 ⬗
Sweden	46 ⬗
Indonesia	46 ⬗
Australia	45 ⬗
Malaysia	45 ⬗
United Arab Emirates	44 ⬗
Bahrain	44 ⬗
New Zealand	43 ⬗
Oman	40 ⬗
Chile	40 ⬗
Saudi Arabia	39 ⬗
Norway	39 ⬗
Slovenia	39 ⬗
United States	**37** ⬗
Qatar	36 ⬗

Benchmarking education system	
Quebec-CAN	61 ⬗
Massachusetts-USA	54
North Carolina-USA	47
Abu Dhabi-UAE	45 ⬗
Ontario-CAN	44 ⬗
Alberta-CAN	43 ⬗
Connecticut-USA	43 ⬗
Dubai-UAE	43 ⬗
Minnesota-USA	40 ⬗
Florida-USA	38 ⬗
Colorado-USA	36 ⬗
California-USA	36 ⬗
Alabama-USA	35 ⬗
Indiana-USA	34 ⬗

⬗ Percent higher than International average
⬗ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing

m boys and n girls in a parade

There were m boys and n girls in a parade. Each person carried 2 balloons. Which of these expressions represents the total number of balloons that were carried in the parade?

A. $2(m + n)$

B. $2 + (m + n)$

C. $2m + n$

D. $m + 2n$

Item Number: M032295

Correct Response:	A

Overall Percent Correct

Education system	Percent correct
Singapore	95 ⬦
Hong Kong-CHN	94 ⬦
Chinese Taipei-CHN	93 ⬦
Korea, Rep. of	91 ⬦
Japan	90 ⬦
Russian Federation	90 ⬦
United States	**88** ⬦
Lebanon	86 ⬦
Lithuania	86 ⬦
Slovenia	85 ⬦
Israel	82 ⬦
Finland	82 ⬦
Italy	82 ⬦
Ukraine	81 ⬦
Hungary	80 ⬦
Romania	77 ⬦
Kazakhstan	76
United Arab Emirates	75 ⬦
England-GBR	74
Australia	73
International average	73
Georgia	72
Malaysia	71
New Zealand	71
Tunisia	70
Armenia	69
Macedonia, Rep. of	67 ⬇
Jordan	67 ⬇
Qatar	65 ⬇
Sweden	65 ⬇
Indonesia	63 ⬇
Turkey	62 ⬇
Iran, Islamic Rep. of	62 ⬇
Thailand	62 ⬇
Bahrain	62 ⬇
Palestinian Nat'l Auth.	62 ⬇
Chile	60 ⬇
Ghana	60 ⬇
Norway	59 ⬇
Morocco	58 ⬇
Oman	58 ⬇
Syrian Arab Republic	48 ⬇
Saudi Arabia	48 ⬇

Benchmarking education system

Massachusetts-USA	92 ⬦
California-USA	91 ⬦
Minnesota-USA	91 ⬦
North Carolina-USA	90 ⬦
Quebec-CAN	90 ⬦
Florida-USA	87 ⬦
Indiana-USA	87 ⬦
Connecticut-USA	83 ⬦
Dubai-UAE	83 ⬦
Colorado-USA	82 ⬦
Alabama-USA	81 ⬦
Alberta-CAN	76
Ontario-CAN	76
Abu Dhabi-UAE	75

⬦ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Applying

The shadow lengths of four bushes

Bush height (cm)	Shadow length (cm)
20	16
40	32
60	48
80	64

The table above shows the shadow lengths of four bushes of different heights at 10 a.m. What is the shadow length at 10 a.m. of a bush that has a height of 50 centimeters?

A.   36 cm

B.   38 cm

C.   40 cm

D.   42 cm

Item Number: M032352

Correct Response:	C

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	86 ⌃
Singapore	84 ⌃
Chinese Taipei-CHN	83 ⌃
Japan	82 ⌃
Hong Kong-CHN	80 ⌃
Russian Federation	72 ⌃
England-GBR	72 ⌃
Slovenia	70 ⌃
United States	**69** ⌃
Australia	69 ⌃
Finland	68 ⌃
Israel	67 ⌃
New Zealand	66 ⌃
Italy	66 ⌃
Lithuania	65 ⌃
Hungary	65 ⌃
Sweden	64 ⌃
Malaysia	63
International average	60
Norway	59
Thailand	59
United Arab Emirates	59
Ukraine	58
Kazakhstan	57
Turkey	56 ⌄
Lebanon	56
Romania	54 ⌄
Chile	54 ⌄
Bahrain	53 ⌄
Armenia	52 ⌄
Qatar	52 ⌄
Ghana	51 ⌄
Iran, Islamic Rep. of	51 ⌄
Indonesia	51 ⌄
Morocco	49 ⌄
Macedonia, Rep. of	49 ⌄
Jordan	49 ⌄
Georgia	48 ⌄
Saudi Arabia	47 ⌄
Palestinian Nat'l Auth.	47 ⌄
Syrian Arab Republic	47 ⌄
Oman	46 ⌄
Tunisia	44 ⌄

Benchmarking education system	
Massachusetts-USA	81 ⌃
Minnesota-USA	80 ⌃
Quebec-CAN	74 ⌃
North Carolina-USA	74 ⌃
Connecticut-USA	71 ⌃
Florida-USA	71 ⌃
Colorado-USA	70 ⌃
Ontario-CAN	69 ⌃
Indiana-USA	68 ⌃
California-USA	67 ⌃
Alberta-CAN	65
Dubai-UAE	64
Alabama-USA	62
Abu Dhabi-UAE	57

⌃ Percent higher than International average
⌄ Percent lower than International average
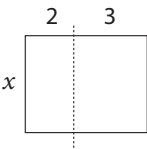
Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing
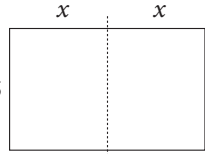
Which represents 2x plus 3x

Which of these could represent the expression $2x + 3x$?

A. The length of this segment:

B. The length of this segment:

C. The area of this figure:

D. The area of this figure:

Item Number: M032419

Correct Response:	C

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	81 ⬆
Singapore	73 ⬆
Japan	73 ⬆
Hong Kong-CHN	72 ⬆
Korea, Rep. of	71 ⬆
Russian Federation	63 ⬆
Israel	58 ⬆
Lithuania	57 ⬆
Finland	55 ⬆
United States	**53** ⬆
Hungary	51 ⬆
England-GBR	49
Turkey	49 ⬆
Slovenia	49
Australia	47
International average	44
Malaysia	43
Ukraine	42
New Zealand	42
Kazakhstan	41
Sweden	40 ⬇
Armenia	40
United Arab Emirates	40 ⬇
Qatar	39 ⬇
Palestinian Nat'l Auth.	39 ⬇
Macedonia, Rep. of	39 ⬇
Lebanon	38 ⬇
Georgia	38 ⬇
Chile	38 ⬇
Norway	37 ⬇
Romania	35 ⬇
Bahrain	35 ⬇
Oman	33 ⬇
Iran, Islamic Rep. of	33 ⬇
Indonesia	33 ⬇
Tunisia	32 ⬇
Thailand	32 ⬇
Italy	31 ⬇
Jordan	31 ⬇
Morocco	30 ⬇
Saudi Arabia	29 ⬇
Syrian Arab Republic	28 ⬇
Ghana	25 ⬇

Benchmarking education system
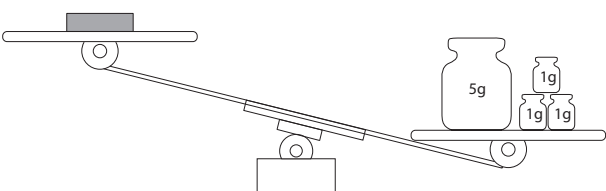
Colorado-USA	66 ⬆
Minnesota-USA	64 ⬆
Massachusetts-USA	63 ⬆
Connecticut-USA	61 ⬆
North Carolina-USA	59 ⬆
California-USA	58 ⬆
Alberta-CAN	55 ⬆
Quebec-CAN	53 ⬆
Indiana-USA	51
Florida-USA	50
Ontario-CAN	47
Alabama-USA	45
Dubai-UAE	44
Abu Dhabi-UAE	36 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average
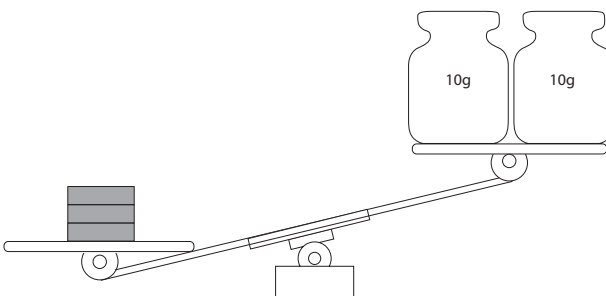
Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Reasoning

Jo has 3 metal blocks to weigh

Jo has three metal blocks. The weight of each block is the same. When she weighed one block against 8 grams, this is what happened.

When she weighed all three blocks against 20 grams, this is what happened.

Which of the following could be the weight of one metal block?

A. 5 g

B. 6 g

C. 7 g

D. 8 g

Item Number: M032424

Correct Response:	C

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	79 ⬘
Japan	76 ⬘
Singapore	75 ⬘
Finland	74 ⬘
Chinese Taipei-CHN	74 ⬘
Hong Kong-CHN	68 ⬘
Russian Federation	67 ⬘
England-GBR	62 ⬘
Australia	62 ⬘
Sweden	62 ⬘
Lithuania	61 ⬘
Hungary	58 ⬘
Slovenia	58 ⬘
Israel	58 ⬘
United States	**57** ⬘
New Zealand	57 ⬘
Norway	55 ⬘
Ukraine	54 ⬘
Italy	51 ⬘
Georgia	50
Turkey	47
International average	47
Thailand	46
Chile	45
Kazakhstan	43
Romania	40 ⬙
Armenia	38 ⬙
United Arab Emirates	37 ⬙
Iran, Islamic Rep. of	37 ⬙
Malaysia	36 ⬙
Macedonia, Rep. of	35 ⬙
Lebanon	34 ⬙
Jordan	33 ⬙
Tunisia	32 ⬙
Qatar	32 ⬙
Bahrain	30 ⬙
Palestinian Nat'l Auth.	26 ⬙
Saudi Arabia	24 ⬙
Syrian Arab Republic	22 ⬙
Oman	22 ⬙
Morocco	18 ⬙
Indonesia	18 ⬙
Ghana	9 ⬙

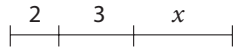| Benchmarking education system	
Massachusetts-USA	69 ⬘
Quebec-CAN	67 ⬘
Minnesota-USA	66 ⬘
Connecticut-USA	61 ⬘
Indiana-USA	61 ⬘
North Carolina-USA	60 ⬘
Florida-USA	60 ⬘
Alberta-CAN	59 ⬘
Colorado-USA	59 ⬘
Ontario-CAN	59 ⬘
California-USA	49
Dubai-UAE	48
Alabama-USA	42
Abu Dhabi-UAE	35 ⬙

⬘ Percent higher than International average
⬙ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing

Cost in zeds for taxi trip of n km

The taxi company has a basic charge of 25 zeds and a charge of 0.2 zeds for each kilometer the taxi is driven. Which of these represents the cost in zeds to hire a taxi for a trip of *n* kilometers?

A. $25 + 0.2n$

B. $25 \times 0.2n$

C. $0.2 \times (25 + n)$

D. $0.2 \times 25 + n$

Item Number: M032477

Correct Response:	A

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	77 ⌃
Singapore	76 ⌃
Hong Kong-CHN	70 ⌃
Russian Federation	70 ⌃
Israel	66 ⌃
Korea, Rep. of	65 ⌃
Lithuania	62 ⌃
United States	**61** ⌃
Slovenia	56 ⌃
Japan	55 ⌃
Norway	53 ⌃
Ukraine	52 ⌃
Tunisia	52 ⌃
Italy	50
Hungary	50
Finland	49
Georgia	49
Macedonia, Rep. of	49
Sweden	48
Australia	47
United Arab Emirates	47
New Zealand	46
International average	46
England-GBR	45
Kazakhstan	44
Jordan	44
Armenia	43
Romania	43 ⌄
Oman	40 ⌄
Turkey	39 ⌄
Saudi Arabia	36 ⌄
Bahrain	36 ⌄
Palestinian Nat'l Auth.	35 ⌄
Syrian Arab Republic	33 ⌄
Qatar	32 ⌄
Lebanon	32 ⌄
Iran, Islamic Rep. of	31 ⌄
Morocco	30 ⌄
Chile	29 ⌄
Malaysia	28 ⌄
Ghana	28 ⌄
Indonesia	24 ⌄
Thailand	24 ⌄

Benchmarking education system

	Percent correct
Massachusetts-USA	82 ⌃
North Carolina-USA	73 ⌃
Minnesota-USA	72 ⌃
Florida-USA	66 ⌃
Colorado-USA	65 ⌃
Indiana-USA	65 ⌃
Quebec-CAN	64 ⌃
Connecticut-USA	64 ⌃
California-USA	60 ⌃
Ontario-CAN	57 ⌃
Alberta-CAN	56 ⌃
Dubai-UAE	50
Abu Dhabi-UAE	45
Alabama-USA	42

⌃ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Knowing

Find the value of y when t is 9

Use the formula $y = 100 - \dfrac{100}{1+t}$ to find the value of y when $t = 9$.

Answer: _____

Item Number: M032538

SCORING

Correct Response

• 90

Incorrect Response

• 10

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	84 ⬦
Chinese Taipei-CHN	82 ⬦
Russian Federation	80 ⬦
Korea, Rep. of	74 ⬦
Hong Kong-CHN	73 ⬦
Japan	69 ⬦
Kazakhstan	66 ⬦
Ukraine	58 ⬦
Israel	57 ⬦
Lithuania	56 ⬦
United States	**55** ⬦
Italy	54 ⬦
Armenia	54 ⬦
Finland	54 ⬦
Slovenia	53 ⬦
Hungary	51 ⬦
Macedonia, Rep. of	50 ⬦
Romania	47 ⬦
Australia	47
England-GBR	45
International average	43
Lebanon	42
United Arab Emirates	39 ⬇
Georgia	39
New Zealand	32 ⬇
Tunisia	31 ⬇
Malaysia	31 ⬇
Qatar	30 ⬇
Turkey	29 ⬇
Palestinian Nat'l Auth.	29 ⬇
Bahrain	28 ⬇
Jordan	26 ⬇
Indonesia	24 ⬇
Norway	24 ⬇
Thailand	24 ⬇
Syrian Arab Republic	23 ⬇
Iran, Islamic Rep. of	22 ⬇
Oman	21 ⬇
Saudi Arabia	20 ⬇
Chile	16 ⬇
Ghana	16 ⬇
Morocco	11 ⬇
Sweden	—

Benchmarking education system

Massachusetts-USA	74 ⬦
Minnesota-USA	70 ⬦
North Carolina-USA	65 ⬦
Indiana-USA	63 ⬦
California-USA	59 ⬦
Florida-USA	58 ⬦
Connecticut-USA	55 ⬦
Colorado-USA	54 ⬦
Quebec-CAN	51 ⬦
Dubai-UAE	49 ⬦
Ontario-CAN	47
Alabama-USA	44
Alberta-CAN	40
Abu Dhabi-UAE	37 ⬇

⬦ Percent higher than International average
⬇ Percent lower than International average
— Not applicable

Find the value of y when t is 9 (continued)

M032538

Student Responses

Correct Response:

Answer: __90__

$$Y = 100 - \frac{100}{10}$$

$$Y = 100 - 10$$

Incorrect Response:

Answer: __10__

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing

If t is a number between 6 and 9

If *t* is a number between 6 and 9, then *t* + 5 is between what two numbers?

A. 1 and 4

B. 10 and 13

C. 11 and 14

D. 30 and 45

Item Number: M032673

Correct Response:	C

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	87 ⬠
Chinese Taipei-CHN	81 ⬠
Singapore	80 ⬠
Hong Kong-CHN	78 ⬠
Japan	75 ⬠
Hungary	64 ⬠
England-GBR	64 ⬠
United States	**61 ⬠**
Russian Federation	61 ⬠
Australia	59 ⬠
Slovenia	56 ⬠
New Zealand	55 ⬠
Italy	54 ⬠
Sweden	53 ⬠
Finland	52 ⬠
Georgia	49
Israel	49
Romania	48
International average	47
Turkey	47
Ukraine	44
Lithuania	43
Thailand	43 ▼
United Arab Emirates	41 ▼
Lebanon	40 ▼
Malaysia	39 ▼
Jordan	39 ▼
Chile	39 ▼
Qatar	38 ▼
Kazakhstan	38 ▼
Norway	37 ▼
Iran, Islamic Rep. of	36 ▼
Tunisia	35 ▼
Macedonia, Rep. of	34 ▼
Palestinian Nat'l Auth.	34 ▼
Armenia	33 ▼
Bahrain	33 ▼
Saudi Arabia	33 ▼
Syrian Arab Republic	32 ▼
Oman	31 ▼
Morocco	27 ▼
Indonesia	24 ▼
Ghana	21 ▼

Benchmarking education system

Massachusetts-USA	76 ⬠
North Carolina-USA	71 ⬠
Minnesota-USA	70 ⬠
Quebec-CAN	67 ⬠
Indiana-USA	66 ⬠
Colorado-USA	64 ⬠
Connecticut-USA	63 ⬠
Florida-USA	60 ⬠
Ontario-CAN	58 ⬠
Alberta-CAN	57 ⬠
California-USA	52
Alabama-USA	51
Dubai-UAE	48
Abu Dhabi-UAE	40 ▼

⬠ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing

Simplify 3x/8 plus x/4 plus x/2

Simplify the expression $\dfrac{3x}{8} + \dfrac{x}{4} + \dfrac{x}{2}$. Show your work.

Answer: _____

Item Number: M032683

SCORING

Correct Response

- $\dfrac{9}{8}x$ or $1\dfrac{1}{8}x$ with work shown

Partially Correct Response

- $\dfrac{9}{8}x$ or $1\dfrac{1}{8}x$ with no work shown

- Any two terms combined correctly or three terms with a common denominator

Incorrect Response

- $\dfrac{5}{14}x$

- Any other expression involving $5x$ or 14

- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	75 ⬠
Chinese Taipei-CHN	63 ⬠
Japan	63 ⬠
Korea, Rep. of	61 ⬠
Hong Kong-CHN	53 ⬠
Lebanon	44 ⬠
Kazakhstan	41 ⬠
Armenia	41 ⬠
Russian Federation	35 ⬠
Hungary	34 ⬠
Ukraine	33 ⬠
Romania	29 ⬠
Georgia	28
Italy	27
Jordan	26
Turkey	25
Malaysia	25
International average	24
Palestinian Nat'l Auth.	24
Lithuania	22
United States	**19** ⬢
Israel	19 ⬢
Syrian Arab Republic	19 ⬢
United Arab Emirates	18 ⬢
Slovenia	18 ⬢
Tunisia	18 ⬢
Australia	14 ⬢
Macedonia, Rep. of	14 ⬢
Iran, Islamic Rep. of	11 ⬢
Qatar	11 ⬢
Bahrain	11 ⬢
Ghana	11 ⬢
Thailand	11 ⬢
Indonesia	10 ⬢
Oman	9 ⬢
Finland	9 ⬢
England-GBR	9 ⬢
Morocco	8 ⬢
New Zealand	8 ⬢
Saudi Arabia	8 ⬢
Norway	6 ⬢
Sweden	5 ⬢
Chile	4 ⬢

Benchmarking education system

Dubai-UAE	30 ⬠
Massachusetts-USA	29
Quebec-CAN	29 ⬠
California-USA	28
Minnesota-USA	25
Connecticut-USA	20
Indiana-USA	19
North Carolina-USA	18 ⬢
Colorado-USA	17 ⬢
Florida-USA	15 ⬢
Abu Dhabi-UAE	15 ⬢
Ontario-CAN	9 ⬢
Alabama-USA	6 ⬢
Alberta-CAN	3 ⬢

⬠ Percent higher than International average
⬢ Percent lower than International average

Simplify 3x/8 plus x/4 plus x/2 (continued)

M032683

Student Responses

Correct Response:

$$= \frac{3x}{8} + \frac{2x}{8} + \frac{4x}{8}$$

Answer: _____ $\frac{9x}{8}$ _____

Partially Correct Response:

Answer: _____ $\frac{9x}{2} + \frac{6x}{24} + \frac{12x}{24} = \frac{27x}{24}$ _____

Incorrect Response:

Answer: _____ $\frac{9x}{14}$ _____ $3x + x + x = 5x$
$8 + 4 + 2 = 14$

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing

What does xy plus 1 mean

What does $xy + 1$ mean?

A.   Add 1 to y, then multiply by x.

B.   Multiply x and y by 1.

C.   Add x to y, then add 1.

D.   Multiply x by y, then add 1.

Item Number: M032738

Correct Response:	D

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	94 ⌂
Korea, Rep. of	91 ⌂
Singapore	91 ⌂
Chinese Taipei-CHN	90 ⌂
Russian Federation	89 ⌂
Japan	87 ⌂
Ukraine	81 ⌂
United States	**80** ⌂
Armenia	79 ⌂
Slovenia	76 ⌂
Lithuania	75 ⌂
Israel	74 ⌂
Kazakhstan	73 ⌂
Hungary	73 ⌂
Finland	72 ⌂
England-GBR	72 ⌂
Georgia	71 ⌂
Australia	71 ⌂
Jordan	69
United Arab Emirates	66
International average	65
Italy	65
Romania	65
Macedonia, Rep. of	63
Bahrain	62
New Zealand	60 ▽
Thailand	60 ▽
Lebanon	59 ▽
Turkey	58 ▽
Chile	58 ▽
Saudi Arabia	57 ▽
Palestinian Nat'l Auth.	56 ▽
Qatar	55 ▽
Iran, Islamic Rep. of	55 ▽
Sweden	53 ▽
Tunisia	49 ▽
Indonesia	48 ▽
Syrian Arab Republic	48 ▽
Oman	47 ▽
Malaysia	43 ▽
Morocco	41 ▽
Ghana	36 ▽
Norway	36 ▽

Benchmarking education system

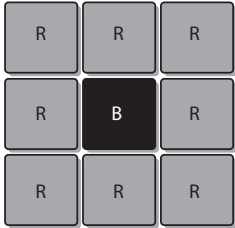|	
Massachusetts-USA	91 ⌂
Minnesota-USA	88 ⌂
Florida-USA	88 ⌂
Indiana-USA	86 ⌂
North Carolina-USA	84 ⌂
Connecticut-USA	83 ⌂
Ontario-CAN	81 ⌂
California-USA	79 ⌂
Alberta-CAN	78 ⌂
Alabama-USA	77 ⌂
Colorado-USA	76 ⌂
Dubai-UAE	72 ⌂
Quebec-CAN	68
Abu Dhabi-UAE	63

⌂ Percent higher than International average
▽ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Reasoning
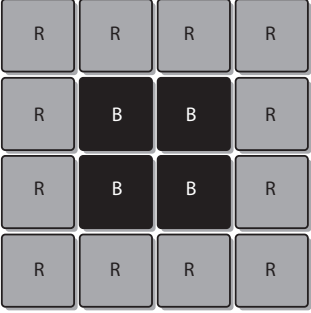
Red&BlackTiles_Complete table

Pat has red tiles and black tiles. Pat uses the tiles to make square shapes.

