

mathematics items

TIMSS 1999 MATHEMATICS ITEMS



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	●		
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

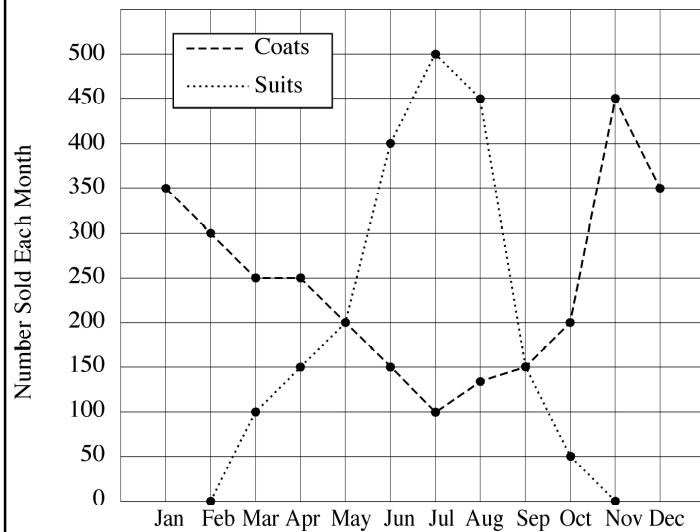
B07	Graph showing greatest increase
F08	Likely result of fifth coin toss
H07	Bar chart histogram of travel time
H11	Defective bulbs from random sample
J13	Interpretation of pictograph of houses
L11	Graph of humidity in room
N18	Probability of drawing chip
P16	Day/time in table at shown temperature
R09	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

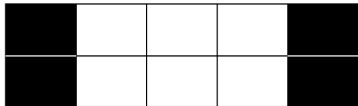
If there are 300 calories in 100 g of a certain food, how many calories are there in a 30 g portion of this food?

- 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 $\frac{4}{10}$?

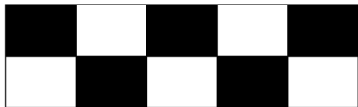
A.



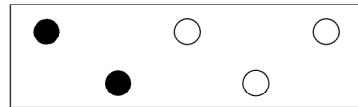
B.



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

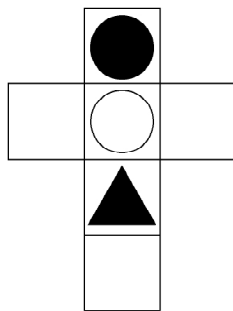
Which of these is the smallest number?

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

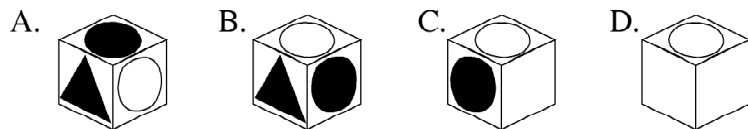
Cube from folded 2-dimensional net

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?

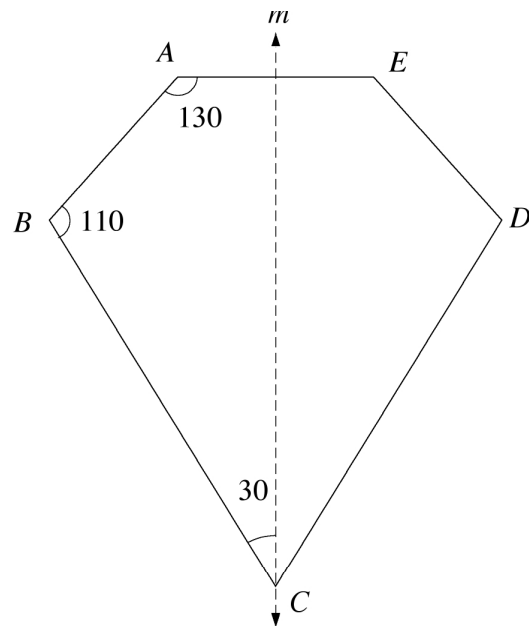
- A. $7n + 6 = 41$
- B. $7n \pm 6 = 41$
- C. $7n \times 6 = 41$
- D. $7(n + 6) = 41$

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?

