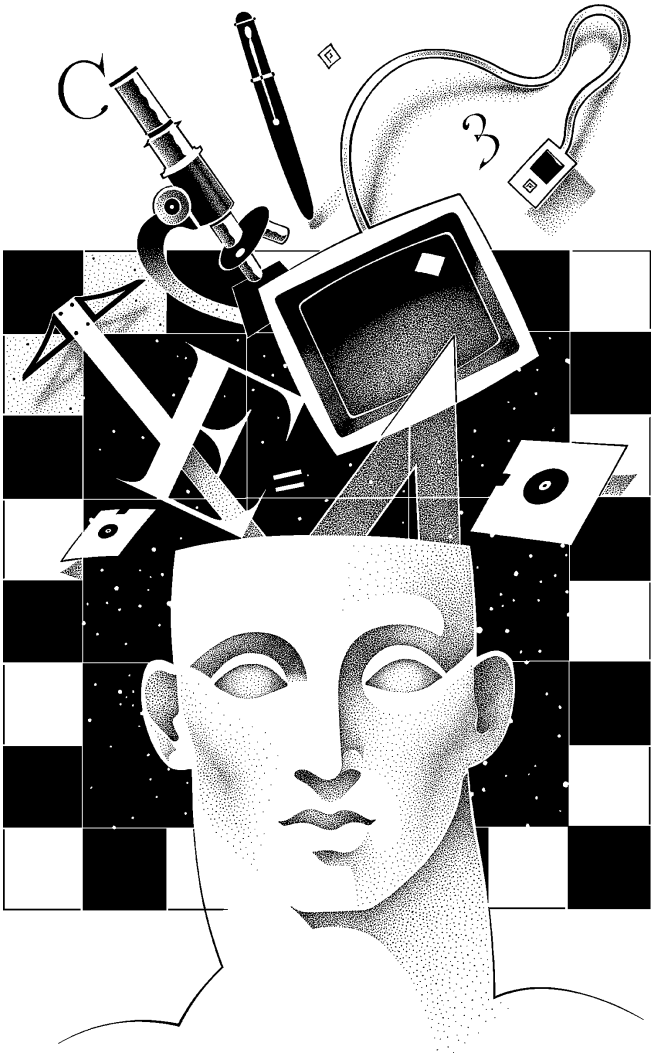
School Achievement Indicators Program

Mathematics Assessment

Information Bulletin for Schools



2001

Council of Ministers of Education, Canada
Conseil des ministres de l'Éducation (Canada)

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THE SCHOOL ACHIEVEMENT INDICATORS PROGRAM

What Is It?

Canadians have long been interested in how well their education systems are meeting the needs of students and society. To answer this question, the provinces and territories, through the Council of Ministers of Education, Canada (CMEC), have developed the School Achievement Indicators Program (SAIP). This is the first Canadian project of its kind.

One purpose of the program is to gather current information about how well students are achieving in mathematics, in reading and writing, and in science. This information will help decision makers in education as they set priorities, develop policy and plan for the future. The results will also provide the Canadian public with information about nationwide achievement levels.

The 2001 Assessment

In April 2001, a random sample of 13- and 16-year-old students (as of August 31, 2000) in schools across Canada will participate in a mathematics assessment as part of the SAIP. In jurisdictions where there are small student populations, all the appropriately aged students will be tested.

Students' achievement will be assessed in two components, mathematics content or mathematics problem solving. Participating students will be asked to complete only one component. For example, a sample of 13-year-old students selected from one school will be divided randomly into two groups. One group will participate in the mathematics content component and the other will participate in the mathematics problem-solving component. Details regarding sample sizes, selection and exemptions will be communicated to participating schools by the Provincial or Territorial Coordinator.

The Council of Ministers of Education, Canada will report the assessment results. The percentage of students attaining each of five performance levels described in this bulletin will be reported provincially, nationally and by language of instruction.

A general summary of results will be available to all interested parties. Each province or territory will also receive detailed technical information. Results for individual students, schools, or school jurisdictions will not be reported, and any identifying information will be removed before scoring and data analysis.

Overview of the Assessment

The mathematics assessment consists of two components and a background questionnaire. Both components of the assessment will be administered in your school, but to different students. Students will participate in only one component of the assessment; either the content component or the problem-solving

component. A list of students in your school, selected to participate in the mathematics assessment, is enclosed with this handbook. **For proper sampling, please ensure students write the test component to which they were assigned (i.e., make no changes).**

Both components can be written at the same time and in the same place. If your school has been selected for testing both 13- and 16- year-old students, these students can write at the same time and in the same place.

General Description of the SAIP Mathematics Assessment

Writing time

Approximately three hours, for example two and one-half hours for the content or problem-solving component and one-half hour for the questionnaire.

Materials

Students will need an HB pencil, an eraser, a ruler, a protractor and a calculator. Formula sheets and all necessary tables and data are provided.

Preparing for the assessment

Students cannot prepare specifically for this assessment. Sample questions for each of the components are included in Appendices A and B. A formula sheet, a trigonometry table and a table of the area under the standard normal curve are provided in Appendix H. Students should be encouraged to do their best so that valid information about nationwide achievement levels can be obtained.

Nature of the Assessment

Although the content of this assessment is consistent with that of mathematics programs across Canada, there are some limitations that should be noted. The assessment focuses on knowledge and skills that can be measured by a paper-and-pencil test. The following dimensions of mathematics, which are important elements of mathematics programs, are not assessed:

- the ability to work with manipulatives to solve problems
- group problem-solving skills, and
- the exploration of complex mathematical issues through investigation, prediction, discovery, discussion, explanation, justification and communication.

These dimensions of mathematics programs often represent important outcomes and also reflect critical processes in the teaching of mathematics. These complex skills and processes are more appropriately measured through a variety of techniques such as interviews, portfolios and performance-based assessment using manipulatives.

ASSESSMENT OF MATHEMATICS CONTENT

Students writing the mathematics content component will answer a placement test of 15 mathematics content questions. The number of questions correct on the placement test will indicate where the student will start in the content booklet.

The supervisor will mark the placement test and indicate in which section of the *Content Item Booklet* the student will start. The students will carefully answer as many of the multiple-choice and short-answer questions as is possible in approximately two and one-half hours. All answers will be written in the appropriate space in the *Content Response Booklet*. It is important that all questions in the assigned section be answered before moving on to the next section.

The mathematics content questions will assess student achievement in these areas:

- numbers and operations;
- algebra and functions;
- measurement and geometry; and
- data management and statistics.

Each section contains 75 questions chosen from the four content strands.

Approximately 40 % of the questions in each section will assess the student's understanding of major concepts. A student may be asked to:

- label, explain or define concepts;
- identify suitable true and false examples of concepts; and
- suggest new ways of representing concepts.

Approximately 30 % of the questions in each section will assess the student's knowledge of procedures. A student may be asked to:

- recognize when a particular procedure should be used;
- carry out procedures to solve particular questions; and
- modify familiar procedures to solve new problems.

Approximately 30 % of the questions in each section will assess the student's ability to solve problems. A student may be asked to:

- formulate problems;
- apply a variety of strategies to solve problems;
- produce solutions to problems; and
- verify that particular solutions are valid.

SUMMARY OF LEVELS FOR MATHEMATICS CONTENT

The expectations of a student performing at each level of the mathematics content component are:

Level One

- Adds, subtracts and multiplies, using a limited range of natural numbers
- Uses concrete materials and diagrams to represent simple relations
- Determines linear dimensions of recognizable simple plane figures
- Reads information from very simple tables

Level Two

- Uses the four basic operations with natural numbers
- Uses patterns and classifications in real-life situations and plots points on a grid
- Calculates dimensions and areas of plane figures, classifies solid forms, and uses single geometric transformations
- Extracts and represents data using tables and diagrams

Level Three

- Uses the four basic operations with integers
- Uses monomial algebraic expressions and plots points on a Cartesian grid
- Uses length, angle measure, area, and volume involving various plane geometric figures and repetitions of the same geometric transformation
- Uses information from various sources and calculates arithmetic mean and simple probabilities

Level Four

- Uses the four basic operations with the full range of rational numbers
- Uses and graphs polynomial algebraic expressions and simple functions
- Uses the characteristics of solid forms, congruence and similarity in polygons, and compositions of plane transformations
- Organizes data, uses measures of central tendency, and calculates the probability of a single event

Level Five

- Uses the four basic operations with the full range of real numbers
- Uses and graphs algebraic expressions with two variables and various functions
- Uses the properties of circles and right-angle triangles
- Calculates statistical information and the probability of combined events

You will find examples of mathematics content questions in Appendix A on pages 14 to 21.

