



10th National Contest for First-Year Classes

Wednesday, February 5, 2025

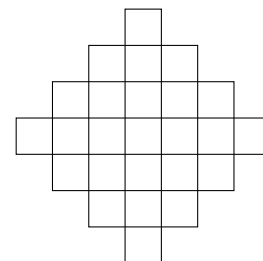
First name: _____	Last name: _____	Sex: <input type="checkbox"/> M <input type="checkbox"/> F
Birth date: _____		City: _____
School: _____		

The competition lasts 2 hours and 30 minutes and consists of 18 problems. Only one answer is correct. The letter corresponding to the correct answer must be written, for each question, in the box below. Each correct answer is worth 5 points, each incorrect answer is worth 0 points, and each unanswered question is worth 1 point. No erasures are allowed on the grid. The use of electronic devices, compass, and protractor is not allowed. The problems are not in order of difficulty but are randomly shuffled.

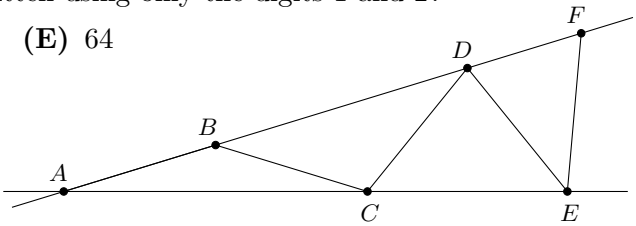
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Test n. 1

1. Using square tiles of side length 1 cm, Raffaella constructs the mosaic shown in the figure. Luca decides to make one with the same shape, but with tiles of side length 5 cm. Claudia, instead, constructs one still using tiles of side 1 cm and maintaining the same rhomboidal structure as Raffaella's, but with diagonals of 35 tiles instead of 7. What is the difference, in cm^2 , between the areas of Claudia's and Luca's figures?



- (A) 12 (B) 0 (C) 24 (D) 25 (E) 13
2. You have 100 bags: the first contains one gold coin, the second contains two, and so on, up to the hundredth, which contains 100 coins. You can fill your chest by emptying, one by one, some of the bags into it. However, when the number of coins in your chest is even and non-zero, you must stop. What is the maximum number of coins you can put in the chest?
- (A) 5050 (B) 3080 (C) 2746 (D) 2649 (E) 2048
3. In a rectangle $ABCD$ with an area of 288 cm^2 , let M and N be the midpoints of the sides AB and AD , respectively. Determine the area of triangle MNC .
- (A) 108 cm^2 (B) 144 cm^2 (C) 96 cm^2 (D) 72 cm^2 (E) 192 cm^2
4. Cecilia, using only the digits 2, 5, x and y , where $x \neq 0 \neq y$, and such that the four digits are distinct, wrote on the board all possible 2-digit numbers with distinct digits. If the total sum of the numbers written is 396, what is the value of $x + y$?
- (A) 4 (B) 5 (C) 8 (D) 9 (E) 12
5. In a rectangular grid made of 20×25 squares, the two diagonals are drawn. How many grid squares are not cut by the diagonals?
- (A) 320 (B) 326 (C) 400 (D) 418 (E) 422

6. How many points can be drawn, at most, inside a circle with an area of $4\pi \text{ cm}^2$ (the boundary can be used) such that each point is at least 1 cm away from every other point?
- (A) 7 (B) 10 (C) 12 (D) 16 (E) 19
7. How many 6-digit numbers divisible by 3 can be written using only the digits 1 and 2?
- (A) 2 (B) 12 (C) 22 (D) 32 (E) 64
8. In the image beside, it is given that $AB = BC = CD = DE = EF$. Knowing that the angle \widehat{DEF} measures 44° , what is the size of angle \widehat{ABC} ?
- (A) 17° (B) 18° (C) 16° (D) 22° (E) 21°
- 
9. How many 3-digit integers (between 100 and 999) contain the digit 3 but not the digit 4?
- (A) 162 (B) 200 (C) 216 (D) 243 (E) 450
10. I take the 90 numbers from the bingo game and want to put some into a bag so that, if I pick two numbers at random, I'm sure their sum will be less than or equal to 25, and their product will be greater than or equal to 50. How many numbers can I choose at most?
- (A) 5 (B) 7 (C) 9 (D) 11 (E) 6
11. How many positive integers n satisfy the inequalities $(15n)^{20} > n^{40} > 2^{80}$?
- (A) 0 (B) 10 (C) 50 (D) 100 (E) an infinite number
12. Two positive real numbers x and y satisfy $(x + y)^2 = 100x + y = 2025$. What is the product xy ?
- (A) 250 (B) 400 (C) 450 (D) 480 (E) 500
13. Given the parallelogram $ABCD$, let M be the midpoint of BC , O be the intersection point of the diagonals, and P be the intersection point of AM and BD . Knowing that the area of triangle APO is 24 cm^2 , what is the area of parallelogram $ABCD$?
- (A) 288 cm^2 (B) 240 cm^2 (C) 336 cm^2 (D) 192 cm^2 (E) 216 cm^2
14. All of the 180 students in the first-year classes of a high school love Mathematics and/or Physics. The number of students who love only Mathematics is twice the number of those who love only Physics. We also know that 20% of the total love both subjects. How many students love Mathematics?
- (A) 108 (B) 144 (C) 120 (D) 132 (E) 96
15. Knowing that $9a^2 + \frac{1}{a^2} = 3$, with a positive real, what is the value of $3a + \frac{1}{a}$?
- (A) 5 (B) $\sqrt{13}$ (C) 13 (D) $\sqrt{19}$ (E) 9
16. The sum of some positive integers is 10. What is the maximum value of their least common multiple?
- (A) less than 16 (B) between 16 and 28 (C) between 29 and 39
(D) between 40 and 49 (E) more than 49
17. In the usual base 10, consider the number 1257. This number, in base B , is represented by the digits xyz , meaning that $1257 = xB^2 + yB + z$. What is the smallest base B for which $x + y + z = 1 + 2 + 5 + 7$?
- (A) 11 (B) 12 (C) 19 (D) 24 (E) 28
18. Lisa wants to multiply 18 by a number so that the result is both a perfect square and a perfect cube. What is the smallest number that Lisa can use?
- (A) 12 (B) 72 (C) 1728 (D) 2592 (E) 46656