



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

Fermat Contest

(Grade 11)

Wednesday, February 26, 2025
(in North America and South America)

Thursday, February 27, 2025
(outside of North America and South America)



UNIVERSITY OF
WATERLOO

Time: 60 minutes

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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.

Instructions

1. Do not open the Contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your response form. If you are not sure, ask your teacher to clarify it. All coding must be done with a pencil, preferably HB. Fill in circles completely.
4. On your response form, print your school name and city/town in the box in the upper right corner.
5. **Be certain that you code your name, age, grade, and the Contest you are writing in the response form. Only those who do so can be counted as eligible students.**
6. Part A and Part B of this contest are multiple choice. Each of the questions in these parts is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. After making your choice, fill in the appropriate circle on the response form.
7. The correct answer to each question in Part C is an integer from 0 to 99, inclusive. After deciding on your answer, fill in the appropriate two circles on the response form. A one-digit answer (such as “7”) must be coded with a leading zero (“07”).
8. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
9. Diagrams are *not* drawn to scale. They are intended as aids only.
10. When your supervisor tells you to begin, you will have 60 minutes of working time.
11. You may not write more than one of the Pascal, Cayley and Fermat Contests in any given year.

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

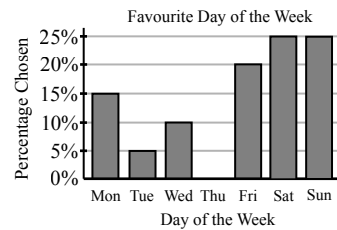
The name, grade, school and location, and score range of some top-scoring students will be published on our website, cemc.uwaterloo.ca. In addition, the name, grade, school and location, and score of some top-scoring students may be shared with other mathematical organizations for other recognition opportunities.

Scoring: There is *no penalty* for an incorrect answer.
 Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $2 - 0 + 2 \times 5$ is
 (A) -8 (B) 10 (C) 0 (D) 12 (E) 2

2. In a survey, each student chose their favourite day of the week. In the graph, the percentages of those surveyed who selected each day of the week is shown. If 3000 students were surveyed, how many people chose Friday as their favourite day of the week?



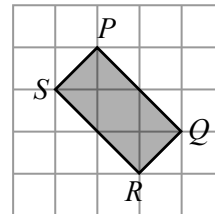
- (A) 400 (B) 600 (C) 700
 (D) 500 (E) 800

3. How many integer values of x satisfy the inequality $2 < x < 14$?
 (A) 10 (B) 7 (C) 13 (D) 14 (E) 11

4. Rachel, Christophe and Alfonzo are paid to organize some books. In total, they are paid \$50. Alfonzo is paid \$14. Rachel is paid twice what Christophe is paid. How much is Christophe paid?

- (A) \$10 (B) \$12 (C) \$14 (D) \$16 (E) \$18

5. In the diagram, points P , Q , R , and S are at the intersection of gridlines in a 5×5 grid of 1×1 squares. The area of rectangle $PQRS$ is

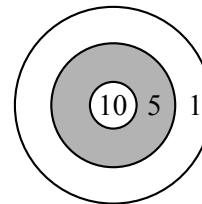


- (A) 5 (B) 8 (C) 4
 (D) 7 (E) 6

6. The current calendar year, 2025, is a perfect square. In n years from 2025, the calendar year will again be a perfect square. The smallest possible value of n is

- (A) 2025 (B) 100 (C) 9 (D) 46 (E) 91

7. In the diagram, the target shown has three scoring areas. An arrow that hits the centre circle is worth 10 points, an arrow that hits the shaded middle ring is worth 5 points, and an arrow that hits the outer ring is worth 1 point. Three arrows are shot and each hits the target. Which of the following *cannot* be the total score for the three arrows?



- (A) 16 (B) 11 (C) 13
 (D) 7 (E) 20

8. The average of 15 integers is 18. The average of 5 of these integers is 12. What is the average of the other 10 integers?

- (A) 15 (B) 21 (C) 24 (D) 18 (E) 12

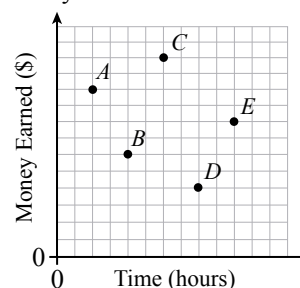
9. If $x^2 - y^2 = 72$ and $x - y = 12$, the value of $x + y$ is
 (A) 8 (B) 60 (C) 9 (D) 72 (E) 6
10. There are 186 students on a class trip. Each student is placed into exactly one of 50 groups. Each group has exactly 3 students or exactly 4 students. There are m groups that have 3 students and n groups that have 4 students. The value of $m - n$ is
 (A) -22 (B) -10 (C) -14 (D) -26 (E) -18

Part B: Each correct answer is worth 6.

11. Twelve lightbulbs are in a row. All lightbulbs are initially turned off. Angie flips the switch for every 2nd lightbulb. Then Bilal flips the switch for every 3rd lightbulb. Finally, Chenxhui flips the switch for every 4th lightbulb. At the end of this process, how many lightbulbs are turned on?
 (A) 5 (B) 6 (C) 7 (D) 8 (E) 9

12. In the graph, the five points show the money earned versus time worked for each of five employees. Each was paid a different but fixed number of dollars per hour. Which letter represents the employee who was paid the most money per hour?

