The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING

cemc.uwaterloo.ca

Fryer Contest

(Grade 9)

Thursday, April 3, 2025
(in North America and South America)

Friday, April 4, 2025
(outside of North America and South America)

UNIVERSITY OF WATERLOO

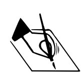
Time: 75 minutes

Do not open this booklet until instructed to do so.

Number of questions: 4 **Each question is worth 10 marks**

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.

Parts of each question can be of two types:

1. **SHORT ANSWER** parts indicated by 
   - worth 2 or 3 marks each
   - full marks given for a correct answer which is placed in the box
   - **part marks awarded only if relevant work** is shown in the space provided
2. **FULL SOLUTION** parts indicated by 
   - worth the remainder of the 10 marks for the question
   - **must be written in the appropriate location** in the answer booklet
   - marks awarded for completeness, clarity, and style of presentation
   - a correct solution poorly presented will not earn full marks

WRITE ALL ANSWERS IN THE ANSWER BOOKLET PROVIDED.

- Extra paper for your finished solutions must be supplied by your supervising teacher and inserted into your answer booklet. Write your name, school name, and question number on any inserted pages.
- Express answers as simplified exact numbers except where otherwise indicated. For example, $\pi + 1$ and $1 - \sqrt{2}$ are simplified exact numbers.

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

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

NOTE:

1. Please read the instructions on the front cover of this booklet.
2. Write all answers in the answer booklet provided.
3. For questions marked , place your answer in the appropriate box in the answer booklet and **show your work**.
4. For questions marked , provide a well-organized solution in the answer booklet. Use mathematical statements and words to explain all of the steps of your solution. Work out some details in rough on a separate piece of paper before writing your finished solution.
5. Diagrams are *not* drawn to scale. They are intended as aids only.
6. 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.
7. No student may write more than one of the Fryer, Galois and Hypatia Contests in the same year.

1. Azizi sold chocolate bars from Monday to Friday over three weeks.

(a) During the first week, he sold the following numbers of chocolate bars:

Monday	Tuesday	Wednesday	Thursday	Friday
15	23	18	15	7

How many chocolate bars did he sell in total during the first week?

(b) During the second week, he sold the following numbers of chocolate bars:

Monday	Tuesday	Wednesday	Thursday	Friday
7	15	x	23	x

He sold a total of 73 chocolate bars during the second week. What is the value of x?

(c) During the third week, he sold y chocolate bars on Monday. Each day from Tuesday to Friday, he sold 6 more chocolate bars than he sold on the previous day. He sold a total of 100 chocolate bars during the third week. Determine the value of y.

2. Three players, Ava, Beau, and Cato, are playing in a tournament. Each person plays exactly two games, one game against each of the other players. If a game ends in a tie, both players are awarded 1 point. Otherwise, the winning player is awarded W points, and the losing player is awarded 0 points.

For example, if the tournament results are as shown below and $W = 2$, then points are awarded as follows:

Game Results	Points Awarded		
	Ava	Beau	Cato
Ava loses to Beau	0	2	——
Beau and Cato tie	——	1	1
Ava and Cato tie	1	——	1

Suppose that S is equal to the sum of the points that have been awarded to the three players when the tournament has finished. In the example above, Ava is awarded 1 point, Beau is awarded 3 points, and Cato is awarded 2 points, so $S = 6$ in the example.

(a) Suppose the tournament results are as follows: Ava and Beau tie, Beau loses to Cato, Ava and Cato tie. If $W = 3$, what is the value of S?

(b) If $W = 4$ and $S = 6$, how many games ended in a tie?

(c) Suppose the tournament finishes with exactly one of the three games ending in a tie. If $S = 24$, what is the value of W?

(d) Suppose the tournament finishes with $S = 21$, but we are not told the results of the games. Determine all possible integer values of W.

3. The prime factorization of 784 is $2 \times 2 \times 2 \times 2 \times 7 \times 7$ or $2^4 \times 7^2$, and so 784 is a perfect square because it can be written in the form $(2^2 \times 7) \times (2^2 \times 7)$. The prime factorization of 45 is $3^2 \times 5$, and so 45 is not a perfect square. However, 45×5 is a perfect square since $45 \times 5 = 3^2 \times 5^2 = (3 \times 5) \times (3 \times 5)$.

(a) What are all positive integers j with $j \leq 20$ for which $2^3 \times 3^2 \times j$ is a perfect square?

(b) Determine all positive integers k so that $20 \times k$ is both a perfect square and a divisor of 3600.

(c) Determine the number of ordered triples of positive integers (a, b, c) so that $a^2 \times b^2 \times c = 2025$.

4. Parallelogram $ABCD$ has vertices $A(0, 0)$, $B(7, 0)$, $C(9, 4)$, and $D(2, 4)$.

(a) Point $E(4, 4)$ lies on CD. What is the sum of the areas of $\triangle ABC$, $\triangle ABD$ and $\triangle ABE$?

(b) Let G be a point with integer coordinates that lies on the perimeter of $ABCD$. Suppose $\triangle CDG$ has non-zero area. How many possibilities are there for the point G?

(c) Determine the sum of the areas of all triangles whose vertices all have integer coordinates and lie on the perimeter of $ABCD$.

2025 Fryer Contest (English)

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For students...

Thank you for writing the 2025 Fryer Contest! Each year, more than 260 000 students from more than 80 countries register to write the CEMC's Contests.

Encourage your teacher to register you for the Canadian Intermediate Mathematics Contest or the Canadian Senior Mathematics Contest, which will be written in November 2025.

Visit our website `cemc.uwaterloo.ca` to find

- Free copies of past contests
- Information about careers in and applications of mathematics and computer science

For teachers...

Visit our website `cemc.uwaterloo.ca` to

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- Find your school's contest results