The 3 × 3 shape has
1 black tile and 8 red tiles.

The 4 × 4 shape has 4 black
tiles and 12 red tiles.

R	R	R
R	B	R
R	R	R

R	R	R	R
R	B	B	R
R	B	B	R
R	R	R	R

B	= Black tile
R	= Red tile

The table below shows the number of tiles for the first three shapes Pat made. Pat continued making shapes using this pattern. Complete the table for the 6 × 6 and 7 × 7 shapes.

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
3 × 3	1	8	9
4 × 4	4	12	16
5 × 5	9	16	25
6 × 6	16		
7 × 7	25		

Questions for Red and Black Tiles continue. ➡

Item Number: M032757

SCORING

Correct Response

• Both rows completely correct

Shape 6 x 6: 20, 36

Shape 7 x 7: 24, 49

Partially Correct Response

• Entries for one row correct but not both

Incorrect Response

• Entries for one column correct but not both

Red Tiles: 20, 24   OR   Total Tiles: 36, 49

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	90 △
Japan	86 △
Singapore	86 △
Chinese Taipei-CHN	85 △
Hong Kong-CHN	79 △
Russian Federation	67 △
Hungary	66 △
Italy	64 △
Israel	63 △
England-GBR	63 △
Slovenia	61 △
Finland	60 △
Australia	59 △
New Zealand	58 △
Lebanon	57
Lithuania	57
United Arab Emirates	57 △
United States	**57**
Kazakhstan	54
International average	54
Malaysia	54
Turkey	52
Sweden	51
Iran, Islamic Rep. of	50
Ukraine	50
Bahrain	50
Qatar	48 ▽
Tunisia	48 ▽
Chile	46 ▽
Thailand	45 ▽
Saudi Arabia	45 ▽
Palestinian Nat'l Auth.	45 ▽
Jordan	44 ▽
Norway	42 ▽
Romania	41 ▽
Indonesia	40 ▽
Georgia	40 ▽
Morocco	39 ▽
Oman	37 ▽
Armenia	37 ▽
Macedonia, Rep. of	35 ▽
Ghana	31 ▽
Syrian Arab Republic	29 ▽

Benchmarking education system	
Massachusetts-USA	78 △
Minnesota-USA	69 △
Ontario-CAN	69 △
Colorado-USA	69 △
North Carolina-USA	68 △
Quebec-CAN	66 △
Alberta-CAN	63 △
Dubai-UAE	62 △
Indiana-USA	58
Florida-USA	58
Connecticut-USA	57
Abu Dhabi-UAE	55
California-USA	53
Alabama-USA	37 ▽

△ Percent higher than International average
▽ Percent lower than International average

Red&BlackTiles_Complete table (continued)

M032757

Student Responses

Correct Response:

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
3 × 3	1	8	9
4 × 4	4	12	16
5 × 5	9	16	25
6 × 6	16	20	36
7 × 7	25	24	49

Partially Correct Response:

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
3 × 3	1	8	9
4 × 4	4	12	16
5 × 5	9	16	25
6 × 6	16	25	30
7 × 7	25	24	49

Incorrect Response:

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
3 × 3	1	8	9
4 × 4	4	12	16
5 × 5	9	16	25
6 × 6	16	20	34
7 × 7	25	24	64

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Reasoning

Red&BlackTiles_Shape with 64 tiles

Red and Black Tiles (Continued)

Use the patterns in the previous table to answer the following questions.

A. Pat made a shape with a **total** of 64 tiles.
   How many were black and how many were red?

   Answer: _____ black tiles   _____ red tiles

Item Number: M032760A

SCORING

Correct Response
- 36 black and 28 red

Partially Correct Response
- 36 black, red incorrect
- 28 red, black incorrect

Incorrect Response
- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	75 ⬡
Singapore	74 ⬡
Korea, Rep. of	74 ⬡
Japan	66 ⬡
Hong Kong-CHN	62 ⬡
Russian Federation	42 ⬡
Israel	38 ⬡
England-GBR	38 ⬡
Australia	35 ⬡
United States	**34** ⬡
Finland	32 ⬡
Slovenia	32
New Zealand	32
Hungary	31 ⬡
Italy	31
Turkey	28
International average	27
Sweden	27
Lithuania	27
Kazakhstan	25
United Arab Emirates	24 ⬇
Malaysia	23
Thailand	23 ⬇
Qatar	20 ⬇
Iran, Islamic Rep. of	20 ⬇
Ukraine	19 ⬇
Norway	19 ⬇
Bahrain	18 ⬇
Romania	16 ⬇
Lebanon	16 ⬇
Chile	16 ⬇
Georgia	16 ⬇
Macedonia, Rep. of	15 ⬇
Jordan	15 ⬇
Saudi Arabia	14 ⬇
Armenia	14 ⬇
Palestinian Nat'l Auth.	12 ⬇
Tunisia	12 ⬇
Oman	9 ⬇
Indonesia	8 ⬇
Syrian Arab Republic	7 ⬇
Morocco	7 ⬇
Ghana	3 ⬇

Benchmarking education system

Massachusetts-USA	54 ⬡
Minnesota-USA	47 ⬡
Ontario-CAN	46 ⬡
North Carolina-USA	41 ⬡
Quebec-CAN	39 ⬡
Connecticut-USA	37 ⬡
Colorado-USA	37 ⬡
Alberta-CAN	34 ⬡
Dubai-UAE	32
Indiana-USA	30
Florida-USA	30
California-USA	28
Abu Dhabi-UAE	22 ⬇
Alabama-USA	16 ⬇

⬡ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Reasoning

Red&BlackTiles_Shape with 49 tiles

Red and Black Tiles (Continued)

Use the patterns in the previous table to answer the following questions.

B. Pat made a shape that used 49 **black** tiles.
   How many **red** tiles did Pat use in that shape?

   Answer: _____ red tiles

Item Number: M032760B

SCORING

Correct Response

• 32

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	65 ⬦
Chinese Taipei-CHN	60 ⬦
Korea, Rep. of	58 ⬦
Hong Kong-CHN	53 ⬦
Japan	50 ⬦
Russian Federation	33 ⬦
England-GBR	29 ⬦
Australia	26 ⬦
Israel	26 ⬦
Hungary	25 ⬦
New Zealand	25
Finland	24 ⬦
United States	**24** ⬦
Slovenia	24
Italy	22
International average	20
Sweden	20
Lithuania	20
Turkey	20
Thailand	18
Kazakhstan	16 ⬇
Qatar	15 ⬇
Malaysia	15 ⬇
Iran, Islamic Rep. of	15 ⬇
United Arab Emirates	14 ⬇
Norway	13 ⬇
Armenia	13 ⬇
Ukraine	12 ⬇
Romania	11 ⬇
Macedonia, Rep. of	11 ⬇
Bahrain	11 ⬇
Jordan	10 ⬇
Georgia	9 ⬇
Lebanon	9 ⬇
Indonesia	8 ⬇
Saudi Arabia	8 ⬇
Chile	8 ⬇
Palestinian Nat'l Auth.	8 ⬇
Tunisia	7 ⬇
Oman	7 ⬇
Syrian Arab Republic	5 ⬇
Morocco	5 ⬇
Ghana	3 ⬇

Benchmarking education system

Massachusetts-USA	44 ⬦
Ontario-CAN	36 ⬦
North Carolina-USA	35 ⬦
Minnesota-USA	33 ⬦
Colorado-USA	30 ⬦
Quebec-CAN	28 ⬦
Connecticut-USA	28 ⬦
Alberta-CAN	25 ⬦
Indiana-USA	22
Dubai-UAE	20
Florida-USA	19
California-USA	18
Abu Dhabi-UAE	13 ⬇
Alabama-USA	11 ⬇

⬦ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Reasoning

Red&BlackTiles_Shape with 44 tiles

Red and Black Tiles (Continued)

Use the patterns in the previous table to answer the following questions.

C. Next, Pat made a shape using 44 of the **red** tiles. How many black tiles would Pat need to complete the black part of the shape?

Answer: _____ black tiles

Item Number: M032760C

SCORING

Correct Response

- 100

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	57 ⬗
Chinese Taipei-CHN	55 ⬗
Singapore	53 ⬗
Hong Kong-CHN	39 ⬗
Japan	37 ⬗
Russian Federation	23 ⬗
England-GBR	21 ⬗
Turkey	19 ⬗
Israel	18 ⬗
Australia	17
United States	**17** ⬗
New Zealand	17
Kazakhstan	16
Hungary	15
International average	15
Slovenia	14
Finland	13
Lithuania	12
Sweden	12 ⬗
Italy	11 ⬗
Thailand	10 ⬗
United Arab Emirates	10 ⬗
Malaysia	10 ⬗
Qatar	10 ⬗
Macedonia, Rep. of	9 ⬗
Armenia	9 ⬗
Georgia	8 ⬗
Romania	8 ⬗
Bahrain	8 ⬗
Ukraine	7 ⬗
Norway	7 ⬗
Iran, Islamic Rep. of	7 ⬗
Palestinian Nat'l Auth.	6 ⬗
Jordan	6 ⬗
Lebanon	5 ⬗
Chile	5 ⬗
Saudi Arabia	4 ⬗
Indonesia	4 ⬗
Oman	4 ⬗
Tunisia	3 ⬗
Morocco	2 ⬗
Syrian Arab Republic	1 ⬗
Ghana	1 ⬗

Benchmarking education system

Education system	Percent
Massachusetts-USA	33 ⬗
Minnesota-USA	28 ⬗
North Carolina-USA	25 ⬗
Ontario-CAN	25 ⬗
Quebec-CAN	21 ⬗
Connecticut-USA	20 ⬗
Colorado-USA	19
Alberta-CAN	16
Florida-USA	16
Dubai-UAE	14
California-USA	14
Indiana-USA	13
Abu Dhabi-UAE	10 ⬗
Alabama-USA	8 ⬗

⬗ Percent higher than International average
⬗ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Reasoning

Red&BlackTiles_Figure n

Pat wanted to add a line to the table showing how to find the number of tiles needed to make a square of any size. Use the patterns in the table on the opposite page to help you complete the line for shape $n \times n$ in the table below.

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
$n \times n$	$(n-2)^2$		

Item Number: M032761

SCORING

Correct Response

- Both expressions correct in simplified form

Red tiles: $4(n-1)$; $4n-4$; or correct verbal expression

Total tiles: n^2, $n \times n$; or correct verbal expression, such as "square the number" or "multiply by itself"

- Both expressions correct with expression for red tiles in the form of total number of tiles minus number of black tiles e.g., $n^2 - (n-2)^2$ or equivalent.

Partially Correct Response

- Expression for red tiles correct as in 20 but not expression for total tiles
- Expression for total tiles correct as in 20 but not expression for red tiles

Incorrect Response

- Incorrect expression including n for red tiles or total or both (includes incorrect attempts to express red tiles as difference from total tiles)
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	53 ⬤
Singapore	47 ⬤
Korea, Rep. of	45 ⬤
Hong Kong-CHN	40 ⬤
Japan	36 ⬤
Russian Federation	21 ⬤
Hungary	14 ⬤
Israel	14 ⬤
England-GBR	13
Kazakhstan	13
Australia	12
Turkey	11
Slovenia	11
International average	11
Italy	9
New Zealand	9
United States	**8** ⬇
Finland	7 ⬇
Lithuania	7 ⬇
Ukraine	7 ⬇
Romania	6 ⬇
Lebanon	6 ⬇
Armenia	5 ⬇
United Arab Emirates	5 ⬇
Qatar	5 ⬇
Macedonia, Rep. of	5 ⬇
Thailand	4 ⬇
Sweden	4 ⬇
Georgia	4 ⬇
Iran, Islamic Rep. of	4 ⬇
Bahrain	3 ⬇
Palestinian Nat'l Auth.	3 ⬇
Tunisia	3 ⬇
Malaysia	3 ⬇
Jordan	2 ⬇
Oman	2 ⬇
Morocco	2 ⬇
Norway	2 ⬇
Saudi Arabia	1 ⬇
Syrian Arab Republic	1 ⬇
Chile	1 ⬇
Indonesia	1 ⬇
Ghana	1 ⬇

Benchmarking education system

Massachusetts-USA	24 ⬤
Quebec-CAN	11
Colorado-USA	11
Connecticut-USA	10
Ontario-CAN	9
Minnesota-USA	9
North Carolina-USA	9
California-USA	9
Florida-USA	8
Dubai-UAE	7 ⬇
Indiana-USA	7 ⬇
Alberta-CAN	7 ⬇
Abu Dhabi-UAE	5 ⬇
Alabama-USA	3 ⬇

⬤ Percent higher than International average
⬇ Percent lower than International average

Red&BlackTiles_Figure n (continued)

M032761

Student Responses

Correct Response:

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
$n \times n$	$(n-2)^2$	$4n - 4$	$n \times n$

Partially Correct Response:

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
$n \times n$	$(n-2)^2$	$4(n-1)$	n

Incorrect Response:

Shape	Number of Black Tiles	Number of Red Tiles	Total Number of Tiles
$n \times n$	$(n-2)^2$	n^4	n^8

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Applying

What is the area of the rectangle
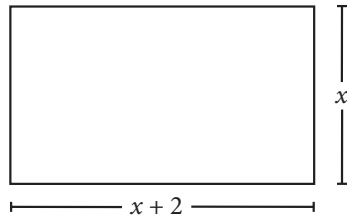
What is the area of this rectangle?

A. $x^2 + 2$

B. $x^2 + 2x$

C. $2x + 2$

D. $4x + 4$

Item Number: M042067

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	83 ⬤
Singapore	79 ⬤
Russian Federation	72 ⬤
Hong Kong-CHN	69 ⬤
Korea, Rep. of	67 ⬤
Kazakhstan	55 ⬤
Armenia	55 ⬤
Ukraine	52 ⬤
Israel	49 ⬤
Japan	48 ⬤
Romania	48 ⬤
Georgia	45 ⬤
Turkey	42
Lithuania	42
Thailand	41
International average	40
Macedonia, Rep. of	39
Lebanon	39
United States	**37**
Indonesia	36
England-GBR	35
Syrian Arab Republic	34 ⬇
Palestinian Nat'l Auth.	34 ⬇
Qatar	33 ⬇
Iran, Islamic Rep. of	33 ⬇
Finland	32 ⬇
Slovenia	32 ⬇
Italy	31 ⬇
Tunisia	30 ⬇
United Arab Emirates	30 ⬇
Hungary	30 ⬇
Bahrain	30 ⬇
Norway	28 ⬇
New Zealand	28 ⬇
Morocco	28 ⬇
Ghana	27 ⬇
Australia	26 ⬇
Malaysia	25 ⬇
Chile	24 ⬇
Sweden	24 ⬇
Saudi Arabia	24 ⬇
Oman	23 ⬇
Jordan	21 ⬇

Benchmarking education system

California-USA	53 ⬤
North Carolina-USA	45
Minnesota-USA	44
Colorado-USA	44
Massachusetts-USA	43
Florida-USA	42
Dubai-UAE	39
Connecticut-USA	38
Indiana-USA	34
Alberta-CAN	26 ⬇
Abu Dhabi-UAE	25 ⬇
Alabama-USA	25 ⬇
Quebec-CAN	24 ⬇
Ontario-CAN	23 ⬇

⬤ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing

Expression equivalent to 4(3+x)

Which expression is equivalent to $4(3 + x)$?

A. $12 + x$

B. $7 + x$

C. $12 + 4x$

D. $12x$

Item Number: M042077

Correct Response:	C

Overall Percent Correct

Education system	Percent correct
Singapore	89 ⌂
Hong Kong-CHN	86 ⌂
Korea, Rep. of	86 ⌂
Chinese Taipei-CHN	85 ⌂
Japan	82 ⌂
Russian Federation	81 ⌂
Lebanon	75 ⌂
Israel	72 ⌂
Ukraine	68 ⌂
Kazakhstan	63 ⌂
Armenia	62 ⌂
Romania	62 ⌂
Lithuania	58 ⌂
Hungary	57 ⌂
United States	**53**
Italy	52
Jordan	51
International average	51
Turkey	50
Qatar	49
Georgia	49
Syrian Arab Republic	48
Bahrain	47
Oman	46 ▽
Macedonia, Rep. of	45 ▽
Finland	44 ▽
Ghana	42 ▽
England-GBR	41 ▽
United Arab Emirates	40 ▽
Australia	40 ▽
Morocco	39 ▽
New Zealand	39 ▽
Palestinian Nat'l Auth.	38 ▽
Tunisia	37 ▽
Malaysia	37 ▽
Iran, Islamic Rep. of	36 ▽
Indonesia	36 ▽
Slovenia	34 ▽
Thailand	33 ▽
Saudi Arabia	28 ▽
Sweden	24 ▽
Chile	18 ▽
Norway	16 ▽

Benchmarking education system

California-USA	72 ⌂
Minnesota-USA	67 ⌂
Massachusetts-USA	63 ⌂
Dubai-UAE	60 ⌂
North Carolina-USA	59
Quebec-CAN	57 ⌂
Florida-USA	55
Indiana-USA	54
Colorado-USA	48
Connecticut-USA	47
Alabama-USA	39 ▽
Abu Dhabi-UAE	35 ▽
Ontario-CAN	23 ▽
Alberta-CAN	23 ▽

⌂ Percent higher than International average
▽ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Applying

What is the value of 2a + 2b + 4

$a + b = 25.$
What is the value of $2a + 2b + 4$?

Answer: _____

Item Number: M042086

SCORING

Correct Response

• 54

Incorrect Response

• 104

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	76 ⬆
Chinese Taipei-CHN	75 ⬆
Korea, Rep. of	68 ⬆
Hong Kong-CHN	65 ⬆
Russian Federation	54 ⬆
Hungary	47 ⬆
Sweden	44 ⬆
Japan	43 ⬆
England-GBR	42 ⬆
Israel	42 ⬆
Kazakhstan	40 ⬆
Armenia	36 ⬆
Italy	34
Romania	34
Australia	34
New Zealand	33
Slovenia	33
United States	**33**
Georgia	33
International average	32
Lebanon	32
Finland	32
Lithuania	31
Turkey	30
Norway	29
United Arab Emirates	27 ⬇
Macedonia, Rep. of	27 ⬇
Ukraine	26 ⬇
Chile	22 ⬇
Malaysia	22 ⬇
Palestinian Nat'l Auth.	20 ⬇
Syrian Arab Republic	19 ⬇
Thailand	18 ⬇
Tunisia	17 ⬇
Qatar	17 ⬇
Jordan	16 ⬇
Bahrain	16 ⬇
Morocco	14 ⬇
Oman	13 ⬇
Iran, Islamic Rep. of	13 ⬇
Saudi Arabia	12 ⬇
Indonesia	12 ⬇
Ghana	6 ⬇

Benchmarking education system	
Massachusetts-USA	56 ⬆
Minnesota-USA	47 ⬆
North Carolina-USA	42 ⬆
Quebec-CAN	42 ⬆
Ontario-CAN	40 ⬆
Connecticut-USA	38
Indiana-USA	37
Alberta-CAN	36
Colorado-USA	36
Dubai-UAE	33
California-USA	28
Alabama-USA	25 ⬇
Florida-USA	25 ⬇
Abu Dhabi-UAE	24 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

What is the value of 2a + 2b + 4 (continued)

M042086

Student Responses

Correct Response:

Answer: 54

Incorrect Response:

Answer: $8ab$

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Knowing

Solve the inequality

Solve this inequality.

$9x - 6 < 4x + 4$

Answer: _____

Item Number: M042103

SCORING

Correct Response

- x < 2 or 2 > x

  Note: 5x < 10 is coded as incorrect

Incorrect Response

- x = 2
- x > 2 OR 2 < x
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	60 ⬣
Chinese Taipei-CHN	52 ⬣
Armenia	47 ⬣
Russian Federation	46 ⬣
Singapore	44 ⬣
Israel	41 ⬣
Lebanon	40 ⬣
Hungary	38 ⬣
Kazakhstan	38 ⬣
Romania	34 ⬣
Macedonia, Rep. of	26 ⬣
Georgia	23 ⬣
Lithuania	23 ⬣
United States	**21** ⬣
International average	17
Hong Kong-CHN	16
Oman	15
Bahrain	13 ⬢
Ghana	13 ⬢
Morocco	13 ⬢
Turkey	10 ⬢
Japan	9 ⬢
Jordan	9 ⬢
Finland	8 ⬢
Australia	8 ⬢
United Arab Emirates	7 ⬢
Syrian Arab Republic	7 ⬢
Qatar	6 ⬢
Ukraine	6 ⬢
England-GBR	5 ⬢
Italy	5 ⬢
Palestinian Nat'l Auth.	4 ⬢
Saudi Arabia	4 ⬢
Indonesia	3 ⬢
Malaysia	3 ⬢
New Zealand	2 ⬢
Thailand	2 ⬢
Slovenia	2 ⬢
Norway	1 ⬢
Tunisia	1 ⬢
Chile	1 ⬢
Iran, Islamic Rep. of	# ⬢
Sweden	—

Benchmarking education system

North Carolina-USA	38 ⬣
California-USA	35 ⬣
Minnesota-USA	33 ⬣
Massachusetts-USA	33 ⬣
Indiana-USA	33 ⬣
Connecticut-USA	22 ⬣
Florida-USA	19
Colorado-USA	13
Dubai-UAE	10 ⬢
Alabama-USA	9 ⬢
Abu Dhabi-UAE	8 ⬢
Quebec-CAN	1 ⬢
Ontario-CAN	1 ⬢
Alberta-CAN	# ⬢

⬣ Percent higher than International average
⬢ Percent lower than International average
— Not applicable
Rounds to zero

Solve the inequality (continued)

M042103

Student Responses

Correct Response:

Solve this inequality.

$9x - 6 < 4x + 4$

Answer: _____ $x < 2$ _____

Incorrect Response:

Solve this inequality.

