

Grade 8

Problem №1.

Find the exact value of the following expression:

$$2 - \sqrt{2 - \sqrt{2 - \sqrt{2 - \dots}}}$$

- A) 4 B) 1 C) 32 D) 3 E) 2

Problem №2.

A rectangle is divided into four smaller rectangles, with the one in the upper right corner being a square. The area of the square is 25 square meters and the area of the other two rectangles are 95 and 228 square meters, as shown.

Find the area, expressed in square meters, of the shaded rectangle in the bottom right corner.



- A) 40 B) 12 C) 10 D) 50 E) 60

Problem №3.

The numbers in the 4-by-4 grid shown follow a certain pattern. What is the sum of the six missing numbers, indicated by the question marks?

| | | | |
|----|----|-----|----|
| ? | 8 | 12 | 7 |
| 4 | ? | 48 | 28 |
| ? | 56 | ? | ? |
| 10 | 80 | 120 | ? |

- A) 160 B) 242 C) 243 D) 512 E) 625

Problem №4.

A and **B** represent numbers, and a binary operation $(*)$ is defined as

$$A * B = A^2 + B^2 - 2 \cdot A \cdot B. \text{ What is the value of } (2 * 4) * (6 * 8) ?$$

- A) 16 B) 8 C) 4 D) 0 E) -4

Problem №5.

A palindrome in mathematics is a positive integer that is the same when read forwards or backwards. The number 11 is an example of a two-digit palindrome and the number 25652 is an example of a five-digit palindrome.

What is the **ratio** of the number of two-digit palindromes to the number of five-digit palindromes?

- A) $\frac{1}{900}$ B) $\frac{1}{100}$ C) $\frac{1}{10}$ D) $\frac{1}{9}$ E) 1

Problem №6.

What is the correct ordering of the three numbers, 10^8 , 5^{12} and 2^{24} ?

- A) $2^{24} < 10^8 < 5^{12}$ B) $2^{24} < 5^{12} < 10^8$ C) $5^{12} < 2^{24} < 10^8$
D) $10^8 < 5^{12} < 2^{24}$ E) $10^8 < 2^{24} < 5^{12}$

Problem №7.

What digit stands in the millionth place of 0.12345678910111213141516... ?

- A) 5 B) 4 C) 3 D) 1 E) 0

Problem №8.

In a fruit basket, the ratio of apples to oranges is 3:2. If there are a total of 40 fruits in the basket, we can find the number of apples and the number of oranges in the basket fairly easily. After calculating the number of oranges in the basket, Ginny adds twice as many bananas. How many **bananas** did Ginny add to the basket?

- A) 23 B) 32 C) 36 D) 48 E) 40

Problem №9.

The values 2, 3, 4 and 5 are assigned to exactly one of the letters A, B, C and D in such a way that the expression $A^B - C^D$ has the greatest value possible.

What is the value of $(A + B) - (C - D)$?

Problem №10.

Marina has 32 coins, consisting of 5-cent, 10-cent, and 25-cent coins. Given that the total value of her coin collection is 390 cents, and she has 4 more 10-cent coins than 5-cent coins, how many 25-cent coins does she have?

Problem №11.

In the equation $A+BC+DEF+ABCDEF=343165$ where A, B, ..., F represent different digits, what is the three-digit number DEF?

Problem №12.

Students from Mrs. Hein's class are standing in a circle. They are evenly spaced and consecutively numbered starting with 1. The student with number 3 is standing directly across from the student with number 17. How many students are there in Ms. Hein's class?

Problem №13.

What is the sum of the prime factors of 2024?

Problem №14.

What is the sum of the digits of greatest three-digit number that has the same remainder when it is divided by 33 and 21?

Problem №15.

Anne and Beate together have \$120, Beate and Cecilie together have \$60, and Anne and Cecilie together have \$70. How much money do they have in total?