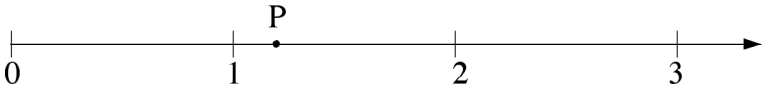
- A. $C = (100 + 6n)$ cents
- B. $C = (106 + n)$ cents
- C. $C = (6 + 100n)$ cents
- D. $C = (106n)$ cents
- E. $C = (600n)$ cents

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?

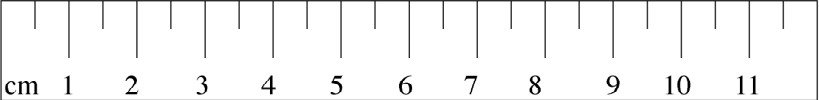
- A. It is more likely to land tails up than heads up.
- B. It is more likely to land heads up than tails up.
- C. It is equally likely to land heads up or tails up.
- D. More information is needed to answer the question.

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

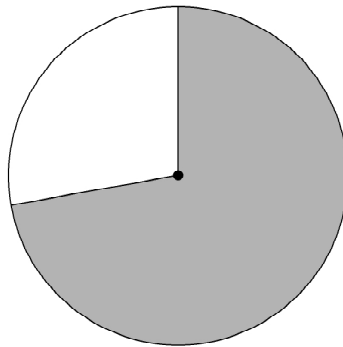
If 4 times a number is 48, what is $\frac{1}{3}$ of the number?

- 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

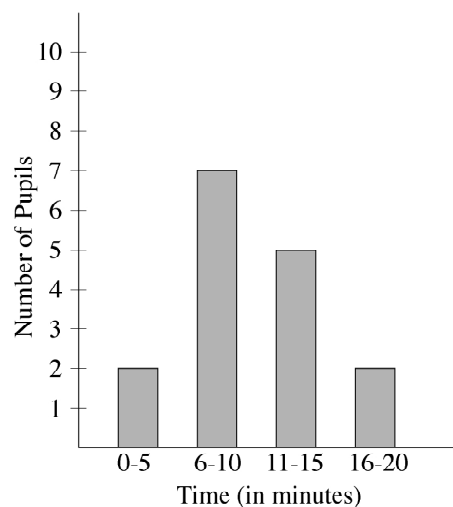
What fraction of the circle is shaded?

- 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.



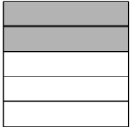
How many pupils must travel for MORE than 10 minutes?

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

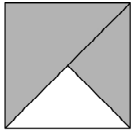
Figure showing fraction of shaded square					H08
Content Category	Performance Expectation	Item Key	Score Points	International Average Percentage of 8th Grade Students Responding Correctly	Used in 1995
Fractions and Number Sense	Knowing	E	1	68	Y

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

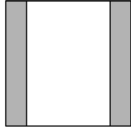
A.



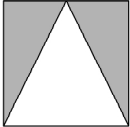
B.



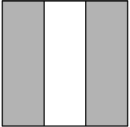
C.



D.



E.



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

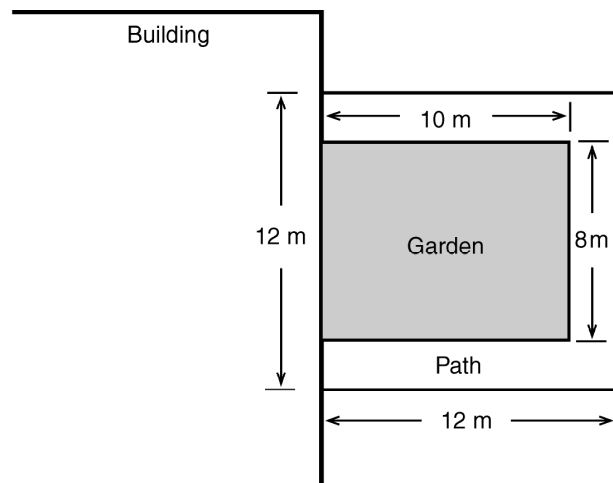
Symbolic linear equation of magazines					H12
Content Category	Performance Expectation	Item Key	Score Points	International Average Percentage of 8th Grade Students Responding Correctly	Used in 1995
Algebra	Knowing	B	1	72	Y