ASSESSMENT OF MATHEMATICS PROBLEM SOLVING

Students participating in the mathematics problem-solving component will attempt six extended-response problems each consisting of five parts. The students will attempt as many parts of one problem as possible before going on to the next problem. When an impasse is encountered in a problem, the student should go to the next problem and come back to the impasse only when all six problems have been attempted.

The students have three hours to complete both the assessment and the associated questionnaire.

The mathematics problem-solving component will assess different aspects of a student's ability to solve problems. The student may be asked to:

- formulate problems;
- apply a variety of strategies to solve problems;
- construct mathematical models that correspond to verbal statements or problems;
- produce both accurate and approximate solutions to problems;
- verify that particular solutions are valid;
- communicate solutions to problems and problem-solving methods; and
- evaluate the validity of mathematical models and solutions to problems.

SUMMARY OF LEVELS FOR MATHEMATICS PROBLEM SOLVING

The expectations of a student performing at each level of the mathematics problem-solving component are:

Level One

- Finds single solutions to one-step problems using obvious algorithms and a limited range of whole numbers
- Uses one case to establish a proof

Level Two

- Makes a choice of algorithms to find a solution to:
  a) multi-step problems, using a limited range of whole numbers or
  b) one-step problems, using rational numbers
- Uses more than one particular case to establish a proof
- Uses common vocabulary to present solutions

Level Three

- Chooses from two algorithms to find a solution to multi-step problems using a limited range of rational numbers
- Uses necessary and sufficient cases to establish proof
- Uses mathematical vocabulary, imprecisely, to present solutions

Level Four

- Adapts one or more algorithms to find solutions to multi-step problems, using the full range of rational numbers
- Constructs structured proofs that may lack some details
- Uses mathematical and common vocabulary correctly, but solutions may lack clarity for the external reader

Level Five

- Creates original algorithms to find solutions to multi-step problems, using the full range of real numbers
- Constructs structured proofs that provide full justification of each step
- Uses mathematical and common vocabulary correctly, and provides clear and precise solutions

You will find examples of mathematics problem-solving problems in Appendix B on pages 22 to 25.

ROLE OF THE SCHOOL COORDINATOR

Prior to the Administration

Review student lists

You have received two student lists for each age group participating in the assessment, the *Student List for the Content Component* and the *Student List for the Problem-Solving Component*.

- Check to make sure the student list is accurate. The student names should correspond to those submitted earlier by your school. If a student no longer attends the school or for some other reason cannot participate, he/she will be assigned a particular participation code (see page 12). **Only those students identified on the student lists are permitted to participate. Schools MUST NOT substitute other students.**
- You and other school staff need to review these lists **during March** to complete the tasks of identifying students with special needs and those to be exempted from participation.

Identify students with special needs

- Review the names on all student lists to determine if any students require Braille, large-print, or French-language versions of the booklets.
- Notify your Provincial or Territorial Coordinator, by March 15, 2001, about students requiring these versions to ensure that they will be provided in your school package.
- **We appreciate your help in ensuring as many students as possible participate in the assessment.**

Plan supports for students with special needs

- As a general guideline, use your school's procedures to administer tests to students with special needs.
- Any amount of additional time can be given to students with special needs. The administration can also be spread over several sessions.
- ESL students may require varying types of assistance, from the use of an interpreter to assistance in clarifying language and reading math questions, while others will be able to respond independently.
- Someone can assist students with reading difficulties by reading the mathematics questions (a separate room may be needed).
- Students who have physical disabilities should receive supports similar to what the school usually provides.
- Students who might disrupt the class or who have difficulty concentrating for extended periods of time could work alone in a room or the assessment could be spread over several short sessions.
- We ask you to describe modifications made to the administration procedures when completing the *Assessment Administrator's Report* (see page 13).
- **Please restrict any assistance to facilitating communication. Do not help interpret the mathematical aspects of the questions or give clues for solving the questions.**

Confidentiality

All information that may identify an individual student will be destroyed by the Provincial or Territorial Coordinator after all assessment materials are marked.

For this reason, do not be concerned about any spelling errors on the student lists, as long as you can identify the student selected.

Inclusiveness

The School Achievement Indicators Program is intended to be as inclusive as possible in order to provide a complete picture of the range of performance among 13- and 16-year-old students.

ALL students of the specified ages were included in the initial student lists from which the sample of students was selected.

Please make provisions to enable students with special needs to participate.

Balancing Inclusiveness and Student Well-being

We want all students to have the opportunity to be represented in this assessment. However, we do not want students with special needs to be overly pressured to participate in the assessment, if they would be adversely affected or if appropriate arrangements cannot be made for them.

For those unable to participate, record the reason code in the participation code column of the student list and on the front cover of the response booklet assigned to the student (see page 12 for codes).

Exemption

We expect that most 13- and 16-year-old students have sufficient math ability to achieve Level 1 or higher on these tests. However, we recognize some students in the country have not developed an understanding of very basic math concepts, and that it would be frustrating and serve no purpose in having them write the test. It is for these students that this exemption is provided (*Note:* See page 12 for other exemption reasons and codes).

Reporting of results will classify these students as being below Level 1 in mathematics achievement.

Doing Their Best

Since students' motivation can have a strong effect on performance levels on assessments, it is important that students be encouraged to give their best effort.

Please communicate to students that we appreciate them doing their best. This can ensure the results will be a true indication in the provinces, territories and country of how well all students understand and apply mathematics.

Identify students with very limited mathematics ability to be exempted from participation in the assessment

- Meet with the school principal and other school staff to review sample Level 1 questions from Appendix C on page 26 and discuss student ability relative to these items.
- For those students on the list with very limited mathematics ability who would not be able to complete approximately 60 % of these basic Level 1 questions, the school can designate them as below Level 1, and exempt them from writing the test.
- Record a "**D**" in the participation status column of the student list and on the front cover of the response booklet assigned to the student (see page 11).

Inform participating students, their families and other school staff

- At least two weeks before the assessment date, gather participating students to tell them about the assessment.
- Distribute copies of the *Information for Parents and Students* brochure and, if you wish, sample questions copied from the *Information Bulletin for Schools*.
- Ask students to identify their current mathematics teacher(s) and arrange to distribute the teacher questionnaires to these teachers.
- We encourage you to announce the school's participation in this national project and discuss its importance with all teachers and students.
- One week before the assessment date, remind students and inform them of the **time and location** of the assessment. Inform students that they will need an HB pencil, an eraser, a ruler, a protractor and a calculator. A formula sheet for the content component will be provided at the time of the assessment.

Arrange for a suitable time and location

- Administer both the content component and the problem-solving component of the assessment at the same time and in the same place.
- If we selected your school to test both 13- and 16-year-olds, please schedule their assessments for the same time and date.
- If possible, schedule the administration for the morning for attaining students' best performance.
- The assessment takes about three hours.
- Administer the assessment between April 2 and May 11, 2001 (unless specified otherwise by Provincial or Territorial Coordinators).
- Please find a quiet area with sufficient desk or table space where students have a half-day to complete the assessment without being interrupted.

Check the package of materials for its completeness

Please confirm that the following were sent in your package:

- School Packing List
- *Student List for the Content Component*
- *Student List for the Problem-Solving Component*
- Placement Test Scoring Overlay
- *Mathematics Teacher's Questionnaire*s—one for each math teacher of the participating students
- *School Questionnaire*—one per school
- *Content Item Booklet*—one for each participating student
- *Content Response Booklet*—one for each participating student
- *Problem-Solving Response Booklet*—one for each participating student
- *Assessment Administrator's Report*

Please ensure that numbered booklets in the package correspond to the booklet ID numbers assigned to your students as recorded on the student lists

If your school has students who will be writing the assessment in French, make sure sufficient French-language materials have been provided.

Distribute teacher questionnaires and school questionnaire

After meeting with participating students and compiling the list of teachers currently teaching them mathematics:

- Assign and track teacher questionnaire numbers with teacher names.
- Distribute the teacher questionnaires and let them know you will collect the completed questionnaires within a day or two of the assessment administration date. All teachers currently teaching the selected students should fill out the *Mathematics Teacher's Questionnaire*.
- Ask the school principal or mathematics department head to complete the *School Questionnaire* and hand it in within a day or two of the assessment administration date.

Photocopying and Security

You may photocopy booklets only if there is a shortage and you cannot obtain copies from the Provincial or Territorial Coordinator in time for the assessment.

Please keep assessment booklets secure prior to the administration time. All materials (including any photocopies) must be returned at the completion of the assessment.

