

mathematics items

TIMSS 1999 MATHEMATICS ITEMS

M



BOSTON
COLLEGE

Released Set for Eighth Grade



TIMSS 1999

IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade

TIMSS Mathematics Items: *Released Set for Eighth Grade*

Overview of TIMSS

TIMSS 1999 represents the continuation of a long series of studies conducted by the International Association for the Evaluation of Educational Achievement (IEA). Since its inception in 1959, the IEA has conducted more than 15 studies of cross-national achievement in the curricular areas of mathematics, science, language, civics, and reading. The Third International Mathematics and Science Study (TIMSS), conducted in 1995-1996, was the largest and most complex IEA study to date, and included both mathematics and science at third and fourth grades, seventh and eighth grades, and the final year of secondary school.

In 1999, TIMSS again assessed eighth-grade students in both mathematics and science to measure trends in student achievement since 1995. This study was also known as TIMSS-Repeat, or TIMSS-R. The results of TIMSS 1999 were published in two companion volumes, *TIMSS 1999 International Mathematics Report* (Mullis, Martin, Gonzalez, Gregory, Garden, O'Connor, Chrostowski, and Smith, 2000) and *TIMSS 1999 International Science Report* (Martin, Mullis, Gonzalez, Gregory, Smith, Chrostowski, Garden, and O'Connor, 2000).

TIMSS 1999 also included a voluntary Benchmarking Study including 13 United States of America states and 14 districts and consortia. The results were published in *Mathematics Benchmarking Report TIMSS 1999 - Eighth Grade: Achievement for U. S. States and Districts in an International Context* (Mullis, Martin, Gonzalez, O'Connor, Chrostowski, Gregory, Garden and Smith, 2001) and *Science Benchmarking Report TIMSS 1999 - Eighth Grade: Achievement for U. S. States and Districts in an International Context* (Martin, Mullis, Gonzalez, O'Connor, Chrostowski, Gregory, Smith and Garden, 2001).

Participants in TIMSS 1999

Of the 42 countries that participated in TIMSS¹ at the eighth grade in 1995, 26 availed themselves of the opportunity to measure changes in the achievement of their students by also taking part in 1999 (see Exhibit 1). Twelve additional countries participated in 1999, for a total of 38 countries. Of those taking part in 1999, 19 had also participated in 1995 at the fourth grade. Since fourth-grade students in 1995 were in eighth grade in 1999, these countries can compare their eighth-grade performance with their performance at the fourth grade, as well as with the eighth-grade performance of students in other countries.

1. Results for 41 countries are reported in the 1995 international reports; Italy also completed the 1995 testing, but too late to be included.

Exhibit 1: Countries Participating in TIMSS 1999 and TIMSS 1995

| Country | TIMSS 1999 | TIMSS 1995 (Grade 8) | TIMSS 1995 (Grade 4) |
|-------------------------------------|------------|----------------------|----------------------|
| Australia | ● | ● | ● |
| Austria | | ● | ● |
| Belgium (Flemish) | ● | ● | |
| Belgium (French) | | ● | |
| Bulgaria | ● | ● | |
| Canada | ● | ● | ● |
| Chile | ● | | |
| Chinese Taipei | ● | | |
| Colombia | | ● | |
| Cyprus | ● | ● | ● |
| Czech Republic | ● | ● | ● |
| Denmark | | ● | |
| England | ● | ● | ● |
| Finland | ● | | |
| France | | ● | |
| Germany | | ● | |
| Greece | | ● | ● |
| Hong Kong, SAR | ● | ● | ● |
| Hungary | ● | ● | ● |
| Iceland | | ● | ● |
| Indonesia | ● | | |
| Iran, Islamic Republic | ● | ● | ● |
| Ireland | | ● | ● |
| Israel | ● | ● | ● |
| Italy | ● | ● | ● |
| Japan | ● | ● | ● |
| Jordan | ● | | |
| Korea, Republic of | ● | ● | ● |
| Kuwait | | ● | ● |
| Latvia | ● | ● | ● |
| Lithuania | ● | ● | |
| Macedonia, Republic of ^a | ● | | |
| Malaysia | ● | | |
| Moldova | ● | | |
| Morocco | ● | | |
| Netherlands | ● | ● | ● |
| New Zealand | ● | ● | ● |
| Norway | | ● | ● |
| Philippines | ● | | |
| Portugal | | ● | ● |
| Romania | ● | ● | |
| Russian Federation | ● | ● | |
| Scotland | | ● | ● |
| Singapore | ● | ● | ● |
| Slovak Republic | ● | ● | |
| Slovenia | ● | ● | ● |

| Country | TIMSS 1999 | TIMSS 1995 (Grade 8) | TIMSS 1995 (Grade 4) |
|---------------|------------|----------------------|----------------------|
| South Africa | ● | ● | |
| Spain | | ● | |
| Sweden | | ● | |
| Switzerland | | ● | |
| Thailand | ● | ● | ● |
| Tunisia | ● | | |
| Turkey | ● | | |
| United States | ● | ● | ● |

The TIMSS 1999 Mathematics Test

The TIMSS curriculum framework underlying the TIMSS 1995 mathematics test was developed by groups of mathematics educators with input from the TIMSS National Research Coordinators (NRCS).² The content aspect of the framework represents the subject matter content of school mathematics. The performance expectations aspect of the framework describes, in a non-hierarchical way, the many kinds of performances or behaviors that might be expected of students in school mathematics. Working within the mathematics curriculum framework, mathematics test specifications were developed for TIMSS 1995 that included items representing a wide range of mathematics topics and eliciting a range of skills from the students.

To provide as much information as possible about the nature and scope of the 1995 TIMSS achievement tests, almost two thirds of the items on the tests were released to the public. The remaining one-third were kept secure as a basis for accurately measuring trends in student achievement from 1995 to 1999. Releasing most of the 1995 items enabled more meaningful reports, both national and international, to be published and also provided information for secondary research. But it also meant that students in the TIMSS 1999 samples may have been exposed to these items, which necessitated the development of new mathematics items for TIMSS 1999.

The major goal of TIMSS 1999 test development was to produce a test that would parallel that of TIMSS 1995 in overall structure and content. The strategy used involved treating the 1995 items as a representative sample from the “pool” of all possible items within the defined test domain and selecting new items from this “pool” with the same subdomains as the released items from TIMSS 1995. In practice, each released item was evaluated to define its

2. The complete TIMSS curriculum frameworks can be found in Robitaille, D.F. et al. (1993). TIMSS Monograph No. 1: Curriculum Frameworks for Mathematics and Science. Vancouver, B.C.: Pacific Educational Press.

subdomain (mathematics or science content, performance expectation, item format, and difficulty level), and a set of potential replacement items from the same subdomain was then created. This method ensured that the final test, comprising the nonreleased and replacement items, covered the same test domain as in TIMSS 1995.

The tests were developed through an international consensus involving input from experts in mathematics and measurement specialists.³ The TIMSS Subject Matter Item Committee, which included distinguished scholars from 10 countries, ensured that the test reflected current thinking and priorities within the field of mathematics. The items underwent an iterative development and review process with one pilot testing effort involving 31 countries. Every effort was made to help ensure that the tests represented the curricula of the participating countries and that the items did not exhibit any bias towards or against particular countries. The final forms of the test were endorsed by the NRCs of all the participating countries. The resulting test for the TIMSS 1999 students (eighth grade in many countries) contained 162 mathematics items representing a range of mathematics topics and skills.

Approximately one-fourth of the TIMSS items were in the free-response format, which required students to generate and write their own answers. Designed to represent approximately one-third of students' response time, some free-response questions asked for short answers, while others called for extended responses and required students to show their work. The remaining questions used a multiple-choice format. The distribution of items across content areas (as reported in the international reports) and performance expectations, as well as by item format, is presented in Exhibits 2 and 3, respectively. To ensure broad subject matter coverage without overburdening individual students, TIMSS used a rotated design that included both the mathematics and science items. In accordance with the design, the mathematics and science items were assembled in 26 different clusters — labeled A through Z. The clusters were assigned to eight different booklets in accordance with the rotated design so that representative samples of students responded to each cluster.⁴ Each student completed one 90-minute test booklet containing both mathematics and science items.

Exhibit 2: Distribution of Mathematics Items by Content Reporting Category

| Reporting Category | Item Type | | | Number of Items | Score Points |
|---|-----------------|--------------|-------------------|-----------------|--------------|
| | Multiple-Choice | Short-Answer | Extended Response | | |
| Fractions and Number Sense | 47 | 11 | 3 | 61 | 62 |
| Measurement | 15 | 4 | 5 | 24 | 26 |
| Data Representation, Analysis and Probability | 19 | 1 | 1 | 21 | 22 |
| Geometry | 20 | 1 | - | 21 | 21 |
| Algebra | 24 | 4 | 7 | 35 | 38 |
| Total | 125 | 21 | 16 | 162 | 169 |

Exhibit 3: Distribution of Mathematics Items by Performance Category

| Performance Category | Percentage of Items | Total Number of Items | Number of Multiple-Choice Items | Number of Free-Response Items | Number of Score points |
|------------------------------------|---------------------|-----------------------|---------------------------------|-------------------------------|------------------------|
| Knowing | 19 | 30 | 28 | 2 | 30 |
| Using Routine Procedures | 23 | 38 | 28 | 10 | 39 |
| Using Complex Procedures | 24 | 39 | 34 | 5 | 40 |
| Investigating and Solving Problems | 31 | 51 | 34 | 17 | 53 |
| Communicating and Reasoning | 2 | 4 | 1 | 3 | 7 |
| Total | 100 | 162 | 125 | 37 | 169 |

3. Garden, R. A. and Smith, T. A. (2000) "TIMSS Test Development" in M.O. Martin, K. D. Gregory, and S. E. Stemler, eds, TIMSS 1999 Technical Report, Chestnut Hill, MA: Boston College.