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 m²
- B. 64 m²
- C. 44 m²
- D. 16 m²

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: $0.003 \overline{)15.45}$

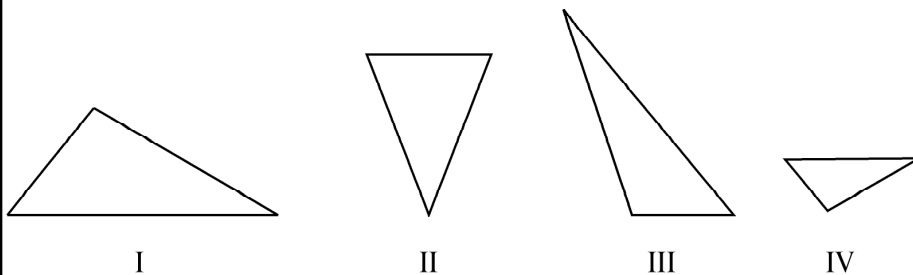
- A. 0.515
- B. 5.15
- C. 51.5
- D. 515
- E. 5150

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.



Which two triangles are similar?

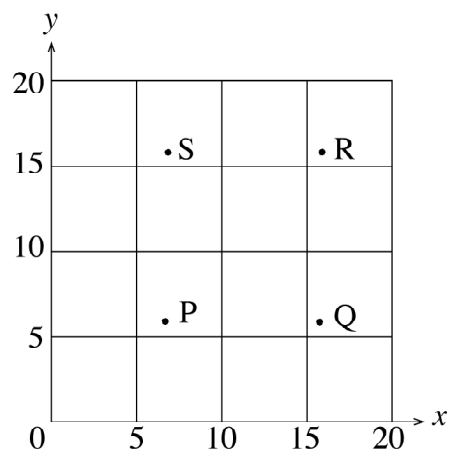
- A. I and II
- B. I and III
- C. I and IV
- D. II and IV
- E. III and IV

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

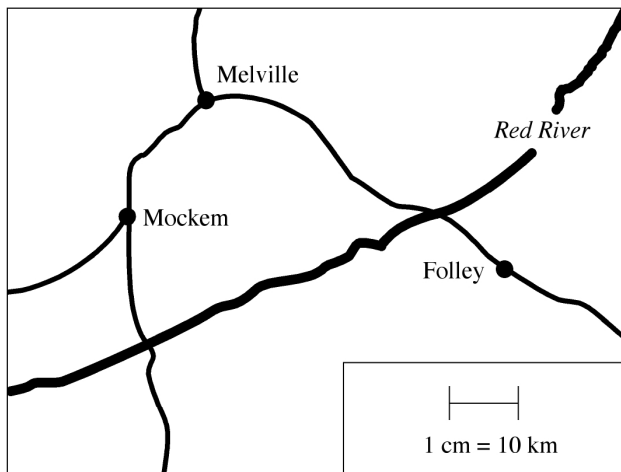
x	y
2	5
3	7
4	?
7	15

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

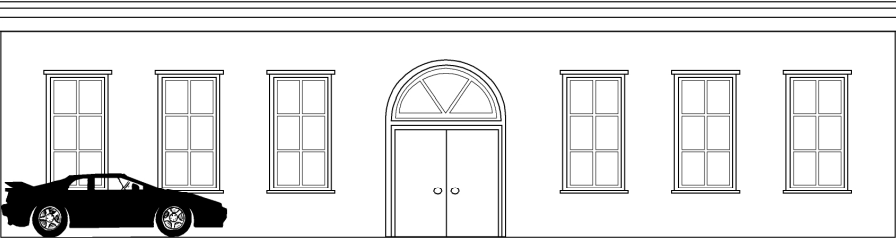
On the map, 1 cm represents 10 km on the land.



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?