Confidentiality

Do not forward any teacher names to us. Any action you take to link teacher names with teacher questionnaire numbers is intended to help you and the students properly link student numbers with teacher numbers. This will facilitate planned data analysis. **Please destroy any lists containing these teachers' names.**

Administration of the Assessment

Please Note:

You may assist students in clarifying language of math and questionnaire items; however, do not answer student questions about math concepts or processes.

Also:

ENSURE THAT EACH STUDENT RECEIVES THE NUMBERED RESPONSE BOOKLET SPECIFICALLY ASSIGNED TO HIM OR HER ON THE STUDENT LISTS.

Gather the needed materials

On the day of the assessment, you will need:

- The script (Part 1 and Part 2) outlining purposes and instructions—found in Appendix D (pages 28 and 29)
- The *Student List for the Content Component*
- The *Student List for the Problem-Solving Component*
- The *Placement Test Scoring Overlay*
- Sufficient copies of each of
  - *Content Item Booklet*
  - *Content Response Booklet*
  - *Problem-Solving Response Booklet*
- Spare pencils, erasers, rulers, protractors and calculators (supplied by the school)

Get the students started

- Prior to students arriving, write teacher names and their corresponding ID numbers on the board or a chart.
- Read the script (Part 1) to the students.
- Distribute the *Problem-Solving Response Booklet,* ensuring that each student listed on the *Student List for the Problem-Solving Component* receives the **correct booklet corresponding to the student ID numbers** on the list.
- Distribute the *Content Item Booklet* and the *Content Response Booklet*, ensuring that each student listed on the *Student List for the Content Component* receives the **correct response booklet corresponding to the student ID numbers** on the list (Note: The *Content Item Booklet* contains no student ID number).
- Ask the students to record on the front cover of their response booklet:
  - Their participation status (students present to write the test are code **B** status);
  - Their age;
  - Their sex;
  - The teacher ID number(s) of **all** teachers currently teaching them math.
- Ask the students writing the problem-solving component to **begin**.
- Read the script (Part 2) to students writing the content component and then ask them to **begin**.

Score the placement test and assign students to the appropriate section of the content component booklets

The assessment tests a range of performance across five achievement levels for 13- and 16-year-olds. The placement test is intended to place students in one of three sections of the test that may be most appropriate to their skill levels.

- Students will write their answers to the 15-question placement test in the designated space on page 1 of the *Content Response Booklet*, and indicate they have completed this section by raising their hand.
- Place the scoring overlay on the student's responses and count the number of correct responses (i.e., the number of blackened boxes appearing in the 15 clear boxes inscribed on the overlay).
- If a student fills in more than one box for a particular question, that question must not be counted as correct. If a student fills in two boxes and puts a "—" or "X" through one, consider the one **without** the "—" or "X" as the intended response.
- Based on the student's placement test score, shade the appropriate directions on the placement sheet and ensure the student can find the designated starting point in both the item and response booklets.

Sensitivity

As much as possible, encourage students as they are placed in the appropriate section. You may wish to count correct responses and direct students to the appropriate section without making checkmarks or reporting to the student about how many responses were correct.

Placement Test Score	In the *Content Item Booklet*, the student should start at	In the *Content Response Booklet*, the students should start at
0–10 correct	Question 16 on page 10	Question 16 on page 2
11–13 correct	Question 41 on page 21	Question 41 on page 4
14–15 correct	Question 66 on page 34	Question 66 on page 5

- Students will have the remainder of the three hours (and whatever extra time you are able to afford) to complete the mathematics assessment, including the questionnaire.

Note: Students assigned to the first or second group of questions based on their placement test scores may wish to continue to answer questions beyond those sections, if they have time and do not become frustrated.

Complete the student list forms and check the completeness of the student booklet front covers

- For each student on both the *Student List for the Content Component* and the *Student List for the Problem-Solving Component*, complete the column entry indicating:
  - Their age;
  - Their sex;
  - Their participation status (see the list of codes described below); and
  - The math teacher's questionnaire booklet number for each of their current math teachers. If they are not currently studying math, leave this entry blank.
- Check the front cover of each student response booklet to verify that the sex, age, participation status and teacher ID number are entered. If necessary, complete any missing data on the cover.
- For students exempted or absent from the assessment, complete the sex, age, participation status and teacher ID number sections on the front cover of the response booklet assigned to them corresponding to the student list.

Tracking the participation status of **all** selected students allows fair sampling from each province and territory. After the assessments are marked, **these lists containing student names are destroyed.**

In some circumstances the assessment may trigger emotional or physical reactions that the principal may consider harmful for the student.

Participation Status Codes:

A - Absent (and not previously categorized as code **D** to **L**)
B - Participated during scheduled session
C - Participated during make-up session
D - Exempted: School designates student's mathematics ability at below Level 1
E - Excluded because interpretation assistance is unavailable for a student who does not understand English or French sufficiently well to attempt the assessment
F - Excluded because of emotional reasons
G - Excluded for physical reasons
H - Excluded because appropriate modifications could not be made to accommodate the student's special needs (see page 7)
I - Wrong birth date (student's birth date is not between September 1, 1983 and August 31, 1984, **OR** between September 1, 1986 and August 31, 1987)
J - No longer enrolled in this school
K - Student refusal: school staff is unable to persuade the student to participate
L - Parent refusal: parent of the student demands that the student not participate

Following the Administration of the Regular Session

- At the conclusion of the assessment, collect all item booklets, student response booklets and supplies.
- If students completed the assessment using Braille or large-print forms, transfer answers from these versions to the assigned student response booklet.
- Collect completed school and teacher questionnaires distributed prior to the assessment.

Determine whether you need to schedule and conduct a make-up session

- Calculate the percentage of students who participated in the regular session for the content component.
- Count the number of **B**'s, **A**'s and **D**'s that you recorded on the *Student List for the Content Component* (ignore all other codes for this calculation).
- Calculate percentage participation using the formula

$$\frac{(B+D)}{(A+B+D)} \times 100\ \%$$

  See Appendix G, page 36, for an example of the calculation.
- Repeat the calculation, this time for the problem-solving component using the codes on the *Student List for the Problem-Solving Component*.

If the percentage participation for *either* the content or the problem-solving component is less than 85 %, a make-up session for *that* component must be conducted before May 11, 2001.

Make-up session

If a make-up session is necessary (as indicated by the calculation above), schedule the session to include as many of the absent students as possible. If a student completes the assessment during the make-up session, change the participation status for that student from "**A**" to "**C**" on the student list.

Ensure that the "**C**" is circled on the top of the front cover of the assigned student response booklet.

Complete the *Assessment Administrator's Report*

Complete this report indicating:

- How well the assessment session proceeded and the general attitudes of other school staff and students;
- Strategies used to motivate students to participate and do their best;
- Satisfaction with materials and information sent and helpfulness of the handbook;
- Modifications made to the assessment for students with special needs; and
- Tally of student participation codes and calculation of student participation rate.

Check materials and return the package

- Complete the *School Packing List* to indicate the numbers of each item being returned to the Provincial or Territorial Coordinator.
- Package the following:
  - School Packing List
  - *Assessment Administrator's Report*
  - Completed *Student List for the Content Component*
  - Completed *Student List for the Problem-Solving Component*
  - Completed *School Questionnaire*
  - All teacher questionnaires (in ascending numerical order would be appreciated)
  - All response booklets (in ascending numerical order would be appreciated)—**please verify that codes on the front cover have been recorded on the student lists**
  - All *Content Item Booklet*s
  - All unused booklets and any photocopies
- Send the package back to the Provincial or Territorial Coordinator as soon as possible after the assessment and not later than the date provided by your Coordinator.

APPENDIX A

Mathematics Content—Sample Questions

Level 1
Algebra and Functions

Conceptual Understanding

Translates and solves single-step problems that are expressed in the form of open sentences and that have solutions in the form of natural numbers.

François has $295 in his savings account. Marie has $341 in hers. Together, they have $636.

Which equation allows us to calculate how much more money Marie has, compared to François?

A. 341 + 295 = ❑
B. 341 – 295 = ❑
C. 636 – 341 = ❑
D. 636 – 295 = ❑

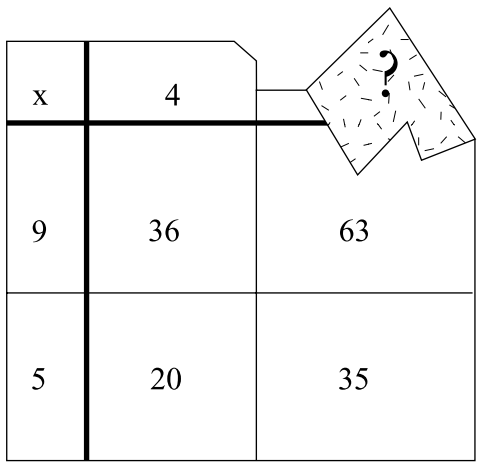
Solution: B

Level 1
Numbers and Operations

Procedural Knowledge

Multiplies two natural numbers smaller than 10.