$9x - 6 < 4x + 4$

Answer: _____ $X > 2$ _____

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Knowing

Next term in the pattern

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}$$

A. What is the next term in this pattern?

Answer: _____

Item Number: M042198A

SCORING

Correct Response

• 6/7

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	94 ⬣
Singapore	94 ⬣
Korea, Rep. of	92 ⬣
Hong Kong-CHN	92 ⬣
Chinese Taipei-CHN	92 ⬣
Finland	91 ⬣
Australia	91 ⬣
Slovenia	90 ⬣
Hungary	90 ⬣
New Zealand	89 ⬣
England-GBR	89 ⬣
Sweden	88 ⬣
Norway	88 ⬣
United States	**87** ⬣
Lithuania	86 ⬣
Israel	85 ⬣
Italy	85 ⬣
Ukraine	85 ⬣
Russian Federation	82 ⬣
Romania	81 ⬣
Kazakhstan	78 ⬣
Turkey	77 ⬣
Tunisia	76 ⬣
United Arab Emirates	70
International average	70
Iran, Islamic Rep. of	68
Thailand	68
Armenia	66
Macedonia, Rep. of	66
Bahrain	62 ⬣
Qatar	56 ⬣
Georgia	53 ⬣
Malaysia	53 ⬣
Jordan	45 ⬣
Syrian Arab Republic	44 ⬣
Lebanon	43 ⬣
Ghana	38 ⬣
Oman	37 ⬣
Palestinian Nat'l Auth.	36 ⬣
Saudi Arabia	33 ⬣
Indonesia	32 ⬣
Chile	32 ⬣
Morocco	15 ⬣

Benchmarking education system

Massachusetts-USA	94 ⬣
Quebec-CAN	92 ⬣
Ontario-CAN	92 ⬣
Indiana-USA	91 ⬣
Alberta-CAN	90 ⬣
Colorado-USA	90 ⬣
Minnesota-USA	90 ⬣
North Carolina-USA	89 ⬣
Connecticut-USA	88 ⬣
Florida-USA	87 ⬣
Alabama-USA	87 ⬣
California-USA	86 ⬣
Dubai-UAE	79 ⬣
Abu Dhabi-UAE	68

⬣ Percent higher than International average
⬣ Percent lower than International average

Next term in the pattern (continued)

M042198A

Student Responses

Correct Response:

A. What is the next term in this pattern?

Answer: _____ $\frac{6}{7}$ _____

Incorrect Response:

A. What is the next term in this pattern?

Answer: _____ $\frac{7}{8}$ _____

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Reasoning

Term number 100 in the pattern

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}$$

B. What would term number 100 be?

Answer: _____

Item Number: M042198B

SCORING

Correct Response

• 100/101

Incorrect Response

• 99/100

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	73 ⬦
Chinese Taipei-CHN	72 ⬦
Hong Kong-CHN	68 ⬦
Korea, Rep. of	65 ⬦
Finland	65 ⬦
Lithuania	61 ⬦
Israel	60 ⬦
Hungary	59 ⬦
England-GBR	59 ⬦
Japan	57 ⬦
Slovenia	57 ⬦
Norway	56 ⬦
New Zealand	56 ⬦
Australia	56 ⬦
Ukraine	52 ⬦
United States	**50** ⬦
Turkey	49 ⬦
Russian Federation	48 ⬦
Sweden	47 ⬦
Thailand	44
Italy	44
Romania	43
Macedonia, Rep. of	41
International average	41
United Arab Emirates	37 ⬇
Kazakhstan	36
Georgia	36
Iran, Islamic Rep. of	34 ⬇
Armenia	30 ⬇
Qatar	30 ⬇
Jordan	29 ⬇
Bahrain	23 ⬇
Tunisia	22 ⬇
Lebanon	22 ⬇
Malaysia	19 ⬇
Syrian Arab Republic	17 ⬇
Chile	17 ⬇
Oman	17 ⬇
Saudi Arabia	16 ⬇
Ghana	12 ⬇
Indonesia	12 ⬇
Palestinian Nat'l Auth.	12 ⬇
Morocco	5 ⬇

Benchmarking education system

	Percent correct
Massachusetts-USA	67 ⬦
Ontario-CAN	65 ⬦
Minnesota-USA	61 ⬦
Quebec-CAN	60 ⬦
North Carolina-USA	57 ⬦
Connecticut-USA	56 ⬦
Alberta-CAN	55 ⬦
Colorado-USA	53 ⬦
Indiana-USA	52 ⬦
California-USA	49 ⬦
Florida-USA	48 ⬦
Dubai-UAE	46 ⬦
Alabama-USA	46
Abu Dhabi-UAE	34 ⬇

⬦ Percent higher than International average
⬇ Percent lower than International average

Term number 100 in the pattern (continued)
M042198B

Student Responses

Correct Response:

B. What would term number 100 be?

Answer: $\frac{100}{101}$

Incorrect Response:

B. What would term number 100 be?

Answer: $\frac{99}{100}$

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Reasoning

Term number n in the pattern

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}$$

C. What would term number n be?

Answer: _____

Item Number: M042198C

SCORING

Correct Response

- $n/(n+1)$

Incorrect Response

- $(n-1)/n$
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	61 ⬦
Singapore	58 ⬦
Hong Kong-CHN	52 ⬦
Korea, Rep. of	50 ⬦
Japan	39 ⬦
Israel	37 ⬦
Russian Federation	35 ⬦
Romania	29 ⬦
Ukraine	25 ⬦
England-GBR	21
Hungary	20
Kazakhstan	20
Turkey	19
Armenia	19
Georgia	19
Slovenia	18
International average	18
Lithuania	17
Macedonia, Rep. of	17
Jordan	15
Italy	15
Syrian Arab Republic	13 ⬮
United States	**13** ⬮
United Arab Emirates	12 ⬮
Iran, Islamic Rep. of	11 ⬮
Australia	11 ⬮
New Zealand	11 ⬮
Qatar	11 ⬮
Thailand	10 ⬮
Finland	8 ⬮
Sweden	8 ⬮
Lebanon	7 ⬮
Tunisia	7 ⬮
Oman	6 ⬮
Chile	5 ⬮
Bahrain	5 ⬮
Palestinian Nat'l Auth.	5 ⬮
Norway	4 ⬮
Saudi Arabia	3 ⬮
Morocco	2 ⬮
Malaysia	1 ⬮
Indonesia	1 ⬮
Ghana	1 ⬮

Benchmarking education system

Education system	Percent correct
Massachusetts-USA	34 ⬦
Minnesota-USA	24
Connecticut-USA	19
Dubai-UAE	18
North Carolina-USA	18
Quebec-CAN	17
Colorado-USA	15
Ontario-CAN	12 ⬮
California-USA	11 ⬮
Indiana-USA	10 ⬮
Florida-USA	10 ⬮
Abu Dhabi-UAE	10 ⬮
Alberta-CAN	6 ⬮
Alabama-USA	4 ⬮

⬦ Percent higher than International average
⬮ Percent lower than International average

Term number n in the pattern (continued)

M042198C

Student Responses

Correct Response:

C. What would term number *n* be?

Answer: $\dfrac{n}{n+1}$

Incorrect Response:

C. What would term number *n* be?

Answer: what n?

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Knowing

What is the value P

$k = 7$ and $l = 10$.

What is the value of P when $P = \dfrac{3kl}{5}$?

Answer: _____

Item Number: M042226

SCORING

Correct Response

• 42

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	88 ⌂
Hong Kong-CHN	87 ⌂
Russian Federation	83 ⌂
Korea, Rep. of	81 ⌂
Chinese Taipei-CHN	77 ⌂
Japan	72 ⌂
United States	**70** ⌂
Kazakhstan	69 ⌂
Armenia	62 ⌂
Lebanon	57 ⌂
Ukraine	56 ⌂
Israel	54 ⌂
United Arab Emirates	53 ⌂
Romania	52 ⌂
Lithuania	50 ⌂
Slovenia	49 ⌂
Macedonia, Rep. of	47
Australia	46
Hungary	46
Italy	46
International average	44
England-GBR	40
Qatar	39
Georgia	39 ⌄
Bahrain	38 ⌄
Saudi Arabia	37 ⌄
Finland	36 ⌄
Palestinian Nat'l Auth.	36 ⌄
Jordan	35 ⌄
New Zealand	30 ⌄
Turkey	29 ⌄
Oman	28 ⌄
Malaysia	28 ⌄
Syrian Arab Republic	28 ⌄
Iran, Islamic Rep. of	27 ⌄
Indonesia	23 ⌄
Tunisia	22 ⌄
Thailand	21 ⌄
Morocco	17 ⌄
Sweden	16 ⌄
Chile	11 ⌄
Ghana	10 ⌄
Norway	7 ⌄

Benchmarking education system

North Carolina-USA	83 ⌂
Minnesota-USA	83 ⌂
Massachusetts-USA	81 ⌂
Indiana-USA	77 ⌂
Florida-USA	76 ⌂
California-USA	70 ⌂
Alabama-USA	65 ⌂
Connecticut-USA	62 ⌂
Colorado-USA	60 ⌂
Dubai-UAE	57 ⌂
Quebec-CAN	50 ⌂
Abu Dhabi-UAE	49 ⌂
Ontario-CAN	48
Alberta-CAN	41

⌂ Percent higher than International average
⌄ Percent lower than International average

What is the value P (continued)

M042226

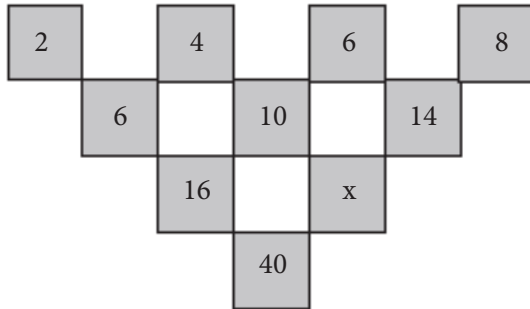## Student Responses

Correct Response:

Answer: $p = 42$

Incorrect Response:

Answer: 882

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Patterns	Reasoning

Value of x in the pattern

2		4		6		8
	6		10		14	
		16		x		
			40			

What is the value of *x* in this pattern?

Answer: _____

Item Number: M042228

SCORING

Correct Response

• 24

Incorrect Response

• 22

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	77 ⌂
Singapore	66 ⌂
Chinese Taipei-CHN	63 ⌂
England-GBR	58 ⌂
Finland	58 ⌂
Japan	57 ⌂
Hong Kong-CHN	55 ⌂
Turkey	51 ⌂
Italy	44 ⌂
Israel	43 ⌂
Hungary	43 ⌂
Norway	42 ⌂
New Zealand	42 ⌂
Australia	41 ⌂
Sweden	40 ⌂
Russian Federation	39
Lithuania	38
Kazakhstan	38
Slovenia	37
United States	**37**
Macedonia, Rep. of	36
International average	35
Chile	35
Armenia	33
United Arab Emirates	28 ▼
Romania	28 ▼
Lebanon	27 ▼
Ukraine	27 ▼
Palestinian Nat'l Auth.	27 ▼
Iran, Islamic Rep. of	27 ▼
Indonesia	27 ▼
Thailand	24 ▼
Georgia	22 ▼
Tunisia	21 ▼
Malaysia	20 ▼
Qatar	19 ▼
Morocco	18 ▼
Bahrain	18 ▼
Oman	15 ▼
Jordan	15 ▼
Saudi Arabia	13 ▼
Syrian Arab Republic	12 ▼
Ghana	10 ▼

Benchmarking education system

Massachusetts-USA	50 ⌂
North Carolina-USA	50 ⌂
Quebec-CAN	47 ⌂
Minnesota-USA	45 ⌂
Colorado-USA	43 ⌂
Connecticut-USA	43 ⌂
Ontario-CAN	43 ⌂
Indiana-USA	40
Florida-USA	39
Alberta-CAN	38
California-USA	35
Dubai-UAE	33
Abu Dhabi-UAE	28 ▼
Alabama-USA	26 ▼

⌂ Percent higher than International average
▼ Percent lower than International average

Value of x in the pattern (continued)

M042228

Student Responses

Correct Response:

Answer: x = 24

Incorrect Response:

Answer: X = 32

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Knowing

What is the value of x and y

$x + y = 12$ and $2x + 5y = 36$.

What are the values of x and y?

A. $x = 2, y = 10$

B. $x = 4, y = 8$

C. $x = 6, y = 6$

D. $x = 8, y = 4$

Item Number: M042235

Correct Response:	D

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	87 ⬣
Singapore	84 ⬣
Hong Kong-CHN	82 ⬣
Chinese Taipei-CHN	81 ⬣
Japan	79 ⬣
Russian Federation	72 ⬣
United States	**70** ⬣
Israel	65 ⬣
Australia	60 ⬣
Finland	58 ⬣
England-GBR	58 ⬣
New Zealand	57 ⬣
Hungary	57 ⬣
Lithuania	56 ⬣
Ukraine	54
Armenia	54
United Arab Emirates	54 ⬣
Kazakhstan	53
Slovenia	53
Sweden	52
Romania	51
Jordan	50
International average	50
Macedonia, Rep. of	48
Georgia	47
Turkey	47
Italy	47
Lebanon	43 ⬙
Qatar	41 ⬙
Malaysia	39 ⬙
Palestinian Nat'l Auth.	39 ⬙
Thailand	37 ⬙
Bahrain	35 ⬙
Iran, Islamic Rep. of	35 ⬙
Saudi Arabia	34 ⬙
Syrian Arab Republic	31 ⬙
Norway	30 ⬙
Oman	30 ⬙
Tunisia	29 ⬙
Chile	25 ⬙
Morocco	20 ⬙
Indonesia	20 ⬙
Ghana	18 ⬙

Benchmarking education system

Massachusetts-USA	82 ⬣
Minnesota-USA	75 ⬣
Indiana-USA	74 ⬣
North Carolina-USA	73 ⬣
California-USA	70 ⬣
Ontario-CAN	67 ⬣
Florida-USA	66 ⬣
Connecticut-USA	63 ⬣
Colorado-USA	62 ⬣
Alberta-CAN	62 ⬣
Quebec-CAN	61 ⬣
Dubai-UAE	58 ⬣
Abu Dhabi-UAE	53
Alabama-USA	50

⬣ Percent higher than International average
⬙ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Knowing

Simplify the expression

Which of these is equal to $3p^2 + 2p + 2p^2 + p$?

A. $8p$

B. $8p^2$

C. $5p^2 + 3p$

D. $7p^2 + p$

Item Number: M042236

Correct Response:	**C**

Overall Percent Correct

Education system	Percent correct
Singapore	93 ⌂
Hong Kong-CHN	88 ⌂
Japan	87 ⌂
Korea, Rep. of	85 ⌂
Chinese Taipei-CHN	84 ⌂
Russian Federation	81 ⌂
Lebanon	70 ⌂
Finland	67 ⌂
Armenia	64 ⌂
Kazakhstan	64 ⌂
Hungary	63 ⌂
Italy	62 ⌂
Lithuania	62 ⌂
Israel	62 ⌂
Slovenia	62 ⌂
Romania	60
United States	**58**
England-GBR	57
Australia	56
Ukraine	56
International average	56
New Zealand	56
Malaysia	51 ⌄
Sweden	51 ⌄
Indonesia	50 ⌄
Qatar	49 ⌄
Turkey	48 ⌄
United Arab Emirates	46 ⌄
Macedonia, Rep. of	46 ⌄
Georgia	45 ⌄
Syrian Arab Republic	45 ⌄
Norway	45 ⌄
Jordan	44 ⌄
Morocco	43 ⌄
Ghana	42 ⌄
Palestinian Nat'l Auth.	42 ⌄
Iran, Islamic Rep. of	41 ⌄
Tunisia	41 ⌄
Thailand	40 ⌄
Bahrain	38 ⌄
Oman	36 ⌄
Chile	35 ⌄
Saudi Arabia	26 ⌄

Benchmarking education system

Quebec-CAN	68 ⌂
California-USA	68 ⌂
North Carolina-USA	68 ⌂
Massachusetts-USA	65 ⌂
Minnesota-USA	64 ⌂
Dubai-UAE	61 ⌂
Colorado-USA	59
Indiana-USA	56
Connecticut-USA	53
Florida-USA	51
Alabama-USA	46 ⌄
Abu Dhabi-UAE	41 ⌄
Ontario-CAN	41 ⌄
Alberta-CAN	32 ⌄

⌂ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Applying

Equation that satisfies number pairs

$(0, -1), \ (1, 3)$

Which equation is satisfied by BOTH of these pairs of numbers (x, y)?

A. $x + y = -1$

B. $2x + y = 5$

C. $3x - y = 0$

D. $4x - y = 1$

Item Number: M042245

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	66 ⬆
Korea, Rep. of	64 ⬆
Russian Federation	53 ⬆
Singapore	52 ⬆
Japan	48 ⬆
Hong Kong-CHN	47 ⬆
Israel	38 ⬆
United States	**38** ⬆
Turkey	33 ⬆
Romania	31 ⬆
Kazakhstan	31
Macedonia, Rep. of	30
Ukraine	29
Hungary	29
Italy	28
Armenia	27
International average	26
Georgia	26
Jordan	25
England-GBR	24
Finland	24
Slovenia	24
Australia	22
United Arab Emirates	22 ⬇
Lithuania	21 ⬇
Qatar	20 ⬇
New Zealand	20 ⬇
Iran, Islamic Rep. of	20 ⬇
Palestinian Nat'l Auth.	19 ⬇
Thailand	19 ⬇
Saudi Arabia	18 ⬇
Ghana	17 ⬇
Oman	17 ⬇
Bahrain	16 ⬇
Malaysia	16 ⬇
Tunisia	15 ⬇
Syrian Arab Republic	15 ⬇
Indonesia	14 ⬇
Chile	11 ⬇
Lebanon	11 ⬇
Morocco	10 ⬇
Norway	10 ⬇
Sweden	8 ⬇

Benchmarking education system

North Carolina-USA	49 ⬆
Massachusetts-USA	45 ⬆
California-USA	43 ⬆
Minnesota-USA	41 ⬆
Indiana-USA	39 ⬆
Connecticut-USA	38 ⬆
Florida-USA	36 ⬆
Colorado-USA	36 ⬆
Alabama-USA	29
Dubai-UAE	24
Alberta-CAN	24
Abu Dhabi-UAE	21 ⬇
Ontario-CAN	20 ⬇
Quebec-CAN	20 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Applying

Length of the longest wood piece

A piece of wood was 40 cm long.

It was cut into 3 pieces.

The lengths in cm are

$2x - 5$

$x + 7$

$x + 6$

A. What is the length of the longest piece?

Answer: _____ cm

B. Show your work. If you use a calculator, you still must describe all the steps you used to obtain your answer.

Item Number: M052002

SCORING

Correct Response

• 15, with $4x + 8 = 40$ or equivalent algebraic reasoning shown

Partially Correct Response

• 8, with correct working shown or indication of $x = 8$ with correct working

• $x + 7$, with correct working shown or indication of $x = 8$

• 15, with numerical (i.e., non-algebraic) reasoning shown

Incorrect Response

• 15 or $x + 7$ with no/incorrect work shown

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	53 ⬡
Chinese Taipei-CHN	50 ⬡
Korea, Rep. of	40 ⬡
Hong Kong-CHN	28 ⬡
Israel	27 ⬡
Hungary	23 ⬡
Russian Federation	22 ⬡
Lithuania	19 ⬡
Ukraine	16 ⬡
Japan	16 ⬡
Turkey	15 ⬡
Finland	11
International average	11
Armenia	10
Georgia	10
Romania	9
Sweden	8 ⬢
United States	**7** ⬢
Australia	7 ⬢
Kazakhstan	7 ⬢
United Arab Emirates	6 ⬢
Bahrain	5 ⬢
Italy	5 ⬢
New Zealand	5 ⬢
Qatar	4 ⬢
Thailand	4 ⬢
Lebanon	4 ⬢
Macedonia, Rep. of	4 ⬢
Slovenia	4 ⬢
Malaysia	3 ⬢
Tunisia	3 ⬢
England-GBR	3 ⬢
Chile	3 ⬢
Syrian Arab Republic	3 ⬢
Palestinian Nat'l Auth.	3 ⬢
Iran, Islamic Rep. of	2 ⬢
Oman	2 ⬢
Jordan	2 ⬢
Saudi Arabia	1 ⬢
Indonesia	1 ⬢
Ghana	1 ⬢
Morocco	# ⬢
Norway	# ⬢

Benchmarking education system

|	
Quebec-CAN	16 ⬡
Massachusetts-USA	16
North Carolina-USA	14
Minnesota-USA	13
Dubai-UAE	10
Connecticut-USA	9
Indiana-USA	9
Florida-USA	9
Ontario-CAN	8 ⬢
California-USA	6 ⬢
Colorado-USA	6 ⬢
Abu Dhabi-UAE	5 ⬢
Alberta-CAN	4 ⬢
Alabama-USA	3 ⬢

⬡ Percent higher than International average
⬢ Percent lower than International average
Rounds to zero

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Algebraic Expressions	Applying

Area of garden's shaded portion
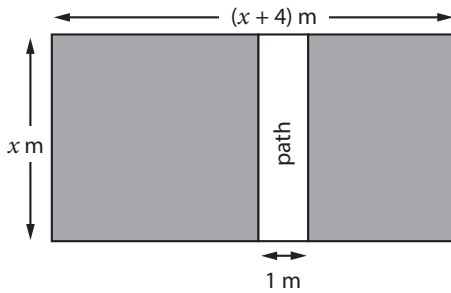
This is a diagram of a rectangular garden.

The white area is a rectangular path that is 1 meter wide.

Which expression shows the area of the shaded portion of the garden in m^2?