4. The TIMSS test design is documented in Garden, R. A. and Smith, T. A. (2000) "TIMSS Test Development" in M.O. Martin, K. D. Gregory, and S. E. Stemler, eds, TIMSS 1999 Technical Report, Chestnut Hill, MA: Boston College.

Item Release Policy

In accordance with IEA policy, TIMSS kept about one-half of the TIMSS 1999 items secure for future use in measuring international trends in mathematics and science achievement. The secure items are in every second cluster, starting with cluster A. All the remaining items, those in every second cluster starting with cluster B, are available for general use. This means that half of the secure items from 1995 are now being released. To facilitate their use, the released TIMSS items for TIMSS 1999 have been replicated in their entirety in this mathematics volume and in the companion science volume. As shown in Exhibit 4, this volume contains 82 mathematics items. To provide a unique identifier for each item, the TIMSS cluster and item number is shown in the black box on the right hand side of each page.

While the purpose of this volume is to encourage the use of TIMSS and TIMSS items, please note the IEA copyright; appropriate references to the IEA and TIMSS should be provided in your use of these items.

Item Documentation and Item Results

The TIMSS tests were prepared in English and translated into 33 additional languages. Each item is reproduced for this volume as it was presented to each of the TIMSS countries. In translating the tests or making adaptations for cultural purposes, every effort was made to ensure that the meaning and difficulty of items did not change. This process required an enormous effort by the national centers, with many checks made along the way.⁵

All of the items in this volume are mathematics items. The science items are provided in a companion volume, *TIMSS 1999 Science Items: Released Set for Eighth Grade*.

Across the top of each item, there is documentation about the item including the item label, item identification, the classification of the item by content category and performance expectation as well as information about scoring, trend status and international performance. If the item is a two-part item, the documentation for Part A is shown on the first page and the documentation for Part B is shown on the following page.

KEY. For multiple-choice items, the key for the correct answer is provided. For free-response questions, the scoring rubrics identifying categories of responses and their codes are shown next to the item. In scoring the TIMSS free-response questions, TIMSS utilized two-digit codes with rubrics specific to each item. The first digit designates the correctness level of the response. The first digit is usually a “1” designating a correct response, a “7” indicating an incorrect response, or a “9” for non-response. Sometimes, however, fully correct responses are differentiated from partially correct responses. In these instances, the fully correct responses are designated by a “2” and the partially correct responses by a “1.” The second digit, combined with the first digit, represents a diagnostic code used to identify specific types of approaches, strategies, or common errors and misconceptions.

CONTENT CATEGORY. The mathematics items were reported according to five content areas.

- Fractions and Number Sense
- Measurement
- Algebra
- Geometry
- Data Representation, Analysis, and Probability

Exhibit 4 indicates which items have been classified into each of the five content areas.

PERFORMANCE EXPECTATION. Items were classified into the following performance expectations.

- Knowing
- Using Routine Procedures
- Investigating and Problem Solving
- Mathematical Reasoning
- Communicating

5. More details about the translation verification procedures can be found in O'Connor, K. M. and Malak, B. (2000) "Translation and Cultural Adaptation of the TIMSS Instruments", in M.O. Martin, K. D. Gregory, and S. E. Stemler, eds, TIMSS 1999 Technical Report, Chestnut Hill, MA: Boston College.

PERCENT OF STUDENTS RESPONDING CORRECTLY. The percent of students responding correctly to the item reflects the international average across the countries participating in TIMSS 1999. That is, first the percentage of students responding correctly to the item was calculated for each country. Next, an average was calculated across the 38 countries. For items using a partial credit scoring scheme, the percentages given are for students responding with fully correct answers.

For More Information About TIMSS

For more details about the TIMSS 1999 results and procedures, please see the following reports:

Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Gregory, K.D., Smith, T.A., Chrostowski, S.J., Garden, R.A., & O'Connor, K.M. (2000). *TIMSS 1999 International Science Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Chestnut Hill, MA: Boston College.

Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowski, S.J., & Smith, T.A. (2000). *TIMSS 1999 International Mathematics Report: Findings from IEA's Repeat of the Third International Mathematics and Science Study at the Eighth Grade*. Chestnut Hill, MA: Boston College.

Martin, M.O., Gregory, K.D., and Stemler, S.E., eds., (2000), *TIMSS 1999 Technical Report*, Chestnut Hill, MA: Boston College.

Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., O'Connor, K.M., Chrostowski, S.J., Gregory, K. D., Smith, T.A. & Garden, R. A. (2001). *Mathematics Benchmarking Report TIMSS 1999 - Eighth Grade: Achievement for U. S. States and Districts in an International Context*. Chestnut Hill, MA: Boston College.

Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., O'Connor, K.M., Chrostowski, S.J., Gregory, K. D., Garden, R. A. & Smith, T.A. (2001). *Science Benchmarking Report TIMSS 1999 - Eighth Grade: Achievement for U. S. States and Districts in an International Context*. Chestnut Hill, MA: Boston College.

Exhibit 4: Item Listing by Mathematics Content Area

| Fractions and Number Sense | |
|----------------------------|--|
| B08 | Calories in portion of food from ratio |
| B09 | Figure showing equivalent fractions |
| B10 | Smallest decimal fraction |
| D09 | Smallest simple fraction |
| D12 | Estimate of point P on number line |
| F07 | Average speed from distance and time |
| F09 | Number between two decimal fractions |
| F12 | Fraction of circle shaded |
| H08 | Figure showing fraction of shaded square |
| H09 | Sum closest to $691 + 208$ |
| J12 | Division of fractions |
| J14 | Division of decimals |
| J18 | Distance between towns from map |
| L09 | Length of building compared to car |
| L10 | Two hundred six and nine-tenths |
| L18 | Subtraction with three fractions |
| N11 | Number of cars from rounded value |

Fractions and Number Sense (Continued)

| | |
|------|--|
| N14 | List of equivalent fractions |
| N16 | Number of marbles in bag |
| N17 | Amount of paint left |
| N19 | Shade in $\frac{3}{8}$ of squares in grid |
| P13 | Estimate of total cars in parking lot |
| P14 | Estimate of distance from explosion |
| P15 | Fraction of cherries in basket |
| P17 | Write decimal as fraction |
| R07 | Subtraction of decimals to 0.001 |
| R08 | Average weight of salt crystals |
| R13 | Subtraction of 4-digit whole numbers |
| R14 | How much money left if spent $\frac{5}{8}$ |
| R15 | Money from total magazine sales |
| T02A | Number/fraction of 2 types of boxes |
| T02B | Number/fraction of 2 types of boxes |
| T04 | Height of stack from paper thickness |
| V01 | Two possibilities for actual height |
| V03 | Ratio of nitrate to total fertilizer |

Algebra

| | |
|------|--|
| B12 | Equation representing relationship |
| D08 | Value of x from equivalent ratios |
| D10 | Equation to determine cost of cards |
| F11 | Find $\frac{1}{3}$ of number from relationship |
| H10 | Equation from x/y table |
| H12 | Symbolic linear equation of magazines |
| J17 | Missing number in table |
| L12 | Distance traveled by elevator |
| L14 | Correct equation based on x/y table |
| L15 | Values in proportionality table |
| L17 | Value of x in mathematical equation |
| N13 | Value of expression substituting $x=3$ |
| P09 | Expression equivalent to $n \times n \times n$ |
| P11 | Equivalent expression: $k+k+k+k+k$ |
| R10 | Expression when a, b, c are real |
| R12 | Operations on negative number |
| T01 | Total club members: boys and girls |
| V04A | Sequence of figures with circles |
| V04B | Sequence of figures with circles |
| V04C | Sequence of figures with circles |

Measurement

| | |
|-----|--|
| D11 | Units to measure mass of egg |
| F10 | Measurement accuracy of ruler |
| J10 | Area of path around garden |
| L13 | Most paces to walk to end of hallway |
| N15 | Angle closest to 45 degrees |
| P08 | Ratio of width/perimeter in rectangle |
| P12 | Length of string pulled straight |
| T03 | Area of rectangle inside parallelogram |

Geometry

| | |
|-----|--------------------------------------|
| B11 | Cube from folded 2-dimensional net |
| D07 | Angles in symmetric polygon |
| J11 | NOT true for all rectangles |
| J15 | Two similar triangles |
| J16 | Point on graph from coordinates |
| L16 | Measure of angle in quadrilateral |
| N12 | Position of point on number line |
| P10 | Length of side from similar triangle |
| R11 | Right triangles to cover rectangle |