Kim found a part of a multiplication table on the ground. One number is missing on the part of the multiplication table shown below.

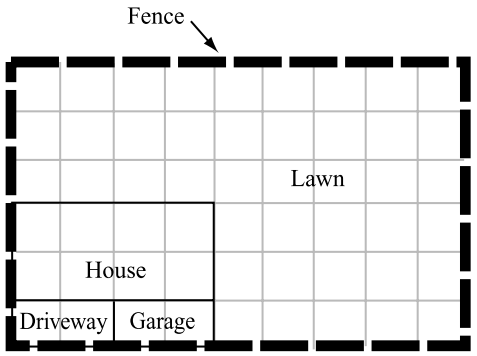


What is the missing number?

Answer: _____ is the missing number

Solution: 7 is the missing number

Look at this diagram of Chris's property.



In this diagram, how many squares on the grid does the lawn cover?

A. 27 squares
B. 30 squares
C. 42 squares
D. 54 squares

Level 1
Measurement and Geometry

Problem Solving

Estimates and measures lengths and areas in terms of non-conventional units.

Solution: C

Here is a sequence of numbers.

2, 5, 9, 14, 20, ❑, 35

Which number must replace the box to complete this sequence?

A. 23
B. 25
C. 26
D. 27

Level 2
Algebra and Functions

Conceptual Understanding

Establishes and uses classifications, patterns and relations in real-life situations as well as in sets of numbers or sets of operations.

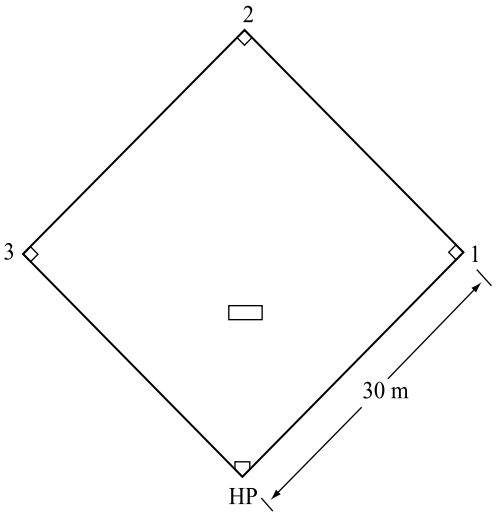
Solution: D

Level 2
Measurement and Geometry

Procedural Knowledge

Estimates and calculates areas in both conventional and non-conventional units.

A baseball diamond is in the form of a square. Tony measured the distance from home plate (HP) to first base to be 30 m, as shown in the diagram.



Based on Tony's measurement, what is the area of the baseball diamond?

A. 27 000 m^2
B. 900 m^2
C. 120 m^2
D. 60 m^2

Solution: B

Level 2
Numbers and Operations

Problem Solving

Solves real-life problems that require several operations with natural numbers less than 1 000 or with decimals with one or two figures beyond the decimal point.

In a 100 m race among three friends, Huan completed the race in 14.00 s, Shahnaz in 12.70 s, and Michelle in 13.13 s.

What is the time difference between second and third place?

Answer:_____ s

Solution: 0.87 s

To raise funds for student activities, students at a school organize a car wash. In one day, a team of 12 students can wash 200 cars.

How many students are required to wash 1 000 cars in one day?

Answer:_____ students

Level 3
Numbers and Operations

Problem Solving

Translates and solves simple real-life problems involving ratios, proportions and percentages.

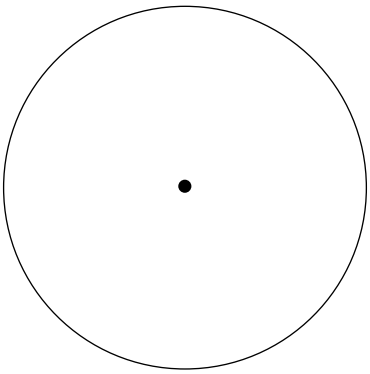
Solution: 60 students

The following table shows the percentage of different types of garbage produced by a typical Canadian family.

What People Throw Out

Food scraps	30 %
Paper	35 %
Glass	13 %
Cans	10 %
Other	12 %

Draw a circle graph that represents these data.

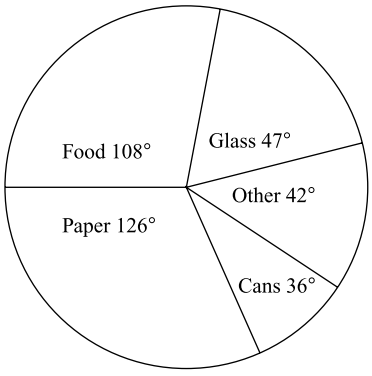


Level 3
Data Management and Statistics

Procedural Knowledge

Represents familiar situations in a data table or in various diagrams, including pie graphs.

Solution:

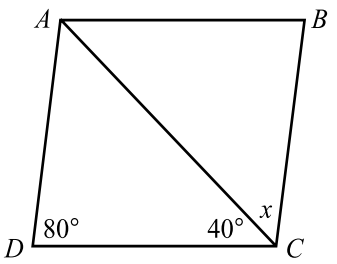


Level 3
Measurement and Geometry

Conceptual Understanding

Identifies and uses various characteristics relating to triangles, quadrilaterals and circles.

ABCD is a parallelogram with the angle ADC measuring 80° and the angle ACD measuring 40°.



What is the measure of angle ACB?

A. 40°
B. 50°
C. 60°
D. 80°

Solution: C

Level 4
Algebra and Functions

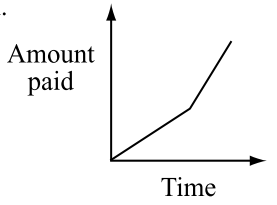
Conceptual Understanding

Demonstrates an understanding of concepts of relation and function.

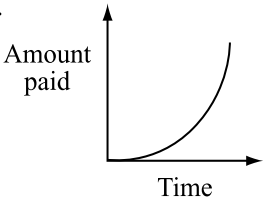
Claude babysat from 8 p.m. on Saturday until 2 a.m. Sunday. He charges $2.00 per hour before midnight and $3.00 per hour after midnight.

Which graph represents Claude's earnings?

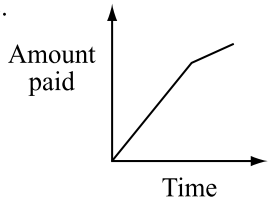
A.



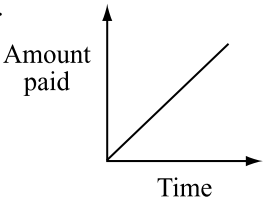
B.



C.

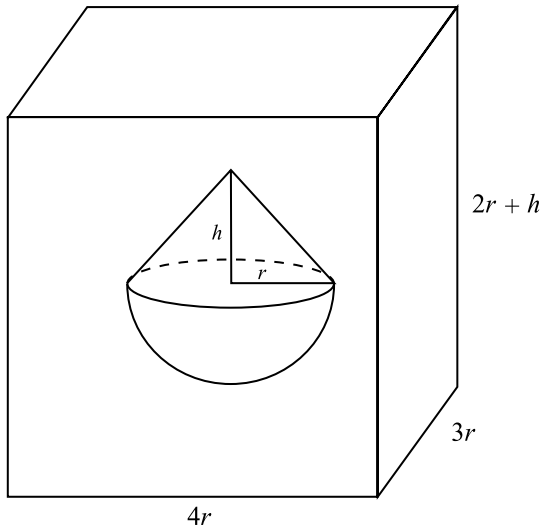


D.



Solution: A

In order to create a bronze piece of artwork, an artist must first produce the work using another kind of material, such as wood or plaster. A metalworker then places the work in the middle of a rectangular box. A mould is made by filling the rest of the rectangular box with a heat-resistant material. The artwork consists of a hemisphere capped by a cone.



If the value of r is 5 cm and the value of h is 4 cm, what is the volume of the heat-resistant material?

Answer:_____ cm^3

Level 4
Measurement and Geometry

Procedural Knowledge

Solves problems derived from real-life situations that use the characteristics of solid forms.

Solution: 3 833 cm^3

Level 4
Numbers and Operations

Problem Solving

Translates and solves real-life problems that require, in their solution, the use of chained calculations and the full range of rational numbers.