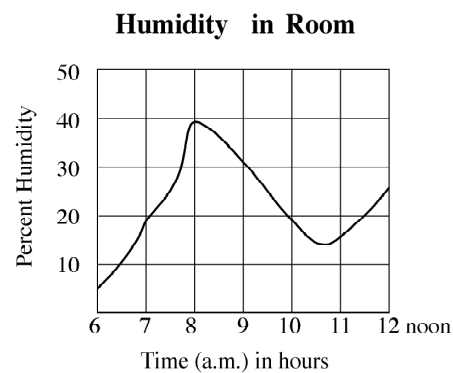
- A. 206.09
- B. 206.9
- C. 206.910
- D. 2006.9

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. $\frac{4}{5}$

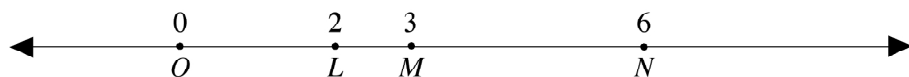
Number of cars from rounded value					N11
Content Category	Performance Expectation	Item Key	Score Points	International Average Percentage of 8th Grade Students Responding Correctly	Used in 1995
Fractions and Number Sense	Using Routine Procedures	C	1	74	N

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, 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?

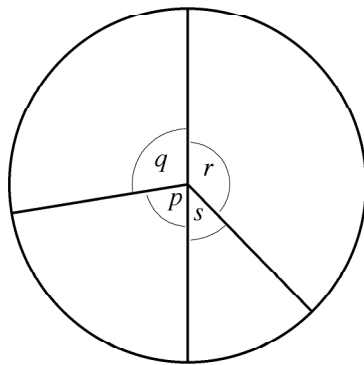
- A. $\frac{1}{2}, \frac{2}{4}, \frac{4}{6}$
- B. $\frac{2}{3}, \frac{4}{6}, \frac{8}{12}$
- C. $\frac{2}{5}, \frac{4}{10}, \frac{8}{50}$
- D. $\frac{3}{4}, \frac{4}{6}, \frac{6}{8}$

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

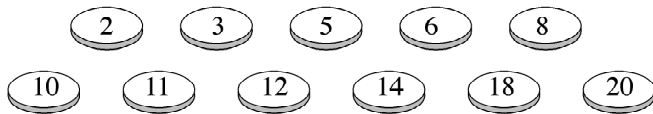
Amount of paint left					N17
Content Category	Performance Expectation	Item Key	Score Points	International Average Percentage of 8th Grade Students Responding Correctly	Used in 1995
Fractions and Number Sense	Investigating and Solving Problems	B	1	35	N

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

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

N19

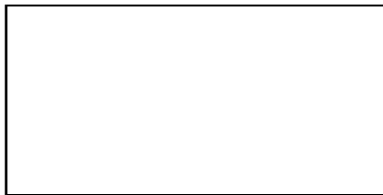
Content Category	Performance Expectation	Item Key	Score Points	International Average Percentage of 8th Grade Students Responding Correctly	Used in 1995
Fractions and Number Sense	Knowing	Rubric	1	49	N

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. $\frac{1}{6}$

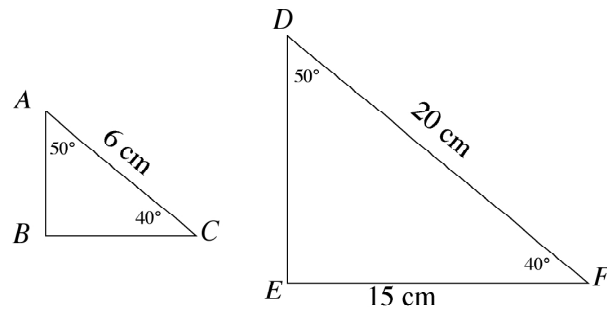
Expression equivalent to $n \times n \times n$					P09
Content Category	Performance Expectation	Item Key	Score Points	International Average Percentage of 8th Grade Students Responding Correctly	Used in 1995
Algebra	Knowing	D	1	71	N

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 ?

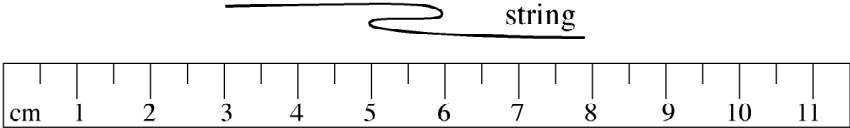
- A 3.5 cm
- B. 4.5 cm
- C. 5 cm
- D. 5.5 cm
- E. 8 cm

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. $\frac{1}{18}$

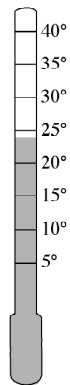
Day/time in table at shown temperature

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.