Data Representation, Analysis and Probability

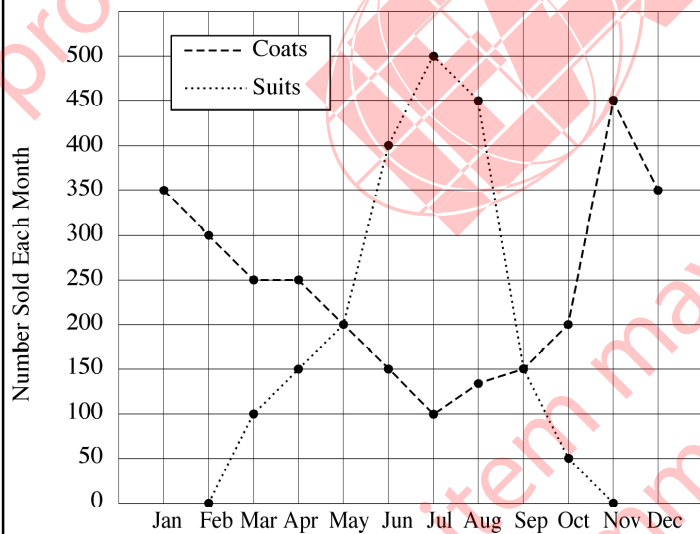
| | |
|-----|--|
| B07 | Graph showing greatest increase |
| F08 | Likely result of fifth coin toss |
| H07 | Bar chart histogram of travel time |
| H11 | Defective bulbs from random sample |
| J13 | Interpretation of pictograph of houses |
| L11 | Graph of humidity in room |
| N18 | Probability of drawing chip |
| P16 | Day/time in table at shown temperature |
| R09 | Time for pendulum to swing 20 times |
| V02 | Cheaper magazine subscription |

Graph showing greatest increase

B07

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|--------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Using Complex Procedures | D | 1 | 60 | Y |

This graph shows the number of suits and coats sold each month.



According to the information in the graph, during which two-month period does the greatest increase in coat sales occur?

- A. December - January
- B. May - June
- C. June - July
- D. October - November

Calories in portion of food from ratio**B08**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | A | 1 | 69 | Y |

If there are 300 calories in 100 g of a certain food, how many calories are there in a 30 g portion of this food?

- A. 90
- B. 100
- C. 900
- D. 1000
- E. 9000

Figure showing equivalent fractions

B09

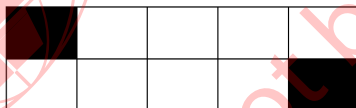
| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | A | 1 | 58 | Y |

Which picture shows that $\frac{2}{5}$ is equivalent to $\frac{4}{10}$?

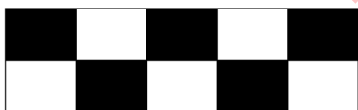
A.



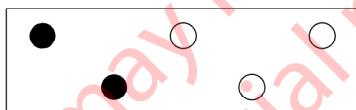
B.



C.



D.



Smallest decimal fraction**B10**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|-------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Knowing | E | 1 | 46 | Y |

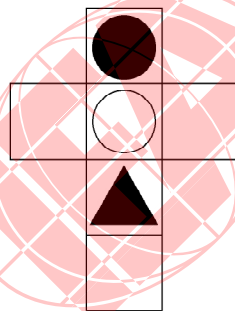
Which of these is the smallest number?

- A. 0.625
- B. 0.25
- C. 0.375
- D. 0.5
- E. 0.125

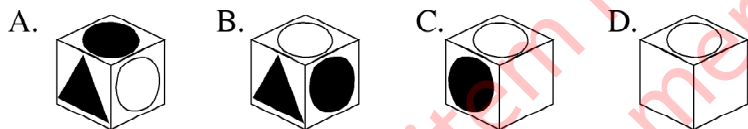
Cube from folded 2-dimensional net

B11

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Geometry | Using Complex Procedures | C | 1 | 59 | Y |



Which of these cubes could be made by folding the figure above?



Equation representing relationship**B12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | A | 1 | 65 | Y |

n is a number. When n is multiplied by 7, and 6 is then added, the result is 41. Which of these equations represents this relation?

- A. $7n + 6 = 41$
- B. $7n \pm 6 = 41$
- C. $7n \times 6 = 41$
- D. $7(n + 6) = 41$

Angles in symmetric polygon

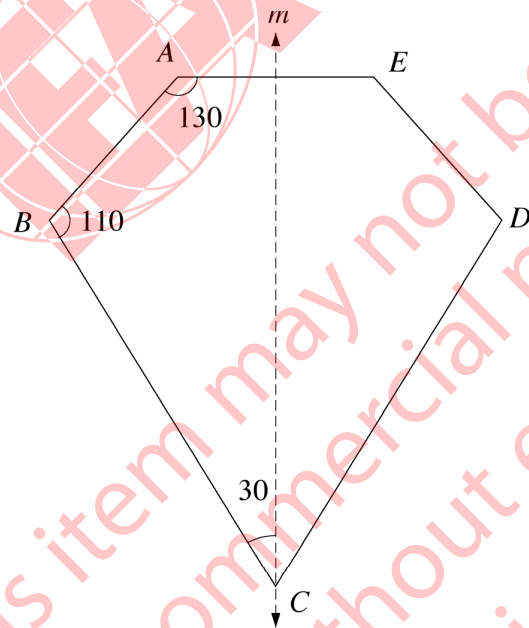
D07

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Geometry | Investigating and Solving Problems | C | 1 | 62 | Y |

The line m is a line of symmetry for figure $ABCDE$.

The measure of angle BCD is

- A. 30°
- B. 50°
- C. 60°
- D. 70°
- E. 110°



Value of x from equivalent ratios**D08**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Algebra | Using Routine Procedures | C | 1 | 69 | Y |

If the ratio 7 to 13 is the same as the ratio x to 52, what is the value of x ?

- A. 7
- B. 13
- C. 28
- D. 364

Smallest simple fraction**D09**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | A | 1 | 62 | Y |

Which of these fractions is smallest?

- A. $\frac{1}{6}$
- B. $\frac{2}{3}$
- C. $\frac{1}{3}$
- D. $\frac{1}{2}$

Equation to determine cost of cards**D10**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | A | 1 | 50 | Y |

The cost, C , of printing greeting cards consists of a fixed charge of 100 cents and a charge of 6 cents for each card printed. Which of these equations can be used to determine the cost of printing n cards?

- A. $C = (100 + 6n)$ cents
- B. $C = (106 + n)$ cents
- C. $C = (6 + 100n)$ cents
- D. $C = (106n)$ cents
- E. $C = (600n)$ cents

Units to measure mass of egg**D11**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Measurement | Knowing | C | 1 | 81 | Y |

What units would be best to use to measure the weight (mass) of an egg?

- A. centimeters
- B. milliliters
- C. grams
- D. kilograms

Estimate of point P on number line**D12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|-------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Knowing | B | 1 | 68 | Y |



What is the best estimate of the number corresponding to P?

- A. 1.1
- B. 1.2
- C. 1.4
- D. 1.5

Average speed from distance and time**F07**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | B | 1 | 33 | Y |

A runner ran 3000 m in exactly 8 minutes. What was his average speed in meters per second?

- A. 3.75
- B. 6.25
- C. 16.0
- D. 37.5
- E. 62.5

Likely result of fifth coin toss**F08**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|-------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Knowing | C | 1 | 57 | Y |

If a fair coin is tossed, the probability that it will land heads up is $\frac{1}{2}$. In four successive tosses, a fair coin lands heads up each time. What is likely to happen when the coin is tossed a fifth time?

- A. It is more likely to land tails up than heads up.
- B. It is more likely to land heads up than tails up.
- C. It is equally likely to land heads up or tails up.
- D. More information is needed to answer the question.

Number between two decimal fractions**F09**

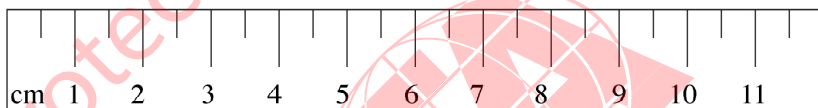
| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | C | 1 | 63 | Y |

Which of these numbers is between 0.07 and 0.08 ?

- A. 0.00075
- B. 0.0075
- C. 0.075
- D. 0.75

Measurement accuracy of ruler**F10**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Measurement | Knowing | D | 1 | 49 | Y |



Using a centimeter ruler like this one, you can measure accurately to the nearest

- A. millimeter
- B. half-millimeter
- C. centimeter
- D. half-centimeter

Find 1/3 of number from relationship**F11**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Algebra | Investigating and Solving Problems | A | 1 | 47 | Y |

If 4 times a number is 48, what is $\frac{1}{3}$ of the number?