A department store has different ways of marking discounts:

household appliances	the store pays the GST of 7 %
car accessories	1/4 off the marked price
sporting goods	get a second item for $1
gardening tools	30 % off the marked price

The regular price of the articles you buy are:

windshield wiper	$6.95
two badminton rackets	$32.95 each
rake	$8.95
kettle	$21.95

What is the total amount of your purchases before the taxes are added?

A. $68.92
B. $68.22
C. $67.39
D. $65.84

Solution: C

Level 5
Algebra and Functions

Procedural Knowledge

Draws the Cartesian graph, determines the domain and range, and applies the properties of linear functions, quadratic functions, exponential functions, logarithmic functions and the three trigonometric functions of sine, cosine and tangent.

Mr. Joyal must lower the water level in his swimming pool for the winter. The quantity of water has to be reduced to three-fifths of the summer level.

The quantity of water $Q(t)$ that remains in the pool after t hours of draining is calculated using the following equation:

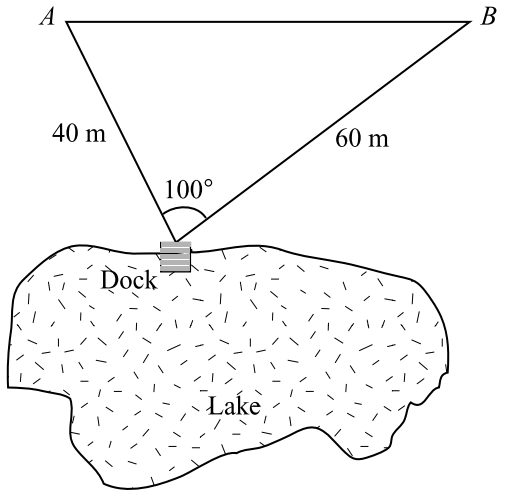
$$Q(t) = 75\,000 - 5\,000t$$

How long will it take Mr. Joyal to lower the water in his swimming pool to the winter level?

A. 6 h
B. 9 h
C. 15 h
D. 24 h

Solution: A

The plan shown below gives the positions of two chalets, *A* and *B*. From each chalet, a path leads to a common dock.



What is the distance between the two chalets?

Answer:_____ m

Level 5
Measurement and Geometry

Procedural Knowledge

Finds unknown elements in general triangles using scale drawing or calculation methods. (Student has the option to choose either method.)

Solution: 78 m

Jane has just finished her school year and wishes to calculate her final mark in mathematics.

Her teacher reminds her that the weighting of marks for each quarter of the year is:
- 20 % for the first quarter;
- 30 % for the second quarter;
- 30 % for the third quarter; and
- 20 % for the fourth quarter.

As well, the final examination mark counts for 25 % of the year's total mark.

Jane has received the following marks:
- 75 % for the first quarter;
- 70 % for the second quarter;
- 62 % for the third quarter; and
- 88 % for the fourth quarter.

She has received 56 % on the final examination.

What is Jane's final mark in mathematics?

A. 64 %
B. 68 %
C. 70 %
D. 72 %

Level 5
Data Management and Statistics

Problem Solving

Calculates the weighted average of a data set.

Solution: B

APPENDIX B

Mathematics Problem Solving— Sample Problems

Criteria

Level 1
Solves problems requiring the use of whole numbers less than 1 000 and solves single-step problems using basic arithmetic operations on these numbers.

Level 2
Is skilled in solving problems requiring the use of whole numbers less than 1 000 or positive rational numbers (in decimal form limited to hundredths or in fractional forms with denominators that are multiples of each other).

Scoring Guide

Level 1
Solution to part a is 250 mL

Level 2
Solution to part b is 167 kJ per serving

Example 1

Klaus wanted to make some jam and read the following recipe in a magazine.

No-Cook Raspberry Pear Jam Recipe

		Metric Quantities	*Food Energy*
1-1/2	cups crushed raspberries (fresh or frozen)	375 mL	720 kJ
2	cups chopped Bartlett pears	500 mL	1 160 kJ
4-1/2	cups sugar	1 125 mL	18 000 kJ
3/4	cup water	188 mL	0 kJ
1	pouch liquid fruit pectin	85 mL	180 kJ

This recipe makes 120 servings.

a. If you wanted the recipe to make only 60 servings (in other words, be half as large), how many millilitres (mL) of chopped Bartlett pears would you use?

b. How much food energy is contained in 1 serving of this jam?
Show all your work.

Solution

a. 120 servings = 500 mL of the pears,
so 60 servings = 250 mL

b. Total food energy =
(720 + 1 160 + 18 000 + 180) kJ
= 20 060 kJ for 120 servings

Food energy per serving = $\frac{20\,060}{120}$

= 167 kJ per serving

Example 2

A Canadian tourist traveling in Switzerland wishes to go to Germany.

The tourist reads the table shown below:

Currency Exchange Rates
Canada (dollar) 1.04 Swiss francs
Germany (mark) 0.81 Swiss francs

Show how the tourist can calculate, to the nearest dollar, the number of Canadian dollars needed to buy 1 000 German marks.
Show all your work.

Solution 1

Let x be the number of Swiss francs needed to buy 1 000 German marks:

$$\frac{1 \text{ mark}}{1\,000 \text{ mark}} = \frac{0.81 \text{ franc}}{x}$$

x = 810 Swiss francs

The tourist has to have 810 Swiss francs.

Let y be the number of Canadian dollars needed to buy 810 Swiss francs:

$$\frac{1 \text{ Can. dollar}}{y} = \frac{1.04 \text{ francs}}{810 \text{ francs}}$$

$$y = \frac{810}{1.04} = \$778.85$$

The tourist will need $778.85 Canadian to buy 1 000 German marks.

Solution 2

1 000 marks = 1 000 (0.81) Swiss francs
= 810 Swiss francs
x = Canadian dollars
$1.04x$ = 810 Swiss francs

$$x = \frac{810}{1.04}$$

= $778.85 (Canadian)

Criteria

Level 2
Can solve multi-step problems using basic arithmetic operations on whole numbers less than 1 000 and can solve single-step problems using a basic arithmetic operation on positive rational numbers.

Level 3
Is skilled in using positive and negative rational numbers (in decimal form to thousandths and most common fractional forms) and can solve multi-step problems involving simple operations on these numbers.

Scoring Guide

Level 2
Either 810 Swiss francs for 1 000 marks
or
Canadian dollars = $\frac{\text{Swiss francs}}{1.04}$
or
1 Can. dollar = 1.28 marks

Level 3
Complete solution

Criteria

Level 2
Can solve multi-step problems using basic arithmetic operations on whole numbers less than 1 000 and can solve single-step problems using a basic arithmetic operation on positive rational numbers.

Level 3
Is skilled in using positive and negative rational numbers (in decimal form to thousandths and most common fractional forms) and can solve multi-step problems involving simple operations on these numbers.

Level 4
Solves problems requiring the use of the full range of rational numbers, including very large and very small numbers, and can use them in long sequences of chained operations.

Level 5
Uses symbolic representations in two real variables to generate solutions to families of problems.

Example 3

The number 992 can be used to explore the properties of numbers. Let us determine the digit in the units place of the product formed when identical numbers are multiplied together, each number being 992.

As an example, 992×992 (or 992^2) = 984 064, and has a 4 in the units place.

As a second example, $992 \times 992 \times 992$ (or 992^3) = 976 191 488, and has an 8 in the units place.

a. What is the digit in the units place of the product formed by four 992s ($992 \times 992 \times 992 \times 992$)?

b. Illustrate, by examples, all possible units digits that can occur in the product of any number of 992s.

c. What is the units digit when fifty-five 992s are multiplied together (992^{55})?
Show all your work.

d. Describe a general rule that determines the digit in the units place in the product of any number of 992s.

Solution 1

a. $992 \times 992 \times 992 \times 992$ has the same units digit as $2 \times 2 \times 2 \times 2$.
As this equals 16, units digit is a 6.

b. 992×992 ends in 4
$992 \times 992 \times 992$ ends in 8
$992 \times 992 \times 992 \times 992$ ends in 6
$992 \times 992 \times 992 \times 992 \times 992$ ends in 2

c. $992^{55} = 8$, $992^{55} = (992)^{52} \times (992)^3$
and has a units digit the same as 6×8, so has a units digit of 8.

d. Group the m factors into groups of 4 992s. There may be 0, 1, 2, or 3 992s left over from the group.
Then if:no 992s left, units digit = 6
one 992 left, units digit = 2
two 992s left, units digit = 4
three 992s left, units digit = 8

Solution 2

a. $\mathbf{2} \times 2 = \mathbf{4} \times 2 = \mathbf{8} \times 2 = \mathbf{16}$

b.
992	…4	…8	…6
$\times$ 992	$\times$ 992	$\times$ 992	$\times$ 992
…4	…8	…6	…2

992^x ends in either 4, 8, 6, or 2.

c. $992^{55} = (992^4)^{13}\,(992)^3 = (..6)^{13}\,(..8)$
$= (..6)^{10}(..6)^3(..8) = (..6)(..6)(..8) = ..8$
so has a units digit of 8

d. For 992^x, if the remainder of $\frac{x}{4}$ is

0, then the units place digit is 6
1, then the units place digit is 2
2, then the units place digit is 4
3, then the units place digit is 8

Scoring Guide:

Level 2
Part a complete

Level 3
Parts a and b complete

Level 4
Parts a, b, and c complete

Level 5
Complete solution to all parts of the problem.