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°



Thermometer

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

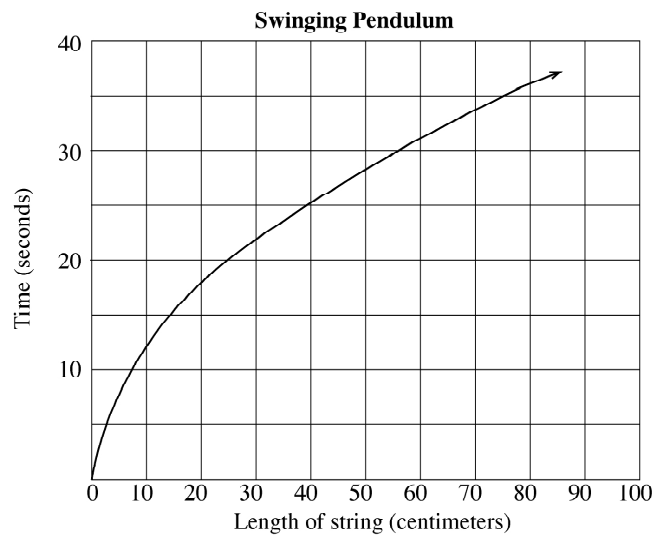
Average weight of salt crystals					R08
Content Category	Performance Expectation	Item Key	Score Points	International Average Percentage of 8th Grade Students Responding Correctly	Used in 1995
Fractions and Number Sense	Using Complex Procedures	B	1	52	N

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

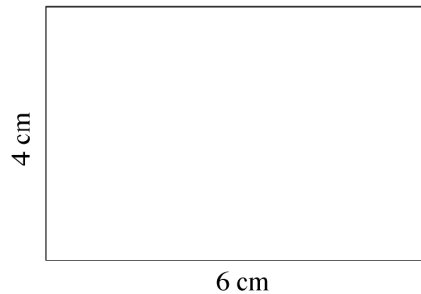
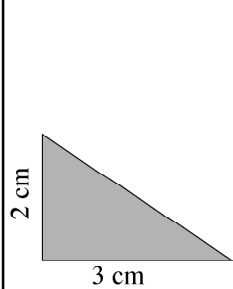
Which of the following is true when a , b , and c are different real numbers?

- 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: _____

<i>Note: There is no distinction made between responses with or without units.</i>		
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 ceds for Teen Life and 63 ceds for Teen News) and correct savings of 3 ceds	
29	Other correct (e.g., Teen Life. Calculation of one magazine correct, the other not shown, and correct savings of 3 ceds).	
	Partial Response	
10	Correct calculations (60 and 63 ceds), but incorrect or no magazine identified and/or no difference given	
11	Correct calculation for Teen News (63 ceds), but incorrect calculation for Teen Life	
12	Incorrect calculation for Teen News but correct calculation for Teen Life (60 ceds)	
13	Teen Life, 3 ceds. 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.

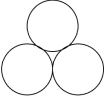
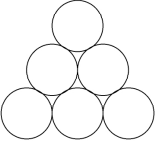
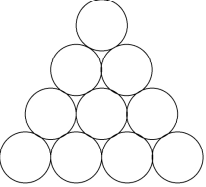





Figure 1
Figure 2
Figure 3
Figure 4

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

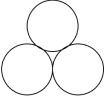


Figure 2

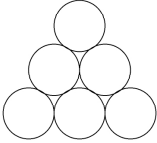


Figure 3

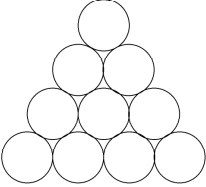


Figure 4

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.

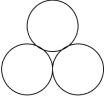
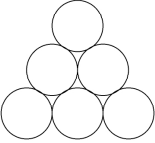
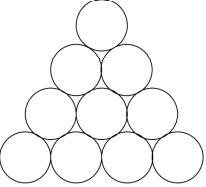





Figure 1 Figure 2 Figure 3 Figure 4

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	