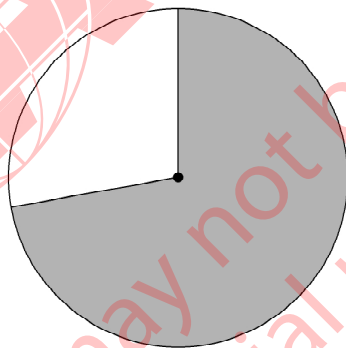
- A. 4
- B. 8
- C. 12
- D. 16

Fraction of circle shaded**F12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|-------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Knowing | C | 1 | 50 | Y |

What fraction of the circle is shaded?

- A. Between 0 and $\frac{1}{4}$
- B. Between $\frac{1}{4}$ and $\frac{1}{2}$
- C. Between $\frac{1}{2}$ and $\frac{3}{4}$
- D. Between $\frac{3}{4}$ and 1

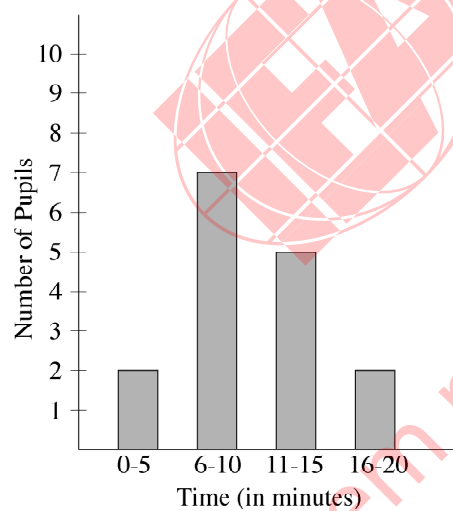


Barchart histogram of travel time

H07

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|--------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Using Complex Procedures | C | 1 | 64 | Y |

The graph shows the time of travel by pupils from home to school.



How many pupils must travel for MORE than 10 minutes?

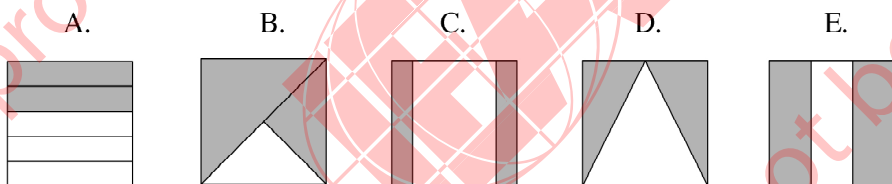
- A. 2
- B. 5
- C. 7
- D. 8
- E. 15

Figure showing fraction of shaded square

H08

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|-------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Knowing | E | 1 | 68 | Y |

Which shows $\frac{2}{3}$ of the square shaded?



Sum closest to $691 + 208$ **H09**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | B | 1 | 80 | Y |

The sum $691 + 208$ is closest to the sum

- A. $600 + 200$
- B. $700 + 200$
- C. $700 + 300$
- D. $900 + 200$

Equation from x/y table**H10**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | D | 1 | 49 | Y |

The table shows a relation between x and y .

| | | | | |
|-----|---|----|----|----|
| x | 2 | 3 | 4 | 5 |
| y | 7 | 10 | 13 | 16 |

Which of these equations expresses this relation?

- A. $y = x + 5$
- B. $y = x \pm 5$
- C. $y = \frac{1}{3}(x \pm 1)$
- D. $y = 3x + 1$

Defective bulbs from random sample**H11**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|------------------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Investigating and Solving Problems | C | 1 | 62 | Y |

From a batch of 3000 light bulbs, 100 were selected at random and tested. If 5 of the light bulbs in the sample were found to be defective, about how many defective light bulbs would be expected in the entire batch?

- A. 15
- B. 60
- C. 150
- D. 300
- E. 600

Symbolic linear equation of magazines**H12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | B | 1 | 72 | Y |

represents the number of magazines that Lina reads each week. Which of these represents the total number of magazines that Lina reads in 6 weeks?

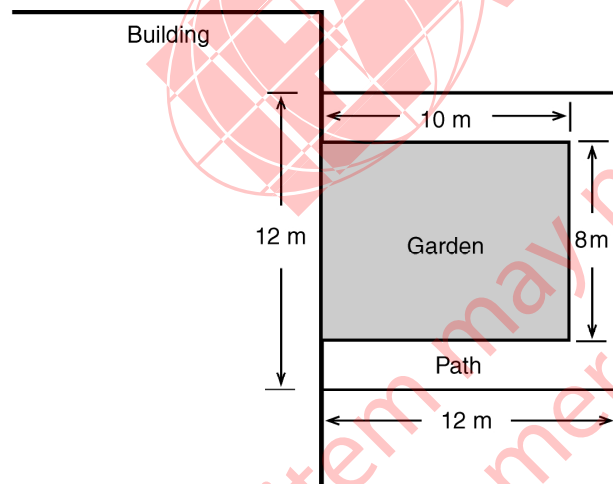
- A. $6 + \square$
- B. $6 \times \square$
- C. $\square + 6$
- D. $(\square + \square) \times 6$

Area of path around garden

J10

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Measurement | Investigating and Solving Problems | B | 1 | 42 | N |

A rectangular garden that is next to a building has a path around the other three sides, as shown.



What is the area of the path?

- A. 144 m^2
- B. 64 m^2
- C. 44 m^2
- D. 16 m^2

NOT true for all rectangles**J11**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Geometry | Knowing | E | 1 | 54 | N |

Of the following, which is NOT true for all rectangles?

- A. The opposite sides are parallel.
- B. The opposite sides are equal.
- C. All angles are right angles.
- D. The diagonals are equal.
- E. The diagonals are perpendicular.

Division of fractions

J12

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Routine Procedures | Rubric | 1 | 45 | N |

Divide: $\frac{6}{55} \div \frac{3}{25} =$

Answer: _____

| Code | Response | Item: M022026 |
|------|---|---------------|
| | Correct Response | |
| 10 | 10/11 | |
| 19 | Other fractions or decimals equivalent to 10/11 (e.g., 30/33, 150/165, .909, .91, etc.) | |
| | Incorrect Response | |
| 70 | Any fraction with 2 as a numerator [Divides 6 by 3] | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Interpretation of pictograph of houses


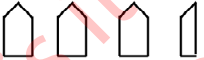
J13


| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|--------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Using Complex Procedures | Rubric | 1 | 69 | N |

The table shows the number of houses on two streets of a town, Konini Street and Rimu Street.

| Street | Number of Houses |
|--------|------------------|
| Konini | 30 |
| Rimu | 21 |

The pictograph below represents the number of houses in each street.

| | |
|------------|---|
| Konini St. |  |
| Rimu St. |  |

How many houses does one  represent?

Answer: _____

| Code | Response | Item: M022030 |
|------|---|---------------|
| | Correct Response | |
| 10 | 6 houses | |
| | Incorrect Response | |
| 70 | One house | |
| 71 | 5 houses | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Division of decimals**J14**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Routine Procedures | E | 1 | 39 | N |

Divide: $0.003 \overline{)15.45}$

- A. 0.515
- B. 5.15
- C. 51.5
- D. 515
- E. 5150

Two similar triangles

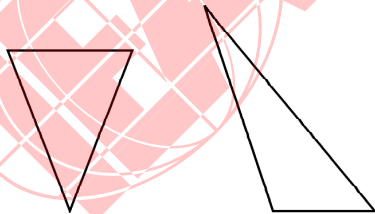
J15

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Geometry | Knowing | C | 1 | 62 | N |

Two of the triangles below are similar.



I



II



III



IV

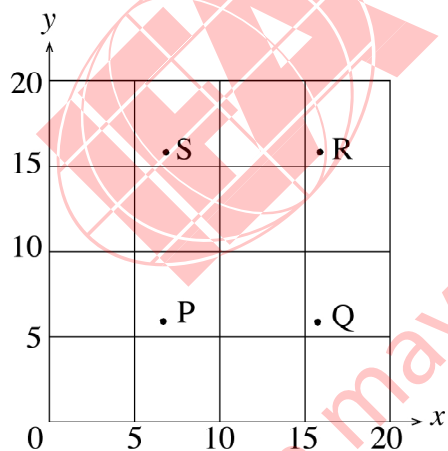
Which two triangles are similar?

- A. I and II
- B. I and III
- C. I and IV
- D. II and IV
- E. III and IV

Point on graph from coordinates**J16**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Geometry | Using Routine Procedures | D | 1 | 58 | N |

Which point on the graph could have coordinates (7,16)?



- A. Point P
- B. Point Q
- C. Point R
- D. Point S

Missing number in table**J17**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Algebra | Using Routine Procedures | A | 1 | 65 | N |

The table represents a relation between x and y .

What is the missing number in the table?

