

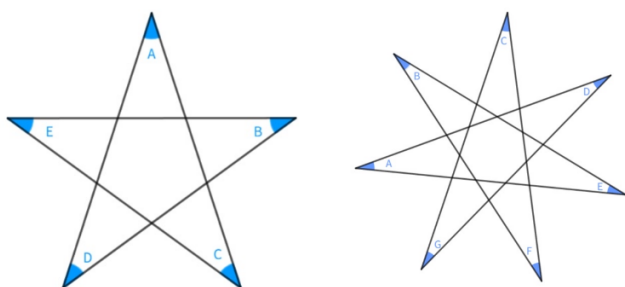
2025 Shibaura Festival

Mathematical Problem-Solving Challenge

Shibaura Institute of Technology, Mathematical Science Club
TOYOSU campus, Lecture Hall Building, Classroom 510

Question. 1 ★☆☆

For each of the following figures, what is the total measure (in degrees) of the colored angles?



Question. 2 ★☆☆

Among all positive integers that leave
a remainder of 1 when divided by 2,
a remainder of 2 when divided by 3,
a remainder of 3 when divided by 4,
a remainder of 4 when divided by 5,
and a remainder of 5 when divided by 6,
what is the smallest such integer?

Question. 3 ★★☆☆

Shibaura-kun (the name of one person) dislikes studying very much. However, because he loves multiples of 3 and numbers containing the digit 3, he studies only on days when the number formed by concatenating the month and day is either a multiple of 3 or contains the digit 3.

For example:

January 24: The number is 124, which satisfies neither condition, so he does not study.

November 25: The number is 1125, which is a multiple of 3, so he studies.

July 3: The number is 73, which contains the digit 3, so he studies.

Between January 1, 2025, and December 31, 2025, how many days in total will Shibaura-kun study?

Question. 4 ★★☆☆

In the following 5×5 grid, each cell shows the amount of stamina consumed when passing through it.

8	3	2	9	6
1	7	8	3	9
9	2	9	2	8
4	6	3	8	3
7	5	4	7	4

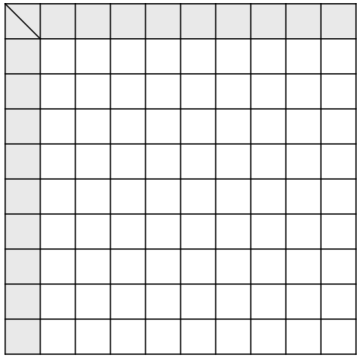
Toyosu-kun (the name of one person) starts from the upper-left cell and wishes to reach the lower-right cell. The movement rules are as follows:

- He can move right(\rightarrow), down(\downarrow), or diagonally down-right(\searrow) by one cell.
- When moving right(\rightarrow) or down(\downarrow), he consumes stamina equal to the number written in the cell he moves into.
- When moving diagonally(\searrow), he consumes the number in the destination cell plus 2 stamina points.
- The stamina value of the starting cell is also counted as consumed.

Find the minimum possible total stamina consumed to reach the lower-right cell, and also indicate the path (sequence of cells) he takes in that case.

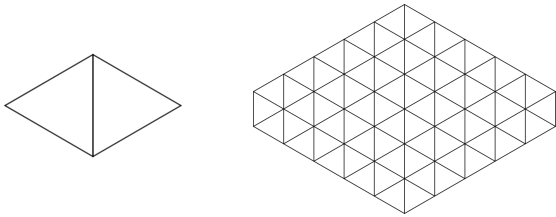
Question. 5 ★★★★★

In a multiplication table (from 1×1 to 9×9), one number in the row labels and one number in the column labels were mistakenly replaced with positive integers different from 0. As a result, the total sum of all entries in the table became 2024. How many different ways are there for such mistakes to occur?



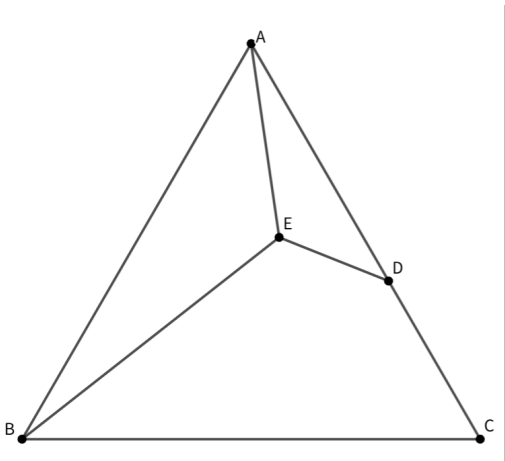
Question. 6 ★★★★★

There is a figure made up of 70 equilateral triangles of side length 1. We want to tile this figure completely using 35 rhombi, each formed by joining two equilateral triangles of side length 1 along a shared edge. In how many distinct ways can this tiling be done?



Question. 7 ★★★★★

In the figure below, triangle ABC is equilateral, and point E satisfies $\angle AED = \angle BED = 120^\circ$. Also, the ratios are given as $AD : DC = 3 : 2$, and $AD : DE = 7 : 3$. Find the ratio of the area of equilateral triangle ABC to that of triangle AED .



Past presentation materials and previous Mathematical Problem-Solving Challenge can be viewed [here](#).



Figure 1 Homepage of our club