The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
cemc.uwaterloo.ca

Canadian Intermediate Mathematics Contest

Wednesday, November 12, 2025
(in North America and South America)

Thursday, November 13, 2025
(outside of North America and South America)

UNIVERSITY OF WATERLOO

Time: 2 hours

Calculating devices are allowed, provided that they do not have any of the following features: (i) internet access, (ii) the ability to communicate with other devices, (iii) information previously stored by students (such as formulas, programs, notes, etc.), (iv) a computer algebra system, (v) dynamic geometry software.

Do not open this booklet until instructed to do so.
There are two parts to this paper. The questions in each part are arranged roughly in order of increasing difficulty. The early problems in Part B are likely easier than the later problems in Part A.

PART A

1. This part consists of six questions, each worth 5 marks.
2. **Enter the answer in the appropriate box in the answer booklet.** For these questions, full marks will be given for a correct answer which is placed in the box. Part marks will be awarded **only if relevant work** is shown in the space provided in the answer booklet.

PART B

1. This part consists of three questions, each worth 10 marks.
2. **Finished solutions must be written in the appropriate location in the answer booklet.** Rough work should be done separately. If you require extra pages for your finished solutions, they will be supplied by your supervising teacher. Insert these pages into your answer booklet. Write your name, school name, and question number on any inserted pages.
3. Marks are awarded for completeness, clarity, and style of presentation. A correct solution, poorly presented, will not earn full marks.

At the completion of the contest, insert your student information form inside your answer booklet.

Do not discuss the problems or solutions from this contest online for the next 48 hours.

The name, grade, school and location, and score range of some top-scoring students will be published on the website, cemc.uwaterloo.ca. In addition, the name, grade, school and location, and score of some students may be shared with other mathematical organizations for other recognition opportunities.

Canadian Intermediate Mathematics Contest

NOTE:
1. Please read the instructions on the front cover of this booklet.
2. Write solutions in the answer booklet provided.
3. Express answers as simplified exact numbers except where otherwise indicated. For example, $\pi + 1$ and $1 - \sqrt{2}$ are simplified exact numbers.
4. While calculators may be used for numerical calculations, other mathematical steps must be shown and justified in your written solutions and specific marks may be allocated for these steps. For example, while your calculator might be able to find the x-intercepts of the graph of an equation like $y = x^3 - x$, you should show the algebraic steps that you used to find these numbers, rather than simply writing these numbers down.
5. Diagrams are not drawn to scale. They are intended as aids only.
6. No student may write both the Canadian Senior Mathematics Contest and the Canadian Intermediate Mathematics Contest in the same year.

PART A

For each question in Part A, full marks will be given for a correct answer which is placed in the box. Part marks will be awarded only if relevant work is shown in the space provided in the answer booklet.

1. There are 140 donkeys in a sanctuary. Of the 140 donkeys, 85% are adults and the rest are babies. How many baby donkeys are there in the sanctuary?

2. Jimmy and Paige each have some stamps. They each have at least one stamp. The number of stamps that Jimmy has is even. The number of stamps that Paige has is a multiple of 5. If the total number of stamps that Jimmy and Paige have together is 18, how many stamps does Jimmy have?

3. Leo filled a vase to $\frac{1}{3}$ of its capacity with water and found its mass including the water to be 600 g. He then filled the same vase to $\frac{2}{3}$ of its capacity with water and found its mass including the water to be 800 g. What is the mass of the vase when it is empty?

4. $\triangle AOB$ has vertices $A(0, 2)$, $O(0, 0)$, and $B(6, 0)$. Point $C(9a, a)$ is on side AB where a is some positive real number. What is the ratio of the area of $\triangle AOC$ to the area of $\triangle BOC$?

5. On Monday afternoon, Raya has n meetings for some positive integer $n \geq 2$.

   The first meeting starts at exactly 1:00 p.m., the last meeting ends at exactly 4:00 p.m., and there is a break between every pair of consecutive meetings. The meetings and breaks satisfy the following conditions.