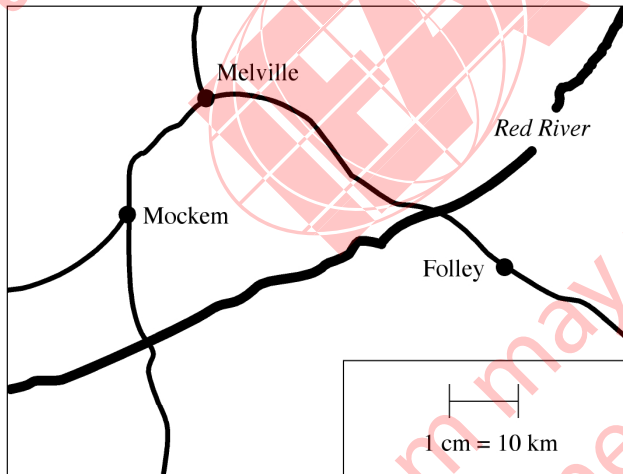
- A. 9
- B. 10
- C. 11
- D. 12
- E. 13

| x | y |
|-----|-----|
| 2 | 5 |
| 3 | 7 |
| 4 | ? |
| 7 | 15 |

Distance between towns from map**J18**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | D | 1 | 57 | N |

On the map, 1 cm represents 10 km on the land.

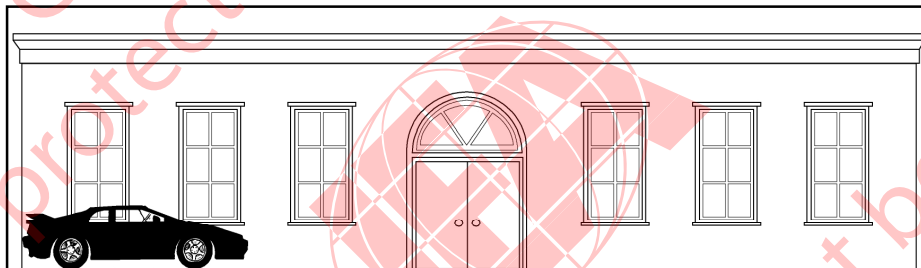


On the land, about how far apart are the towns Melville and Folley?

- A. 5 km
- B. 30 km
- C. 40 km
- D. 50 km

Length of building compared to car**L09**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | B | 1 | 75 | N |



The car is 3.5 m long. About how long is the building?

- A. 18 m
- B. 14 m
- C. 10 m
- D. 4 m

Two hundred six and nine-tenths**L10**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|-------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Knowing | B | 1 | 65 | N |

Which number is two hundred six and nine-tenths?

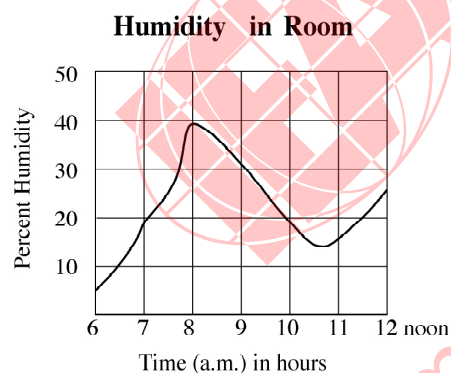
- A. 206.09
- B. 206.9
- C. 206.910
- D. 2006.9

Graph of humidity in room

L11

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|--------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Using Complex Procedures | C | 1 | 58 | N |

The graph below shows the humidity in a room as recorded on a certain morning.



On the morning shown in the graph, how many times between 6 a.m. and 12 noon was the humidity exactly 20 percent?

- A. One
- B. Two
- C. Three
- D. Four

Distance traveled by elevator**L12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Algebra | Investigating and Solving Problems | C | 1 | 53 | N |

In a sequence of starts and stops, an elevator travels from the first floor to the fifth floor and then to the second floor. From there, the elevator travels to the fourth floor and then to the third floor. If the floors are 3 m apart, how far has the elevator traveled?

- A. 18 m
- B. 27 m
- C. 30 m
- D. 45 m

Most paces to walk to end of hallway**L13**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Measurement | Investigating and Solving Problems | D | 1 | 67 | N |

Four girls measured the length of their paces. The chart shows their measurements.

| Name | Length of Pace |
|-------|----------------|
| Polly | 80 cm |
| Maria | 65 cm |
| Helen | 75 cm |
| Susan | 60 cm |

Who would take the most paces in walking from one end of a hallway to the other?

- A. Polly
- B. Maria
- C. Helen
- D. Susan

Correct equation based on x/y table**L14**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-----------------------------|----------|--------------|---|--------------|
| Algebra | Communicating and Reasoning | E | 1 | 45 | N |

The table represents a relation between x and y .

Which of the following equations could represent the same relation?

A. $y = 2x + 2$

B. $y = 2x - 1$

C. $y = 3x + 2$

D. $y = 3x + 1$

E. $y = 3x - 2$

| x | y |
|-----|-----|
| 1 | 1 |
| 2 | 4 |
| 3 | 7 |
| 4 | 10 |

Values in proportionality table

L15

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Algebra | Using Routine Procedures | E | 1 | 33 | N |

The table shows some values of x and y , where x is proportional to y .

| | | | |
|-----|---|-----|-----|
| x | 4 | 8 | Q |
| y | 9 | P | 45 |

What are the values of P and Q ?

- A. $P = 40$ and $Q = 13$
- B. $P = 18$ and $Q = 17$
- C. $P = 20$ and $Q = 18$
- D. $P = 40$ and $Q = 18$
- E. $P = 18$ and $Q = 20$

Measure of angle in quadrilateral**L16**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Geometry | Investigating and Solving Problems | A | 1 | 40 | N |

In a quadrilateral, each of two angles has a measure of 115° . If the measure of a third angle is 70° , what is the measure of the remaining angle?

- A. 60°
- B. 70°
- C. 130°
- D. 140°
- E. None of the above

Value of x in mathematical equation

L17

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Algebra | Using Routine Procedures | Rubric | 1 | 44 | N |

Find the value of x if $12x - 10 = 6x + 32$

Answer: _____

| Code | Response | Item: M022089 |
|---------------------------|--|---------------|
| Correct Response | | |
| 10 | 7 | |
| Incorrect Response | | |
| 70 | $3\frac{2}{3}$ OR $2\frac{1}{3}$ OR $1\frac{2}{9}$ [uses incorrect operation: $32 - 10 = 22$, $12x + 6x = 18x$, or both] | |
| 71 | Any expression or equation, other than $x = 7$, containing x | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

Subtraction with three fractions**L18**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Routine Procedures | B | 1 | 52 | N |

What is the value of $\frac{4}{5} - \frac{1}{3} - \frac{1}{15}$?

- A. $\frac{1}{5}$
- B. $\frac{2}{5}$
- C. $\frac{7}{15}$
- D. $\frac{3}{4}$
- E. $\frac{4}{5}$

| Number of cars from rounded value | | | | | N11 |
|-----------------------------------|--------------------------|----------|--------------|---|--------------|
| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
| Fractions and Number Sense | Using Routine Procedures | C | 1 | 74 | N |

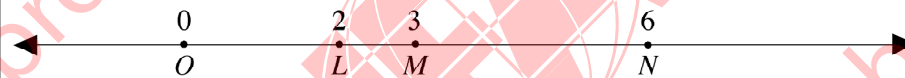
A company produced 17 175 cars in 1996. For a report, this number was rounded to the nearest hundred. Which was the number of cars given in the report?

- A. 17 000
- B. 17 100
- C. 17 200
- D. 17 270

Position of point on number line**N12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Geometry | Using Routine Procedures | A | 1 | 42 | N |

Point P (not shown) on the number line is 5 units from point N and 2 units from point M .



Where is point P located?

- A. Between O and L
- B. Between L and M
- C. Between M and N
- D. To the right of N

Value of expression substituting x=3

N13

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Algebra | Using Routine Procedures | Rubric | 1 | 53 | N |

If $x = 3$, what is the value of $\frac{5x + 3}{4x - 3}$?

Answer: _____

| Code | Response | Item: M022118 |
|---------------------------|--|---------------|
| Correct Response | | |
| 10 | 2 | |
| 11 | 18/9, 2/1 or other fraction equivalent to 2 | |
| 19 | Other correct | |
| Incorrect Response | | |
| 70 | Indicates the correct substitution of $x = 3$ in numerator and/or denominator but student did not correctly complete the solution. | |
| 71 | Indicates a wrong substitution such as $5x = 53$ or $5x = 5 + 3$ in the numerator; for example, any fractions with 56 or 11 as numerators, or 40 or 4 as denominators. | |
| 72 | A response containing the variable x | |
| 73 | Cancels or ignores x 's (e.g., $8/1$, $8 \cdot 7$, etc.) | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

List of equivalent fractions**N14**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|-------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Knowing | B | 1 | 61 | N |

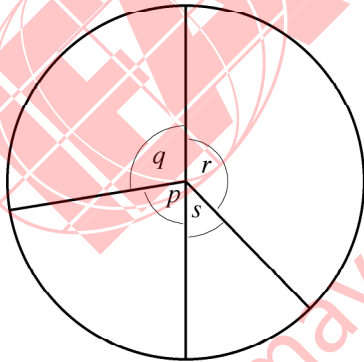
In which list of fractions are all of the fractions equivalent?