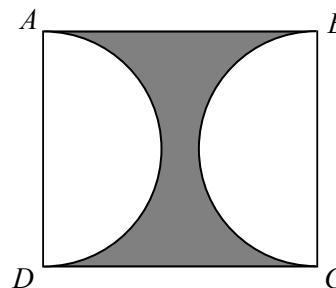
Money earned vs. time worked



- (A) A (B) B (C) C
 (D) D (E) E

13. If the equation $(x + 2)(x + t) = x^2 + bx + 12$ is true for all real numbers x , the value of b is
 (A) 6 (B) 8 (C) 10 (D) 12 (E) 14
14. A substance doubles its volume every minute. At 9:00 a.m. a small amount of the substance was placed in a large empty container. At 9:20 a.m. the same day, the container became full. At what time was the container one-quarter full?
 (A) 9:15 a.m. (B) 9:10 a.m. (C) 9:16 a.m. (D) 9:04 a.m. (E) 9:18 a.m.
15. The hundreds digit of the *smallest* five-digit positive integer that is divisible by 12, 13, 14 and 15 is
 (A) 2 (B) 7 (C) 1 (D) 9 (E) 3

16. In the diagram, $ABCD$ is a rectangle with area 224. Semi-circles with diameters AD and BC are drawn inside the rectangle. If the shortest distance between the semi-circles is 2, the area of the shaded region is closest to



- (A) 50 (B) 55 (C) 60
 (D) 65 (E) 70

17. A tennis tournament starts with 8 players. Francesca is equally likely to play against any of the other 7 players in her first match. If Francesca plays against Dominique or Estella, the probability that Francesca wins is $\frac{2}{5}$. If Francesca plays against any of the other 5 players, the probability that she wins is $\frac{3}{4}$. What is the probability that Francesca wins her first match?
 (A) $\frac{23}{50}$ (B) $\frac{29}{50}$ (C) $\frac{3}{5}$ (D) $\frac{13}{20}$ (E) $\frac{2}{3}$
18. In a 2000 m race, Arturo, Morgan and Henri run at constant but different speeds. Arturo finishes 200 m ahead of Morgan and 290 m ahead of Henri. If Morgan and Henri each continue at their same speeds, how far ahead of Henri will Morgan finish?
 (A) 90 m (B) 100 m (C) 110 m (D) 120 m (E) 130 m
19. The lines with equations $y = mx + 7$, $y = 2$, $x = 0$, and $y = 0$ form a trapezoid with area 3. If $m > 0$, what is the value of m ?
 (A) 2 (B) 3 (C) 4 (D) 5 (E) 8
20. Some integers m with $1 < m < 100\,000$ have the property that the product of the digits of m is equal to 200. If N is the number of such integers m , what is the integer formed by the rightmost two digits of N ?
 (A) 17 (B) 27 (C) 37 (D) 47 (E) 57

Part C: Each correct answer is worth 8.

Each correct answer is an integer from 0 to 99, inclusive.

A one-digit answer (such as “7”) must be coded with a leading zero (“07”).

Note: The integer formed by the rightmost two digits of 12 345 is 45.

The integer formed by the rightmost two digits of 6307 is 7, coded 07.

21. The area of a right-angled triangle is 54 cm^2 . The side lengths of the triangle are $a \text{ cm}$, $b \text{ cm}$, and $c \text{ cm}$, where a , b and c are positive integers with $a < b < c$. What is the value of c ?
22. The triple (x, y, z) of integers satisfies the following system of equations:

$$2^x + 2^y + 3^{z-1} = 2259$$

$$2^{x+y} + 3^z = 7073$$

$$2^x + 2^y + 3^z = 6633$$

If P is equal to the product xyz , what is the integer formed by the rightmost two digits of P ?

23. When two ants work together they can build an anthill in 24 minutes. When the bigger ant works alone, an anthill can be built in 14 minutes less than when the smaller ant works alone. How many minutes does it take the smaller ant to build an anthill when working alone?
24. Suppose that $f(x) = x^4 + px^3 + qx^2 + rx + s$ for some real numbers p , q , r , s . In addition, $f(1) = 59$, $f(2) = 118$ and $f(3) = 177$. If $T = f(9) + f(-5)$, what is the sum of the digits of the integer equal to T ?
25. A sequence a_1, a_2, \dots has $a_1 = 1$, $a_2 = 3$ and $a_n = -a_{n-1} + a_{n-2}$ for each integer $n \geq 3$. For example, $a_3 = -a_2 + a_1 = -2$. How many of the 2025 integers $(a_1)^2, (a_2)^2, (a_3)^2, \dots, (a_{2025})^2$ are divisible by 2025?



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For students...

Thank you for writing the 2025 Fermat Contest! Each year, more than 265 000 students from more than 80 countries register to write the CEMC's Contests.

Encourage your teacher to register you for the Hypatia Contest which will be written in April.

Visit our website cemc.uwaterloo.ca to find

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- 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

- Register your students for the Fryer, Galois and Hypatia Contests which will be written in April
- Look at our free online courseware
- Use our free Problem Set Generator to create problem sets for curriculum support and enrichment
- Learn about our face-to-face workshops and our web resources
- Subscribe to our free Problem of the Week
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- Find your school's contest results