   - The meetings all have the same length. This length in minutes is a positive integer.
   - The breaks all have the same length. This length in minutes is a positive integer.
   - Each meeting is 10 minutes longer than each break.

   What are the different possibilities for the value of n, the number of meetings?

6. For a positive real number x, the expression $[x]$ represents the integer part of x. For example, $[4.3] = 4$, $[15.95] = 15$, and $[7] = 7$. How many positive integers n with $1 \leq n \leq 2025$ have the property that $n = [2x] + [3x] + [5x] + [7x]$ for some positive real number x? For example, one such integer is $n = 26$ since $x = 1.6$ gives $26 = [2(1.6)] + [3(1.6)] + [5(1.6)] + [7(1.6)]$.

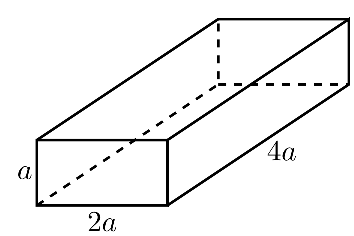
PART B

For each question in Part B, your solution must be well-organized and contain words of explanation or justification. Marks are awarded for completeness, clarity, and style of presentation. A correct solution, poorly presented, will not earn full marks.

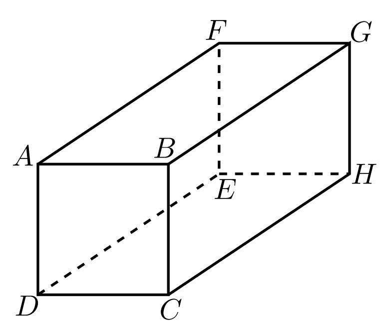
1. The surface area of a rectangular prism with width x, length y, and height z can be calculated using the formula $2(xy + xz + yz)$.

   (a) A rectangular prism has width 3 cm, length 6 cm, and height 11 cm. Determine the surface area of the prism.

   (b) The rectangular prism shown to the right has height a cm, width $2a$ cm, and length $4a$ cm for some positive real number a. The surface area of the prism is 9072 cm^2. Determine the value of a.



   (c) In the rectangular prism $ABCDEFGH$ shown to the right, the height AD and the width AB are equal, the length CH is double the width, and $CG = 10$ cm. Determine the surface area of the prism.



2. Blaise's calculator has a random number generator that generates one of the three integers 1, 2, or 3. He generates lists of 1s, 2s, and 3s by repeatedly generating random integers and including them in the list. For example, if he generates 1, then 2, then 1, then 3, his list will be $1, 2, 1, 3$.

   (a) Blaise generated a list of exactly two integers. At least one of the two integers was 2. Determine all possibilities for the list.

   (b) Blaise generated a list of exactly three integers. The third integer was 3 and there were no other 3s in the list. Determine the number of possibilities for the list.

   In parts (c) and (d), Blaise will generate a list of integers and will continue to make the list longer until *either* he generates a 3 *or* he generates two consecutive 2s. (Hence, the list will either end with a 3 or it will end with two consecutive 2s. The theoretical possibility that the list goes on forever does not matter for what follows.)

   (c) Blaise generated a list of exactly 4 integers. Determine the number of possibilities for the list.

   (d) Blaise generated a list of exactly 10 integers. Determine the number of possibilities for the list.

3. (a) List all positive three-digit integers that are divisible by 8, have no digits equal to 0, and have no odd digits.

   (b) Noah writes down a positive 13-digit integer n that is divisible by 17^2 and has only odd digits. Melaku places m odd digits to the *left* of n, creating a larger $(13+m)$-digit integer. This new integer is also divisible by 17^2. Determine the smallest possible value of m if $m > 0$.

   (c) Prove that there is a 2025-digit positive integer that has only odd digits and is divisible by 5^{2025}.