- A. $\frac{1}{2}$, $\frac{2}{4}$, $\frac{4}{6}$
- B. $\frac{2}{3}$, $\frac{4}{6}$, $\frac{8}{12}$
- C. $\frac{2}{5}$, $\frac{4}{10}$, $\frac{8}{50}$
- D. $\frac{3}{4}$, $\frac{4}{6}$, $\frac{6}{8}$

Angle closest to 45 degrees**N15**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Measurement | Knowing | D | 1 | 60 | N |

Which angle in the figure has a measure closest to 45° ?



- A. p
- B. q
- C. r
- D. s

| Number of marbles in bag | | | | | N16 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
| Fractions and Number Sense | Investigating and Solving Problems | B | 1 | 44 | N |

Penny had a bag of marbles. She gave one-third of them to Rebecca, and then one-fourth of the remaining marbles to John. Penny then had 24 marbles left in the bag. How many marbles were in the bag to start with?

- A. 36
- B. 48
- C. 60
- D. 96

This item may not be used for commercial purposes without express permission from IEA.

| Amount of paint left | | | | | N17 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
| Fractions and Number Sense | Investigating and Solving Problems | B | 1 | 35 | N |

A painter had 25 L of paint. He used 2.5 L of paint every hour. He finished the job in 5.5 hours. How much paint did he have left?

- A. 10.25 L
- B. 11.25 L
- C. 12.75 L
- D. 13.75 L

This item may not be used
 for commercial purposes
 without express
 permission from IEA.

Probability of drawing chip**N18**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|------------------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Investigating and Solving Problems | C | 1 | 48 | N |

The eleven chips shown below are placed in a bag and mixed.



Chelsea draws one chip from the bag without looking. What is the probability that Chelsea draws a chip with a number that is a multiple of three?

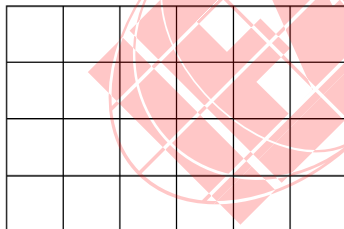
- A. $\frac{1}{11}$
- B. $\frac{1}{3}$
- C. $\frac{4}{11}$
- D. $\frac{4}{7}$

Shade in $\frac{3}{8}$ of squares in grid

N19

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|-------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Knowing | Rubric | 1 | 49 | N |

Shade in $\frac{3}{8}$ of the unit squares in the grid.

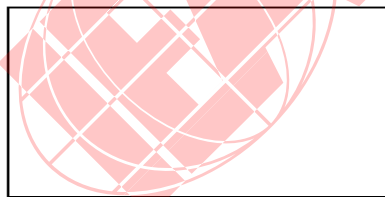


| Code | Response | Item: M022132 |
|------|--|---------------|
| | Correct Response | |
| 10 | 9 squares are shaded (regardless of which squares) | |
| 19 | Other correct (e.g., 6 full squares and 6 half squares shaded or other equivalent of nine squares) | |
| | Incorrect Response | |
| 70 | 3 squares shaded | |
| 71 | 8 squares shaded | |
| 72 | 11 or 13 squares shaded | |
| 73 | 3 squares shaded and 8 more squares shaded (areas are shaded separately) | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Ratio of width/perimeter in rectangle**P08**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Measurement | Investigating and Solving Problems | D | 1 | 22 | N |

The rectangle below is twice as long as it is wide.



What is the ratio of the width of the rectangle to its perimeter?

- A. $\frac{1}{2}$
- B. $\frac{1}{3}$
- C. $\frac{1}{4}$
- D. $\frac{1}{6}$

Expression equivalent to $n \times n \times n$ **P09**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | D | 1 | 71 | N |

Which of these expressions is equivalent to $n \times n \times n$ for all values of n .

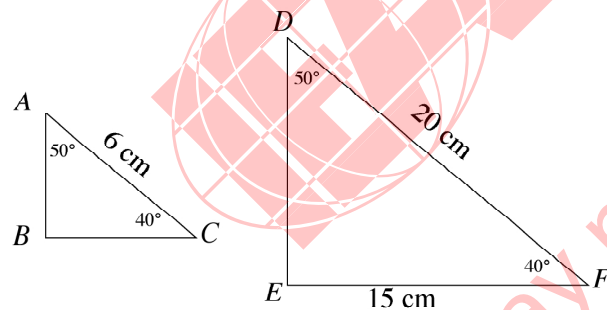
- A. $\frac{n}{3}$
- B. $n + 3$
- C. $3n$
- D. n^3

Length of side from similar triangle

P10

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Geometry | Using Routine Procedures | B | 1 | 37 | N |

The figure represents two similar triangles. The triangles are not drawn to scale.



In the actual triangle ABC , what is the length of side BC ?

- A. 3.5 cm
- B. 4.5 cm
- C. 5 cm
- D. 5.5 cm
- E. 8 cm

Equivalent expression: $k+k+k+k+k$

P11

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | B | 1 | 57 | N |

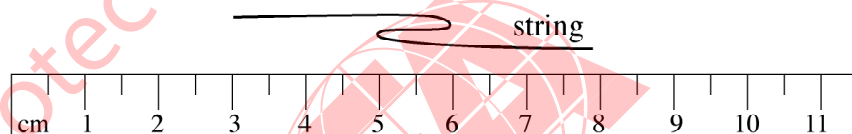
For all numbers k ,

$k + k + k + k + k$ can be written as

- A. $k + 5$
- B. $5k$
- C. k^5
- D. $5(k + 1)$

Length of string pulled straight**P12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Measurement | Using Complex Procedures | C | 1 | 41 | N |



If the string in the diagram is pulled straight, which of these is closest to its length?

- A. 5 cm
- B. 6 cm
- C. 7 cm
- D. 8 cm

Estimate of total cars in parking lot**P13**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | C | 1 | 65 | N |

There are 68 rows of cars in a parking lot. Each row has 92 cars. Which of these would give the closest estimate of the total number of cars in the parking lot?

- A. $60 \times 90 = 5400$
- B. $60 \times 100 = 6000$
- C. $70 \times 90 = 6300$
- D. $70 \times 100 = 7000$

Estimate of distance from explosion**P14**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | B | 1 | 56 | N |

Sound travels at approximately 330 meters per second. The sound of an explosion took 28 seconds to reach a person. Which of these is the closest estimate of how far away the person was from the explosion?

- A. 12 000 m
- B. 9000 m
- C. 8000 m
- D. 6000 m

Fraction of cherries in basket**P15**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | A | 1 | 45 | N |

Robin and Jim took cherries from a basket. Robin took $\frac{1}{3}$ of the cherries and Jim took $\frac{1}{6}$ of the cherries. What fraction of the cherries remained in the basket?

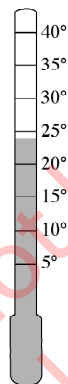
- A. $\frac{1}{2}$
- B. $\frac{1}{3}$
- C. $\frac{1}{6}$
- D. $\frac{1}{18}$

Day/time in table at shown temperature

P16

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|--------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Using Complex Procedures | A | 1 | 79 | N |

This table shows temperatures at various times on four days.



Thermometer

| TEMPERATURE | | | | | |
|-------------|--------|--------|------|--------|--------|
| | 6 a.m. | 9 a.m. | Noon | 3 p.m. | 6 p.m. |
| Monday | 15° | 17° | 24° | 21° | 16° |
| Tuesday | 20° | 16° | 15° | 10° | 9° |
| Wednesday | 8° | 14° | 16° | 19° | 15° |
| Thursday | 8° | 11° | 19° | 26° | 20° |

On which day and at what time was the temperature shown in the table the same as that shown on the thermometer?

- A. Monday, Noon
- B. Tuesday, 6 a.m.
- C. Wednesday, 3 p.m.
- D. Thursday, 3 p.m.

Write decimal as fraction

P17

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Routine Procedures | Rubric | 1 | 36 | N |

Write 0.48 as a fraction reduced to its lowest terms

Answer: _____

| Code | Response | Item: M022178 |
|---------------------------|---|---------------|
| Correct Response | | |
| 10 | 12/25 | |
| Incorrect Response | | |
| 70 | 48/100 OR 24/50 | |
| 71 | Any fraction other than 48/100 with 48 as numerator | |
| 72 | Any fraction with 48 as denominator | |
| 73 | 4/8 OR 2/4 OR 1/2 | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

Subtraction of decimals to 0.001**R07**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Routine Procedures | A | 1 | 77 | N |

Subtract: $4.722 - 1.935 =$

- A. 2.787
- B. 2.797
- C. 2.887
- D. 2.897

Average weight of salt crystals**R08**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | B | 1 | 52 | N |

The total weight of a pile of 500 salt crystals is 6.5 g. What is the average weight of a salt crystal?