APPENDIX C

Sample Level 1 Test Items

These Level 1 sample test items show the most basic level of questions in the assessment. Use these questions as a guide when you meet with staff to determine whether a student with very low math ability would become very frustrated and would not be able to get 60 % of such questions correct, despite best effort attempts. You would then exempt this student from the assessment using code **D** as the participation status.

Students receiving code D exemption are included in the participation statistics for your school and will be reported as below Level 1. In effect, their level of achievement is being assessed by classroom teachers in the day-to-day context of the school (designated by staff, not by participation in the assessment).

Note: There are other reasons and codes for exempting a student on the list from participating. These are outlined on page 12 in this handbook.

Some of the criteria describing a student performing at Level 1 of the mathematics content component are:

- adds, subtracts and multiplies, using a limited range of natural numbers;
- uses concrete materials and diagrams to represent simple relations;
- determines linear dimensions of recognizable simple plane figures; and
- reads information from very simple tables.

Sample Level 1 Content Component Questions

1. Leslie counted the number of cars in the parking lot. There were two hundred thirty-six cars. What number is the number of cars in the parking lot?

   A) 36 **B) 236** C) 20 036 D) 2.36

2. What is the approximate width of this page?

   A) 21 m B) 21 dm **C) 21 cm** D) 21 mm

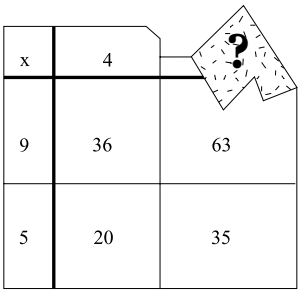
3. Four students entered the long jump competition. Pat jumped 198 cm, Chris jumped 216 cm, Terry jumped 186 cm, and Jamie jumped 209 cm. Which student jumped the third greatest distance?

   A) Pat B) Chris C) Terry D) Jamie

4. François has $295 in his savings account. Marie has $341 in hers. Together, they have $636. Which equation allows us to calculate how much more money Marie has, compared to François?

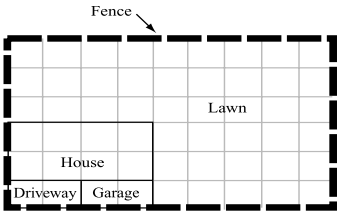
   A) 341 + 295 = ❑ **B) 341 – 295 = ❑**
   C) 636 – 341 = ❑ D) 636 – 295 = ❑

5. Kim found a part of a multiplication table on the ground. One number is missing on the part of the multiplication table shown to the side. What is the missing number?



   Answer: **7** is the missing number.

6. Look at the diagram of Chris's property. In this diagram, how many squares on the grid does the lawn cover?



   A) 27 squares B) 30 squares
   C) 42 squares D) 54 squares

Mathematics Problem Solving— Sample Level 1 Problem

Some of the criteria describing a student performing at Level 1 of the mathematics problem-solving component are:

- finds single solutions to one-step problems using obvious algorithms and a limited range of whole numbers; and
- uses one case to establish a proof.

Klaus wanted to make some jam and read the following recipe in a magazine.

No-Cook Raspberry Pear Jam Recipe

Ingredient	*Quantity*	*Food Energy*
Crushed raspberries (fresh or frozen)	375 mL	720 kJ
Chopped Bartlett pears	500 mL	1 160 kJ
Sugar	1 125 mL	18 000 kJ
Water	188 mL	0 kJ
Liquid fruit pectin	85 mL	180 kJ

This recipe makes 120 servings.

If you wanted the recipe to make only 60 servings (in other words, be half as large), how many millilitres (mL) of chopped Bartlett pears would you use?

Solution

120 servings = 500 mL of the pears,
so 60 servings = 250 mL

APPENDIX D

Script for Administration of the Assessment

Part 1

"Good morning. Our school has been chosen to take part in an important national project to discover what Canadian students know about mathematics, so that educators can plan better mathematics courses and produce better teaching materials. Young people from all of Canada's provinces and territories are taking part in the same activity you are about to take part in today."

"Please give your best effort. This will help us gather the best information possible and show how well (*province/territory*) students, as well as all Canadian students, understand and use mathematics."

"There are two different components to today's assessment. Half of you will write an assessment of mathematics content while the other half will write an assessment of problem solving. For both groups, after you finish the math questions, we ask you to answer the student questionnaire in the back of the response booklet. This will help us learn some background information about students such as you, what your attitudes toward school and math might be, and the kinds of things you experience when learning mathematics."

"On the front cover of your response booklet, please darken the circle below the letter B for your participation status, indicate your sex, your age and also write down the teacher ID number for each teacher who currently teaches you mathematics. The list of teacher ID numbers is written on the board (or chart)."

"Since this is an assessment, I can answer only questions that help you understand directions or questionnaire items, but I can't help you remember or think of mathematics skills and strategies."

"There is no time limit on completing this assessment, but most of you should finish by at least [2.5 HOURS AFTER BEGINNING THE ADMINISTRATION]. After you finish the math questions, **please take about 15 to 20 minutes to complete the questionnaire at the end of the response booklet**."

"If you finish early, you may return to your regular class."

[FOLLOW LOCAL POLICY IN THIS MATTER]

"First, I am going to get those students who are writing the problem-solving test (green booklet) started. I will talk to those writing the content test (blue booklets) in a minute."

"The green booklet has 6 problems, each consisting of 5 parts. You will probably find the first parts of each problem to be relatively simple but the latter parts to increase in difficulty. Do not spend too much time on any one problem, or part of a problem, that you find more difficult. Leave those problems, but please return to them to do your best when you have completed the problems that you find less difficult."

"Are there any questions?"

[BRIEFLY ANSWER ANY QUESTIONS]

"You may begin."

Part 2

"Now for those of you with blue booklets, open up the *Content Item Booklet* to question 1 on page 1 and open up the *Content Response Booklet* to question 1 on page 1. Please put all of your answers in the *Content Response Booklet*. When you have completed the first 15 questions, stop, raise your hand, and I will come to your desk and score your work."

"After scoring your work, I will instruct you to complete either the questions numbered 16 to 75, the questions numbered 41 to 100, or the questions numbered 66 to 125. Some of these questions will be multiple-choice and some of them will be calculation or short answer. You may find some parts of this assessment very easy, and other parts difficult. There may even be a few questions on things you haven't studied yet but don't let that worry you. Make sure you complete (or attempt) all questions that you have been assigned. After completing all the questions you were assigned, you can try other questions, if you wish."

"You will find a formula sheet at the end of your booklet."

"Are there any questions?"

[BRIEFLY ANSWER ANY QUESTIONS]

"You may begin."

APPENDIX E

Frequently Asked Questions

Questions Related to the Design of the Assessment

Are these mathematics assessments valid and authentic for our students?

Student performance on these tests represents a snapshot of their understanding and application of math concepts and problem-solving strategies. Although different provinces and territories have different math curricula, all provinces and territories agreed to a common criteria framework describing the fundamental math skills tested in this assessment. These tests were reviewed by teachers and consultants and were field-tested throughout the country to verify their suitability. The tests provide students the opportunity to use different strategies to show a range of achievement through a variety of question formats. The use of manipulatives and communication with peers when solving problems are not tested in this assessment and are left to classroom assessment activities.

Why do 13-year-old and 16-year-old students write the same test?

Administering the same test to 13- and 16-year-old students allows educators to see some of the development that takes place between these two age cohorts. The results show the benefit of three additional years of schooling and maturity, and also communicate that students in both age groups achieve the full range of performance. A consequence of having both age groups write the same test is that some questions will be particularly difficult for 13-year-olds, containing concepts that they have not yet experienced. A placement test is used for the content component to try to focus students' time on the portion of the test for which their skills match best. Each problem in the problem-solving test offers opportunity to answer relatively easy to relatively difficult questions. It is expected that most 13-year-olds would achieve at least Level 2 performance and most 16-year-olds would achieve at least Level 3 performance. Please encourage students to try their best no matter which section of the test they complete.

