# Canadian Mathematical Olympiad
# 1987

## Problem 1

Find all solutions of $a^2 + b^2 = n!$ for positive integers $a$, $b$, $n$ with $a \leq b$ and $n < 14$.

## Problem 2

The number 1987 can be written as a three digit number $xyz$ in some base $b$. If $x + y + z = 1 + 9 + 8 + 7$, determine all possible values of $x$, $y$, $z$, $b$.

## Problem 3

Suppose $ABCD$ is a parallelogram and $E$ is a point between $B$ and $C$ on the line $BC$. If the triangles $DEC$, $BED$ and $BAD$ are isosceles what are the possible values for the angle $DAB$?

## Problem 4

On a large, flat field $n$ people are positioned so that for each person the distances to all the other people are different. Each person holds a water pistol and at a given signal fires and hits the person who is closest. When $n$ is odd show that there is at least one person left dry. Is this always true when $n$ is even?

## Problem 5

For every positive integer $n$ show that

$$[\sqrt{n} + \sqrt{n+1}] = [\sqrt{4n+1}] = [\sqrt{4n+2}] = [\sqrt{4n+3}]$$

where $[x]$ is the greatest integer less than or equal to $x$ (for example $[2.3] = 2$, $[\pi] = 3$, $[5] = 5$).