A.　$x^2 + 3x$

B.　$x^2 + 4x$

C.　$x^2 + 4x - 1$

D.　$x^2 + 3x - 1$

Item Number: M052173

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	65 ⬓
Singapore	55 ⬓
Hong Kong-CHN	46 ⬓
Korea, Rep. of	46 ⬓
Japan	27 ⬓
Russian Federation	26 ⬓
Turkey	21 ⬓
Armenia	21
Kazakhstan	20
Israel	19
Macedonia, Rep. of	18
International average	16
Romania	16
England-GBR	15
Australia	14
Lithuania	14 ⬓
Slovenia	13
Italy	13 ⬓
Ukraine	12 ⬓
Georgia	12 ⬓
Malaysia	11 ⬓
Sweden	11 ⬓
Oman	11 ⬓
Palestinian Nat'l Auth.	11 ⬓
New Zealand	10 ⬓
United Arab Emirates	10 ⬓
United States	**10** ⬓
Ghana	10 ⬓
Iran, Islamic Rep. of	10 ⬓
Chile	9 ⬓
Syrian Arab Republic	9 ⬓
Saudi Arabia	9 ⬓
Qatar	9 ⬓
Finland	9 ⬓
Tunisia	9 ⬓
Hungary	9 ⬓
Lebanon	9 ⬓
Thailand	8 ⬓
Bahrain	8 ⬓
Jordan	8 ⬓
Indonesia	8 ⬓
Morocco	6 ⬓
Norway	—

Benchmarking education system

Massachusetts-USA	20
Colorado-USA	16
Minnesota-USA	15
Connecticut-USA	15
North Carolina-USA	13
Ontario-CAN	11 ⬓
Dubai-UAE	11 ⬓
Indiana-USA	11 ⬓
Florida-USA	10 ⬓
Quebec-CAN	10 ⬓
Abu Dhabi-UAE	10 ⬓
Alberta-CAN	9 ⬓
Alabama-USA	9 ⬓
California-USA	8 ⬓

⬓ Percent higher than International average
⬓ Percent lower than International average
— Not applicable

Content Domain	Main Topic	Cognitive Domain
ALGEBRA	Equations/ Formulas and Functions	Knowing

Value of y in an expression

$$y = \frac{a+b}{c}$$

$a = 8$, $b = 6$, and $c = 2$

What is the value of y?

A.   7

B.   10

C.   11

D.   14

Item Number: M052302

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	92 ⬦
Chinese Taipei-CHN	91 ⬦
Singapore	91 ⬦
Russian Federation	91 ⬦
United States	**89** ⬦
Japan	86 ⬦
Kazakhstan	86 ⬦
Hong Kong-CHN	83 ⬦
Lithuania	83 ⬦
Ukraine	81 ⬦
Hungary	81 ⬦
Armenia	81 ⬦
Italy	80 ⬦
Slovenia	78 ⬦
Finland	78 ⬦
Romania	75 ⬦
Sweden	75 ⬦
England-GBR	73
Israel	72
Macedonia, Rep. of	71
Australia	71
International average	71
Norway	70
Georgia	68
Qatar	66 ⬦
Turkey	66 ⬦
Jordan	65 ⬦
Indonesia	65 ⬦
Chile	65 ⬦
Syrian Arab Republic	65 ⬦
United Arab Emirates	64 ⬦
Bahrain	64 ⬦
Tunisia	62 ⬦
New Zealand	61 ⬦
Lebanon	60 ⬦
Palestinian Nat'l Auth.	59 ⬦
Saudi Arabia	57 ⬦
Thailand	56 ⬦
Iran, Islamic Rep. of	51 ⬦
Ghana	49 ⬦
Oman	48 ⬦
Malaysia	47 ⬦
Morocco	45 ⬦

Benchmarking education system

Massachusetts-USA	94 ⬦
Indiana-USA	93 ⬦
Minnesota-USA	92 ⬦
Florida-USA	90 ⬦
California-USA	89 ⬦
North Carolina-USA	89 ⬦
Connecticut-USA	88 ⬦
Alabama-USA	84 ⬦
Colorado-USA	84 ⬦
Ontario-CAN	78 ⬦
Quebec-CAN	75 ⬦
Dubai-UAE	73
Alberta-CAN	71
Abu Dhabi-UAE	64 ⬦

⬦ Percent higher than International average
⬦ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Measurement	Applying

Shape made up of same size cubes
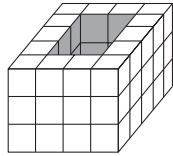
The figure above shows a shape made up of cubes that are all the same size. There is a hole all the way through the shape. How many cubes would be needed to fill the hole?

A.   6

B.   12

C.   15

D.   18

Item Number: M032100

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	87 ⬆
Chinese Taipei-CHN	84 ⬆
Japan	80 ⬆
Singapore	77 ⬆
Finland	77 ⬆
Hong Kong-CHN	74 ⬆
Australia	72 ⬆
Lithuania	70 ⬆
New Zealand	68 ⬆
England-GBR	66 ⬆
Hungary	65 ⬆
Slovenia	64 ⬆
Russian Federation	63 ⬆
United States	**60** ⬆
Norway	58 ⬆
Sweden	57 ⬆
Italy	57 ⬆
Chile	52 ⬆
Ukraine	50
Israel	48
Turkey	47
International average	47
Malaysia	40 ⬇
Kazakhstan	39 ⬇
Macedonia, Rep. of	38 ⬇
Thailand	38 ⬇
Romania	38 ⬇
Georgia	35 ⬇
United Arab Emirates	35 ⬇
Armenia	35 ⬇
Iran, Islamic Rep. of	30 ⬇
Qatar	30 ⬇
Oman	28 ⬇
Bahrain	27 ⬇
Saudi Arabia	26 ⬇
Indonesia	24 ⬇
Lebanon	23 ⬇
Palestinian Nat'l Auth.	20 ⬇
Tunisia	20 ⬇
Morocco	19 ⬇
Jordan	19 ⬇
Syrian Arab Republic	14 ⬇
Ghana	11 ⬇

Benchmarking education system

Massachusetts-USA	74 ⬆
Minnesota-USA	72 ⬆
Quebec-CAN	71 ⬆
Indiana-USA	68 ⬆
North Carolina-USA	67 ⬆
Colorado-USA	67 ⬆
Alberta-CAN	67 ⬆
Ontario-CAN	65 ⬆
Connecticut-USA	57 ⬆
Florida-USA	55 ⬆
California-USA	53
Alabama-USA	48
Dubai-UAE	38 ⬇
Abu Dhabi-UAE	35 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Measurement	Applying

Area of a square is 144 square cm

The area of a square is 144 cm^2. What is the perimeter of the square?

A.   12 cm

B.   48 cm

C.   288 cm

D.   576 cm

Item Number: M032116

Correct Response:	**B**

Overall Percent Correct

Education system	Percent correct
Singapore	79 ⬤
Chinese Taipei-CHN	75 ⬤
Korea, Rep. of	69 ⬤
Italy	67 ⬤
Hong Kong-CHN	66 ⬤
Russian Federation	62 ⬤
Israel	55 ⬤
Lithuania	53 ⬤
Romania	52 ⬤
Slovenia	51 ⬤
Hungary	49 ⬤
Armenia	48
Australia	48
Turkey	48
Ukraine	47
Japan	47
Georgia	47
England-GBR	47
United States	**46**
Norway	46
International average	45
New Zealand	45
Macedonia, Rep. of	45
Kazakhstan	45
Sweden	44
Malaysia	43
Finland	42
Tunisia	41
United Arab Emirates	39 ⬤
Chile	39 ⬤
Iran, Islamic Rep. of	38 ⬤
Palestinian Nat'l Auth.	37 ⬤
Syrian Arab Republic	36 ⬤
Bahrain	36 ⬤
Thailand	35 ⬤
Jordan	34 ⬤
Qatar	33 ⬤
Lebanon	33 ⬤
Oman	32 ⬤
Saudi Arabia	31 ⬤
Morocco	27 ⬤
Ghana	27 ⬤
Indonesia	25 ⬤

Benchmarking education system

Massachusetts-USA	61 ⬤
Colorado-USA	58 ⬤
Indiana-USA	57 ⬤
North Carolina-USA	55 ⬤
Ontario-CAN	54 ⬤
Quebec-CAN	51 ⬤
Connecticut-USA	50
Minnesota-USA	48
Alberta-CAN	45
Dubai-UAE	44
Florida-USA	44
California-USA	42
Alabama-USA	41
Abu Dhabi-UAE	36 ⬤

⬤ Percent higher than International average
⬤ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Reasoning

Distance between the midpoints

Points *A*, *B*, and *C* lie on a line and *B* is between *A* and *C*. If *AB* = 10 cm and *BC* = 5.2 cm, what is the distance between the midpoints of *AB* and *BC*?

A. 2.4 cm

B. 2.6 cm

C. 5.0 cm

D. 7.6 cm

Item Number: M032324

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	69 ⬆
Korea, Rep. of	68 ⬆
Singapore	65 ⬆
Japan	63 ⬆
Russian Federation	60 ⬆
Ukraine	50 ⬆
Hong Kong-CHN	48 ⬆
Armenia	48 ⬆
Lithuania	45 ⬆
Georgia	44 ⬆
Finland	44 ⬆
Lebanon	44 ⬆
Kazakhstan	42
Hungary	41
Sweden	41
Slovenia	40
Australia	40
Italy	39
International average	39
Romania	38
Norway	38
England-GBR	38
Israel	37
Turkey	36
Palestinian Nat'l Auth.	35
Malaysia	35
Macedonia, Rep. of	34 ⬇
Tunisia	33 ⬇
Morocco	32 ⬇
New Zealand	31 ⬇
United Arab Emirates	31 ⬇
Iran, Islamic Rep. of	30 ⬇
Jordan	30 ⬇
United States	**29** ⬇
Bahrain	28 ⬇
Syrian Arab Republic	28 ⬇
Saudi Arabia	27 ⬇
Thailand	26 ⬇
Oman	26 ⬇
Qatar	25 ⬇
Chile	25 ⬇
Ghana	19 ⬇
Indonesia	18 ⬇

Benchmarking education system	
Quebec-CAN	54 ⬆
Massachusetts-USA	40
Ontario-CAN	39
Alberta-CAN	38
Indiana-USA	35
Minnesota-USA	35
North Carolina-USA	34
Colorado-USA	33
Dubai-UAE	32 ⬇
Connecticut-USA	31 ⬇
Abu Dhabi-UAE	30 ⬇
California-USA	29 ⬇
Florida-USA	29 ⬇
Alabama-USA	21 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Applying

Degrees minute hand of clock turns

How many degrees does a minute hand of a clock turn through from 6:20 a.m. to 8:00 a.m. on the same day?

A. 680°

B. 600°

C. 540°

D. 420°

Item Number: M032331

Correct Response:	**B**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	63 ⬣
Japan	58 ⬣
Singapore	57 ⬣
Chinese Taipei-CHN	56 ⬣
Hong Kong-CHN	51 ⬣
Finland	32
Sweden	31
England-GBR	31
Slovenia	31
Morocco	30
Hungary	30
Syrian Arab Republic	30
Palestinian Nat'l Auth.	29
International average	29
Russian Federation	29
Saudi Arabia	28
Macedonia, Rep. of	28
Turkey	27
Israel	27
Australia	27
New Zealand	26
Iran, Islamic Rep. of	26
Tunisia	26
Malaysia	26 ⬇
Ukraine	25
Armenia	25 ⬇
Italy	25 ⬇
Jordan	25 ⬇
Lebanon	24 ⬇
Bahrain	24 ⬇
Romania	23 ⬇
Norway	23 ⬇
Kazakhstan	23 ⬇
United Arab Emirates	23 ⬇
United States	**22** ⬇
Qatar	22 ⬇
Oman	21 ⬇
Lithuania	21 ⬇
Ghana	21 ⬇
Georgia	19 ⬇
Indonesia	19 ⬇
Thailand	16 ⬇
Chile	—

Benchmarking education system

Quebec-CAN	30
Minnesota-USA	29
Ontario-CAN	26
North Carolina-USA	26
Massachusetts-USA	25
Dubai-UAE	24 ⬇
Connecticut-USA	24
Abu Dhabi-UAE	23 ⬇
Indiana-USA	19 ⬇
Alberta-CAN	19 ⬇
Alabama-USA	18 ⬇
Colorado-USA	18 ⬇
Florida-USA	18 ⬇
California-USA	17 ⬇

⬣ Percent higher than International average
⬇ Percent lower than International average
— Not applicable

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Location and Movement	Knowing

Figure 1 transformed to 2 and 3

Figure 1   Figure 2   Figure 3

Which of these transformations, taken in order, can be used so that Figure 1 above becomes Figure 2 and then Figure 3?

A.   reflection and then translation

B.   reflection and then $\frac{1}{4}$ turn rotation clockwise

C. $\frac{1}{2}$ turn rotation and then translation

D. $\frac{1}{4}$ turn rotation counterclockwise and then reflection

Item Number: M032397

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	84 ⬠
Korea, Rep. of	83 ⬠
Japan	78 ⬠
Chinese Taipei-CHN	69 ⬠
Singapore	67 ⬠
New Zealand	65 ⬠
Hungary	65 ⬠
Australia	63 ⬠
England-GBR	61 ⬠
Finland	59 ⬠
United States	**58** ⬠
Turkey	55 ⬠
Sweden	54 ⬠
Russian Federation	52 ⬠
Italy	50 ⬠
Slovenia	48
Norway	47
International average	43
Malaysia	42
Lithuania	41
United Arab Emirates	40 ⬡
Thailand	38 ⬡
Ukraine	38 ⬡
Israel	37 ⬡
Qatar	33 ⬡
Palestinian Nat'l Auth.	33 ⬡
Iran, Islamic Rep. of	32 ⬡
Oman	32 ⬡
Jordan	32 ⬡
Georgia	32 ⬡
Indonesia	31 ⬡
Kazakhstan	31 ⬡
Romania	31 ⬡
Tunisia	30 ⬡
Bahrain	30 ⬡
Syrian Arab Republic	27 ⬡
Saudi Arabia	27 ⬡
Macedonia, Rep. of	26 ⬡
Chile	24 ⬡
Lebanon	21 ⬡
Armenia	20 ⬡
Ghana	20 ⬡
Morocco	18 ⬡

Benchmarking education system

Ontario-CAN	76 ⬠
Massachusetts-USA	75 ⬠
Alberta-CAN	69 ⬠
Minnesota-USA	69 ⬠
North Carolina-USA	67 ⬠
Connecticut-USA	66 ⬠
Florida-USA	65 ⬠
Indiana-USA	63 ⬠
Quebec-CAN	63 ⬠
Colorado-USA	62 ⬠
Alabama-USA	54 ⬠
California-USA	46
Dubai-UAE	43
Abu Dhabi-UAE	39

⬠ Percent higher than International average
⬡ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Reasoning

Value of angle x in figure
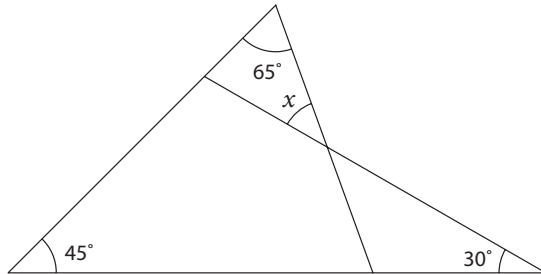
In the figure above, what is the value of *x*?

A. 30°

B. 40°

C. 45°

D. 65°

Item Number: M032398

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Singapore	83 ⬤
Japan	81 ⬤
Korea, Rep. of	81 ⬤
Hong Kong-CHN	79 ⬤
Chinese Taipei-CHN	76 ⬤
Russian Federation	58 ⬤
Lebanon	52 ⬤
Kazakhstan	50
Italy	50
Finland	49
Malaysia	49
Israel	49
Hungary	49
Turkey	48
Lithuania	46
International average	46
England-GBR	44
Ukraine	43
New Zealand	43
Australia	43
Sweden	43
Thailand	42
United States	**42** ⬇
Ghana	42 ⬇
Armenia	41 ⬇
Saudi Arabia	41 ⬇
Jordan	40 ⬇
Slovenia	40 ⬇
Iran, Islamic Rep. of	39 ⬇
United Arab Emirates	38 ⬇
Indonesia	37 ⬇
Chile	37 ⬇
Norway	36 ⬇
Oman	35 ⬇
Georgia	35 ⬇
Bahrain	33 ⬇
Qatar	33 ⬇
Romania	33 ⬇
Macedonia, Rep. of	33 ⬇
Morocco	32 ⬇
Syrian Arab Republic	32 ⬇
Palestinian Nat'l Auth.	31 ⬇
Tunisia	27 ⬇

Benchmarking education system

Massachusetts-USA	56 ⬤
Quebec-CAN	53 ⬤
Alberta-CAN	50
North Carolina-USA	48
California-USA	48
Minnesota-USA	47
Ontario-CAN	43
Indiana-USA	43
Florida-USA	42
Colorado-USA	41
Dubai-UAE	41
Abu Dhabi-UAE	40 ⬇
Connecticut-USA	39 ⬇
Alabama-USA	38 ⬇

⬤ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Reasoning

Why PQR is a right angle triangle
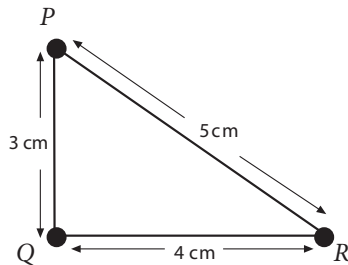
Which of these is the reason that triangle *PQR* is a right angle triangle?

A. $3^2 + 4^2 = 5^2$

B. $5 < 3 + 4$

C. $3 + 4 = 12 - 5$

D. $3 > 5 - 4$

Item Number: M032402

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	87 ⬥
Singapore	79 ⬥
Chinese Taipei-CHN	76 ⬥
Russian Federation	71 ⬥
Lebanon	70 ⬥
Israel	66 ⬥
Lithuania	65 ⬥
Romania	63 ⬥
Ukraine	60 ⬥
United States	**59** ⬥
Italy	59 ⬥
Kazakhstan	58 ⬥
Turkey	58 ⬥
Hungary	57 ⬥
Thailand	56 ⬥
Indonesia	55 ⬥
Macedonia, Rep. of	55
Palestinian Nat'l Auth.	54
United Arab Emirates	53
Iran, Islamic Rep. of	52
Georgia	52
Malaysia	52
International average	51
Australia	50
Armenia	50
England-GBR	50
Morocco	49
Finland	45 ⬇
Jordan	45 ⬇
Saudi Arabia	44 ⬇
Qatar	44 ⬇
Bahrain	42 ⬇
Chile	41 ⬇
Korea, Rep. of	41 ⬇
Syrian Arab Republic	40 ⬇
Oman	34 ⬇
Slovenia	34 ⬇
Ghana	34 ⬇
Norway	33 ⬇
New Zealand	32 ⬇
Japan	27 ⬇
Sweden	23 ⬇
Tunisia	19 ⬇

Benchmarking education system

Massachusetts-USA	74 ⬥
North Carolina-USA	68 ⬥
Minnesota-USA	66 ⬥
Indiana-USA	64 ⬥
Florida-USA	63 ⬥
Colorado-USA	63 ⬥
Alberta-CAN	62 ⬥
Dubai-UAE	56 ⬥
California-USA	55
Ontario-CAN	54
Alabama-USA	52
Connecticut-USA	51
Abu Dhabi-UAE	48
Quebec-CAN	29 ⬇

⬥ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Measurement	Applying

Area of the shaded region in figure
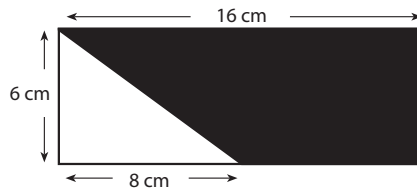
In the figure above, what is the area of the shaded region in cm^2?

A.   24

B.   44

C.   48

D.   72

Item Number: M032623

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	84 ⏶
Hong Kong-CHN	84 ⏶
Singapore	80 ⏶
Korea, Rep. of	79 ⏶
Japan	76 ⏶
Italy	56 ⏶
Israel	48 ⏶
Russian Federation	46 ⏶
Sweden	44 ⏶
Lithuania	42 ⏶
Finland	42 ⏶
Romania	39
England-GBR	38
Australia	38
International average	36
Hungary	36
Slovenia	35
United States	**35**
Norway	35
New Zealand	34
Turkey	30 ⏷
Tunisia	29 ⏷
United Arab Emirates	29 ⏷
Malaysia	29 ⏷
Kazakhstan	28 ⏷
Ukraine	27 ⏷
Armenia	27 ⏷
Georgia	27 ⏷
Chile	26 ⏷
Iran, Islamic Rep. of	24 ⏷
Saudi Arabia	23 ⏷
Palestinian Nat'l Auth.	22 ⏷
Jordan	22 ⏷
Indonesia	22 ⏷
Bahrain	21 ⏷
Macedonia, Rep. of	21 ⏷
Thailand	21 ⏷
Qatar	21 ⏷
Syrian Arab Republic	19 ⏷
Lebanon	19 ⏷
Oman	17 ⏷
Morocco	17 ⏷
Ghana	14 ⏷

Benchmarking education system

Quebec-CAN	63 ⏶
Massachusetts-USA	57 ⏶
Colorado-USA	50 ⏶
North Carolina-USA	48 ⏶
Ontario-CAN	45 ⏶
Connecticut-USA	44 ⏶
Minnesota-USA	43 ⏶
Indiana-USA	42 ⏶
Alberta-CAN	40
Dubai-UAE	34
Florida-USA	29
Abu Dhabi-UAE	27 ⏷
California-USA	24 ⏷
Alabama-USA	23 ⏷

⏶ Percent higher than International average
⏷ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Knowing

Shape of cutout figure
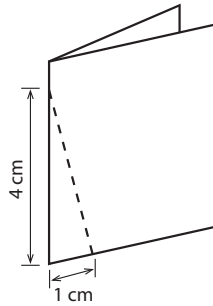
A piece of paper in the shape of a rectangle is folded in half as shown in the figure above. It is then cut along the dotted line, and the small piece that is cut is opened. What is the shape of the cutout figure?

A. an isosceles triangle

B. two isosceles triangles

C. a right triangle

D. an equilateral triangle

Item Number: M032679

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	88 ⬠
Chinese Taipei-CHN	87 ⬠
Korea, Rep. of	85 ⬠
Japan	85 ⬠
Singapore	80 ⬠
Russian Federation	73 ⬠
Italy	69 ⬠
England-GBR	66 ⬠
Israel	64 ⬠
Ukraine	63 ⬠
Australia	63 ⬠
Lithuania	60 ⬠
Hungary	59 ⬠
New Zealand	57 ⬠
Kazakhstan	57
Norway	56
Slovenia	56
United States	**55**
Sweden	53
Finland	53
International average	52
Romania	51
Chile	49
Georgia	48
Thailand	47 ⬟
United Arab Emirates	46 ⬟
Indonesia	44 ⬟
Iran, Islamic Rep. of	44 ⬟
Tunisia	44 ⬟
Macedonia, Rep. of	41 ⬟
Qatar	39 ⬟
Lebanon	39 ⬟
Turkey	39 ⬟
Armenia	37 ⬟
Syrian Arab Republic	35 ⬟
Palestinian Nat'l Auth.	35 ⬟
Morocco	35 ⬟
Bahrain	34 ⬟
Jordan	34 ⬟
Malaysia	33 ⬟
Saudi Arabia	30 ⬟
Oman	28 ⬟
Ghana	28 ⬟

Benchmarking education system	
Quebec-CAN	69 ⬠
Minnesota-USA	67 ⬠
Massachusetts-USA	65 ⬠
Connecticut-USA	64 ⬠
Ontario-CAN	63 ⬠
North Carolina-USA	60 ⬠
Colorado-USA	59 ⬠
Florida-USA	58
Indiana-USA	57
Dubai-UAE	50
Alberta-CAN	49
Abu Dhabi-UAE	49
California-USA	47
Alabama-USA	41 ⬟

⬠ Percent higher than International average
⬟ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Reasoning

Interior angles of pentagon
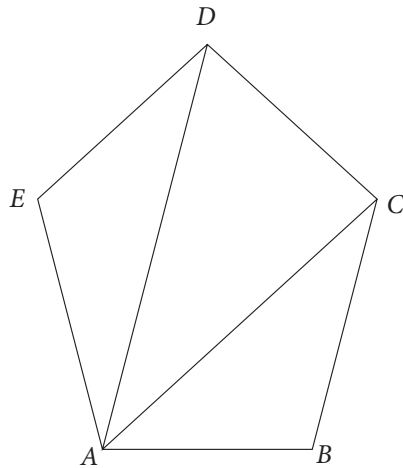
What is the sum of all the interior angles of pentagon *ABCDE*?
Show your work.