Questions Related to Sampling Procedures and the Use of Results

How do our students and the school benefit from participating in the assessment?

Participating schools and students do not receive direct benefit in that school and individual results are not shared with the participants. However, schools and students have opportunity to see and experience the types of math questions and assessment approaches that have resulted from collaborative

and national efforts of teachers and consultants. Also, the provincial and territorial results assist educators and other decision-makers in planning to strengthen mathematics teaching and learning to the benefit of all schools and students.

Can students find out how well they did in the assessment? Can our school find out how well our students did in the assessment?

The principles of anonymity and confidentiality do not allow individual results to be shared with the student. Once all assessment materials have been marked, lists linking student names with test booklet numbers are destroyed, thereby ensuring anonymity and disabling individual reporting. These lists remain in the province or territory where the student resides; they are not sent to the marking centre.

For the same reason, schools cannot find out their students' individual results. Also, sampling is conducted to provide a provincial or territorial picture of students' achievement in mathematics, but the sampling is not sufficient to accurately represent the mathematics performance of students in a particular school or school division.

What if the sample for our school does not represent well the range of mathematics skills evident in our school?

The sample is not intended to represent the range of math skills in a particular school or school division. It is intended to provide a provincial or territorial picture of students' achievement in mathematics. It is quite possible that a given sample from a school may have a disproportionate number of low-level or high-level mathematics achievers. However, these disproportions balance out when compiling results from the many schools that contribute to the provincial or territorial profile of math achievement and experiences.

What if students with low math ability were chosen as part of the sample?

It is anticipated that most 13- and 16-year-olds would experience some success on this assessment, most achieving at least Level 1 or Level 2 performance. We suggest you encourage as many students as possible to write the assessment. However, some students have very limited math skills and would experience difficulty and frustration in doing the very basic and elementary math processes. For these few students, staff can pre-determine that they are below Level 1 and they can be exempted from participation in the assessment. During data analysis, they will be treated as if they had written the assessment, and scored below Level 1. Please see Appendix C, page 26, for more details.

Why can't a whole math class be tested for this assessment instead of pulling students from several classes to write the assessment?

The assessment's goal is to provide a snapshot of the full range of student mathematics performance. Sampling theory suggests this is done best by sampling from the pool of individual students, not classrooms that might have some homogeneous grouping. We realize this can be disruptive to that day's instruction, similar to that experienced when students from a school team are dismissed from class for a tournament. We know your involvement requires time and effort and we appreciate your contribution to this project.

Are individual test and questionnaire results kept confidential?

Yes. Any links that identify student, teacher or school responses are destroyed after all provincial or territorial data have been collected, and before any data are forwarded for analysis at the national level.

Questions Related to Preparation for and Administration of the Assessment

What can be done to encourage students to do their best?

Individual students are motivated in different ways, some responding better to extrinsic motivational factors and rewards and some to intrinsic motivation. You probably know what is best for your situation. In the past, teachers have reported doing the following:

- appealing to the students' pride in representing their province or territory, and providing information that could affect mathematics education in different parts of the country;
- recognizing students' participation through announcements, posting of names, and/or certificates from school principals or directors of education;
- discussing and doing sample questions from the *Information Bulletin for Schools*;
- encouraging them that they can do well;
- providing a breakfast before the assessment or offering a celebration with cookies or a pizza lunch following the assessment; and
- offering bonus marks or reflecting in students' participation mark some credit for their conscientious effort in the assessment.

During the assessment, whatever individual encouragement you can provide to students when they complete the placement test or when they show frustration will be helpful.

Are there suggestions for organizing and running the administration of the assessment?

This handbook contains directions for administering the assessment. Two commonly used ways of distributing assessment materials to ensure each student has the correct booklet(s) are:

- At each workspace lay out the booklet(s) along with a name tag corresponding to the booklet number (as designated on the student list). When students enter the room, ask them to find the workspace labelled with their name, and await further instructions.
  or
- After all students have arrived, ask them to find any workspace. From the student list, read out the name of each student and ask them to come receive the booklet(s) assigned to them and then have them return to their workspace to await further instructions.

A script (see Appendix D) has been prepared to help introduce the assessment and provide instructions for students.

For students writing the content component, you will instruct them to raise their hand after completing the first 15 questions (the placement test). Use the scoring overlay to count the number of correct responses. Tell the student where to continue in the *Content Item Booklet* and the *Content Response Booklet* based on his or her placement score.

After the initial distribution of the assessment booklets and the scoring of the placement test, relatively few actions are usually required of the assessment administrator until assessment materials are collected when the students are finished, other than answering periodic student questions.

Do students need to do all the questions in this lengthy test?

No. For the content component, students are expected to do 75 of the 125 questions. The placement test will identify on which questions a particular student should focus. If time permits and the students so wish, they can attempt additional questions. For the problem-solving component, students should do as many parts of the six problems as they can. The later parts of each problem are usually more difficult, and it is expected that some students may leave these parts unfinished, returning to them if they have time and the desire to do so. They should complete at least some parts of every one of the six problems.

Is there a time limit for the assessment?

There is no time limit for the assessment. We expect that most students would complete the tests and questionnaires within a three hour time period, but some students, particularly those with special needs, may require extra time. We realize the amount of extra time you can provide will depend on a number of factors.

Can students take a break during the assessment?

We invite you to judge the needs of your students and orderliness of administration. We realize the assessment period is long, and students may require washroom or relaxation/stretching breaks. You can decide on the necessary number of breaks, if any, and whether students should leave individually, in small groups or in a whole group for these breaks. We ask you to stress the importance of not discussing the assessment with one another during the breaks, in order to preserve the integrity of the assessment.

How much should I assist students when they write the assessment?

Prior to the assessment, you might provide copies of sample questions from the *Information Bulletin for Schools* and encourage them to work together or individually responding to the questions. This might prepare them for what to expect when writing the assessment.

During the assessment you can answer student questions to clarify wording on the test or questionnaire items, but do not provide any help in remembering, understanding or applying math concepts and problem-solving strategies.

APPENDIX F

Example of a Student List for the Content Component

Student List for the Content Component

School Number: XS1234567 School Name: I.M Learning High School Age: 16

Student Name	Sex F/M	ID Number	*Participation Status	Math Teacher's Questionnaire ID Number
Adams R.	M	X12345	B	XT1234
Anderson D.	M	X12346	B	XT1232
Bourassa D.	M	X12347	B	XT1232
Brown J.	F	X12348	B	XT1233
Chiasson F.	M	X12349	A	XT1234
Genge D.	F	X12350	B	XT1233, XT1234
Gillap D.	F	X12351	B	XT1234
Hall J.	M	X12352	B	XT1233, XT1234
Kanerva E.	F	X12353	D	XT1234
Kuttner W.	F	X12354	D	
Lizaire F.	M	X12355	B	XT1235
Ouellet H.	F	X12356	B	XT1234
Pietschmann F.	F	X12357	A	XT1235
Sherwood P.	M	X12358	B	XT1232
Wilson T.	F	X12359	B	XT1233

***Transfer the participation code beside the student's name to the top of the front cover of the booklet assigned to the student.**

A - Absent
B - Participated During Scheduled Session
C - Participated During Make-up Session
D - Exempted: school designates student's mathematics ability at below Level 1
E - Excluded because interpreter not available
F - Excluded because of emotional reasons
G - Excluded for physical reasons
H - Excluded because appropriate modifications could not be made
I - Wrong birth date
J - No longer enrolled in this school
K - Student refusal: did not participate
L - Parent refusal: did not participate

If $\frac{(B + D)}{(A + B + D)} \times 100\ \% < 85\ \%$, then a make-up session is required.

All participation codes are explained on page 12 in the *Information Bulletin for Schools*.

