Hogstadiet's Mathematics

crop 2023/24

Qualification board 8-14 November 2023

Writing time: 120 minutes.

Aids: Pencil, eraser, ruler and calipers. Not a mini calculator.

Justify all solutions, answers alone give no points unless otherwise stated.

Submit everything you come up with, including partial solutions. Write legibly.

Each solution gives 0 – 3 points. Good luck!

ATTENTION! This competition text must not be included in the qualification writing. The competition text is available on HMT's website, www.matematiktavling.org, after November 14.

1. What two-digit integers are equal to the sum of their digit product and their digit sum?

2. The three outer angles of a triangle are related as 7:9:14. Determine the smallest of the triangle angle.
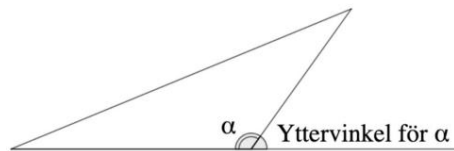

Figure 1: Definition of exterior angle

3. Aunt Ester loves parties, she almost always has guests. She has invited 26 guests (including four priests from Manchester). She has also made sure that the average age of the guests is exactly the same as her own. Unfortunately, not all guests can fit in the same room, so she is forced to divide them into two rooms, 15 in the living room and 11 in the kitchen. When Aunt Ester walks into the living room and calculates the average age of everyone in that room (including herself), the average age is 3 years more than her own age. After that, she enters the store and calculates the average age of all the people in the store (again including herself). How much less than Aunt Ester's age is the average age?

4. Express the following numbers using all six numbers

$$2, 5, \quad 7, 10, 25, 100$$

each exactly once, as well as optional operations (+, ÿ, ×, ÷) and parentheses.

a) 2023

b) 2024

c) 2025

(For example, 42 can be expressed as 42 = 100 ÿ (7 ÿ 5) · 25 ÿ 10 + 2.)

Only answers are required for this problem!

Have a good time!

5. Viktualia must buy weights to be able to strength train. There are weights in every integer number of tons. At least how many weights does she have to buy in order to be able to add up all the whole tons from 3 to 9 tons?

6. In the game "The winding road" you have to get from the left side of a grid to the right side. The sum of all numbers along the road must equal a predetermined number. The road must also divide the grid into two parts that have equal sums.

In the example below, the sum of the roads should be 12. As we can see, all three variants of roads fulfill this while the upper part of the grid has the same sum as the lower part (in this case, 5).

Find all possible paths through the grid below, such that the sum of the tortuous paths is exactly 30.

2	4	2	4	2	4
3	3	3	3	3	3
1	2	3	4	5	6
2	3	4	4	3	2
1	1	1	1	1	1
4	2	4	2	4	2

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