Answer: _____

Item Number: M032692

SCORING

Correct Response

• 540 degrees with work shown

Examples:

3 (triangles) × 180° = 540°

6 (right angles) × 90° = 540°

Partially Correct Response

• 540 degrees with no work shown

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	72 ⬤
Chinese Taipei-CHN	70 ⬤
Korea, Rep. of	69 ⬤
Singapore	55 ⬤
Hong Kong-CHN	38 ⬤
Slovenia	31 ⬤
Israel	30 ⬤
Turkey	28 ⬤
Armenia	23
Hungary	22
Iran, Islamic Rep. of	21
Kazakhstan	20
International average	19
Russian Federation	19
Italy	18
Macedonia, Rep. of	18
Palestinian Nat'l Auth.	18
Oman	17
England-GBR	17
Lithuania	16 ⬇
Jordan	15 ⬇
Ukraine	15 ⬇
Norway	15 ⬇
Australia	13 ⬇
Georgia	12 ⬇
Tunisia	12 ⬇
Finland	12 ⬇
United States	**12** ⬇
Sweden	11 ⬇
New Zealand	11 ⬇
United Arab Emirates	10 ⬇
Saudi Arabia	10 ⬇
Qatar	10 ⬇
Lebanon	8 ⬇
Romania	8 ⬇
Syrian Arab Republic	7 ⬇
Chile	7 ⬇
Malaysia	6 ⬇
Bahrain	6 ⬇
Thailand	6 ⬇
Ghana	4 ⬇
Morocco	3 ⬇
Indonesia	# ⬇

Benchmarking education system	
Massachusetts-USA	40 ⬤
Quebec-CAN	21
North Carolina-USA	17
Dubai-UAE	16 ⬇
Minnesota-USA	15
Florida-USA	15
Connecticut-USA	12 ⬇
Colorado-USA	12 ⬇
Indiana-USA	12 ⬇
Ontario-CAN	10 ⬇
Abu Dhabi-UAE	8 ⬇
California-USA	7 ⬇
Alabama-USA	5 ⬇
Alberta-CAN	4 ⬇

⬤ Percent higher than International average
⬇ Percent lower than International average
\# Rounds to zero

Interior angles of pentagon (continued)
M032692

Student Responses

Correct Response:

Answer: ___540___

$$180$$
$$180$$
$$+180$$
$$540$$

Partially Correct Response:

Answer: ___540___

Incorrect Response:

Answer: ___20___

$$8$$
$$7$$
$$5$$
$$20$$

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Knowing

View of shape directly from above
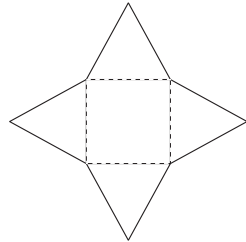
The shape shown above is cut out of cardboard. The triangle flaps are then folded up along the dotted lines until they touch the edges of the flaps next to them.

Complete the diagram below to show what the shape would look like when viewed from directly above.

Item Number: M032734

SCORING

Correct Response

• Correct figure (square with diagonals meeting in center)

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	89 ⬤
Finland	89 ⬤
Australia	87 ⬤
Korea, Rep. of	85 ⬤
New Zealand	84 ⬤
Singapore	83 ⬤
England-GBR	82 ⬤
United States	**81** ⬤
Slovenia	81 ⬤
Lithuania	78 ⬤
Hungary	77 ⬤
Hong Kong-CHN	77 ⬤
Russian Federation	75 ⬤
Norway	74 ⬤
Chinese Taipei-CHN	74 ⬤
Chile	70 ⬤
Italy	70 ⬤
Israel	66 ⬤
Sweden	65 ⬤
Kazakhstan	60
Ukraine	59
International average	58
Turkey	57
Malaysia	53 ⬇
Thailand	51 ⬇
United Arab Emirates	50 ⬇
Bahrain	49 ⬇
Romania	47 ⬇
Macedonia, Rep. of	47 ⬇
Iran, Islamic Rep. of	45 ⬇
Tunisia	44 ⬇
Jordan	42 ⬇
Armenia	41 ⬇
Qatar	40 ⬇
Palestinian Nat'l Auth.	37 ⬇
Saudi Arabia	37 ⬇
Georgia	37 ⬇
Oman	36 ⬇
Morocco	35 ⬇
Indonesia	27 ⬇
Syrian Arab Republic	26 ⬇
Lebanon	22 ⬇
Ghana	10 ⬇

Benchmarking education system

Massachusetts-USA	90 ⬤
Minnesota-USA	89 ⬤
Alberta-CAN	86 ⬤
Ontario-CAN	86 ⬤
Colorado-USA	85 ⬤
North Carolina-USA	82 ⬤
Quebec-CAN	80 ⬤
Indiana-USA	79 ⬤
Florida-USA	79 ⬤
Connecticut-USA	79 ⬤
California-USA	76 ⬤
Alabama-USA	69 ⬤
Dubai-UAE	57
Abu Dhabi-UAE	50 ⬇

⬤ Percent higher than International average
⬇ Percent lower than International average

View of shape directly from above (continued)
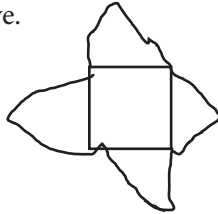
M032734

Student Responses

Correct Response:

Complete the diagram below to show what the shape would look like when viewed from directly above.

Incorrect Response:

Complete the diagram below to show what the shape would look like when viewed from directly above.
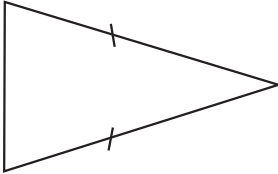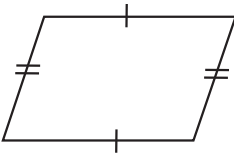
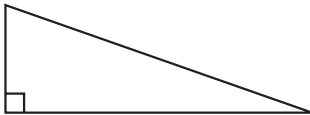| Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Knowing

Which shape has a line of symmetry

Which shape has a line of symmetry?

A.

B.

C.

D.

Item Number: M042150

Correct Response:	**B**

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	81 ⌃
England-GBR	71 ⌃
Singapore	70 ⌃
Hong Kong-CHN	64 ⌃
Australia	60 ⌃
New Zealand	57 ⌃
Hungary	57 ⌃
Lithuania	56 ⌃
United States	**52** ⌃
Iran, Islamic Rep. of	52 ⌃
Russian Federation	52 ⌃
Japan	50 ⌃
Slovenia	49 ⌃
United Arab Emirates	45 ⌃
Qatar	45
Kazakhstan	42
International average	41
Italy	38
Oman	38
Korea, Rep. of	38
Jordan	37
Morocco	36 ⌄
Macedonia, Rep. of	36 ⌄
Armenia	35 ⌄
Palestinian Nat'l Auth.	35 ⌄
Israel	34 ⌄
Georgia	32 ⌄
Turkey	32 ⌄
Malaysia	32 ⌄
Ukraine	32 ⌄
Finland	31 ⌄
Saudi Arabia	31 ⌄
Romania	30 ⌄
Thailand	29 ⌄
Norway	29 ⌄
Indonesia	28 ⌄
Lebanon	28 ⌄
Bahrain	27 ⌄
Tunisia	27 ⌄
Chile	26 ⌄
Sweden	23 ⌄
Syrian Arab Republic	21 ⌄
Ghana	17 ⌄

Benchmarking education system

Massachusetts-USA	65 ⌃
Ontario-CAN	65 ⌃
Connecticut-USA	60 ⌃
Colorado-USA	60 ⌃
Florida-USA	59 ⌃
North Carolina-USA	52 ⌃
Minnesota-USA	51 ⌃
Quebec-CAN	48 ⌃
Abu Dhabi-UAE	47 ⌃
Indiana-USA	47
Dubai-UAE	46 ⌃
Alabama-USA	45
Alberta-CAN	41
California-USA	37

⌃ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Location and Movement	Knowing

Half-turn around point O

Which of these shows the result of a half-turn clockwise around point *O*?

Item Number: M042152

Correct Response:	D

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	79 ⌂
Japan	73 ⌂
Hong Kong-CHN	71 ⌂
Finland	66 ⌂
Chinese Taipei-CHN	64 ⌂
New Zealand	63 ⌂
Hungary	62 ⌂
Singapore	62 ⌂
Slovenia	58 ⌂
England-GBR	56 ⌂
Australia	55 ⌂
Italy	52 ⌂
Ukraine	52
Israel	51 ⌂
Sweden	50 ⌂
Norway	48
Russian Federation	48
International average	45
Lithuania	45
Thailand	44
Malaysia	44
Saudi Arabia	43
United Arab Emirates	42 ▼
Jordan	40 ▼
Georgia	40 ▼
Indonesia	40 ▼
Bahrain	40 ▼
Qatar	39 ▼
United States	**39** ▼
Chile	37 ▼
Kazakhstan	36 ▼
Iran, Islamic Rep. of	36 ▼
Palestinian Nat'l Auth.	36 ▼
Turkey	35 ▼
Oman	34 ▼
Tunisia	34 ▼
Romania	32 ▼
Syrian Arab Republic	30 ▼
Armenia	28 ▼
Lebanon	28 ▼
Macedonia, Rep. of	27 ▼
Morocco	26 ▼
Ghana	26 ▼

Benchmarking education system

Quebec-CAN	61 ⌂
Ontario-CAN	55 ⌂
Alberta-CAN	54 ⌂
Minnesota-USA	50
Connecticut-USA	48
Massachusetts-USA	44
Dubai-UAE	42
Indiana-USA	42
North Carolina-USA	41
Abu Dhabi-UAE	41
Colorado-USA	41
California-USA	39 ▼
Florida-USA	38 ▼
Alabama-USA	29 ▼

⌂ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Measurement	Applying

Length of the rectangular box
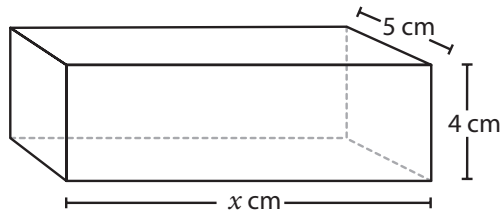
The volume of the rectangular box is 200 cm^3. What is the value of x?

Answer: _____

Item Number: M042201

SCORING

Correct Response
- 10

Incorrect Response
- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	92 ⬠
Chinese Taipei-CHN	89 ⬠
Hong Kong-CHN	87 ⬠
Japan	79 ⬠
Korea, Rep. of	78 ⬠
Russian Federation	65 ⬠
United States	**58** ⬠
Kazakhstan	56 ⬠
Slovenia	56 ⬠
Lithuania	55 ⬠
Israel	54 ⬠
Australia	53 ⬠
Finland	51 ⬠
England-GBR	49
Norway	48
New Zealand	48
Italy	44
Romania	44
United Arab Emirates	44
Hungary	44
International average	43
Ukraine	43
Armenia	42
Malaysia	42
Macedonia, Rep. of	38 ▼
Turkey	35 ▼
Indonesia	35 ▼
Sweden	33 ▼
Palestinian Nat'l Auth.	33 ▼
Georgia	32 ▼
Thailand	30 ▼
Iran, Islamic Rep. of	28 ▼
Lebanon	28 ▼
Bahrain	27 ▼
Qatar	26 ▼
Chile	25 ▼
Tunisia	22 ▼
Jordan	22 ▼
Oman	21 ▼
Saudi Arabia	20 ▼
Morocco	19 ▼
Syrian Arab Republic	18 ▼
Ghana	17 ▼

Benchmarking education system

Massachusetts-USA	80 ⬠
North Carolina-USA	75 ⬠
Minnesota-USA	72 ⬠
Indiana-USA	68 ⬠
Connecticut-USA	67 ⬠
Ontario-CAN	66 ⬠
Colorado-USA	64 ⬠
Alberta-CAN	58 ⬠
Florida-USA	58 ⬠
California-USA	56 ⬠
Quebec-CAN	51 ⬠
Dubai-UAE	50 ⬠
Abu Dhabi-UAE	42
Alabama-USA	41

⬠ Percent higher than International average
▼ Percent lower than International average

Length of the rectangular box (continued)
M042201

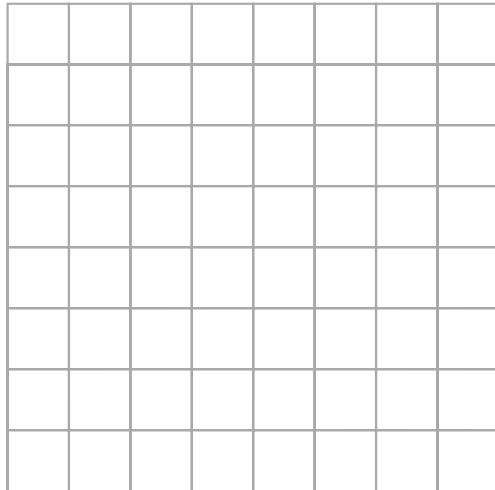## Student Responses

Correct Response:

Answer: 10

Incorrect Response:

Answer: 50

Length of the rectangular box (continued)

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Applying

Draw an isosceles triangle

The length of side of each of the small squares represents 1 cm. Draw an isosceles triangle with a base of 4 cm and a height of 5 cm.
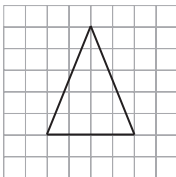
Item Number: M042270

SCORING

Correct Response

• Correct triangle drawn (any orientation)

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	85 ⬣
Korea, Rep. of	84 ⬣
Hong Kong-CHN	82 ⬣
Chinese Taipei-CHN	82 ⬣
Italy	81 ⬣
Russian Federation	75 ⬣
Singapore	72 ⬣
Hungary	68 ⬣
Kazakhstan	65 ⬣
Slovenia	63 ⬣
Sweden	60 ⬣
Ukraine	60 ⬣
Romania	59 ⬣
Lebanon	58 ⬣
Lithuania	57 ⬣
Israel	56 ⬣
Norway	53
Finland	52
Tunisia	51
Morocco	50
Armenia	49
International average	48
New Zealand	46
Macedonia, Rep. of	43 ⬇
Australia	41 ⬇
Palestinian Nat'l Auth.	40 ⬇
England-GBR	40 ⬇
Malaysia	39 ⬇
Turkey	39 ⬇
Indonesia	39 ⬇
Chile	39 ⬇
Georgia	38 ⬇
Syrian Arab Republic	33 ⬇
Jordan	32 ⬇
Iran, Islamic Rep. of	30 ⬇
Thailand	30 ⬇
Oman	27 ⬇
United States	**27** ⬇
Bahrain	27 ⬇
United Arab Emirates	26 ⬇
Qatar	17 ⬇
Saudi Arabia	10 ⬇
Ghana	9 ⬇

Benchmarking education system

|	
Quebec-CAN	62 ⬣
Ontario-CAN	48
Massachusetts-USA	43 ⬇
Connecticut-USA	36 ⬇
North Carolina-USA	35 ⬇
Minnesota-USA	35 ⬇
Alberta-CAN	32 ⬇
Colorado-USA	29 ⬇
Abu Dhabi-UAE	29 ⬇
Indiana-USA	27 ⬇
Florida-USA	26 ⬇
Dubai-UAE	26 ⬇
California-USA	25 ⬇
Alabama-USA	14 ⬇

⬣ Percent higher than International average
⬇ Percent lower than International average
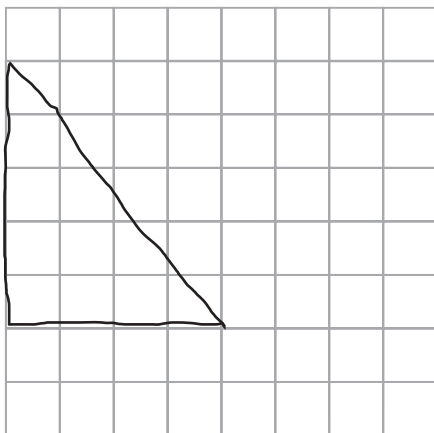
Draw an isosceles triangle (continued)
M042270

Student Responses
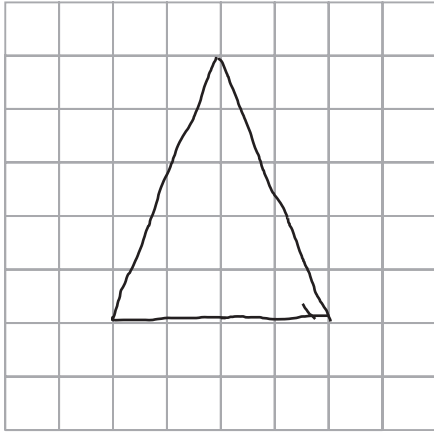
Correct Response:

Incorrect Response:

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Measurement	Applying

Mark the points B and C on graph

The diagram shows a system for locating points

In this system, the position of a point *P* is described by its distance from origin, *O,* and the amount of counterclockwise turn from a baseline *OA* to *OP.* Thus, the coordinates of *P* are (5, 340°).

A. Mark the points *B* (3, 30°) and *C* (4, 120°) on the graph above.

B. Draw the angle *BOC.* What is the measure of angle *BOC*?

Angle *BOC* = _____°

Item Number: M042300Z

SCORING

Note: Two score points will be given if both parts A and B are correct. One score point will be given if only part A is correct. No credit is given if only part B is correct.

M042300A

Correct Response

• Both points correctly marked (pictured on right)

Incorrect Response

• One point correctly marked

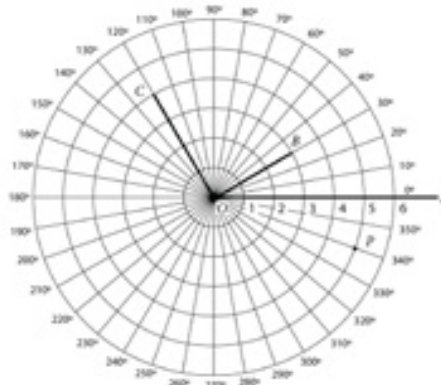• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

M042300B

Correct Response

• 90°

Incorrect Response

• Correct value given for incorrect point(s) drawn in A

• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	73 ⏶
Chinese Taipei-CHN	71 ⏶
Korea, Rep. of	71 ⏶
Hong Kong-CHN	68 ⏶
Singapore	63 ⏶
Russian Federation	59 ⏶
Slovenia	46 ⏶
Italy	45 ⏶
Lithuania	45 ⏶
Australia	43 ⏶
Ukraine	42 ⏶
Kazakhstan	39 ⏶
Finland	39 ⏶
Lebanon	37 ⏶
England-GBR	37 ⏶
Hungary	36
Israel	33
New Zealand	32
Romania	32
United States	**32**
International average	31
Tunisia	29
Malaysia	25 ⏷
Armenia	25 ⏷
Macedonia, Rep. of	23 ⏷
Norway	22 ⏷
Sweden	21 ⏷
United Arab Emirates	21 ⏷
Thailand	21 ⏷
Iran, Islamic Rep. of	21 ⏷
Turkey	20 ⏷
Jordan	20 ⏷
Qatar	17 ⏷
Georgia	17 ⏷
Bahrain	17 ⏷
Oman	14 ⏷
Palestinian Nat'l Auth.	13 ⏷
Syrian Arab Republic	11 ⏷
Indonesia	9 ⏷
Chile	9 ⏷
Morocco	9 ⏷
Saudi Arabia	7 ⏷
Ghana	3 ⏷

Benchmarking education system

Quebec-CAN	50 ⏶
Massachusetts-USA	49 ⏶
Ontario-CAN	46 ⏶
Minnesota-USA	45 ⏶
Florida-USA	41 ⏶
Indiana-USA	39 ⏶
Colorado-USA	38 ⏶
Alberta-CAN	38 ⏶
North Carolina-USA	32
Dubai-UAE	31
Connecticut-USA	31
California-USA	27
Alabama-USA	24 ⏷
Abu Dhabi-UAE	20 ⏷

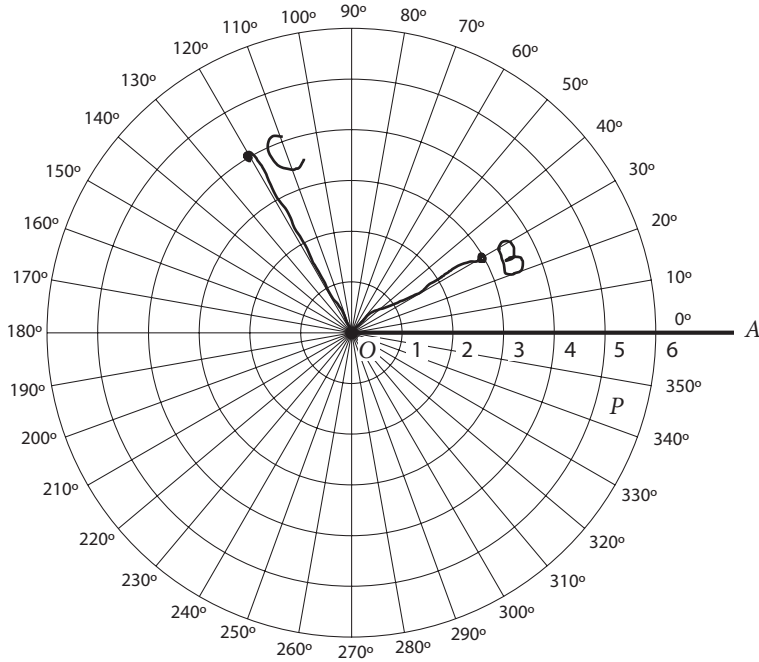⏶ Percent higher than International average
⏷ Percent lower than International average

Mark the points B and C on graph (continued)

M042300Z

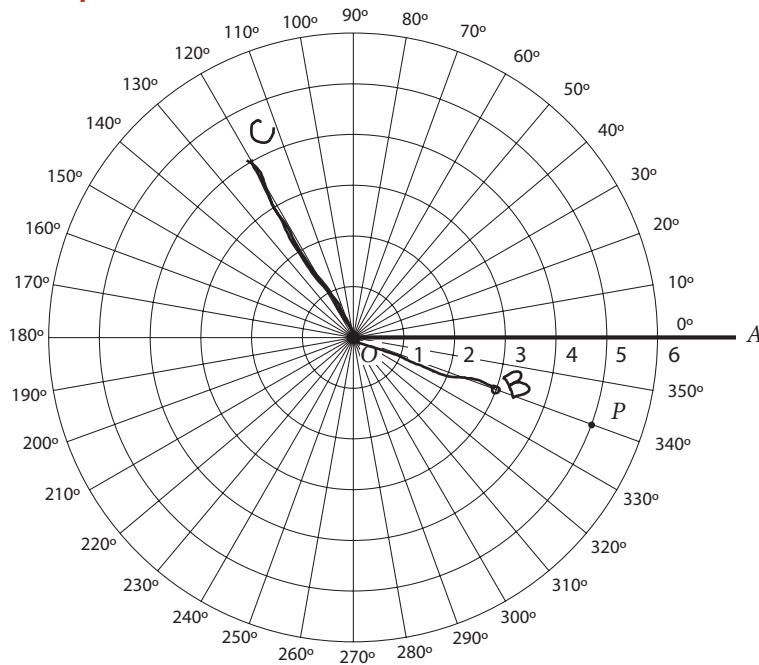## Student Responses

Correct Response:

B. Draw the angle *BOC*. What is the measure of angle *BOC*?

Angle *BOC* = _____90_____ °

Incorrect Response:

B. Draw the angle *BOC*. What is the measure of angle *BOC*?

Angle *BOC* = _____140_____°

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Measurement	Applying

Calculate the area of a square

The perimeter of a square is 36 cm.