APPENDIX G

Example of the Calculations for the School Percentage Participation

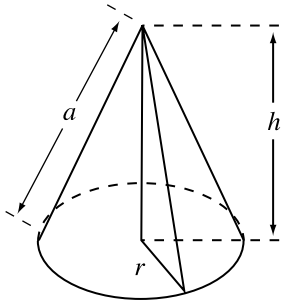
	13-Year-Old		16-Year-Old	
	Content	Problem Solving	Content	Problem Solving
Total students on Student List			**15**	
Total: **A**			**2**	
Total: **B**			**11**	
Total: **C**				
Total: **D**			**2**	
Total: **E**				
Total: **F**				
Total: **G**				
Total: **H**				
Total: **I**				
Total: **J**				
Total: **K**				
Total: **L**				
Percentage Participation $\frac{(B + C + D)}{(A + B + C + D)} \times 100\,\%$			**13/15 × 100 % = 87 %**	

APPENDIX H

Formula Sheet

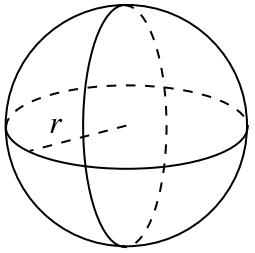
Geometry

The value of π can be considered to be 3.14159 ……



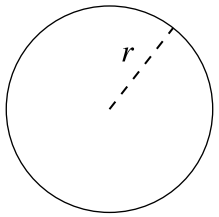
Right Circular Cone

Volume = $\frac{1}{3}\pi r^2 h$



Sphere

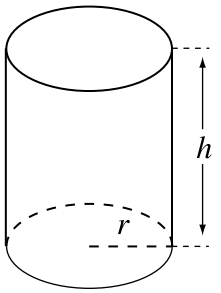
Volume = $\frac{4}{3}\pi r^3$



Circle

Area = πr^2

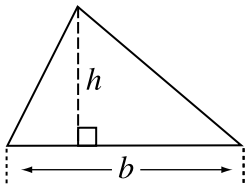
Circumference = $2\pi r$



Right Circular Cylinder

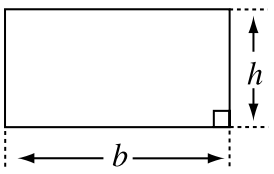
Lateral Surface Area = $2\pi rh$

Volume = $\pi r^2 h$



Triangle

Area = $\frac{1}{2}bh$



Rectangle

Area = bh

Algebra

The *roots of a quadratic equation* are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Trigonometry

Sine law

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Cosine law

$$c^2 = a^2 + b^2 - 2ab\cos C$$

Statistics

Standard deviation

$$\text{SD} = s = \sigma = \sqrt{\frac{\Sigma\left(X - \overline{X}\right)^2}{n}}$$

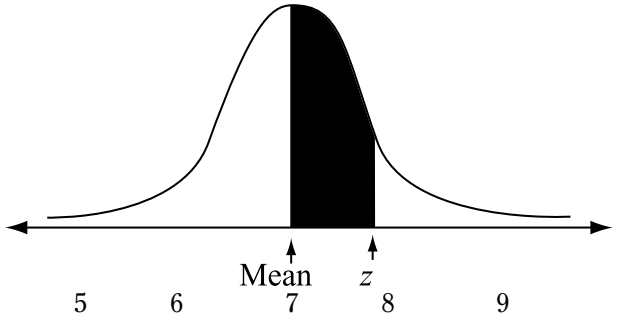
z-*score*

$$z = \frac{X - \overline{X}}{s}$$

Values of Trigonometric Functions

Angle	Sin	Cos	Tan	Angle	Sin	Cos	Tan
0°	0.0000	1.0000	0.0000	**45**°	0.7071	0.7071	1.0000
1°	0.0175	0.9998	0.0175	**46**°	0.7193	0.6947	1.0355
2°	0.0349	0.9994	0.0349	**47**°	0.7314	0.6820	1.0724
3°	0.0523	0.9986	0.0524	**48**°	0.7431	0.6691	1.1106
4°	0.0698	0.9976	0.0699	**49**°	0.7547	0.6561	1.1504
5°	0.0872	0.9962	0.0875	**50**°	0.7660	0.6428	1.1918
6°	0.1045	0.9945	0.1051	**51**°	0.7771	0.6293	1.2349
7°	0.1219	0.9925	0.1228	**52**°	0.7880	0.6157	1.2799
8°	0.1392	0.9903	0.1405	**53**°	0.7986	0.6018	1.3270
9°	0.1564	0.9877	0.1584	**54**°	0.8090	0.5878	1.3764
10°	0.1736	0.9848	0.1763	**58**°	0.8192	0.5736	1.4281
11°	0.1908	0.9816	0.1944	**56**°	0.8290	0.5592	1.4826
12°	0.2079	0.9781	0.2126	**57**°	0.8387	0.5446	1.5399
13°	0.2250	0.9744	0.2309	**58**°	0.8480	0.5299	1.6003
14°	0.2419	0.9703	0.2493	**59**°	0.8572	0.5150	1.6643
15°	0.2588	0.9659	0.2679	**60**°	0.8660	0.5000	1.7321
16°	0.2756	0.9613	0.2867	**61**°	0.8746	0.4848	1.8040
17°	0.2924	0.9563	0.3057	**62**°	0.8829	0.4695	1.8807
18°	0.3090	0.9511	0.3249	**63**°	0.8910	0.4540	1.9626
19°	0.3256	0.9455	0.3443	**64**°	0.8988	0.4384	2.0503
20°	0.3420	0.9397	0.3640	**65**°	0.9063	0.4226	2.1445
21°	0.3584	0.9336	0.3839	**66**°	0.9135	0.4067	2.2460
22°	0.3746	0.9272	0.4040	**67**°	0.9205	0.3907	2.3559
23°	0.3907	0.9205	0.4245	**68**°	0.9272	0.3746	2.4751
24°	0.4067	0.9135	0.4452	**69**°	0.9336	0.3584	2.6051
25°	0.4226	0.9063	0.4663	**70**°	0.9397	0.3420	2.7475
26°	0.4384	0.8988	0.4877	**71**°	0.9455	0.3256	2.9042
27°	0.4540	0.8910	0.5095	**72**°	0.9511	0.3090	3.0777
28°	0.4695	0.8829	0.5317	**73**°	0.9563	0.2924	3.2709
29°	0.4848	0.8746	0.5543	**74**°	0.9613	0.2756	3.4874
30°	0.5000	0.8660	0.5774	**75**°	0.9659	0.2588	3.7321
31°	0.5150	0.8572	0.6009	**76**°	0.9703	0.2419	4.0108
32°	0.5299	0.8480	0.6249	**77**°	0.9744	0.2250	4.3315
33°	0.5446	0.8387	0.6494	**78**°	0.9781	0.2079	4.7046
34°	0.5592	0.8290	0.6745	**79**°	0.9816	0.1908	5.1446
35°	0.5736	0.8192	0.7002	**80**°	0.9848	0.1736	5.6713
36°	0.5878	0.8090	0.7265	**81**°	0.9877	0.1564	6.3138
37°	0.6018	0.7986	0.7536	**82**°	0.9903	0.1392	7.1154
38°	0.6157	0.7880	0.7813	**83**°	0.9925	0.1219	8.1443
39°	0.6293	0.7771	0.8098	**84**°	0.9945	0.1045	9.5144
40°	0.6428	0.7660	0.8391	**85**°	0.9962	0.0872	11.4301
41°	0.6561	0.7547	0.8693	**86**°	0.9976	0.0698	14.3007
42°	0.6691	0.7431	0.9004	**87**°	0.9986	0.0523	19.0811
43°	0.6820	0.7314	0.9325	**88**°	0.9994	0.0349	28.6363
44°	0.6947	0.7193	0.9657	**89**°	0.9998	0.0175	57.2900
45°	0.7071	0.7071	1.0000	**90**°	1.0000	0.0000	———

Areas under the standard normal curve from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000

APPENDIX I

Sample Letter to Parents

(*Province/Territory*) is continuing its participation in the School Achievement Indicators Program Mathematics Assessment of the Council of Ministers of Education, Canada (CMEC). This program is intended to conduct a comparative cross-Canada assessment of what 13- and 16-year-old students have learned in mathematics.

The first mathematics assessment was conducted in April 1993 and results were released in December 1993; the second assessment was conducted in 1997, with the results being released in January 1998. The third assessment of mathematics is scheduled for administration in April 2001.

The assessment has two separate components; a test of mathematics content and a test on problem solving, both to be administered by local teachers. Students selected will take part in only one component. In (*Province/Territory*), (*number*) English-language schools and (*number*) French-language schools have been chosen to participate in the 13-year-old population. A total of (*number*) English-language schools and (*number*) French-language schools will take part in the 16-year-old population and (*number*) of English-language schools, and (*number*) of French-language schools have been selected to take part in the assessment of both age populations. A random sample of schools has been chosen to ensure representation from all regions in (*Province/Territory*) and from public and private schools.

Except for a few instances, in each of the selected schools, only a sample of the 13-year-old or 16-year-old students will take part in the assessment activity. These students will be chosen systematically from lists provided by the schools. In most schools, approximately 20 students will be selected; 10 will do the Content Component and 10 will do the Problem-Solving Component.

Enclosed is a brochure describing the mathematics assessment.

The summary report of the results will be published in 2002. The results will be compiled on a national and provincial scale for the two language groups. No results will be published by school district, school or student.

Thank you for supporting your child's participation in the 2001 School Achievement Indicators Program (SAIP) Mathematics Assessment.

(Enclosure)