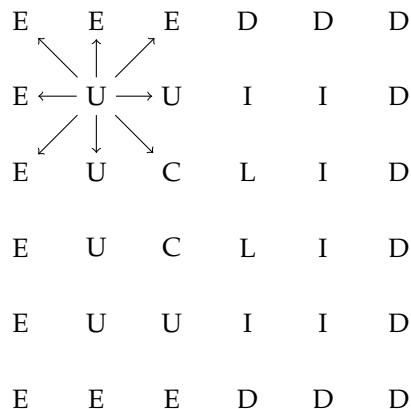# BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2023

Junior Final, Part B

May 5, 2023

1. The word EUCLID can be spelled by tracing paths through the given array of letters.

   As shown in the diagram, steps to adjacent letters horizontally, vertically, or diagonally are allowed.

 | | | | | | |
   |---|---|---|---|---|---|
   | E | E | E | D | D | D |
   | E | U | U | I | I | D |
   | E | U | C | L | I | D |
   | E | U | C | L | I | D |
   | E | U | U | I | I | D |
   | E | E | E | D | D | D |

   Determine the number of different paths which spell the word EUCLID.

2. How many integer solutions are there to the equation

   $$\frac{P}{Q} - \frac{Q}{P} = \frac{P+Q}{PQ}$$

   where $1 \le P \le 9$ and $1 \le Q \le 9$.

3. Find the sum of all distinct four-digit numbers that contain only the digits $1, 2, 3, 4, 5$ each at most once.

4. Suppose n is an integer greater than 1, that leaves the same non-zero remainder when divided into 1108, 1453, 1844, and 2258. Find n.

5. Circles of radius 1 can be arranged neatly in the shape of a hexagon, if you have an appropriate number of them. Two are shown below. The shape that is formed by an elastic stretched around the outside of one of these will be called a *circagon*, and we refer to the circagon with $6n$ circles touching its elastic as C_n. So C_1 and C_2 are the figures below.
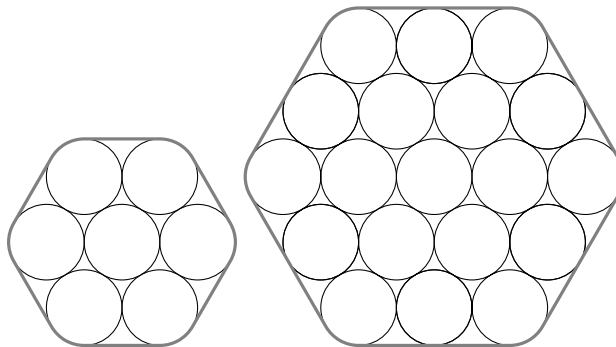
   (a) How many circles are used to form C_n?
   (b) What is the perimeter of C_n? This is the length of the stretched elastic.
   (c) What is the area of C_n? This is the area inside the stretched elastic.