What is the area of this square?

A.   81 cm^2

B.   36 cm^2

C.   24 cm^2

D.   18 cm^2

Item Number: M052084

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Singapore	89 ⬠
Chinese Taipei-CHN	83 ⬠
Hong Kong-CHN	82 ⬠
Italy	78 ⬠
Korea, Rep. of	78 ⬠
Japan	66 ⬠
Israel	66 ⬠
Russian Federation	62 ⬠
Sweden	62 ⬠
Slovenia	60 ⬠
Lithuania	57 ⬠
Hungary	55 ⬠
Australia	54 ⬠
United States	**53** ⬠
England-GBR	51
Armenia	50
Finland	50
Turkey	49
Kazakhstan	48
International average	47
Ukraine	47
Romania	47
Georgia	46
New Zealand	45
Norway	45
Tunisia	43 ▼
Macedonia, Rep. of	41 ▼
Malaysia	40 ▼
Chile	39 ▼
United Arab Emirates	39 ▼
Iran, Islamic Rep. of	35 ▼
Palestinian Nat'l Auth.	34 ▼
Syrian Arab Republic	33 ▼
Lebanon	31 ▼
Qatar	30 ▼
Bahrain	29 ▼
Indonesia	29 ▼
Saudi Arabia	27 ▼
Jordan	26 ▼
Oman	25 ▼
Morocco	23 ▼
Ghana	22 ▼
Thailand	20 ▼

Benchmarking education system

Quebec-CAN	77 ⬠
Massachusetts-USA	75 ⬠
Colorado-USA	67 ⬠
North Carolina-USA	66 ⬠
Ontario-CAN	65 ⬠
Indiana-USA	61 ⬠
Alberta-CAN	60 ⬠
Connecticut-USA	59 ⬠
Minnesota-USA	57 ⬠
Florida-USA	53
California-USA	44
Dubai-UAE	43
Alabama-USA	42
Abu Dhabi-UAE	37 ▼

⬠ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Measurement	Reasoning

Number of books to fill the box

Ryan is packing books into a rectangular box.

All the books are the same size.

Book

Box

6 cm

20 cm

15 cm

30 cm

36 cm

20 cm
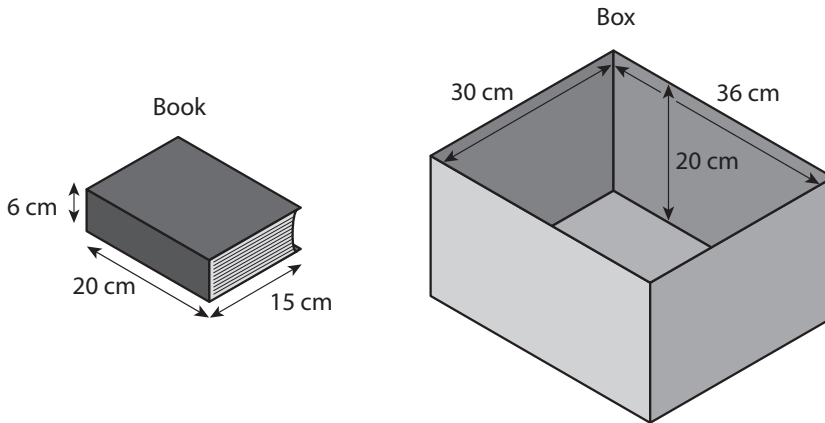
What is the largest number of books that will fit inside the box?

Answer: _____

Item Number: M052206

SCORING

Correct Response

• 12

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	66 ⬦
Hong Kong-CHN	65 ⬦
Korea, Rep. of	62 ⬦
Singapore	60 ⬦
Japan	58 ⬦
Russian Federation	36 ⬦
Israel	34 ⬦
Kazakhstan	33 ⬦
Lithuania	30 ⬦
Australia	29 ⬦
Finland	29
Malaysia	28
Slovenia	28
New Zealand	27
England-GBR	26
United States	**26**
Armenia	25
International average	25
Ukraine	23
Norway	22
Italy	22
Romania	22
Hungary	21 ⬥
Sweden	20 ⬥
United Arab Emirates	20 ⬥
Turkey	20 ⬥
Thailand	16 ⬥
Chile	16 ⬥
Macedonia, Rep. of	16 ⬥
Georgia	15 ⬥
Palestinian Nat'l Auth.	14 ⬥
Bahrain	14 ⬥
Iran, Islamic Rep. of	14 ⬥
Qatar	13 ⬥
Tunisia	12 ⬥
Saudi Arabia	12 ⬥
Indonesia	11 ⬥
Oman	11 ⬥
Lebanon	11 ⬥
Jordan	9 ⬥
Syrian Arab Republic	9 ⬥
Morocco	8 ⬥
Ghana	4 ⬥

Benchmarking education system	
Massachusetts-USA	49 ⬦
North Carolina-USA	46 ⬦
Indiana-USA	45 ⬦
Ontario-CAN	39 ⬦
Alberta-CAN	39 ⬦
Minnesota-USA	36 ⬦
Quebec-CAN	34 ⬦
Connecticut-USA	33 ⬦
Colorado-USA	32
Florida-USA	32 ⬦
Dubai-UAE	26
California-USA	22
Abu Dhabi-UAE	19 ⬥
Alabama-USA	18 ⬥

⬦ Percent higher than International average
⬥ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Reasoning

What is the size of angle B
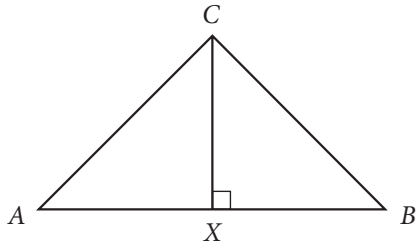
In this triangle:

$AC = BC$

AB is twice as long as CX.

What is the size of angle B?

Answer: _____ °

Item Number: M052362

SCORING

Correct Response

• 45

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	89 ⌂
Japan	85 ⌂
Singapore	83 ⌂
Hong Kong-CHN	72 ⌂
Chinese Taipei-CHN	72 ⌂
Lebanon	57 ⌂
England-GBR	52 ⌂
Russian Federation	52 ⌂
Italy	52 ⌂
Hungary	51 ⌂
Finland	48 ⌂
Australia	48 ⌂
Israel	46 ⌂
Slovenia	43
Kazakhstan	43
International average	41
Lithuania	41
Norway	40
Ukraine	40
New Zealand	40
Romania	39
United States	**39**
Thailand	39
Iran, Islamic Rep. of	37 ▼
Macedonia, Rep. of	37
Sweden	36 ▼
Armenia	35 ▼
Tunisia	34 ▼
Syrian Arab Republic	33 ▼
Georgia	33 ▼
Turkey	33 ▼
Palestinian Nat'l Auth.	30 ▼
Malaysia	28 ▼
Jordan	27 ▼
Morocco	27 ▼
United Arab Emirates	25 ▼
Qatar	24 ▼
Bahrain	19 ▼
Indonesia	18 ▼
Oman	17 ▼
Chile	17 ▼
Ghana	13 ▼
Saudi Arabia	12 ▼

Benchmarking education system

Massachusetts-USA	63 ⌂
Minnesota-USA	56 ⌂
Quebec-CAN	56 ⌂
Florida-USA	53 ⌂
Ontario-CAN	52 ⌂
North Carolina-USA	46
Connecticut-USA	45
Indiana-USA	44
Colorado-USA	43
Alberta-CAN	35 ▼
Dubai-UAE	34 ▼
California-USA	27 ▼
Alabama-USA	24 ▼
Abu Dhabi-UAE	23 ▼

⌂ Percent higher than International average
▼ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
GEOMETRY	Geometric Shapes	Reasoning

Value of angle b
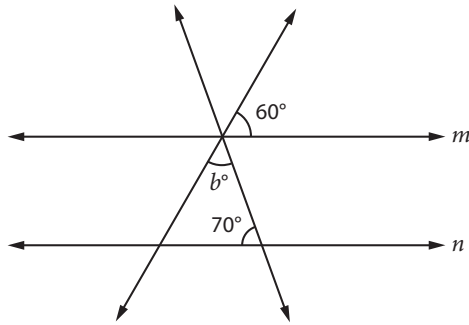
Lines *m* and *n* are parallel.

What is the value of *b*?

Answer: _____

Item Number: M052408

SCORING

Correct Response

• 50

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct	
Japan	86	⬢
Korea, Rep. of	85	⬢
Singapore	80	⬢
Hong Kong-CHN	75	⬢
Chinese Taipei-CHN	49	⬢
Russian Federation	48	⬢
Kazakhstan	44	⬢
Israel	41	⬢
Turkey	39	⬢
Finland	36	
Ukraine	35	
Lebanon	34	
Slovenia	33	
International average	33	
Armenia	32	
Malaysia	32	
Italy	32	
England-GBR	30	
Iran, Islamic Rep. of	29	
Thailand	29	⬢
Australia	28	
Tunisia	28	⬢
Lithuania	28	⬢
Hungary	27	⬢
New Zealand	25	⬢
Romania	25	⬢
United States	**24**	⬢
Jordan	23	⬢
Macedonia, Rep. of	23	⬢
United Arab Emirates	22	⬢
Sweden	22	⬢
Syrian Arab Republic	22	⬢
Palestinian Nat'l Auth.	21	⬢
Norway	20	⬢
Chile	20	⬢
Indonesia	20	⬢
Ghana	19	⬢
Saudi Arabia	18	⬢
Bahrain	18	⬢
Georgia	18	⬢
Qatar	17	⬢
Morocco	17	⬢
Oman	12	⬢

Benchmarking education system

Massachusetts-USA	39	
Minnesota-USA	36	
Quebec-CAN	35	
Ontario-CAN	34	
Florida-USA	30	
Colorado-USA	29	
Dubai-UAE	27	⬢
Indiana-USA	25	⬢
North Carolina-USA	25	⬢
Alberta-CAN	23	⬢
Alabama-USA	21	⬢
Connecticut-USA	21	⬢
Abu Dhabi-UAE	21	⬢
California-USA	20	⬢

⬢ Percent higher than International average
⬢ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Chance	Knowing

How likely to get pink candy

A machine has 100 candies and dispenses a candy when a lever is turned. The machine has the same number of blue, pink, yellow, and green candies all mixed together. Megan turned the lever and obtained a pink candy. Peter turned the lever next.

How likely is it that Peter will get a pink candy?

A. It is certain that his candy will be pink.

B. It is more likely than it was for Megan.

C. It is exactly as likely as it was for Megan.

D. It is less likely than it was for Megan.

Item Number: M032132

Correct Response:	**D**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	84 ⌃
Hong Kong-CHN	71 ⌃
Singapore	71 ⌃
Chinese Taipei-CHN	68 ⌃
Slovenia	67 ⌃
Australia	65 ⌃
Israel	65 ⌃
Japan	64 ⌃
United States	**63** ⌃
Italy	61 ⌃
Lithuania	60 ⌃
Norway	60 ⌃
Finland	59 ⌃
New Zealand	59 ⌃
England-GBR	58 ⌃
Hungary	58 ⌃
Sweden	55 ⌃
Turkey	54 ⌃
Romania	54 ⌃
Russian Federation	52
Thailand	52
Ukraine	50
Chile	48
International average	48
United Arab Emirates	44 ⌄
Saudi Arabia	42 ⌄
Georgia	42 ⌄
Macedonia, Rep. of	40 ⌄
Iran, Islamic Rep. of	40 ⌄
Kazakhstan	40 ⌄
Jordan	37 ⌄
Tunisia	37 ⌄
Qatar	37 ⌄
Armenia	34 ⌄
Bahrain	31 ⌄
Syrian Arab Republic	29 ⌄
Indonesia	26 ⌄
Oman	26 ⌄
Malaysia	25 ⌄
Palestinian Nat'l Auth.	24 ⌄
Morocco	24 ⌄
Lebanon	21 ⌄
Ghana	11 ⌄

Benchmarking education system	
Massachusetts-USA	74 ⌃
North Carolina-USA	68 ⌃
Minnesota-USA	68 ⌃
Quebec-CAN	64 ⌃
California-USA	64 ⌃
Indiana-USA	61 ⌃
Ontario-CAN	60 ⌃
Alberta-CAN	59 ⌃
Connecticut-USA	58 ⌃
Colorado-USA	58 ⌃
Florida-USA	56 ⌃
Alabama-USA	54
Dubai-UAE	47
Abu Dhabi-UAE	44

⌃ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Chance	Applying

Number of times spinner in red area
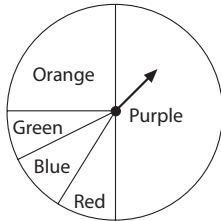
The spinner is for Steve's new game. Out of 600 spins, approximately how many times should he expect the arrow to land on the red sector?

A.   30

B.   40

C.   50

D.   60

Item Number: M032507

Correct Response:	C

Overall Percent Correct

Education system	Percent correct
Singapore	70 ⬆
Korea, Rep. of	68 ⬆
Japan	60 ⬆
Hong Kong-CHN	55 ⬆
Chinese Taipei-CHN	55 ⬆
England-GBR	50 ⬆
Australia	45 ⬆
United States	**40 ⬆**
Israel	40 ⬆
Finland	39 ⬆
New Zealand	38 ⬆
Sweden	37 ⬆
Norway	32
Russian Federation	32
International average	31
Hungary	31
Slovenia	31
Italy	31
Malaysia	29
Turkey	29
Lithuania	28
Ukraine	26 ⬇
Chile	26 ⬇
Qatar	25 ⬇
Saudi Arabia	24 ⬇
Kazakhstan	24 ⬇
Iran, Islamic Rep. of	24 ⬇
Tunisia	24 ⬇
Bahrain	23 ⬇
United Arab Emirates	23 ⬇
Palestinian Nat'l Auth.	23 ⬇
Lebanon	23 ⬇
Romania	23 ⬇
Macedonia, Rep. of	23 ⬇
Oman	22 ⬇
Thailand	22 ⬇
Syrian Arab Republic	21 ⬇
Georgia	20 ⬇
Morocco	20 ⬇
Jordan	20 ⬇
Armenia	16 ⬇
Indonesia	14 ⬇
Ghana	13 ⬇

Benchmarking education system

Minnesota-USA	56 ⬆
Massachusetts-USA	53 ⬆
Quebec-CAN	49 ⬆
Connecticut-USA	46 ⬆
Alberta-CAN	45 ⬆
North Carolina-USA	44 ⬆
Colorado-USA	43 ⬆
Ontario-CAN	42 ⬆
Indiana-USA	38 ⬆
Florida-USA	35
California-USA	30
Alabama-USA	28
Dubai-UAE	25 ⬇
Abu Dhabi-UAE	24 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Organization and Representation	Knowing

Car production graph/time cars made

The solid line (——) on the graph shows car production by the NU Car Motor Company during a particular day.

The dotted line (-----) shows what the total number of cars produced would be if the rate of production were constant.

A. By what time had a total of 150 cars been produced?

Answer: _____

Item Number: M032681A

SCORING

Correct Response

- 10 a.m.

Incorrect Response

- 11 a.m.
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	87 ⬡
Japan	85 ⬡
Finland	83 ⬡
Singapore	82 ⬡
Hungary	81 ⬡
Chinese Taipei-CHN	80 ⬡
Hong Kong-CHN	80 ⬡
Russian Federation	76 ⬡
Italy	75 ⬡
Australia	73 ⬡
Slovenia	72 ⬡
Lithuania	71 ⬡
Sweden	71 ⬡
England-GBR	70 ⬡
Israel	70 ⬡
Ukraine	70 ⬡
United States	**70** ⬡
Thailand	68 ⬡
New Zealand	66 ⬡
Tunisia	65 ⬡
Malaysia	61
International average	60
Norway	59
Turkey	59
Indonesia	57
United Arab Emirates	57 ⬡
Romania	55 ⬡
Chile	54 ⬡
Palestinian Nat'l Auth.	52 ⬡
Lebanon	52 ⬡
Kazakhstan	51 ⬡
Saudi Arabia	49 ⬡
Jordan	48 ⬡
Bahrain	45 ⬡
Iran, Islamic Rep. of	44 ⬡
Qatar	44 ⬡
Oman	41 ⬡
Macedonia, Rep. of	40 ⬡
Morocco	36 ⬡
Georgia	35 ⬡
Ghana	29 ⬡
Armenia	27 ⬡
Syrian Arab Republic	26 ⬡

Benchmarking education system

Education system	Percent correct
Massachusetts-USA	78 ⬡
Minnesota-USA	77 ⬡
Quebec-CAN	77 ⬡
Indiana-USA	75 ⬡
Alberta-CAN	73 ⬡
Connecticut-USA	72 ⬡
North Carolina-USA	72 ⬡
Colorado-USA	72 ⬡
Ontario-CAN	68 ⬡
Florida-USA	67 ⬡
California-USA	66 ⬡
Alabama-USA	66
Dubai-UAE	65 ⬡
Abu Dhabi-UAE	53 ⬡

⬡ Percent higher than International average
⬡ Percent lower than International average

Car production graph/time cars made (continued)
M032681A

Student Responses

Correct Response:

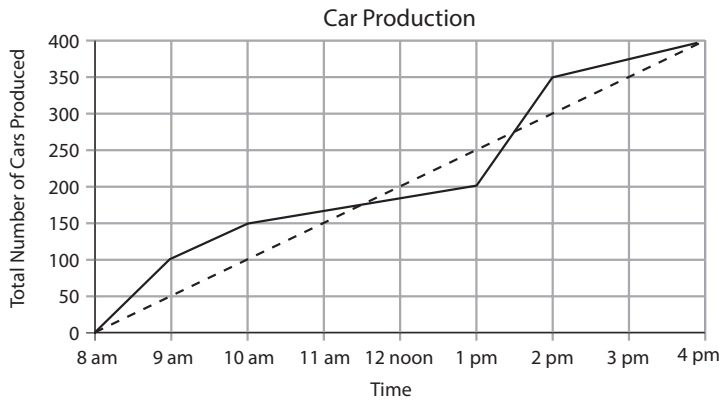A. By what time had a total of 150 cars been produced?

Answer: _____10am_____

Incorrect Response:

A. By what time had a total of 150 cars been produced?

Answer: __11am_____

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Applying

Car production graph/avg by hour

The solid line (——) on the graph shows car production by the NU Car Motor Company during a particular day.

The dotted line (-----) shows what the total number of cars produced would be if the rate of production were constant.

B. What was the average number of cars produced per hour on this day?

Answer: _____

Item Number: M032681B

SCORING

Correct Response
• 50

Incorrect Response
• 400
• Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Chinese Taipei-CHN	65 ⬆
Japan	57 ⬆
Hong Kong-CHN	56 ⬆
Finland	55 ⬆
England-GBR	52 ⬆
New Zealand	50 ⬆
Singapore	49 ⬆
United States	**48** ⬆
Australia	47 ⬆
Korea, Rep. of	46 ⬆
Turkey	42 ⬆
Slovenia	40 ⬆
Hungary	37 ⬆
Sweden	36 ⬆
Thailand	36 ⬆
Israel	34 ⬆
Romania	32
Tunisia	31
Kazakhstan	30
International average	29
Chile	29
Italy	29
Norway	27
Russian Federation	26
Iran, Islamic Rep. of	23 ⬇
United Arab Emirates	23 ⬇
Malaysia	23 ⬇
Lithuania	22 ⬇
Qatar	19 ⬇
Macedonia, Rep. of	19 ⬇
Indonesia	19 ⬇
Bahrain	18 ⬇
Ukraine	17 ⬇
Lebanon	16 ⬇
Armenia	13 ⬇
Ghana	13 ⬇
Georgia	11 ⬇
Jordan	10 ⬇
Oman	8 ⬇
Syrian Arab Republic	8 ⬇
Palestinian Nat'l Auth.	7 ⬇
Morocco	7 ⬇
Saudi Arabia	6 ⬇

Benchmarking education system

Massachusetts-USA	55 ⬆
Minnesota-USA	53 ⬆
California-USA	52 ⬆
Florida-USA	51 ⬆
Alberta-CAN	49 ⬆
Indiana-USA	46 ⬆
North Carolina-USA	45 ⬆
Colorado-USA	44 ⬆
Alabama-USA	43 ⬆
Connecticut-USA	43 ⬆
Ontario-CAN	40 ⬆
Dubai-UAE	37 ⬆
Quebec-CAN	33
Abu Dhabi-UAE	18 ⬇

⬆ Percent higher than International average
⬇ Percent lower than International average

Car production graph/avg by hour (continued)

M032681B

Student Responses

Correct Response:

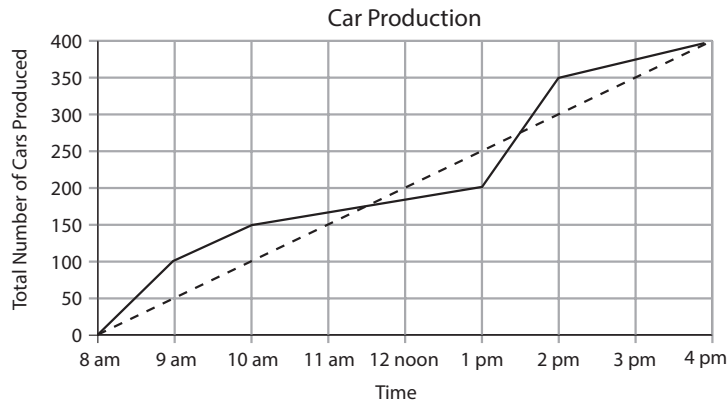B. What was the average number of cars produced per hour on this day?