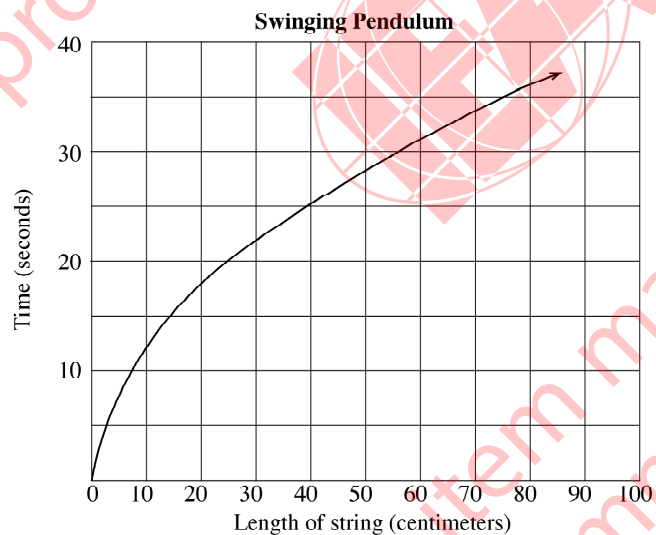
- A. 0.0078 g
- B. 0.013 g
- C. 0.0325 g
- D. 0.078 g

Time for pendulum to swing 20 times

R09

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|--------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Using Complex Procedures | B | 1 | 54 | N |

The graph shows the time taken for a pendulum to swing backwards and forwards 20 times for different lengths of the string.



The length of a string is 90 cm. About how long would it take for the pendulum to swing backwards and forwards 20 times?

- A. 35 seconds
- B. 38 seconds
- C. 42 seconds
- D. 45 seconds

Expression when a,b,c are real**R10**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | D | 1 | 37 | N |

Which of the following is true when a , b , and c are different real numbers?

A. $a - b = b - a$

B. $a(b - c) = b(c - a)$

C. $b - c = c - b$

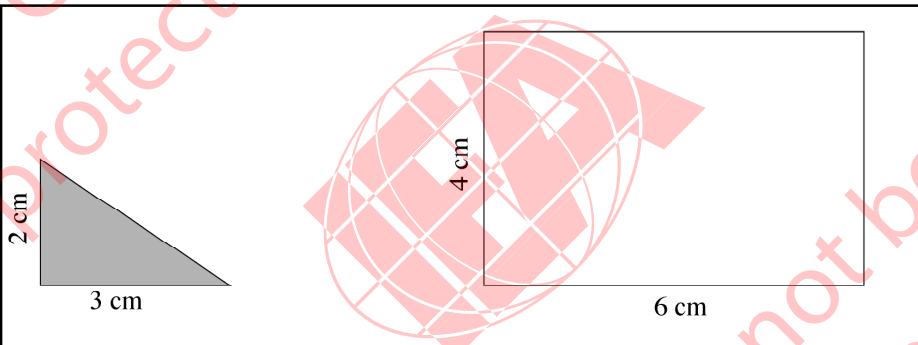
D. $ab = ba$

E. $ab - c = ac - b$

Right triangles to cover rectangle

R11

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|--------------------------|----------|--------------|---|--------------|
| Geometry | Using Complex Procedures | C | 1 | 46 | N |



How many of the shaded right triangles shown above are needed to exactly cover the surface of the rectangle?

A. Four

B. Six

C. Eight

D. Ten

Operations on negative number**R12**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-------------------------|----------|--------------|---|--------------|
| Algebra | Knowing | A | 1 | 47 | N |

If k represents a negative number, which of these is a positive number?

- A. k^2
- B. k^3
- C. $2k$
- D. $\frac{k}{2}$

Subtraction of 4-digit whole numbers**R13**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Routine Procedures | B | 1 | 74 | N |

Subtract:

$$\begin{array}{r} 7003 \\ - 4078 \\ \hline \end{array}$$

- A. 2035
- B. 2925
- C. 3005
- D. 3925

How much money left if spent $\frac{5}{8}$

R14

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | Rubric | 1 | 30 | N |

Laura had \$240. She spent $\frac{5}{8}$ of it. How much money did she have left?

Answer: _____

Note: There is no distinction made between responses with or without units.

| Code | Response | Item: M022219 |
|------|---|---------------|
| | Correct Response | |
| 10 | 90 | |
| | Incorrect Response | |
| 70 | 150 [money spent] | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Money from total magazine sales

R15

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | Rubric | 1 | 44 | N |

John sold 60 magazines and Mark sold 80 magazines. The magazines were all sold for the same price. The total amount of money received for the magazines was \$700. How much money did Mark receive?

Answer: _____

Note: There is no distinction made between responses with or without units.

| Code | Response | Item: M022222 |
|---------------------------|---|----------------------------|
| Correct Response | | |
| 10 | 400 | |
| Incorrect Response | | |
| 70 | 500 | [price per magazine x 100] |
| 71 | 350 | [700 ÷ 2] |
| 72 | 300 | [money John received] |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

Total club members: boys and girls

T01

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Algebra | Investigating and Solving Problems | Rubric | 2 | 33 | N |

A club has 86 members, and there are 14 more girls than boys. How many boys and how many girls are members of the club?

Show your work.

| Code | Response | Item: M022228 |
|---------------------------|--|--|
| Correct Response | | |
| 20 | 36 boys and 50 girls | [Numerical method: e.g., $86 \div 2 = 43$; $43 - 7 = 36$ boys; $43 + 7 = 50$ girls] |
| 21 | 36 boys and 50 girls | [Algebraic method: e.g., $b + (b + 14) = 86$; $2b = 72$; $b = 36$; $g = 36 + 14 = 50$] |
| 29 | Other fully satisfactory method including "guess and check" with justification that $36 + 50 = 86$ | |
| Partial Response | | |
| 10 | Either 36 boys or 50 girls, with or without another (incorrect) number | |
| 11 | 36 and 50 are given | [Makes correct computations but reverses labels or does not include any mention of which is boys or girls] |
| 12 | 36 boys and 50 girls, no method shown | |
| 13 | Gives an algebraic equation or system of equations that can lead to the correct solution | |
| 19 | Other partially correct | |
| Incorrect Response | | |
| 70 | 29 boys and 57 girls | [Computes $86 \div 2 = 43$; $43 - 14 = 29$ and $43 + 14 = 57$] |
| 71 | One of the numbers is 72 | [Computes $86 - 14$] |
| 72 | 29 boys and 43 girls | [Computes $43 - 14 = 29$] |
| 73 | Gives an algebraic equation or system of equations that cannot lead to a correct solution | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

Number/fraction of 2 types of boxes

T02A

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | Rubric | 1 | 26 | N |

A book publisher sent 140 copies of a certain book to a bookstore. The publisher packed the books in two types of boxes. One type of box held 8 copies of the book, and the other type of box held 12 copies of the book. The boxes were all full, and there were equal numbers of both types of boxes.

a) How many boxes holding 12 books were sent to the bookstore?

Answer: _____

b) What fraction of the books sent to the bookstore were packed in the smaller boxes?

Answer: _____

A: Codes for Total Number of Boxes

| Code | Response | Item: M022231a |
|------|---|----------------|
| | Correct Response | |
| 10 | 7 | |
| | Incorrect Response | |
| 79 | Incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Number/fraction of 2 types of boxes

T02B

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | Rubric | 1 | 12 | N |

A book publisher sent 140 copies of a certain book to a bookstore. The publisher packed the books in two types of boxes. One type of box held 8 copies of the book, and the other type of box held 12 copies of the book. The boxes were all full, and there were equal numbers of both types of boxes.

a) How many boxes holding 12 books were sent to the bookstore?

Answer: _____

b) What fraction of the books sent to the bookstore were packed in the smaller boxes?

Answer: _____

B: Codes for Fraction of Books in Smaller Boxes

Note: The term "equivalent" in the codes below includes decimal fractions and percentages.

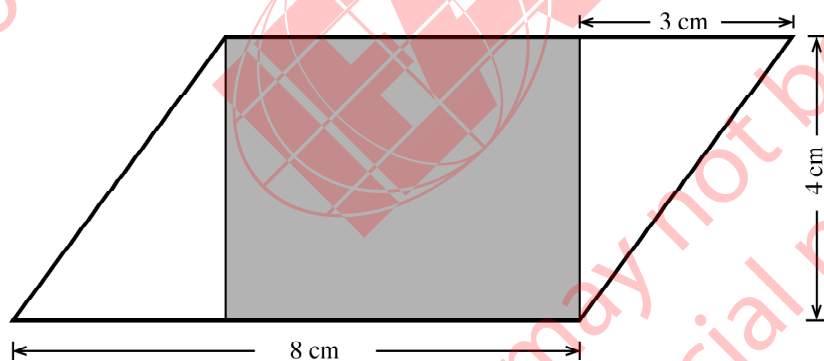
| Code | Response | Item: M022231b |
|---------------------------|---|----------------|
| Correct Response | | |
| 10 | 2/5 | |
| 11 | Another fraction or percent equivalent to 2/5 (e.g., 8/20, 14/35, 28/70, etc.) | |
| 19 | Other correct | |
| Incorrect Response | | |
| 70 | 1/2 | |
| 71 | 2/3 OR 8/12 OR 56/84 [fraction of boxes] | |
| 72 | Any integer | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

Area of rectangle inside parallelogram

T03

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Measurement | Investigating and Solving Problems | Rubric | 1 | 43 | N |

The figure shows a shaded rectangle inside a parallelogram.



What is the area of the shaded rectangle?