Answer: ___50 cars___

Incorrect Response:

B. What was the average number of cars produced per hour on this day?

Answer: ___216___

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Applying

Car production graph/identify time

Car Production

The solid line (——) on the graph shows car production by the NU Car Motor Company during a particular day.

The dotted line (-----) shows what the total number of cars produced would be if the rate of production were constant.

C. During which hour were the most cars produced?

Between _____ and _____

Item Number: M032681C

SCORING

Correct Response
- 1 p.m. and 2 p.m.

Incorrect Response
- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Japan	82 ⌃
Korea, Rep. of	78 ⌃
Finland	77 ⌃
Hong Kong-CHN	73 ⌃
England-GBR	70 ⌃
Chinese Taipei-CHN	69 ⌃
Singapore	67 ⌃
Sweden	64 ⌃
Australia	63 ⌃
New Zealand	61 ⌃
United States	**59** ⌃
Slovenia	55 ⌃
Norway	53 ⌃
Hungary	50 ⌃
Russian Federation	47 ⌃
Israel	45 ⌃
Lithuania	35
Ukraine	35
Turkey	34
International average	34
Italy	28 ⌄
Thailand	28 ⌄
Kazakhstan	25 ⌄
Chile	20 ⌄
Malaysia	20 ⌄
United Arab Emirates	20 ⌄
Qatar	17 ⌄
Bahrain	16 ⌄
Lebanon	16 ⌄
Tunisia	13 ⌄
Armenia	13 ⌄
Romania	13 ⌄
Macedonia, Rep. of	13 ⌄
Iran, Islamic Rep. of	12 ⌄
Georgia	9 ⌄
Indonesia	8 ⌄
Saudi Arabia	6 ⌄
Jordan	6 ⌄
Oman	5 ⌄
Morocco	4 ⌄
Palestinian Nat'l Auth.	3 ⌄
Ghana	3 ⌄
Syrian Arab Republic	2 ⌄

Benchmarking education system

Massachusetts-USA	72 ⌃
Minnesota-USA	70 ⌃
Indiana-USA	67 ⌃
Connecticut-USA	64 ⌃
Alberta-CAN	63 ⌃
Colorado-USA	63 ⌃
Quebec-CAN	62 ⌃
North Carolina-USA	59 ⌃
Ontario-CAN	54 ⌃
California-USA	51 ⌃
Florida-USA	49 ⌃
Alabama-USA	40
Dubai-UAE	34
Abu Dhabi-UAE	17 ⌄

⌃ Percent higher than International average
⌄ Percent lower than International average

Car production graph/identify time (continued)
M032681C

Student Responses

Correct Response:

C. During which hour were the most cars produced?

Between _____ *1 pm* _____ and _____ *2 pm* _____

Incorrect Response:

C. During which hour were the most cars produced?

Between _____ *10 am* _____ and *1 p m* _____

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Organization and Representation	Applying

Make a pie chart with labels

Of the 400 students in a school, 50 plan to go to university, 100 to a polytechnic school, 150 to a business college, and the remainder plan to enter workforce.

Use the circle below to make a pie chart showing the proportions of students planning to do each of these. Put labels on your chart.
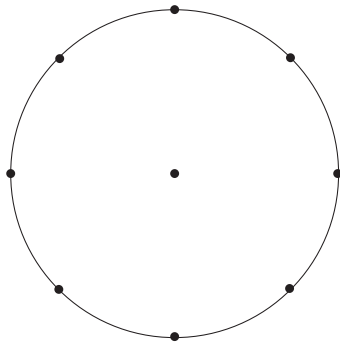
Item Number: M032695

SCORING

Correct Response

- Pie chart correctly divided and labeled

(1 section – university; 2 sections – polytechnic; 2 sections – workforce; 3 sections – business college)

Partially Correct Response

- Four sections with at least two, but not all, of correct size and correctly labeled
- Four sections of correct size but no labels, or labels 50, 100, 150, 100

Incorrect Response

- Four sections with one or none of correct size
- Other incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	84 ⌃
Chinese Taipei-CHN	80 ⌃
Japan	77 ⌃
Korea, Rep. of	77 ⌃
Hong Kong-CHN	74 ⌃
Finland	70 ⌃
Russian Federation	67 ⌃
Australia	65 ⌃
Slovenia	64 ⌃
Hungary	63 ⌃
England-GBR	61 ⌃
New Zealand	60 ⌃
Lithuania	58 ⌃
Norway	57 ⌃
Israel	55 ⌃
Sweden	54 ⌃
Italy	53 ⌃
United States	**53** ⌃
International average	45
Malaysia	45
Ukraine	44
Turkey	43
Thailand	43
Chile	43
United Arab Emirates	35 ⌄
Romania	35 ⌄
Kazakhstan	34 ⌄
Iran, Islamic Rep. of	33 ⌄
Macedonia, Rep. of	30 ⌄
Jordan	29 ⌄
Bahrain	29 ⌄
Tunisia	28 ⌄
Oman	27 ⌄
Indonesia	26 ⌄
Palestinian Nat'l Auth.	25 ⌄
Qatar	25 ⌄
Armenia	25 ⌄
Georgia	23 ⌄
Saudi Arabia	23 ⌄
Lebanon	20 ⌄
Syrian Arab Republic	19 ⌄
Morocco	13 ⌄
Ghana	10 ⌄

Benchmarking education system

Massachusetts-USA	70 ⌃
Quebec-CAN	69 ⌃
Ontario-CAN	63 ⌃
Minnesota-USA	61 ⌃
North Carolina-USA	61 ⌃
Connecticut-USA	60 ⌃
Colorado-USA	60 ⌃
Alberta-CAN	58 ⌃
Indiana-USA	58 ⌃
California-USA	47
Florida-USA	43
Dubai-UAE	39 ⌄
Alabama-USA	39 ⌄
Abu Dhabi-UAE	36 ⌄

⌃ Percent higher than International average
⌄ Percent lower than International average

Make a pie chart with labels (continued)
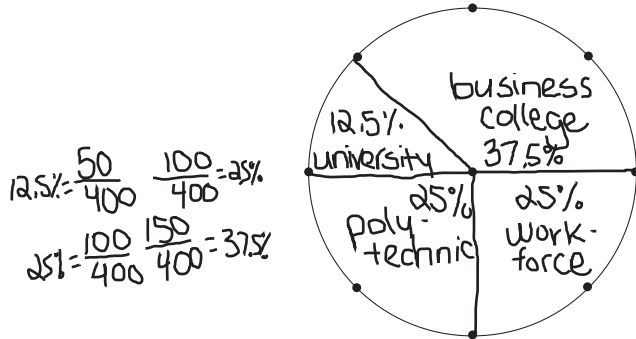
M032695

Student Responses

Correct Response:

$$12.5\% = \frac{50}{400} \quad \frac{100}{400} = 25\%$$

$$25\% = \frac{100}{400} \quad \frac{150}{400} = 37.5\%$$

business college 37.5%

12.5% university

25% poly-technic

25% work-force

Partially Correct Response:

50
100
150
———
300

400
300
100

university 50%

workforce 100%

150% buisness college

60% Polytechnic
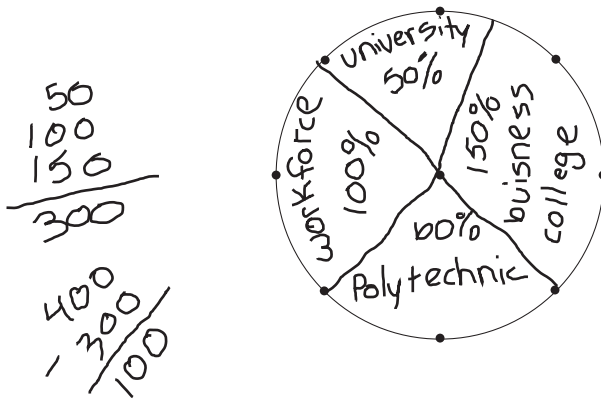
Make a pie chart with labels (continued)

M032695

Student Responses

Incorrect Response:

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Reasoning

Sales of two types of soft drinks
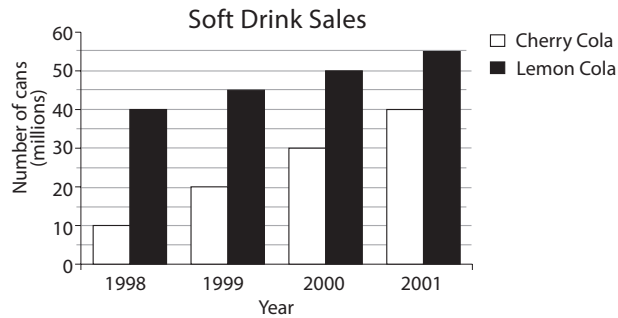
Soft Drink Sales

The graph shows the sales of two types of soft drink over 4 years. If the sales trends continue for the next 10 years, determine the year in which the sales of Cherry Cola will be the same as the sales of Lemon Cola.

A.   2003

B.   2004

C.   2005

D.   2006

Item Number: M032721

Correct Response:	**B**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	68 ⌃
Singapore	60 ⌃
Chinese Taipei-CHN	58 ⌃
Japan	57 ⌃
Australia	48 ⌃
Finland	48 ⌃
Hong Kong-CHN	48 ⌃
Israel	46 ⌃
England-GBR	46 ⌃
Hungary	45 ⌃
Italy	45 ⌃
Sweden	44 ⌃
Turkey	43 ⌃
Slovenia	43
Russian Federation	42
New Zealand	42
Norway	40
International average	40
Lithuania	39
Ukraine	38
United Arab Emirates	38
United States	**38**
Chile	37
Qatar	36
Thailand	35 ⌄
Macedonia, Rep. of	35
Malaysia	35 ⌄
Tunisia	35 ⌄
Kazakhstan	34 ⌄
Oman	34 ⌄
Morocco	34 ⌄
Georgia	33 ⌄
Lebanon	33 ⌄
Bahrain	33 ⌄
Indonesia	33 ⌄
Syrian Arab Republic	32 ⌄
Saudi Arabia	32 ⌄
Palestinian Nat'l Auth.	32 ⌄
Iran, Islamic Rep. of	32 ⌄
Ghana	30 ⌄
Romania	29 ⌄
Jordan	29 ⌄
Armenia	24 ⌄

Benchmarking education system

Massachusetts-USA	55 ⌃
Quebec-CAN	51 ⌃
North Carolina-USA	50 ⌃
Florida-USA	47 ⌃
Ontario-CAN	45 ⌃
Minnesota-USA	44
Alberta-CAN	43
Dubai-UAE	42
Indiana-USA	39
Colorado-USA	38
Connecticut-USA	38
California-USA	35
Abu Dhabi-UAE	33 ⌄
Alabama-USA	33 ⌄

⌃ Percent higher than International average
⌄ Percent lower than International average

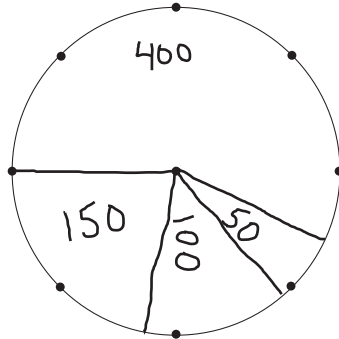| Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Knowing

Mean number of staff members

The Real Burger Company owns 5 restaurants. The numbers of staff members employed in its 5 restaurants are: 12, 18, 19, 21, and 30 people.

A. What is the mean number of staff members in the 5 restaurants?

Answer: _____

Item Number: M042169A

SCORING

Correct Response

- 20

Incorrect Response

- Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	85 △
Japan	83 △
Singapore	81 △
Korea, Rep. of	81 △
Chinese Taipei-CHN	76 △
Lithuania	73 △
Finland	72 △
Israel	67 △
United States	**64** △
Norway	64 △
Hungary	63 △
Italy	61 △
Russian Federation	61 △
Sweden	56 △
England-GBR	56 △
Ukraine	52 △
Slovenia	49 △
Turkey	48 △
Australia	46
International average	43
Iran, Islamic Rep. of	41
New Zealand	38
Armenia	38
Kazakhstan	36 ▽
Palestinian Nat'l Auth.	36 ▽
United Arab Emirates	34 ▽
Saudi Arabia	33 ▽
Macedonia, Rep. of	31 ▽
Georgia	31 ▽
Syrian Arab Republic	30 ▽
Romania	28 ▽
Bahrain	26 ▽
Oman	23 ▽
Qatar	20 ▽
Malaysia	19 ▽
Indonesia	19 ▽
Thailand	15 ▽
Lebanon	15 ▽
Jordan	14 ▽
Chile	12 ▽
Ghana	10 ▽
Tunisia	9 ▽
Morocco	2 ▽

Benchmarking education system

Education system	Percent correct
Florida-USA	79 △
Massachusetts-USA	79 △
Indiana-USA	75 △
Minnesota-USA	75 △
North Carolina-USA	72 △
Quebec-CAN	69 △
Connecticut-USA	66 △
Colorado-USA	64 △
Ontario-CAN	56 △
California-USA	50 △
Alabama-USA	46
Alberta-CAN	37
Abu Dhabi-UAE	37 ▽
Dubai-UAE	33 ▽

△ Percent higher than International average
▽ Percent lower than International average

Mean number of staff members (continued)

M042169A

Student Responses

Correct Response:

Answer: ____20_____

Incorrect Response:

Answer: ____12_____

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Knowing

Median number of staff members

The Real Burger Company owns 5 restaurants. The numbers of staff members employed in its 5 restaurants are: 12, 18, 19, 21, and 30 people.

B. What is the median number of staff members in the 5 restaurants?

Answer: _____

Item Number: M042169B

SCORING

Correct Response

• 19

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
United States	**81** ⬢
England-GBR	63 ⬢
Norway	61 ⬢
Turkey	58 ⬢
Saudi Arabia	58 ⬢
Singapore	56 ⬢
New Zealand	56 ⬢
United Arab Emirates	54 ⬢
Australia	48 ⬢
Israel	47 ⬢
Bahrain	45 ⬢
Ghana	42 ⬢
Chinese Taipei-CHN	40 ⬢
Sweden	40 ⬢
Japan	38 ⬢
Syrian Arab Republic	35 ⬢
Armenia	32
Qatar	30
International average	29
Jordan	29
Oman	26
Italy	26
Palestinian Nat'l Auth.	26
Lithuania	25
Russian Federation	24 ⬢
Hong Kong-CHN	23 ⬢
Chile	21 ⬢
Kazakhstan	19 ⬢
Macedonia, Rep. of	16 ⬢
Hungary	14 ⬢
Lebanon	13 ⬢
Korea, Rep. of	12 ⬢
Tunisia	12 ⬢
Georgia	11 ⬢
Romania	10 ⬢
Thailand	8 ⬢
Ukraine	7 ⬢
Iran, Islamic Rep. of	7 ⬢
Malaysia	6 ⬢
Finland	6 ⬢
Morocco	6 ⬢
Indonesia	3 ⬢
Slovenia	2 ⬢

Benchmarking education system

Florida-USA	90 ⬢
North Carolina-USA	89 ⬢
Indiana-USA	88 ⬢
Massachusetts-USA	87 ⬢
Colorado-USA	86 ⬢
Minnesota-USA	83 ⬢
Connecticut-USA	80 ⬢
Alabama-USA	75 ⬢
California-USA	70 ⬢
Ontario-CAN	68 ⬢
Abu Dhabi-UAE	60 ⬢
Dubai-UAE	46 ⬢
Alberta-CAN	45 ⬢
Quebec-CAN	9 ⬢

⬢ Percent higher than International average
⬢ Percent lower than International average

Median number of staff members (continued)

M042169B

Student Responses

Correct Response:

Answer: ___19___

Incorrect Response:

Answer: ___12___

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Applying

Change in mean and median

The Real Burger Company owns 5 restaurants. The numbers of staff members employed in its 5 restaurants are: 12, 18, 19, 21, and 30 people.

C. If the restaurant with 30 staff members increased its number of staff members to 50, how would this affect the median and the mean?

Item Number: M042169C

SCORING

Correct Response

• The mean would increase/change, the median would not change. If student gives a new value for the mean, it should be between 21 and 29. If a value is given for the median, it must be correct (i.e., 19 or the answer given for Part B if incorrect)

Incorrect Response

• Both would increase

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	46 ⌂
United States	**43** ⌂
England-GBR	37 ⌂
Norway	35 ⌂
Israel	31 ⌂
Sweden	27 ⌂
Turkey	25 ⌂
Australia	25 ⌂
New Zealand	24 ⌂
Chinese Taipei-CHN	22 ⌂
United Arab Emirates	17 ⌂
Bahrain	17 ⌂
Lithuania	15
Italy	15
Japan	14
Saudi Arabia	14
International average	13
Russian Federation	13
Hong Kong-CHN	12
Hungary	11
Qatar	9 ▽
Palestinian Nat'l Auth.	9 ▽
Oman	9 ▽
Macedonia, Rep. of	8 ▽
Georgia	7 ▽
Kazakhstan	7 ▽
Armenia	7 ▽
Finland	6 ▽
Korea, Rep. of	6 ▽
Jordan	6 ▽
Chile	6 ▽
Syrian Arab Republic	5 ▽
Romania	5 ▽
Ukraine	4 ▽
Indonesia	4 ▽
Ghana	2 ▽
Malaysia	2 ▽
Tunisia	2 ▽
Iran, Islamic Rep. of	2 ▽
Lebanon	1 ▽
Thailand	1 ▽
Slovenia	# ▽
Morocco	# ▽

Benchmarking education system

Massachusetts-USA	61 ⌂
North Carolina-USA	60 ⌂
Minnesota-USA	56 ⌂
Florida-USA	53 ⌂
Indiana-USA	51 ⌂
Colorado-USA	48 ⌂
Connecticut-USA	45 ⌂
Ontario-CAN	41 ⌂
California-USA	29 ⌂
Alabama-USA	29 ⌂
Alberta-CAN	27 ⌂
Abu Dhabi-UAE	18 ⌂
Dubai-UAE	16 ⌂
Quebec-CAN	7 ▽

⌂ Percent higher than International average
▽ Percent lower than International average
Rounds to zero

Change in mean and median (continued)

M042169C

Student Responses

Correct Response:

The mean would increace, but the median would stay the same

Incorrect Response:

Because of how many people it is.

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Chance	Applying

Number of regular size bottles

Over recent weeks, a shop's average sales of bottles of soda have been 50% in the regular size, 40% in the small size, and 10% in the large size. Next week, the shopkeeper will order 1,200 bottles of soda. How many of these bottles should he order in the regular size?

A. 120

B. 480

C. 600

D. 720

Item Number: M042177

Correct Response:	**C**

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	83 ⌃
Singapore	82 ⌃
Hong Kong-CHN	80 ⌃
Japan	80 ⌃
Finland	79 ⌃
Norway	77 ⌃
Chinese Taipei-CHN	77 ⌃
Hungary	75 ⌃
Slovenia	71 ⌃
Italy	71 ⌃
England-GBR	68 ⌃
Lithuania	68 ⌃
Australia	66 ⌃
Russian Federation	64 ⌃
Israel	64 ⌃
New Zealand	63 ⌃
United States	**63** ⌃
Sweden	61 ⌃
Turkey	57
Ukraine	56
Chile	55
International average	54
Thailand	52
Romania	49 ⌄
Malaysia	49 ⌄
United Arab Emirates	49 ⌄
Georgia	45 ⌄
Armenia	44 ⌄
Bahrain	43 ⌄
Kazakhstan	41 ⌄
Iran, Islamic Rep. of	41 ⌄
Macedonia, Rep. of	41 ⌄
Qatar	41 ⌄
Lebanon	40 ⌄
Tunisia	37 ⌄
Palestinian Nat'l Auth.	37 ⌄
Saudi Arabia	35 ⌄
Jordan	34 ⌄
Syrian Arab Republic	34 ⌄
Morocco	32 ⌄
Indonesia	30 ⌄
Oman	30 ⌄
Ghana	20 ⌄

Benchmarking education system

Quebec-CAN	74 ⌃
Minnesota-USA	72 ⌃
Massachusetts-USA	72 ⌃
Colorado-USA	70 ⌃
Alberta-CAN	69 ⌃
North Carolina-USA	69 ⌃
Ontario-CAN	68 ⌃
Connecticut-USA	66 ⌃
Indiana-USA	64 ⌃
Florida-USA	59
California-USA	58
Alabama-USA	55
Dubai-UAE	52
Abu Dhabi-UAE	47 ⌄

⌃ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Chance	Applying

Chance of getting a button

There are 10 red, 8 blue, and 4 white buttons in a bag. What is the chance of taking out either a blue button or a white button?

A. $\dfrac{4}{22}$

B. $\dfrac{8}{22}$

C. $\dfrac{10}{22}$

D. $\dfrac{12}{22}$

Item Number: M042179

Correct Response:	D

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	92 ⌃
Singapore	85 ⌃
Japan	83 ⌃
United States	**80** ⌃
Australia	77 ⌃
England-GBR	77 ⌃
Israel	75 ⌃
Italy	69 ⌃
Chinese Taipei-CHN	68 ⌃
Finland	68 ⌃
Sweden	67 ⌃
New Zealand	66 ⌃
Hong Kong-CHN	65 ⌃
Turkey	63 ⌃
Norway	62 ⌃
Slovenia	57
United Arab Emirates	55
Hungary	55
International average	54
Lithuania	53
Russian Federation	53
Palestinian Nat'l Auth.	52
Oman	48 ⌄
Bahrain	47 ⌄
Qatar	45 ⌄
Ukraine	45 ⌄
Saudi Arabia	45 ⌄
Thailand	44 ⌄
Chile	43 ⌄
Romania	43 ⌄
Georgia	43 ⌄
Jordan	42 ⌄
Kazakhstan	41 ⌄
Iran, Islamic Rep. of	40 ⌄
Macedonia, Rep. of	37 ⌄
Armenia	37 ⌄
Syrian Arab Republic	37 ⌄
Lebanon	35 ⌄
Tunisia	35 ⌄
Ghana	35 ⌄
Indonesia	34 ⌄
Malaysia	33 ⌄
Morocco	29 ⌄

Benchmarking education system

Minnesota-USA	90 ⌃
Massachusetts-USA	86 ⌃
Colorado-USA	85 ⌃
Indiana-USA	84 ⌃
Alberta-CAN	82 ⌃
North Carolina-USA	82 ⌃
Ontario-CAN	79 ⌃
Connecticut-USA	78 ⌃
Florida-USA	78 ⌃
Quebec-CAN	78 ⌃
Alabama-USA	75 ⌃
California-USA	69 ⌃
Dubai-UAE	58 ⌃
Abu Dhabi-UAE	55

⌃ Percent higher than International average
⌄ Percent lower than International average

| Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Organization and Representation	Applying

Complete and label this pie chart

480 students were asked to name their favorite sport. The results are shown in this table.

Sport	Number of Students
Hockey	60
Football	180
Tennis	120
Basketball	120

Use the information in the table to complete and label this pie chart.

Popularity of Sports
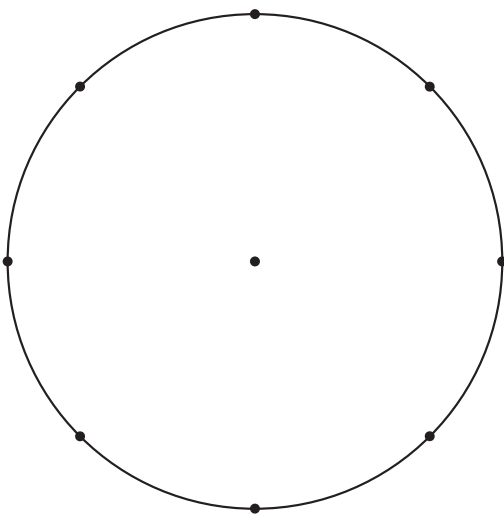
Item Number: M042207

SCORING

Correct Response

• Hockey1/8, Football 3/8, Tennis, Basketball both 1/4 , and labels all correct

Partially Correct Response

• All sectors correct size but labeling incomplete or missing

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Overall Percent Correct

Education system	Percent correct
Singapore	85 ⏶
Korea, Rep. of	85 ⏶
Chinese Taipei-CHN	80 ⏶
Hong Kong-CHN	76 ⏶
Japan	75 ⏶
Finland	70 ⏶
Slovenia	67 ⏶
Australia	67 ⏶
England-GBR	65 ⏶
Israel	63 ⏶
Russian Federation	63 ⏶
United States	**62 ⏶**
Lithuania	62 ⏶
Hungary	62 ⏶
Norway	61 ⏶
New Zealand	59 ⏶
Sweden	58 ⏶
Italy	54 ⏶
Malaysia	50
Ukraine	48
Turkey	48
International average	47
Thailand	45
Chile	44
United Arab Emirates	41 ⏷
Kazakhstan	40 ⏷
Jordan	34 ⏷
Qatar	33 ⏷
Bahrain	33 ⏷
Oman	30 ⏷
Palestinian Nat'l Auth.	30 ⏷
Georgia	30 ⏷
Romania	29 ⏷
Indonesia	28 ⏷
Tunisia	27 ⏷
Armenia	25 ⏷
Macedonia, Rep. of	24 ⏷
Iran, Islamic Rep. of	23 ⏷
Syrian Arab Republic	23 ⏷
Saudi Arabia	19 ⏷
Morocco	18 ⏷
Lebanon	17 ⏷
Ghana	11 ⏷

Benchmarking education system

| Education system	Percent correct
Massachusetts-USA	74 ⏶
Quebec-CAN	72 ⏶
Minnesota-USA	71 ⏶
Connecticut-USA	70 ⏶
Indiana-USA	69 ⏶
Colorado-USA	69 ⏶
North Carolina-USA	67 ⏶
Ontario-CAN	67 ⏶
Alberta-CAN	66 ⏶
Florida-USA	65 ⏶
California-USA	58 ⏶
Alabama-USA	55 ⏶
Dubai-UAE	48
Abu Dhabi-UAE	40 ⏷

⏶ Percent higher than International average
⏷ Percent lower than International average

Complete and label this pie chart (continued)
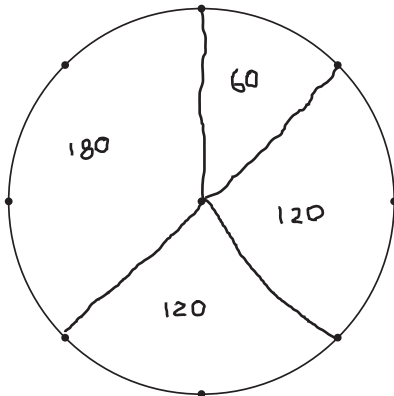*M042207*

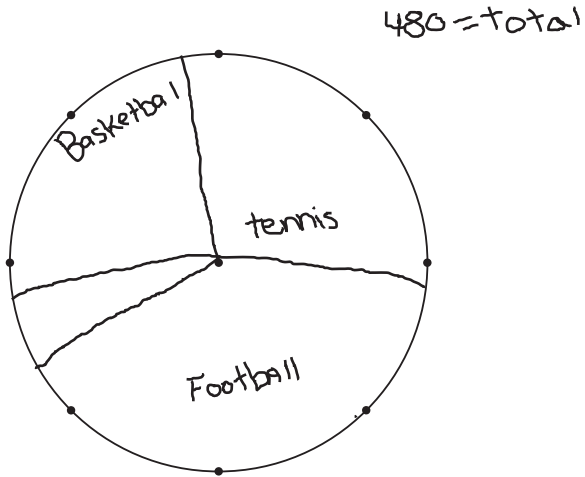## Student Responses
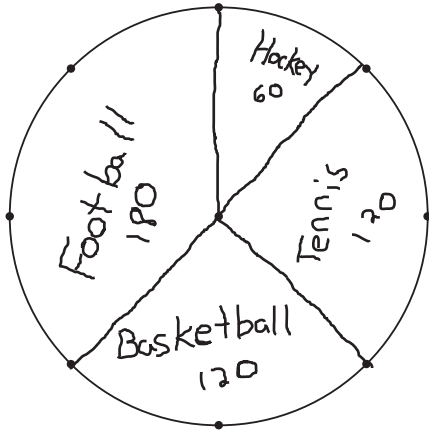
Correct Response:

Partially Correct Response:

Complete and label this pie chart (continued)

M042207

Student Responses

Incorrect Response:

480 = total

Basketball

tennis

Football

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Chance	Knowing

How likely student voted for Pat

Pat and Chris were candidates for school president.

Here are the election results:

Pat	80%
Chris	20%

How likely would it be for a student asked at random to have voted for Pat?

A. It is certain that the student voted for Pat.

B. It is likely that the student voted for Pat.

C. It is unlikely that the student voted for Pat.

D. It is certain that the student did not vote for Pat.

Item Number: M042260

Correct Response:	B

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	95 ⌃
Chinese Taipei-CHN	89 ⌃
Finland	89 ⌃
Japan	88 ⌃
Hong Kong-CHN	87 ⌃
England-GBR	87 ⌃
Australia	84 ⌃
Lithuania	84 ⌃
Italy	82 ⌃
New Zealand	80 ⌃
Norway	77 ⌃
Slovenia	77 ⌃
Israel	77 ⌃
Singapore	77 ⌃
Turkey	77 ⌃
United States	**76** ⌃
Hungary	74 ⌃
Ukraine	70 ⌃
Sweden	70 ⌃
Romania	67
Chile	65
Russian Federation	65
International average	64
Bahrain	59 ⌄
United Arab Emirates	55 ⌄
Jordan	53 ⌄
Iran, Islamic Rep. of	53 ⌄
Thailand	52 ⌄
Georgia	52 ⌄
Kazakhstan	52 ⌄
Saudi Arabia	51 ⌄
Qatar	48 ⌄
Armenia	47 ⌄
Oman	46 ⌄
Palestinian Nat'l Auth.	46 ⌄
Ghana	46 ⌄
Macedonia, Rep. of	45 ⌄
Lebanon	45 ⌄
Syrian Arab Republic	44 ⌄
Malaysia	37 ⌄
Tunisia	36 ⌄
Indonesia	35 ⌄
Morocco	28 ⌄

Benchmarking education system

Quebec-CAN	87 ⌃
Ontario-CAN	85 ⌃
Massachusetts-USA	84 ⌃
Alberta-CAN	84 ⌃
Minnesota-USA	84 ⌃
Connecticut-USA	82 ⌃
Indiana-USA	80 ⌃
North Carolina-USA	79 ⌃
Colorado-USA	78 ⌃
Alabama-USA	76 ⌃
Florida-USA	76 ⌃
California-USA	70 ⌃
Dubai-UAE	66
Abu Dhabi-UAE	53 ⌄

⌃ Percent higher than International average
⌄ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Reasoning

Long jump competition

The results of a long jump competition were reported as follows:

Average Length

Team A   3.6 m

Team B   4.8 m

There were the same number of students in each team.
Which statement about the competition MUST be true?

A.   Each student in team B jumped farther than any student in team A.

B.   After every student in team A jumped, there was a student in team B who jumped farther.

C.   As a group, team B jumped farther than team A.

D.   Some students in team A jumped farther than some students in team B.

Item Number: M042269

Correct Response:	C

Overall Percent Correct

Education system	Percent correct
Hong Kong-CHN	87 ⬦
Korea, Rep. of	83 ⬦
Chinese Taipei-CHN	82 ⬦
Japan	77 ⬦
Finland	75 ⬦
Australia	73 ⬦
Singapore	73 ⬦
Slovenia	73 ⬦
Italy	72 ⬦
England-GBR	71 ⬦
New Zealand	69 ⬦
Norway	68 ⬦
Sweden	67 ⬦
United States	**67** ⬦
Israel	66 ⬦
Iran, Islamic Rep. of	65 ⬦
Romania	65 ⬦
Hungary	65 ⬦
Turkey	63 ⬦
Malaysia	61
Russian Federation	60
Chile	59
International average	58
Ukraine	55
Georgia	53
Macedonia, Rep. of	52 ⬇
Jordan	51 ⬇
Lebanon	50 ⬇
United Arab Emirates	50 ⬇
Kazakhstan	47 ⬇
Morocco	46 ⬇
Qatar	45 ⬇
Bahrain	45 ⬇
Palestinian Nat'l Auth.	45 ⬇
Tunisia	44 ⬇
Syrian Arab Republic	44 ⬇
Saudi Arabia	44 ⬇
Armenia	44 ⬇
Ghana	40 ⬇
Thailand	40 ⬇
Lithuania	38 ⬇
Oman	38 ⬇
Indonesia	29 ⬇

Benchmarking education system

Minnesota-USA	80 ⬦
North Carolina-USA	79 ⬦
Massachusetts-USA	76 ⬦
Indiana-USA	76 ⬦
Connecticut-USA	74 ⬦
Alberta-CAN	73 ⬦
Quebec-CAN	69 ⬦
Ontario-CAN	66 ⬦
Colorado-USA	65
California-USA	63
Alabama-USA	62
Florida-USA	62
Dubai-UAE	54
Abu Dhabi-UAE	49 ⬇

⬦ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Chance	Reasoning

Probability that the marble is red

There are 10 marbles in a bag: 5 red, and 5 blue.

Sue draws a marble from the bag at random. The marble is red.

She puts the marble back into the bag.

What is the probability that the next marble she draws at random is red?

A. $\dfrac{1}{2}$

B. $\dfrac{4}{10}$

C. $\dfrac{1}{5}$

D. $\dfrac{1}{10}$

Item Number: M052429

Correct Response:	**A**

Overall Percent Correct

Education system	Percent correct
Singapore	78 ⬧
Korea, Rep. of	76 ⬧
Australia	75 ⬧
England-GBR	72 ⬧
Japan	70 ⬧
Chinese Taipei-CHN	70 ⬧
New Zealand	68 ⬧
Slovenia	67 ⬧
United States	**66** ⬧
Finland	66 ⬧
Sweden	65 ⬧
Norway	64 ⬧
Hong Kong-CHN	64 ⬧
Israel	59 ⬧
Hungary	51 ⬧
Lithuania	51 ⬧
Russian Federation	47
International average	45
Turkey	44
Italy	42
Macedonia, Rep. of	41
Romania	39 ⬇
Armenia	39 ⬇
Palestinian Nat'l Auth	38 ⬇
Ukraine	38 ⬇
Kazakhstan	38 ⬇
Thailand	37 ⬇
United Arab Emirates	36 ⬇
Indonesia	35 ⬇
Iran, Islamic Rep. of	35 ⬇
Saudi Arabia	35 ⬇
Qatar	34 ⬇
Georgia	33 ⬇
Chile	31 ⬇
Ghana	28 ⬇
Malaysia	28 ⬇
Jordan	26 ⬇
Bahrain	24 ⬇
Oman	23 ⬇
Lebanon	21 ⬇
Tunisia	20 ⬇
Syrian Arab Republic	18 ⬇
Morocco	16 ⬇

Benchmarking education system

Massachusetts-USA	79 ⬧
Minnesota-USA	78 ⬧
Connecticut-USA	78 ⬧
Colorado-USA	76 ⬧
Indiana-USA	76 ⬧
North Carolina-USA	74 ⬧
Alberta-CAN	73 ⬧
Ontario-CAN	73 ⬧
Quebec-CAN	72 ⬧
Florida-USA	60 ⬧
California-USA	60 ⬧
Alabama-USA	52
Dubai-UAE	45
Abu Dhabi-UAE	34 ⬇

⬧ Percent higher than International average
⬇ Percent lower than International average

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Reasoning

Age structures of country X and Y

Comparison of Age Structure Between Country X and Country Y

The graphs for Country X and Country Y show the age structure of each country's population. The population is divided into three age groups from youngest to oldest. The graphs enable predictions about population growth.

A. Why could the age structure of Country X lead to more rapid population growth than the age structure of Country Y?

Item Number: M052503A

SCORING

Correct Response

• Within Country X there is a larger percentage of people in the "having children" or "going to have children" categories than in Country Y.

Note: The reference to country X needs to be clear. The comparison with Country Y does not need to be stated.

Also, accept "more people" as "proportionately more" and "young or younger" in place of "having children" or "going to have children"

Examples: Country X has more people about to have children or having children than country Y

    There are more people going to have children in country X

    More young people in country X

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Examples: There are more "going to have children"

    Country X has more population compared to country Y

Overall Percent Correct

Education system	Percent correct
Korea, Rep. of	79 ⬘
Russian Federation	41 ⬘
Singapore	40 ⬘
Ukraine	39 ⬘
Hong Kong-CHN	34 ⬘
Romania	34 ⬘
Kazakhstan	32 ⬘
Japan	29 ⬘
Turkey	28 ⬘
Israel	28 ⬘
Finland	25 ⬘
Tunisia	25 ⬘
Bahrain	23
Chinese Taipei-CHN	22
International average	21
Indonesia	21
Australia	21
Lithuania	20
Norway	20
United States	**18** ⬙
Syrian Arab Republic	18
Hungary	18
Oman	18 ⬙
England-GBR	17
New Zealand	17
United Arab Emirates	17 ⬙
Armenia	16 ⬙
Macedonia, Rep. of	15 ⬙
Georgia	15 ⬙
Sweden	15 ⬙
Thailand	15 ⬙
Iran, Islamic Rep. of	14 ⬙
Slovenia	14 ⬙
Jordan	13 ⬙
Malaysia	13 ⬙
Italy	11 ⬙
Qatar	11 ⬙
Palestinian Nat'l Auth.	10 ⬙
Chile	9 ⬙
Lebanon	9 ⬙
Morocco	8 ⬙
Saudi Arabia	5 ⬙
Ghana	4 ⬙

Benchmarking education system

Massachusetts-USA	30 ⬘
Connecticut-USA	26
Minnesota-USA	26
Ontario-CAN	25
Dubai-UAE	23
Florida-USA	21
Indiana-USA	20
Colorado-USA	19
Quebec-CAN	19
Abu Dhabi-UAE	18
Alberta-CAN	16 ⬙
California-USA	16 ⬙
North Carolina-USA	15 ⬙
Alabama-USA	15 ⬙

⬘ Percent higher than International average
⬙ Percent lower than International average

Age structures of country X and Y (continued)

M052503A

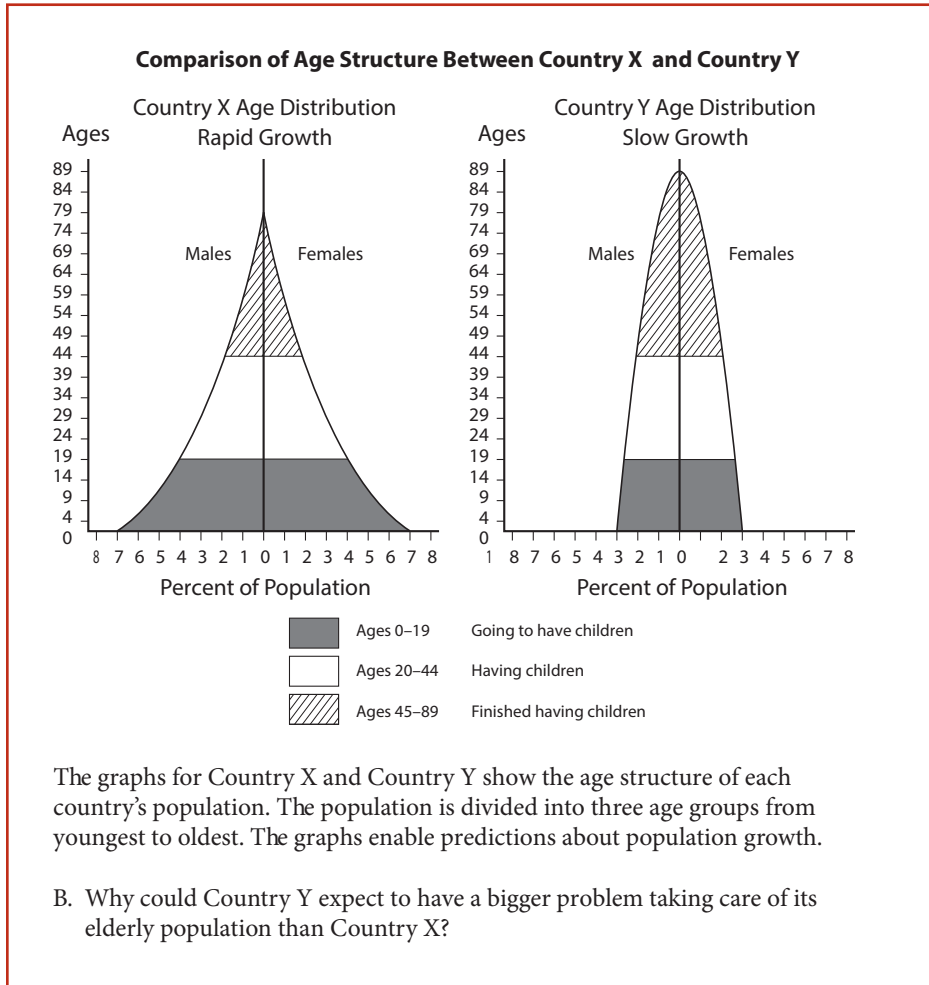## Student Responses

Correct Response:

Country x has more people going to have children, meaning when they do have children the population will grow greatly.

Incorrect Response:

They have earlier marraige.

Content Domain	Main Topic	Cognitive Domain
DATA AND CHANCE	Data Interpretation	Reasoning

Problem of taking care of elderly

Comparison of Age Structure Between Country X and Country Y

	Ages 0–19	Going to have children
(grey)	Ages 0–19	Going to have children
(white)	Ages 20–44	Having children
(hatched)	Ages 45–89	Finished having children

The graphs for Country X and Country Y show the age structure of each country's population. The population is divided into three age groups from youngest to oldest. The graphs enable predictions about population growth.

B. Why could Country Y expect to have a bigger problem taking care of its elderly population than Country X?

Item Number: M052503B

SCORING

Correct Response

• Within Country Y, there is a relatively larger population of elderly people ("finished having children") compared with younger populations.

Note: The comparison between older and younger people must be made or implied.

Country X and Country Y do not have to be mentioned.

Examples: More older people than younger people

> Not enough young people to take care of the elderly

> Less number of people "having children" to keep up the population

> Aging population, less youngsters, lesser workforce

Incorrect Response

• Incorrect (including crossed out, erased, stray marks, illegible, or off task)

Examples: There are many more elders in Y than X

> Country Y has a wider range of not having children than country X

Overall Percent Correct

Education system	Percent correct
Singapore	39 ⌃
Japan	37 ⌃
Korea, Rep. of	36 ⌃
Chinese Taipei-CHN	32 ⌃
Bahrain	30 ⌃
Kazakhstan	29 ⌃
Finland	27 ⌃
Romania	26 ⌃
Tunisia	25 ⌃
Russian Federation	24 ⌃
Hungary	24 ⌃
Ukraine	23 ⌃
Australia	20
Israel	20
Turkey	19
United States	**18**
England-GBR	18
Indonesia	18
Hong Kong-CHN	18
International average	17
New Zealand	17
Italy	17
Oman	17
Slovenia	17
Jordan	16
Lithuania	14
Sweden	13 ⌄
Macedonia, Rep. of	13 ⌄
Syrian Arab Republic	13 ⌄
Norway	12 ⌄
Malaysia	11 ⌄
United Arab Emirates	10 ⌄
Palestinian Nat'l Auth.	10 ⌄
Armenia	9 ⌄
Thailand	8 ⌄
Georgia	8 ⌄
Morocco	7 ⌄
Lebanon	7 ⌄
Qatar	7 ⌄
Iran, Islamic Rep. of	6 ⌄
Chile	5 ⌄
Saudi Arabia	3 ⌄
Ghana	2 ⌄

Benchmarking education system	
Ontario-CAN	24 ⌃
Massachusetts-USA	23 ⌃
Minnesota-USA	21
Connecticut-USA	20
Alberta-CAN	20
Quebec-CAN	20
Colorado-USA	19
North Carolina-USA	19
Florida-USA	17
Indiana-USA	16
Alabama-USA	15
Abu Dhabi-UAE	12 ⌄
California-USA	11 ⌄
Dubai-UAE	11 ⌄

⌃ Percent higher than International average
⌄ Percent lower than International average

Problem of taking care of elderly (continued)

M052503B

Student Responses

Correct Response:

Because the number of people going to have babies is high in Country X than in country Y.

Incorrect Response:

larger group of elderly people to take care of. Country y has a