Answer: _____

Note: There is no distinction made between responses with or without units.

| Code | Response | Item: M022244 |
|---------------------------|---|---------------|
| Correct Response | | |
| 10 | 20 | |
| Incorrect Response | | |
| 70 | 32 | [4 x 8] |
| 71 | 18 | [perimeter] |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

Height of stack from paper thickness**T04**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | C | 1 | 54 | N |

A sheet of paper is 0.012 cm thick. Of the following, which would be the height of a stack of 400 sheets of this paper?

- A. 0.048 cm
- B. 0.48 cm
- C. 4.8 cm
- D. 48 cm

Two possibilities for actual height

V01

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|--------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Using Complex Procedures | Rubric | 1 | 44 | N |

The height of a boy was reported as 140 cm. The height had been rounded to the nearest 10 cm. What are two possibilities for the boy's actual height.

Answer: _____ cm and _____ cm

| Code | Response | Item: M022237 |
|------|---|---------------|
| | Correct Response | |
| 10 | One answer 140 and the other answer is in an acceptable range, $135 \leq x < 140$ or $140 < x < 145$. | |
| 11 | Neither answer is 140 cm but both are in the acceptable range $135 \leq x < 140$ and/or $140 < x < 145$. | |
| | Incorrect Response | |
| 70 | Both answers within the intervals $145 \leq x \leq 150$ and/or $130 \leq x < 135$ | |
| 71 | 130 AND 150 | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Cheaper magazine subscription

V02

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|---|-----------------------------|----------|--------------|---|--------------|
| Data Representation, Analysis and Probability | Communicating and Reasoning | Rubric | 2 | 24 | N |

Chris plans to order 24 issues of a magazine. He reads the following advertisements for two magazines. *Ceds* are the units of currency in Chris' country.

Teen Life Magazine

24 issues
First four issues FREE
The rest
3 *ceds* each.

Teen News Magazine

24 issues
First six issues FREE
The rest
3.5 *ceds* each.

Which magazine is the least expensive for 24 issues? How much less expensive? Show your work.

Note: There is no distinction made between responses with or without units.

| Code | Response | Item: M022256 |
|---------------------------|--|---------------|
| Correct Response | | |
| 20 | Teen Life. Calculations of both magazines are correct (60 <i>ceds</i> for Teen Life and 63 <i>ceds</i> for Teen News) and correct savings of 3 <i>ceds</i> | |
| 29 | Other correct (e.g., Teen Life. Calculation of one magazine correct, the other not shown, and correct savings of 3 <i>ceds</i>). | |
| Partial Response | | |
| 10 | Correct calculations (60 and 63 <i>ceds</i>), but incorrect or no magazine identified and/or no difference given | |
| 11 | Correct calculation for Teen News (63 <i>ceds</i>), but incorrect calculation for Teen Life | |
| 12 | Incorrect calculation for Teen News but correct calculation for Teen Life (60 <i>ceds</i>) | |
| 13 | Teen Life, 3 <i>ceds</i> . No work shown | |
| 19 | Other partially correct response (e.g., correct calculations but incorrect difference) | |
| Incorrect Response | | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |

Ratio of nitrate to total fertilizer**V03**

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|----------------------------|------------------------------------|----------|--------------|---|--------------|
| Fractions and Number Sense | Investigating and Solving Problems | D | 1 | 45 | N |

In making a garden fertilizer, a gardener mixes 2 kg of a nitrate, 3 kg of a phosphate, and 6 kg of potash. What is the ratio of nitrate to the total amount of fertilizer?

- A. $\frac{11}{9}$
- B. $\frac{2}{3}$
- C. $\frac{2}{9}$
- D. $\frac{2}{11}$

Sequence of figures with circles

V04A

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Algebra | Investigating and Solving Problems | Rubric | 1 | 65 | N |

The figures show four sets consisting of circles.



Figure 1

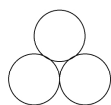


Figure 2

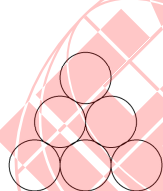


Figure 3

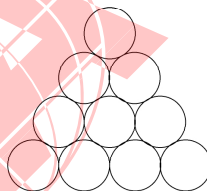


Figure 4

- a) Complete the table below. First, fill in how many circles make up Figure 4. Then, find the number of circles that would be needed for the 5th figure if the sequence of figures is extended.

| Figure | Number of circles |
|--------|-------------------|
| 1 | 1 |
| 2 | 3 |
| 3 | 6 |
| 4 | |
| 5 | |

- b) The sequence of figures is extended to the 7th figure. How many circles would be needed for Figure 7?

Answer: _____

- c) The 50th figure in the sequence contains 1275 circles. Determine the number of circles in the 51st figure. Without drawing the 51st figure, explain or show how you arrived at your answer.

A. Codes for Number of Circles in Figures 4 and 5

| Code | Response | Item: M022262a |
|------|---|----------------|
| | Correct Response | |
| 10 | 10 AND 15 | |
| | Incorrect Response | |
| 70 | 10 and any number other than 15 | |
| 71 | 10 and no numerical response for 5 th figure | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Sequence of figures with circles

V04B

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|------------------------------------|----------|--------------|---|--------------|
| Algebra | Investigating and Solving Problems | Rubric | 1 | 54 | N |

The figures show four sets consisting of circles.



Figure 1

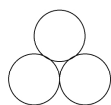


Figure 2

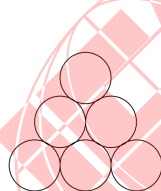


Figure 3

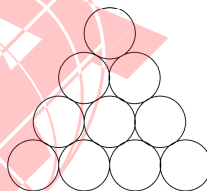


Figure 4

- a) Complete the table below. First, fill in how many circles make up Figure 4. Then, find the number of circles that would be needed for the 5th figure if the sequence of figures is extended.

| Figure | Number of circles |
|--------|-------------------|
| 1 | 1 |
| 2 | 3 |
| 3 | 6 |
| 4 | |
| 5 | |

- b) The sequence of figures is extended to the 7th figure. How many circles would be needed for Figure 7?

Answer: _____

- c) The 50th figure in the sequence contains 1275 circles. Determine the number of circles in the 51st figure. Without drawing the 51st figure, explain or show how you arrived at your answer.

B. Codes for Number of Circles in Figure 7

| Code | Response | Item: M022262b |
|------|---|----------------|
| | Correct Response | |
| 10 | 28 | |
| | Incorrect Response | |
| 70 | 21 | |
| 71 | 22 | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| | Nonresponse | |
| 99 | BLANK | |

Sequence of figures with circles

V04C

| Content Category | Performance Expectation | Item Key | Score Points | International Average Percentage of 8th Grade Students Responding Correctly | Used in 1995 |
|------------------|-----------------------------|----------|--------------|---|--------------|
| Algebra | Communicating and Reasoning | Rubric | 2 | 30 | N |

The figures show four sets consisting of circles.



Figure 1

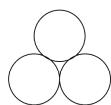


Figure 2

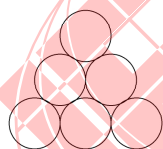


Figure 3

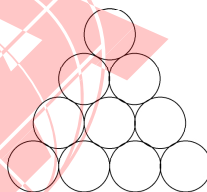


Figure 4

- a) Complete the table below. First, fill in how many circles make up Figure 4. Then, find the number of circles that would be needed for the 5th figure if the sequence of figures is extended.

| Figure | Number of circles |
|--------|-------------------|
| 1 | 1 |
| 2 | 3 |
| 3 | 6 |
| 4 | |
| 5 | |

- b) The sequence of figures is extended to the 7th figure. How many circles would be needed for Figure 7?

Answer: _____

- c) The 50th figure in the sequence contains 1275 circles. Determine the number of circles in the 51st figure. Without drawing the 51st figure, explain or show how you arrived at your answer.

C. Codes for Explanation and Answer for 51st Figure

Note: Code 20 takes priority over Code 21.

| Code | Response | Item: M022262c |
|---------------------------|--|----------------|
| Correct Response | | |
| 20 | 1326. Correct general expression $\frac{n(n+1)}{2}$, $\frac{51(52)}{2}$, or equivalent | |
| 21 | 1326 [Adds 1275 + 51] | |
| 29 | Other fully correct, including [(figure number) ² - number of circles in previous figure] | |
| Partial Response | | |
| 10 | 1326 without showing how obtained | |
| 11 | Correct method but does not write 1326 as answer | |
| 19 | Other partially correct | |
| Incorrect Response | | |
| 79 | Other incorrect (including crossed out/erased, stray marks, illegible, or off task) | |
| Nonresponse | | |
| 99 | BLANK | |



TIMSS and PIRLS are copyrighted and are registered trademarks of IEA. Released items from TIMSS and PIRLS assessments are for non-commercial, educational, and research purposes only. Translated versions of items remain the intellectual property of IEA. Although the items are in the public domain, please print an acknowledgement of the source, including the year and name of the assessment you are using.

mathematics items

TIMSS 1999 MATHEMATICS ITEMS

M



BOSTON
COLLEGE

Released Set for Eighth Grade